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Digby Wind Power Project

Environmental Assessment Report

Report Prepared for:
SkyPower Corp
250 Yonge Street
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Project No.1030972.01

April 2009

FOREWORD

This Environmental Assessment Report is intended to meet the requirements for a Screening under the *Canadian Environmental Assessment Act* and requirements of an environmental registration pursuant to the Nova Scotia *Environment Act*. The two separate environmental assessment processes are similar in certain aspects but have their own requirements as set by provincial and federal government agencies. This report integrates the work completed to meet both sets of requirements, including those requirements that do not overlap the two processes. This report generally follows the structure expected by Natural Resources Canada, as presented in their guidance document, "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act"* (2003) supplemented by provincial requirements for environmental assessment registration outlined in "The Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document" (NSE 2007, updated 2008).

EXECUTIVE SUMMARY

Introduction

SkyPower Corp. (SkyPower) a Toronto based renewable energy developer, partnering with Nova Scotia-based community economic development organization Scotian Windfields Inc., is proposing to construct and operate a 30-megawatt (MW) wind power facility. The wind power facility will consist of 20 1.5 MW wind turbine generators with a 34.5 kV collection system connected to a new substation, on land located in Gulliver's Cove, Digby County, Nova Scotia. The proposed Project is referred to as the Digby Wind Power Project ("the Project").

The Digby Wind Power Project will provide enough power for more than 10,000 homes annually and have a positive effect on the environment through displacement of burning fossil fuel. In light of both Canada's and Nova Scotia's commitment to reduce greenhouse gas emissions and invest in renewable energy, the Digby Wind Power Project will be an important component of Nova Scotia's energy mix.

Regulatory Approvals

The Digby Wind Power Project has a nameplate capacity exceeding 2 MW, which requires the Proponent to undertake a Class I Undertaking pursuant to the Nova Scotia *Environment Act*. In addition, SkyPower is anticipating the requirement to undertake a screening-level environmental assessment for this Project under the *Canadian Environmental Assessment Act* (*CEAA*) as a result of applying for funding from Natural Resources Canada (NRCan) under the ecoEnergy for Renewable Power (EERP) program. This environmental assessment (EA) report is intended to meet the requirements of both federal and provincial EA processes. Additionally, this EA will provide support in seeking other environmental and planning approvals necessary for this Project.

Project Description

The Project will consist of 20, 1.5 MW, GE 1.5sle wind turbine generators. The following ancillary facilities are also considered part of the Project:

- 34.5 kV collection lines (to link the wind turbines to the onsite substation);
- 575V – 34.5kV range pad transformers located beside each turbine;
- substation (to step up the electric output from 34.5 kV to 69 kV);
- access roads;
- transmission line to Conway substation (approximately 10.6 km long); and
- crane pads for assembly of wind turbines.

There will be no maintenance building on site. The onsite substation area will be fenced and graveled.

Project Activities

The development of the proposed Project will include several phases, including site preparation and construction, operations and maintenance, and decommissioning. Activities within these phases will include:

- surveying;
- developing access roads;
- clearing and grubbing;
- grading;
- piling and foundation excavation;
- pouring turbine foundations;

- equipment lay-down and turbine assembly;
- tower, generator, and rotor assembly;
- collection system and transmission line/connection to grid;
- installation of substation equipment;
- clean-up and reclamation;
- turbine commissioning;
- access and inspection;
- rotor, generator and tower disassembly;
- access roads;
- removal of concrete foundation; and
- decommissioning of the distribution lines.

Construction Schedule

The proposed construction schedule for the Project is presented in Table E.1. The life-span of the proposed Project will likely equal or exceed 20 years. Decommissioning activities will last roughly the same amount of time as comparable construction activities.

Table E.1 Anticipated Project Activity Schedule

Surveying	August 2009
Clearing	September 2009-February 2010
Development of access roads	September 2009-February 2010
Delivery of equipment	November 2009-January 2010
Foundation construction	October 2009-January 2010
Wind turbine installation	November 2009-February 2010
Construction of overhead collection system	September 2009-January 2010
Installation of substation equipment	November 2009-February 2010
Installation of transmission line	September 2009 –January 2010
Turbine commissioning	February - April 2010
In-service	No later than April 2010

Environmental Management Strategy

SkyPower is committed to ensuring that the construction, operation, and decommissioning of the proposed Project are conducted in an environmentally responsible manner. SkyPower will ensure the recommended mitigation measures for the Project are successfully implemented. To accomplish this objective, the following initiatives will be addressed: integration with the corporate environmental management framework; compliance with worker health and safety rules; emergency response planning; environmental protection planning; and environmental monitoring.

Stakeholder Consultation and Aboriginal Engagement

The consultation activities for the Digby Wind Power Project included a public Project announcement in the local community of Rossway (May 2008), a presentation to the Municipality of Digby County Council (November 2008) and meeting with the Planning Advisory Committee (December 2008), a public Open House in Rossway (November 2008), and direct contacts with regulatory agencies, landowners and other interested parties throughout the course of the study. SkyPower has directly engaged the Mi'Kmaq community through information mailouts, face to face meetings and the commissioning of a Mi'Kmaq Ecological Knowledge Study. The public and Aboriginal communities will be invited to submit written comments on the proposed Project and information contained in the EA document during the EA review process. Additional stakeholder and community outreach initiatives are planned for the Spring and Summer of 2009 including the launch of a Project website, mailout of community newsletter, meeting with municipal council, door-to-door community outreach program and a public open house. The public and Mi'kmaq community will continue to be engaged in future phases of development. SkyPower will develop and implement a community liaison and issues resolution program for Project operations.

Impact Assessment

No significant adverse residual environmental effects of the Digby Wind Power Project are likely, considering the existing conditions of the Project site, the design of the Project and mitigation measures recommended to be implemented as part of the Project. A summary of the predicted environmental effects and mitigation measures for this Project is presented in Table E.2.

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
Birds and Other Wildlife	Construction & Decommissioning	Sensory disturbance	• Visitors will remain within relevant areas, both in-vehicle and on- foot and will aim to preserve the site's natural areas. • Ensure that overall disturbance will be limited to designated workspaces and performed in compliance with the *Migratory Birds Convention Act*. • Delivery vehicles will remain on designated roads.
		Habitat loss/alteration	• Habitat loss may be mitigated by only clearing the land necessary for construction activities and by limiting the overall land disturbance to within designated workspaces. • Upon completion of construction and/or decommissioning, habitat will be restored to the extent possible. • Areas of significance (*e.g.,* nesting sites) will be avoided, to the extent possible.
		Mortality	• In order to reduce the potential of bird mortality, land clearing and construction activities will be performed in compliance with the *Migratory Birds Convention Act (e.g.,* outside the critical time periods for breeding birds). If this is not possible during detailed layout surveying activities, a biologist on-site, in consultation with NSDNR and CWS, will prepare and implement a monitoring and mitigation plan for breeding activity which may include: the identification of nests within or

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			immediately adjacent to work areas, and flagging them for avoidance during construction, to the extent possible.
	Operation	Sensory disturbance	• None required.
		Mortality	• To reduce the potential for increased bird fatalities due to collision with wind turbines, several decisions were made in the planning of the wind farm. The turbines to be used extend no higher than 120 m above the ground thus avoiding the flight height of nocturnally migrating landbirds. Lighting will be the minimum allowed by Transport Canada for aeronautical safety, and white strobe lights (CL-865) may be used with the minimum intensity and flashes per minute allowable. The turbines for this Project will be built using tubular steel towers, as some data indicate that lattice towers encourage perching by raptors during hunting and, as a result, may put these birds at risk of collisions. Post-construction monitoring will direct the need and form of further post-construction mitigation measures • A bird and bat monitoring program will be developed in consultation with NSDNR and CWS. Based on the results of the program necessary modifications to mitigation plans and/or wind farm operations will be undertaken.
Soils and Vegetation	Construction & Decommissioning	Soil erosion and compaction	• Limit access to the turbine sites via established access roads, where possible. • Size of access roads will be kept to the minimum required for the safe construction, operation and decommissioning of the equipment. • Whenever possible, clearing activities will be timed to periods when the ground surface is best able to support construction equipment (winter or dry season). • Replace topsoil stored on-site to enable the reclamation of land to its original condition. • Compacted soil will be reclaimed as required. • Topsoil will be stored onsite for future use in restoring the land to its original condition • Standard erosion and sediment control measures will be implemented as required. • Topsoil and subsurface soils will be separated and stored on-site to be replaced appropriately after the pouring of the concrete foundation. When the soils are stored they will be covered with a tarp or otherwise protected from erosion and runoff.
		Loss of plant species	• Follow- up rare plant surveys will be conducted to assist with micrositing of turbines and access roads. • Where Plant Species of Conservation Concern are encountered, avoidance to the extent possible will be considered, especially where there maybe be a threat

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			to the regional population. • Prior to construction, digital way-point files revealing the precise locations of all “Red”, “Yellow” and “Undetermined” listed species identified during field work within the area proposed for development will be provided to NSDNR.
Wetlands	Construction & Decommissioning	Loss of wetland area and/or function	• Avoid all wetlands, where possible. • Conduct functional analyses for wetlands that cannot be avoided. • Obtain regulatory approval (including compensation for no net loss of function) from NSE for wetland alteration as required. Turbines will not be constructed within 30 m of a wetland unless approved by NSE.
Water Quality/ Aquatic Environment	Construction & Decommissioning	Surface water contamination	• Watercourses will be avoided to the extent possible. • Overhead powerlines preclude the need for instream work. • If alteration of watercourses is required, regulatory approval from NSE of the proposed alteration will be obtained prior to construction. • All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. • Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks. • A contingency plan for accidental spills will be developed for the Project. • Turbines will not be constructed within 30 m of a watercourse unless approved by NSE.
		Sediment loading	• Watercourses will be avoided to the extent possible • If watercourse alterations are required, they will be done in consultation with NSE/DFO in accordance with regulatory requirements. • Land clearing and construction near watercourses should occur between June and September 30 where possible. • Temporary erosion and sediment control measures, silt fence, straw bales (*etc.*) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. • Visual assessments will be completed both quarterly and after severe storm events to ensure the effectiveness of erosion and sedimentation controls. • Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.
		Surface water flow	• Watercourses will be avoided to the extent possible. • Access roads constructed across existing watercourse that require a culvert will follow standard industry

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			practice, installing culverts of sufficient size to accommodate expected maximum flows within the watercourse. • A Water Approval will be obtained for all required watercourse crossings and the conditions of approvals will be followed.
		Fish mortality	• Watercourses will be avoided to the extent possible. • Watercourse crossings, where required, will occur between the period of June 1 to September 30 unless otherwise approved by NSE • Where possible, culverts will be installed during low flow periods. If water is present, watercourses will be dammed and flow will be preserved through water pumps. In this case, a biologist would be on site to facilitate fish rescue within the dammed area.
Noise	Construction & Decommissioning	Increases in sound levels due to the transportation and operation of clearing equipment	• Nearby residents will be advised of significant sound generating activities and these will be scheduled to create the least disruption to receptors. • Heavy equipment will be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. • Construction equipment will have mufflers. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.
	Operation	Increase sound levels	• None required.
Tourism	Construction & Decommissioning	Effect on tourism and recreation	• None required.
	Operation	Effect on tourism and recreation	• None required.
Visual	Operation	Change to visual landscape	• Turbines will be all of the same type and model, and will be painted light grey to reduce reflection. • Screening opportunities for adjacent residences through tree planting or other measures may be considered where post-construction evaluation indicates a legitimate concern.
		Lighting	• Lighting will be the minimum allowed by Transport Canada to ensure the appropriate level of aeronautical safety.
		Shadow flicker	• None required.
Archaeological and Cultural Resources	Construction	Disturbance	• Areas of significance will be avoided to the extent possible. • Additional follow-up work may be required depending on final design and layout. • Upon discovery of an artifact, work will be stopped in the area and the appropriate authorities will be contacted.
Land Use	Construction	Reduction of forested land	• Existing RoWs (*e.g.*, woods roads) will be used to the greatest extent possible. New access roads will be constructed to minimize the Project footprint. • Turbines and substations, with their relatively small footprint on the land, have been sited with consideration

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			for the potential impact to existing land uses. • Existing logging and access roads built earlier in construction schedule will be used to install the collection system.
	Operation	Disruption to undeveloped woodlands or infrastructure	• The Project has been designed to minimize impacts to the local land use. No mitigation, therefore, is required as no significant impacts are predicted.
Health and Safety	Operation	Electromagnetic Fields (EMFs)	• None required.
		Infrasound energy	• None required.
		Ice throw	• During construction and operation activities, access to the wind turbine facility will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. • During site visits, vehicles will be parked up-wind of the turbines. • Warning signs will be posted at the perimeter of the Project area, discouraging trespassing on private lands. • During operation, access to the wind turbine sites will be restricted to authorized personnel only.
Local Community	Construction	Hazards and/or inconveniences to forestry operation	• Road construction schedule will consider planned forestry operation in the area to ensure required access is maintained. • No modification to existing roads expected • A Special Move Permit and any associated approvals will be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport.
	Operation	Effect on local economy	• Local residents will be employed to the extent possible during the construction, operation and decommissioning of the Project. • Municipal taxes will be remunerated, thus increasing the local tax base, which could be used to increase funding of local municipal initiatives.
		Effect on property values	• None required.

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1 PROJECT SUMMARY

Project developer SkyPower Corp. (SkyPower) is proposing to construct and operate a wind energy facility located in Digby County in Gulliver's Cove, Nova Scotia (the Digby Wind Power Project; the Project). The Toronto-based renewable energy developer SkyPower has partnered with Nova Scotia-based community economic development organization Scotian WindFields Inc. SkyPower has retained Jacques Whitford Stantec Limited to assist in the environmental assessment (EA) process for this Project. This Project is subject to provincial environmental registration requirements as a Class I Undertaking pursuant to the Nova Scotia *Environment Act*. "The Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document" (NSEL 2007, updated 2008) was used to ensure provincial requirements for registration are met.

The Proponent has applied for funding from Natural Resources Canada (NRCan) under the ecoEnergy for Renewable Power (EERP) program. Under the new Terms and Conditions of this EERP, NRCan will be identified as a "Responsible Authority" (RA) for the Project once Step 2 (the Technical Project Information (TPI) package has been submitted and approved and a Contribution Agreement has been fully executed. This will then trigger the requirement for a federal environmental assessment under the *Canadian Environmental Assessment Act (CEAA).* At the time of submission, it is unclear whether other agencies such as Fisheries and Oceans Canada (DFO) have regulatory responsibilities under *CEAA*. This document has therefore been prepared in compliance with *CEAA* requirements following NRCan's "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms under the *Canadian Environmental Assessment Act*" (NRCan 2003).

This report includes:

- a description of the Project, including its location and details regarding its construction, operation and decommissioning;
- a summary of the existing biophysical and socioeconomic features of the area which may be subject to Project-related adverse environmental effects;
- a summary of specific environmental concerns, identified through data collection, consultation with agencies and the public, and/or based on professional judgement;
- an assessment of the positive and/or adverse effects associated with this Project;
- an assessment of cumulative environmental effects of this Project;
- an assessment of the effect of the environment on the Project;
- a summary of mitigation, impact management and monitoring measures of this Project; and
- a summary of the advantages and disadvantages of the Project taking the foregoing into account.

1.1 Project Proponent

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1.2 Title of Project

The Project is referred to as the Digby Wind Power Project.

1.3 Project Location

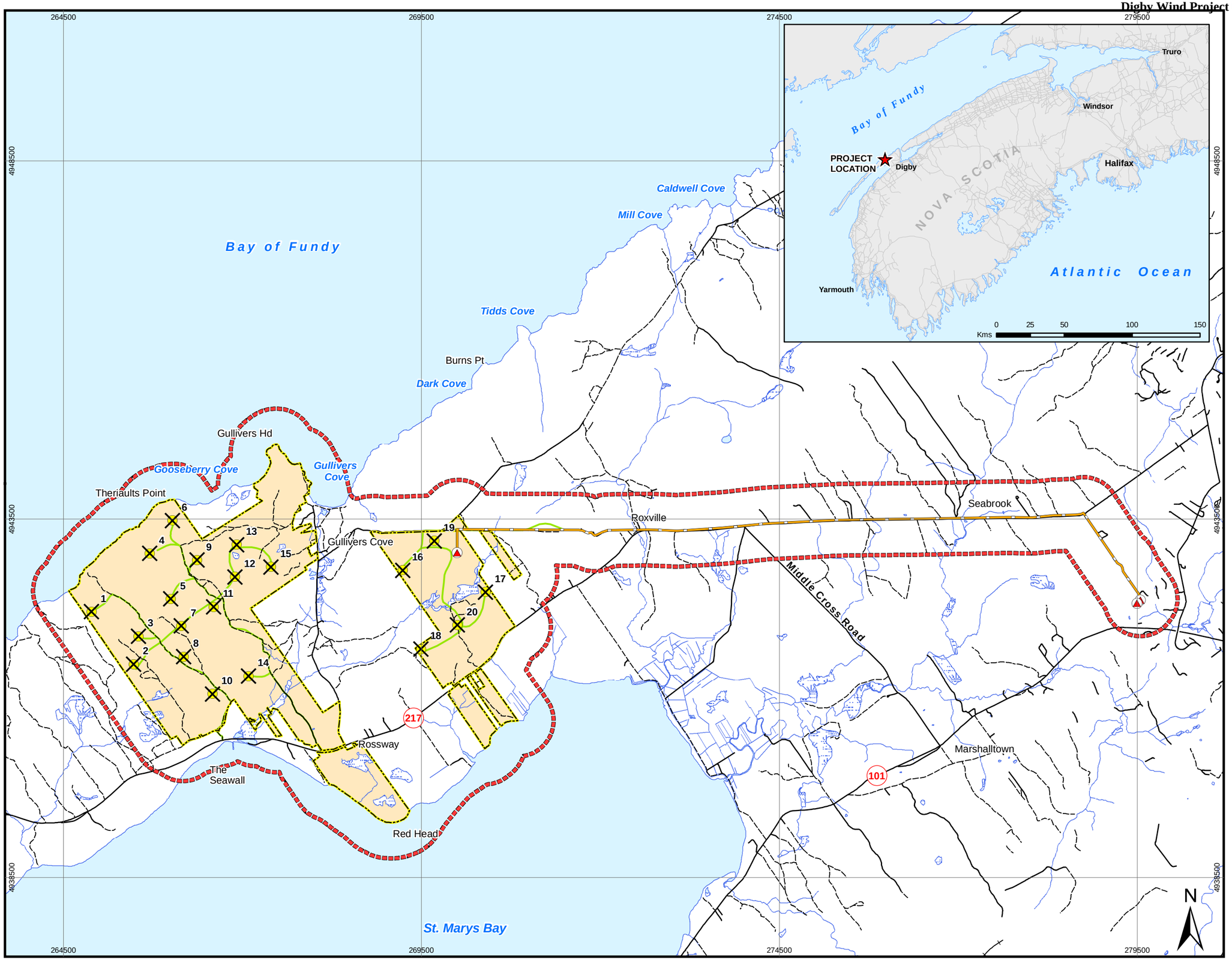
The proposed Project is located in Digby County, near Gulliver's Cove, Nova Scotia (Figure 1.1). The selection of the Digby Wind Power Project site was based on a number of factors including:

- preliminary wind resource assessment;
- review of terrain and topography;
- access to power grid interconnection;
- site access;
- existing land use; and
- community support.

The wind energy facility will be constructed on undeveloped land (primarily forested), approximately 1,132 ha (2,797 acres) in size ("proposed site development area" on Figure 1.1). This area, along with the transmission line corridor is considered the "Project Area "for the purpose of this environmental assessment (EA). The "Study Area" shown on Figure 1.1 includes the proposed site development area, transmission line corridor and surrounding lands.

1.4 Estimated Capacity of Facility

The proposed Project will consist of 20 wind turbine generators (WTGs) and ancillary facilities. The energy produced by the Project will be linked to the Nova Scotia electrical transmission system. Each turbine has a nameplate capacity of 1.5 MW, for a total capacity of 30 MW. This will provide enough power for more than 10,000 homes annually. The electricity will be supplied directly to the Nova Scotia Power Inc. (NSPI) electric grid under a Power Purchase Agreement.



SKYPOWER

Figure 1.1

DIGBY WIND POWER PROJECT

Project Location

Project Components

- Proposed/Existing Power Station
- Proposed Turbine Location
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area
- Study Area

Map Features

- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

0 0.5 1 1.5 2 2.5

Kilometres

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:50,000
Date: April 2009
Project No.: 1030972.01

Stantec

1.5 Construction Schedule

The proposed construction schedule for the Project is presented in Table 1.1. The lifespan of the proposed Project will likely equal or exceed 20 years. Decommissioning activities will last roughly the same amount of time as comparable construction activities.

Table 1.1 Project Activity Schedule

Surveying	August 2009
Clearing	September 2009-February 2010
Development of access roads	September 2009-February 2010
Delivery of equipment	November 2009-January 2010
Foundation construction	October 2009-January 2010
Wind turbine installation	November 2009-February 2010
Construction of overhead collection system	September 2009-January 2010
Installation of substation equipment	November 2009-February 2010
Installation of transmission line	September 2009 –January 2010
Turbine commissioning	February - April 2010
In-service	No later than April 2010

The construction schedule was designed to account for minor delays that could result from delayed equipment arrival and adverse weather conditions.

1.6 Regulatory Framework

1.6.1 Environmental Assessment

Pursuant to the Nova Scotia *Environment Act*, environmental registration with Nova Scotia Environment (NSE) is required for an electric generating facility which has a production rating of two megawatts (2 MW) or more derived from wind energy.

The Digby Wind Power Project will have a capacity exceeding 2 MW and is therefore subject to environmental registration. This EA satisfies the requirements outlined for provincial environmental registration as a Class I Undertaking and was prepared following guidance from “The Proponent’s Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document” (NSEL 2007, updated 2008).

To date, the Project has one known trigger under *CEAA* due to the application for federal funding under NRCan’s ecoEnergy for Renewable Power (EERP) program. This process has been started for the Project with the Notice Project Application (Step 1). Under the new Terms and Conditions of this EERP, NRCan will be identified as a “Responsible Authority” (RA) for the Project once Step 2 (the Technical Project Information (TPI) package has been submitted and approved and a Contribution Agreement has been fully executed. It is currently unknown if other federal agencies such as Environment Canada, Transport Canada, Health Canada and DFO have an interest either as an RA or expert department in the review of the Project under *CEAA*; however there are no obvious *CEAA* triggers besides the federal funding.

To ensure that *CEAA* requirements are met, this EA was undertaken following the guidance provided in NRCan’s “Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act”* (NRCan 2003). In the absence of an executed Contribution Agreement under the new EERP Terms and Conditions, NRCan has no formal involvement in the review of this Project at this time.

1.6.2 Environmental and Land Use Approvals

In addition to provincial and federal EA requirements, federal, provincial and municipal environmental and land use permits, licenses and approvals may be required for this Project. Table 1.2 summarizes approvals and authorizations likely to be required for the Project; this list is intended to be illustrative for environmental assessment purposes only.

Table 1.2 Required Environmental and Land Use Approvals

Approvals Required	Summary
Federal	
Canadian Aviation Regulations Standard 621.19	Section 5.9 of these regulations state that a wind turbine should have a flashing white beacon mounted on the highest practical point of the turbine if the structure is taller than 90 m. Lighting requirements have been determined in consultation with Transport Canada. Consultation is required with the appropriate regional Civil Aviation authority, providing information on the planned obstruction using the Aeronautical Obstruction Clearance Form (#26-0427).
Provincial	
Water Approval for Watercourse Alteration (Activities Designation Regulations)	Alteration of any watercourse will require authorization from NSE under the Activities Designation Regulations. SKYPOWER proposes to avoid watercourses to the extent practical during detailed design. Based on the current proposed road layout, it is anticipated that there could potentially be at least one watercourse crossing (*i.e.,* upgrade of culvert at Haight Brook).
Water Approval for Wetland Alteration (Activities Designation Regulations)	Alterations of a wetland will require authorization from NSE under the Activities Designation Regulations. SkyPower proposes to avoid wetlands through turbine siting and road layout design. If however, it is not possible to avoid a wetland, a functional analysis will be conducted and an application will be submitted for approval of the proposed alteration.
Breaking Soil of Highways Permit (*Public Highways Act*)	The proposed transmission line may disturb the surface, soil, or any structure within a highway right-of-way (including the road surface) in Nova Scotia requires a Breaking Soil of Highways Permit from Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR).
Building Near a Highway and Access to Property Permit (*Public Highways Act*)	Approval from NSTIR may be required for installation of transmission line.
Use of Right-of-Way for Pole Lines Permit (*Public Highways Act*)	Approval from NSTIR may be required for installation of transmission line.
Special Move Permit with Department of Transportation and Infrastructure Renewal (*Public Highways Act*)	A Special Move Permit and any associated approvals will be obtained for heavy load transport as required.

1.7 Structure of this Report

This report is intended to meet both the federal and provincial environmental assessment requirements. To ensure that the federal environmental assessment requirements were met, this report generally follows the structure recommended by NRCan in their guidance document “Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act*” (NRCan 2003). Likewise, in accordance with the Nova Scotia *Environment Act*, this report also documents how the requirements of the provincial registration were met.

The following outlines the structure of the Report:

- Section 1 introduces the Project and summarizes the key elements of the Project and the regulatory regime.
- Section 2 provides additional Project detail on components and activities required to support this EA.
- Section 3 describes the assessment method and scope of the assessment.
- Section 4 describes the existing environment of the Project site, including both biophysical and socioeconomic elements.
- Section 5 presents the assessment of potential environmental effects for each component of the Project, including accidents and malfunctions, and discusses the potential cumulative effects of the Project in association with other existing and planned projects.
- Section 6 identifies follow-up measures that are intended to be implemented for the Project.
- Section 7 describes the consultation program undertaken for this Project.
- The conclusion of this EA is presented in Section 8.
- Section 9 presents the signature page followed by a list of supporting documents used to prepare the report in Section 10.
- Technical reports and supporting information are presented in appendices at the end of this document.

1.8 Author of EA

This EA was completed by Jacques Whitford Stantec Limited, an independent, multi-disciplinary team of consultants with extensive experience in undertaking environmental assessments across Canada and internationally. Specifically, and on behalf of Jacques Whitford Stantec Limited, the report was prepared and reviewed by the following:

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2 PROJECT DESCRIPTION

The following describes the proponent, background and location of the Project, and detailed Project activities.

2.1 Presentation of the Proponent

SkyPower has partnered with Nova Scotia-based community economic development organization Scotian WindFields Inc. for this Project. Scotian WindFields Inc. is a Nova Scotia based, owned and operated company that develops renewable energy projects through wind, solar and biomass applications. The company was formed in January 2007 as a result of an agreement between eight Nova Scotia community-owned renewable energy companies formed under the Community Economic Development Investment Fund (CEDIF) initiative.

Established in 2003, SkyPower is a leading developer of renewable wind and solar energy projects. The company has interests in over 200 projects at various stages of development, representing over 11,000 MW of potential nameplate capacity. SkyPower is developing significant renewable energy projects in Canada, the United States, India and Panama and the company continues to look for new opportunities in emerging markets. SkyPower drives all phases of project development including exploration, construction and operation. SkyPower has an Atlantic Canada wind project under construction for 27 MW in progress which will be in completion by the first quarter of 2009.

2.2 Background of the Project

SkyPower is proposing to construct and operate a wind energy facility, the Digby Wind Power Project, near Gulliver's Cove, Digby County, Nova Scotia. The Digby Wind Power Project site will have a nameplate capacity of 30 MW. The Project is planned to connect into the Nova Scotia electrical grid.

Several years worth of wind data has been gathered from the site from five meteorological stations. A combination of consistent wind and community desire to develop the wind potential make the site an ideal location for wind development (refer to Section 2.5 for more information on Project siting).

2.3 Purpose of Project

The Project has been proposed in response to a request for proposals issued by Nova Scotia Power Inc. (NSPI). The Project would have the capacity to contribute up to 30 MW of clean, renewable energy to the provincial grid, producing energy sufficient to power more than 10,000 homes annually. The Digby Wind Power Project is a key part of the Nova Scotia Government's plan to integrate renewable assets into its energy mix and will assist the Province to meet its 2010 renewable energy targets.

2.4 Summary of Project

The Project will consist of 20, 1.5 MW wind turbine generators (refer to Figure 2.1 for site layout). The Proponent intends to use General Electric (GE) turbine (GE 1.5sle) for this Project. Table 2.1 includes the technical specifications for this turbine model.

Table 2.1 Turbine Technical Specifications GE 1.5sle

Turbine Component	Specifications
Rated capacity	1.5 MW
Cut-in wind speed	3.5 m/sec
Cut-out wind speed	25 m/sec (1 minute)
Rated wind speed	12 m/sec
Number of blades	3

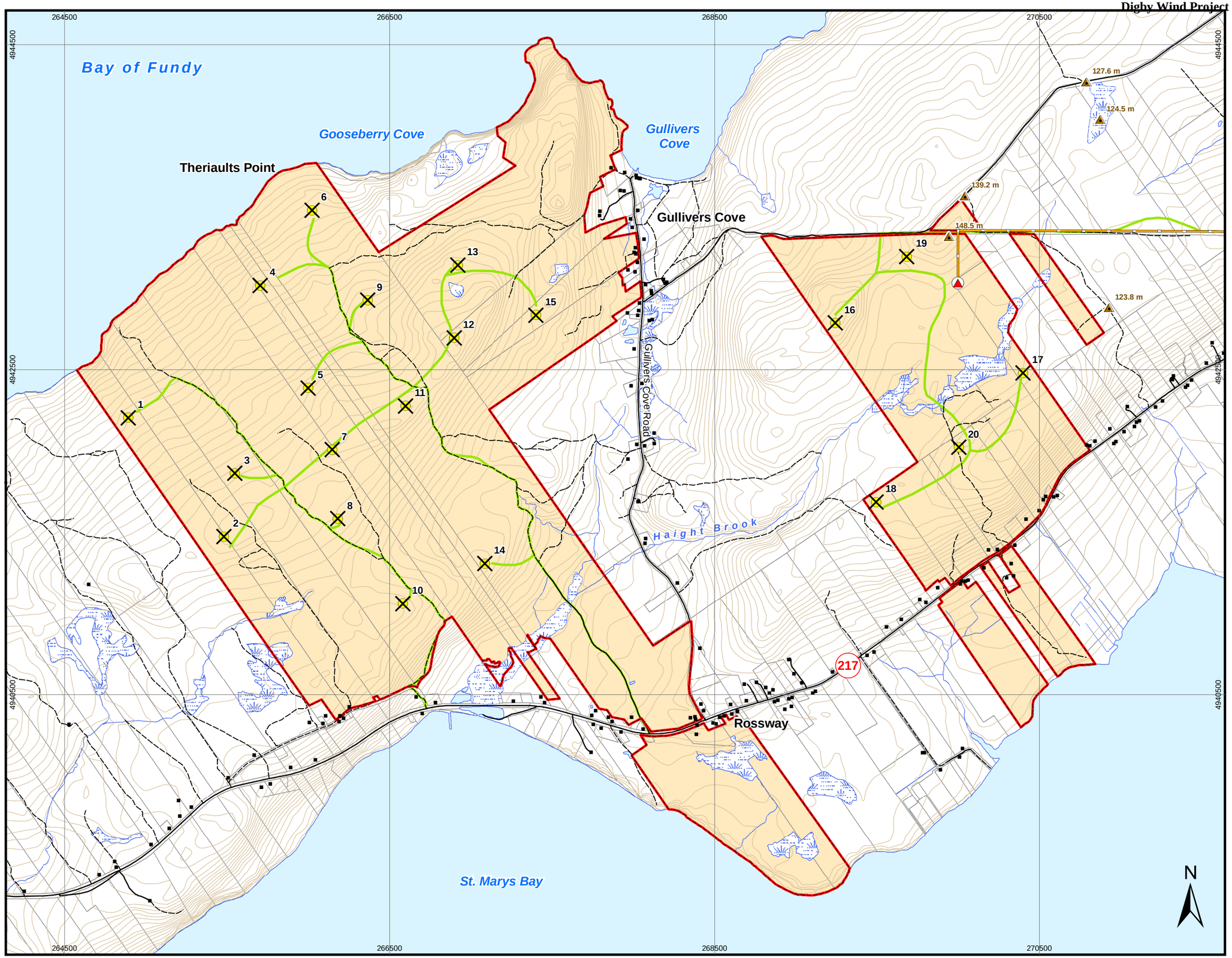
Table 2.1 Turbine Technical Specifications GE 1.5sle

Turbine Component	Specifications
Diameter	77 m
Swept area	4657 m^2
Rotor speed (variable)	20.4 rpm
Tower (hub) height	80 m
Gearbox	Three-step planetary spur gear system
Generator	Double-fed three-phase asynchronous generator
Yaw system	Electromechanical driven with wind direction sensor and automatic cable unwind
Control system	Programmable logic controller (PLC)/ remote and monitoring system
Tower design lightning protection	Lighting receptors installed on blade tips / surge protection in electrical components

In addition, the following ancillary facilities are also considered part of the Project:

- 34.5 kV collection lines (to link the wind turbines to the substation);
- 575V – 34.5kV range pad transformers located beside each turbine;
- substation (to step up the electric output from 34.5 kV to 69 kV);
- access roads;
- transmission line to Conway substation (approximately 10.6 km long) (refer to Figure 2.2); and
- crane pads for assembly of wind turbines.

There will be no maintenance buildings on site. The onsite substation area will be fenced and graveled.



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Figure 2.1

DIGBY WIND POWER PROJECT

Site Plan

Project Components

- Proposed 69 kV Substation
- Proposed Turbine Location
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Spot Elevation
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland
- Waterbody
- Property Boundary

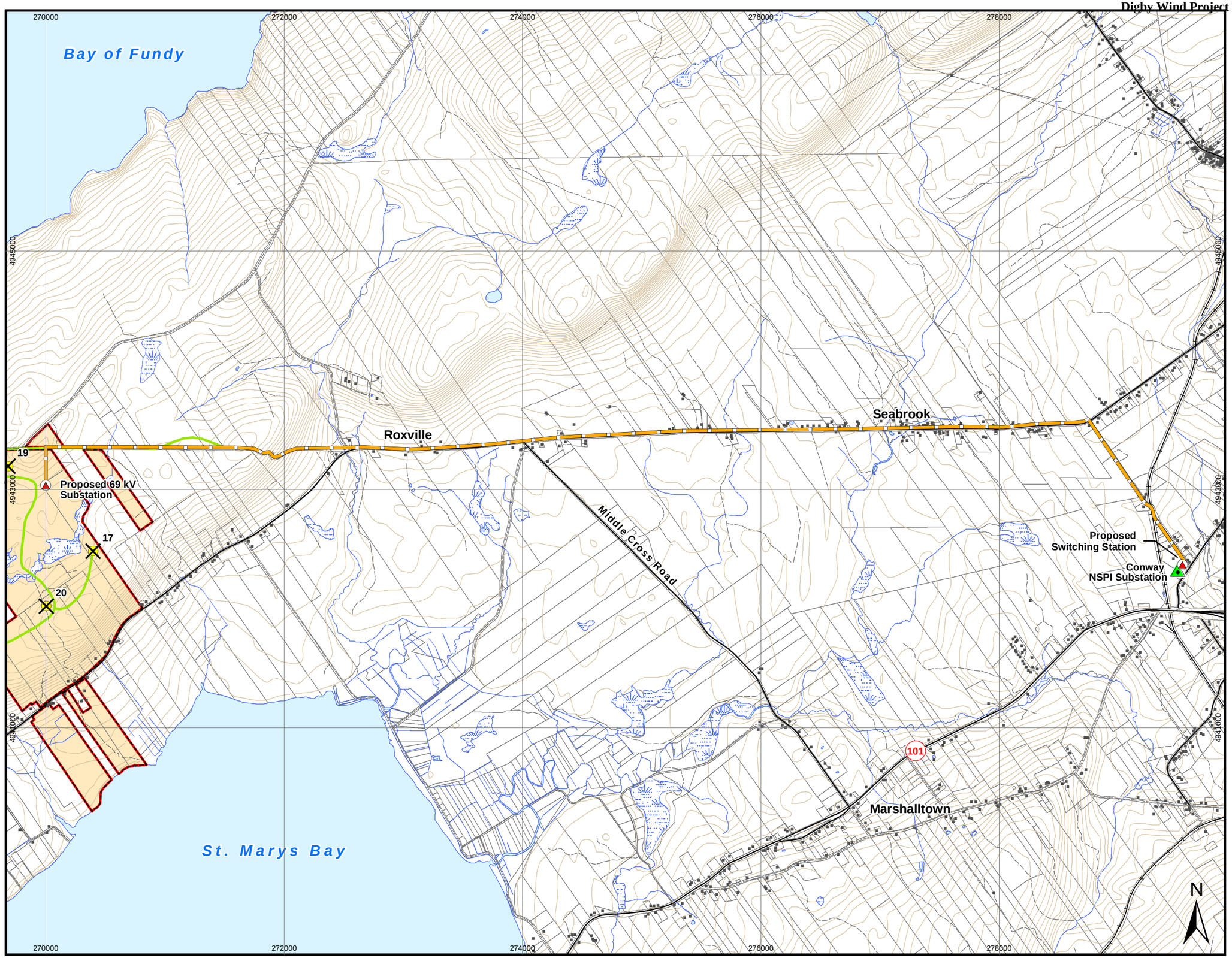
0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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Figure 2.2

DIGBY WIND POWER PROJECT

Proposed Transmission Line

Project Components

- Proposed Turbine Location
- Existing NSPI Sub- Station
- Proposed Power Station Location
- Proposed Turbine Access Road
- Proposed Transmission Route - Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Waterbody
- Wetland
- Property Boudries

0 400 800 1,200 1,600

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:30,000
Date: April 2009
Project No.: 1030972.01

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2.5 Location of Project

The proposed Project is to be located in the Municipality of Digby, near Gulliver's Cove, Nova Scotia. The wind energy facility will be constructed on undeveloped woodlands generally bounded to the north by the Bay of Fundy; to the east and west by undeveloped land and sparsely populated residential areas; and to the south by the Evangeline Trail (Route 217), sparsely populated residential areas and St. Mary's Bay (refer to Figures 2.1 and 2.2). Gulliver's Cove Road divides the Project Area. The Study Area identified for the Project is considered that area within which direct Project interactions with the natural environment could occur. It is within this area that information on natural, socioeconomic and environment features and activities has been collected for the purpose of assessing the potential impacts of the proposed Digby Wind Power Project.

The Study Area comprises approximately 1,132 ha (2,797 acres) at the wind farm site with an additional 10.6 km of transmission line following Route 217 to the Conway substation (refer to Figure 2.2). However the actual footprint of the tower structures and ancillary facilities for the proposed wind farm will occupy only a small fraction of the land base within the Study Area.

The location of the turbines and substation is shown in Figure 2.1. This current site configuration is based on a variety of factors. Original turbine layout was based predominantly on land availability and wind regime monitoring results collected on site. The original layout, which included turbines south of Highway 217 in Rossway, was revised based on input received through stakeholder consultation. In particular, feedback received during a council meeting with the Municipality of Digby in November 2008, suggested the community did not wish to have turbines overlooking St. Mary's Bay so those turbines were relocated north to the current Project Area. Furthermore, as additional lands were added to the Project Area, this facilitated a more efficient layout of turbines.

As detailed design and planning progresses (including, but not limited to, site specific geotechnical tests and follow-up biological surveys) SkyPowerwill continue to optimize site layout to minimize biophysical and socioeconomic effects while improving Project efficiencies.

A description of the biophysical and socio-economic features of the Study Area is provided in Section 4.

2.6 Detailed Project Activities

The following section provides details on the planning, construction, operation, maintenance and decommissioning of the Project. Activities that have the potential for environmental effects in the Study Area are addressed in Section 5.

The development of the proposed Project will include several phases: site preparation and construction; operations and maintenance; and decommissioning.

Table 2.2 Typical Project Activities

Site Preparation and Construction	
Surveying	Activities include staking the boundaries of the construction area, temporary workspace, substation site, aboveground collector lines and transmission lines, as well as marking the location of any existing underground pipelines and cables.

Table 2.2 Typical Project Activities

Site Preparation and Construction	
Development of access roads	Access roads will be surveyed and staked/flagged. It is anticipated that the majority of onsite roads will generally involve upgrading existing logging roads, with new access roads added as required. Roads on the wind farm site will be approximately 11 m wide during construction to accommodate crane movements for installation, trailers for transportation of heavy and bulky turbine and substation equipments, maintenance vehicles and equipment for repairs/replacements. In special cases if difficult turns are required, roads may be made wider than 11 m. Construction roads will be designed to accommodate the crane types that will be required to erect the wind turbine generators and towers. Roads will be constructed by placing a layer of geogrid on the native soil, followed by layers of compacted shale or sandstone with a screened stone topping. The thickness of the layers will be in accordance with the geotechnical report's recommendations for Project road construction. Wetlands and watercourses will be avoided to the extent practical in designing access roads. Follow –up surveys will be conducted as necessary to conduct wetland functional analyses and/or assist with design of watercourse crossings if required. Water Approvals will be sought from NSE for wetland/watercourse alterations if these features are unavoidable. Based on the current proposed road layout, it is anticipated that a culvert at Haight Brook will require upgrading as the existing road is upgraded.
Clearing and grubbing	The Project Area generally consists of undeveloped wooded land which will require clearing and grubbing. All roads will be built on top of the topsoil. A layer of geogrid will be rolled out on the surface and the rock or gravel road material would be placed in layers on the geogrid to make the road. Approximately 1.5 ha of land will be cleared for each turbine, within which turbine foundations and crane pads will be located. After construction and installation, the majority of the cleared area will be revegetated; a much smaller pad for service and maintenance vehicles will remain.
Grading	Grading will be necessary to construct the access roads and pad construction. Where possible, existing grades will be maintained.
Soil stockpiling	All soil will be stockpiled on site during construction so that it can be used in revegetation and reclamation of the site once the turbines are erected.
Piling and foundation excavation	The turbine foundations will be determined by the final geotechnical report and structural engineering at each turbine site, as is necessary to properly support the loads. The substation area will consist of a raised pad approximately 2,500 m^2.
Pouring turbine foundation	For excavated foundations, after excavation and piling installation, foundation forms and rebar will be installed. Concrete will be poured into the pile cap forms continuously. Forms will be removed after the concrete is cured and the excavated area is back-filled and compacted such that only the tower base portion of the foundation is above ground.
Equipment lay-down and turbine assembly	To create a safe and level work area for storing and assembling the wind turbine generators and towers, an area of approximately 1.5 ha may have to cleared, grubbed and graded. Each of the turbines and generators will be trucked on a flat-deck trailer to the site and assembled.
Tower, generator, and rotor assembly	The tower will be transported in three sections that will be assembled on site. The blade system, consisting of 3 blades and a hub, will also be assembled on site, attached to the generator and lifted into place at the top of the tower by a crane.
Collection system and transmission line/connection to grid	It is anticipated that the 34.5 kV electrical collection system will consist of aboveground electrical poles between turbines, distributing power from each turbine to the onsite substation where the output will stepped up from 34.5 kV to 69 kV distribution line. Aerial cabling is installed by first drilling and placing poles, then stringing each phase of wire. Approximately 10.6 km of aboveground pole-mounted 69 kV distribution line will be installed along the RoW of Route 217 to link the project to the Conway substation.
Installation of substation equipment	Onsite substation equipment will be installed within a fenced yard that will be surfaced with gravel.

Table 2.2 Typical Project Activities

Site Preparation and Construction	
Clean-up and reclamation	Construction waste will be removed and disposed of at an approved location in accordance with local and provincial waste management requirements. The temporary lay-down areas and disturbed areas around the foundation of each turbine and at the substation will be replaced with the previously excavated and stockpiled topsoil. The disturbed areas will be re-seeded. High voltage signage will be installed at the substation and elsewhere, as necessary.
Turbine commissioning	Turbine commissioning can occur once the wind turbines have been fully installed and when NSPI is ready to accept grid interconnection. Commissioning involves testing and inspection of electrical, mechanical, and communications operability. A detailed set of operating instructions must be followed in order to connect with the electrical grid.
Operations and Maintenance	
Access and inspection	Maintenance inspections will be required approximately once every month for routine servicing. Light 4 x 4 trucks, vehicles, and ATVs may be used to access the towers. Larger trucks and cranes may be required periodically for larger repairs, but this is expected to occur infrequently. In addition, throughout the course of the year, access to the turbines as part of regular non-scheduled maintenance activities will be required for resetting faults, minor component replacement and related activities. New and used lubricants, cleaning supplies and other controlled substances will be delivered, stored, handled and disposed of according to local regulations.
Decommissioning and Abandonment	
Rotor, generator and tower disassembly	The rotor, generator and towers would be disassembled using a crane and removed from the site for re-use, reconditioning or disposal using a flatbed truck.
Access roads	Access roads will be removed where appropriate and in consultation with landowners.
Removal of concrete foundation	Decommissioning and reclamation will be done in accordance with landowner agreements. In some cases, foundations will be removed to a depth of approximately 1 m below original ground level and filled with subsoil to rebuild the grade. Piling and most of the concrete foundation can remain in place. Stockpiled topsoil will be placed over the area to approximate depth of adjacent ground and the area seeded and left for cultivation or grazing, depending on the land use at the time and the preference of the landowner. In some cases, depending on landowner agreements, concrete pads may stay in place.
Decommissioning of distribution lines	Aboveground powerlines will be removed from the ground during decommissioning, or as determined necessary by NSPI.

2.6.1 Construction Phase

Clearing activities will be scheduled outside of the breeding bird season (May to August) to the extent practical. However, in the remote possibility that clearing activities will need to take place during the breeding bird season, an adequately trained specialist will be required to inspect the proposed work area for nesting birds prior to any site clearing. In addition, any clearing and disturbance within 50 m of identified nesting or breeding areas should be avoided, if possible. Current forest roads have been considered to the extent possible as access roads to turbine locations. Compaction of soil will be minimized to the extent possible with compacted soil recovered following turbine installation. In addition, silt fencing will be erected, if required, to help prevent erosion of bare lands caused by construction activities.

Watercourses and wetlands will be avoided to the extent practical. Where applicable, wetland functional analyses will be conducted for unavoidable wetlands and Water Approvals for watercourse and/or wetland alterations will be obtained from NSE. If construction is necessary in or near watercourses or wetlands (*e.g.,* access road crossing Haight Brook) sediment control measures will be put in place for the duration of construction in those areas.

Information and warning signs will be erected adjacent to the wind farm at the start of construction, to provide public information about the facility and to discourage trespassing on private lands. This signage will be maintained and updated as necessary.

Equipment on site during construction could include hydraulic fluid, brake fluid, transmission fluid, and oil from the wind turbine generator. Any refilling activities will take place in designated areas and at a minimum of 30 m from wetlands or watercourses.

The turbine nacelles (which house the gearbox and the generator) and hubs will be delivered directly to the project site. A detailed transport study will be undertaken to determine the appropriate routes and means for the equipment to be delivered to the site. It is anticipated that the current road network (outside of onsite turbine access roads) will not require upgrades to accommodate construction traffic.

Approvals for transporting these materials will be sought from the provincial transportation departments. As the turbine components are oversized, a Special Move Permit and any associated approvals will be obtained through the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) for heavy load transport.

2.6.2 Operation and Maintenance Activities

Activities associated with the operation and maintenance of the Digby Wind Power Project will not be as extensive as during the construction phase. Maintenance inspections are required approximately once a month for routine servicing and lubricant replacement. Light-duty 4x4 trucks, vehicles, and ATVs may be used to access the wind turbines. Larger trucks and cranes may be required infrequently for larger repairs.

Aside from normal recovery of lubricants from the gearbox and yaw mechanism, operation activities do not generate waste. Lubricants will not contain any PCBs. New and used lubricants, cleaning supplies and other controlled substances will be delivered, stored, handled and disposed of according to local regulations.

Each turbine houses a sophisticated Supervisory Control And Data Acquisition (SCADA) system which continuously monitors equipment performance and instantly detects any faults to be addressed. This system will determine the frequency of regular and non-scheduled maintenance activities onsite.

2.6.3 Decommissioning

The Digby Wind Power Project is expected to be operational for at least 20 years. In the event that decommissioning and abandonment is necessary, the activities associated with the Project include:

- rotor, generator and tower disassembly;
- decommissioning of access roadways;
- removal of concrete foundation;
- removal of distribution and transmission lines;
- removal of pad mount transformers; and
- removal of substation.

Well-designed and constructed wind energy facilities may be operated for decades. Individual wind turbines are expected to perform for up to 35 years without significant repair or replacement. Transformer facilities, underground wiring and substation facilities are designed for at least a 50 year life span. Individual wind turbines may be replaced or repaired as their useful life comes to an end, or if more efficient and cost-effective technology becomes available.

Upon a decision to decommission a single wind turbine or the entire wind farm, all equipment above ground, including towers, nacelles, transformers and controllers will be removed. Wind turbines that are operational and have market value would be carefully removed using a crane, essentially in a reverse process to assembly and installation. The resale value of such equipment would cover the cost of removal in such a

case. A market for good, used wind turbines has developed in North America, and a number of wind turbines installed in Alberta in the early 1990s originated from the U.S. used wind turbine market.

Other above-ground equipment in the wind farm, including transformers and wiring, has a ready market in either used equipment sales or in salvage. Transformers will be simply removed and sold. Wiring will be removed and sold to metal salvage companies.

As discussed above, wind energy facilities do not use or produce harmful waste products and therefore aside from normal recovery of lubricants from the gearbox and yaw mechanism, there are no requirements for harmful waste handling during decommissioning.

Wind energy facilities removed from undeveloped woodlands which will require minimal remediation; native seed mixtures will be used to revegetate the area. Where necessary, topsoil and re-grading of access roads in the fields will occur as per the landowner's preference.

All decommissioning activities will be conducted in accordance with landowner agreements and applicable regulations and agreements at that time. It is not anticipated that watercourse crossings would be removed during decommissioning.

2.6.4 Future Phases of Project

At the present time SkyPower does not intend to expand the Digby Wind Power Project.

3 SCOPE OF THE ASSESSMENT

The following section provides the scope of the Project to be assessed as well as the factors and scope of factors to be assessed. The methods used for the environmental assessment are also described.

3.1 Scope of the Assessment

The scope of the Project to be assessed includes:

- surveying activities, such as identifying location of wind turbines and follow-up biophysical and archaeological surveys as required;
- clearing of vegetation;
- constructing and upgrading access roads, including installation of culverts as required;
- delivery of equipment and materials including the wind turbines, foundation materials, electrical cables and ancillary equipment;
- foundation construction;
- wind turbine installation;
- electrical cabling installation (*i.e.,* installation of 34.5 kV aboveground collection system);
- construction of ancillary equipment (*e.g.,* substation);
- installation of a 69 kV transmission line (approximately 10.6 km);
- operation and maintenance of the Project; and
- decommissioning of the turbines and the overall Project.

The potential effects of accidents and malfunctions are also considered within this EA, as are the potential cumulative effects of this Project in relation to other projects/activities in the regional area. The potential effects of the environment on the Project are also addressed.

Environmental Assessments are typically organized and focused according to VECs which are those biophysical and socioeconomic elements that are of particular importance to the proponent, as well as public and regulatory stakeholders involved in the assessment process. This EA evaluates the potential environmental effects of the proposed Project elements and activities, for all Project phases, with regard to each VEC. By assessing potential impacts on VECs within the study boundaries, a meaningful evaluation of project effects on relevant environmental aspects is achieved. VECs evaluated for this assessment include:

- soil;
- water quality (surface and groundwater);
- aquatic environment (including fish and fish habitat);
- terrestrial vegetation;
- wildlife (including birds, mammals, reptiles and amphibians);
- archaeological and heritage resources;
- existing and planned land use (including forestry);
- local community;
- visual aesthetics;
- noise;

- recreation and tourism; and
- safety.

3.2 Methods

The EA is structured to include proposed mitigation to reduce or eliminate potential adverse environmental effects. The determination of significance of adverse environmental effects is based on post-mitigation (residual or net) effects, rather than unmitigated potential effects. The significance of residual or net effects of the Project was determined using the following criteria, based on federal and provincial EA guidance:

- value of the resource affected;
- magnitude of the effect;
- geographic extent of the effect;
- duration and frequency of the effect;
- reversibility of the effect; and
- ecological and/or social context.

A significant adverse effect is defined as a permanent change in the quality or condition of a component of the environment. It must be spatially and temporally extensive and not within acceptable limits in terms of magnitude or nature based on guidelines, standards and professional judgement. Many construction-related environmental effects are not considered to be significant as they are relatively brief in duration (six months or less), restricted to the existing site and temporary laydown area in extent, and reversible over the short term. The potential level of impact (*i.e.,*adverse environmental effect) after mitigation measures (*i.e.,* net or residual effects) were identified based on NRCan's criteria and definitions provided in "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act" (NRCan 2003), presented below in Table 3.1.

Table 3.1 Definitions for the Level of Impact After Mitigation Measures

Level	Definition
High	Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recovery initiatives should be considered.
Medium	Potential impact could result in a decline in resource to lower-than baseline but stable levels in the study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring and/or recovery initiatives may be required.
Low	Potential impact may result in a slight decline in resource in study area during the life of the project. Research, monitoring and/or recovery initiatives would not normally be required.
Minimal	Potential impact may result in a slight decline in resource in study area during construction phase, but the resource should return to baseline levels.
N/A	There is no interaction possible between the project activity in question and the associated potential adverse effect.

Source: *Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act* (NRCan 2003)

Issues scoping is a critical first step in the environmental assessment process to ensure completeness and focus for the EA process. The issues scoping process included the following activities:

- review of regulatory guidelines;
- public and agency consultation;

- literature and background information review; and
- field studies.

The following sections discuss these activities in more detail.

3.2.1 Regulatory Guidelines

As an energy generating facility that has a production rating of at least 2 MW derived from wind, this Project is Class I Undertaking as defined in Schedule A of the Nova Scotia Environmental Assessment Regulations and as such requires an environmental assessment registration. The *Proponent's Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment Registration Document* (NSEL 2007, updated 2008) provides guidance on EA approach and issues scoping and was used extensively to guide the EA for this Project. Additional provincial legislation and policies that influenced this EA include the *Endangered Species Act,* Activities Designation Regulations, Nova Scotia *Wetlands Designation Policy* (NSEL 2006a), and the *Operational Bulletin Respecting the Alterations of Wetlands* (NSEL 2006b).

Regulatory guidance for this Project was also obtained from several federal documents, including:

- *Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act* (NRCan 2003).
- *Wind Turbines and Birds – A Guidance Document for Environmental Assessment* (Environment Canada 2007a).
- *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (Environment Canada 2007b)
- *Cumulative Effects Assessment Practitioners Guide* (Canadian Environmental Assessment Agency 1999).
- *The Responsible Authority's Guide* (Canadian Environmental Assessment Agency 2003).

In addition to these regulatory guidelines, federal legislation has also been used to guide the EA in terms of issues scoping, effects assessment and mitigation requirements, including, but not limited to the *Species at Risk Act* (*SARA*) and *Migratory Birds Convention Act, 1994*.

3.2.2 Public and Stakeholder Consultation

Over the course of Project planning, SkyPower representatives have consulted with the local community and stakeholders primarily through a public meeting at the Rossway Community Centre with representatives from NSPI (May 2008), a municipal council meeting (November 2008) and a public open house at the Rossway Community Centre (November 2008). These meetings have provided the local public and community leaders an opportunity to learn more about the Project and express issues or concerns about the Project. Additional details and issues that were raised at the Open Houses are discussed in Section 7. Copies of handouts are provided in Appendix A. During the EA review process, additional issues may be raised by the public. The public will be invited to submit written comments on the proposed Project and information contained in the EA document to regulators for consideration. Additional stakeholder and community outreach initiatives are planned for the Spring and Summer of 2009 including the launch of a Project website, mailout of community newsletter, meeting with municipal council, door-to-door community outreach program and a public open house. The public will continue to be consulted in future phases of development (refer to Section 7 for additional information).

3.2.3 Regulatory Consultation

Various regulatory and other agencies were consulted early in the planning process to provide input into the Project and the process, and advice in terms of likely approvals and considerations for environmental assessment. To date, the following agencies have been contacted by SkyPower and/or the Jacques Whitford Stantec Limited Study Team:

- Canadian Environmental Assessment Agency (CEA Agency);
- Canadian Wildlife Service (CWS);
- Nova Scotia Environment (NSE);
- NS Aboriginal Affairs;
- Nova Scotia Department of Natural Resources (NSDNR); and
- Natural Resources Canada (NRCan).

A draft environmental assessment was also submitted for regulatory review and comment. Comments received were taken into consideration in preparing the final EA Registration document. Regulatory consultation is further discussed in Section 7.

3.2.4 First Nation and Aboriginal Engagement

The Project Area consists of privately held land used primarily for forestry and residential uses and there is no known traditional use by First Nation people. SkyPower has commissioned the Confederacy of Mainland Mi'kmaq (CMM) to conduct a Mi'kmaq Ecological Knowledge Study (MEKS) for the Project. The MEKS will identify land and resource use which is of particular importance to the Mi'kmaq people with respect to the Digby Wind Power Project and as well, will seek to identify and document ecological knowledge which may be significant to the project. It is anticipated that this MEKS will be completed by September 2009, with progress updates provided in May and July.

SkyPower also attended a scoping meeting with NSE, NS Aboriginal Affairs, and representatives from the Mi'kmaq Rights Initiative (KMK) in early April 2009 to help NSE facilitate early, meaningful consultation with the Nova Scotia Mi'kmaq community. This meeting allowed SkyPower to provide an overview of the Project and obtain feedback on issues scoping relative to Aboriginal issues. First Nation and Aboriginal communities will also be invited to review and comment on the EA report during the registration process.

3.2.5 Literature Review

For this Project, existing information was collected from a number of sources including, but not limited to:

- municipal documentation from the Municipality of the District of Digby;
- 1:20,000 aerial photos;
- 1:10,000 Nova Scotia Base Mapping;
- NSDNR wetland inventory mapping;
- Atlantic Canada Conservation Data Centre (ACCDC);
- Provincial water well inventory;
- reports, books and other materials on the area's natural history and geology (see Section 10);
- reports, books and other materials relative to wind turbine developments and environmental effects (see Section 10); and
- information available at selected websites (*e.g.*, Statistics Canada, *Species at Risk Act* registry; see Section 10).

3.2.6 Field Studies

Field studies are aimed at characterizing the natural and social-economic environment of the Study Area. This work included:

- spring, summer, winter and fall avian monitoring (2008);
- vegetation surveys (June and August 2008);
- aquatic surveys (September 2008);
- site visits for characterization of socio-economic environment (June 2008);
- ambient sound monitoring (June 2008); and
- site visits to support the visual impact assessment (June and November 2008).

As described in Section 4, various field studies were conducted prior to the availability of the current turbine and access road layout; therefore it will be necessary to conduct localized follow-up surveys to refine mitigation presented in the EA, refine turbine and access road locations, and support additional regulatory permitting (*e.g.*, Water Approvals). Follow-up surveys planned for the Spring/Summer of 2009 include:

- additional rare plant surveys along the transmission route and within planned turbine footprints during detailed planning and design ;
- wetland surveys and functional analyses (if wetland impacts cannot be avoided);
- additional breeding bird surveys;
- aquatic surveys (*e.g.,* if watercourses not previously surveyed are likely crossed by a road alignment); and
- follow-up archaeological surveys if required.

3.2.7 Professional Judgment

Project personnel involved in the completion of this EA are trained, professional biologists, scientists, planners and/or EA practitioners. Professional judgment was exercised through the selection of environmental components and in the evaluation of environmental effects in this report. The use of professional judgment in environmental assessment practice is widely accepted and complements the aforementioned scoping techniques.

3.3 Spatial and Temporal Boundaries of the Assessment

For this Project, the assessment of effects was undertaken for the area identified as the Study Area (see Figure 1.1), unless otherwise identified. Use of the term “Project Area” is meant to signify site development areas for the wind farm and transmission line (*i.e.,* Project lands within the Study Area). For the purpose of data collection of the socio-economic environment, the Municipality of the District of Digby was also considered. The temporal scope of this assessment covers the construction, operation and decommissioning phases of the Project, which is expected to extend over the next 20 years.

4 ENVIRONMENTAL CHARACTERISTICS

The general and specific biophysical and socio-economic conditions of the Study Area are described in this section.

4.1 Geophysical Environment

The following sections outline the geophysical environment of the Study Area including the physiography and topography, surficial geology, bedrock geology, and hydrogeology of the area.

4.1.1 Physiography and Topography

The Project is located in the physiographic region known as the Basalt Peninsula, which is part of the Atlantic Coast theme region. The peninsula is an extension of the North Mountain basalt ridge, with topographic elevations declining towards the western end of the peninsula. There are two dominant ridges that form the peninsula and a central valley situated between the ridges.

4.1.2 Surficial Geology

The Study Area consists of four types of surficial geology groups. The first is on the north side of the site, abutting the Bay of Fundy. Here the surficial geology is a glaciomarine deposit, which gently slopes towards the shoreline and has protruding ridges and scarps. This is a marine deposit that has lifted due to isostatic rebound. The primary materials in the deposit are gravel and sand, and secondary materials are silt and clay.

On the south shore, which abuts the Atlantic Ocean, there is a thin band of colluvial deposit. This is composed of a mixture of glacial deposits and weathered and frost shattered rocks and soils. This type of deposit is typically formed through down-slope creep and mass movement. In the south-east area of the site there is a silty till plain deposit, comprised of silt from material derived from local and distant sources. This deposit occurred with ice-sheet basal melting. The largest portion of the site is situated on a stony till plain deposit, which is a stony-sand matrix. This deposit can create a flat or rolling surface and typically has surface boulders. The stony till plain formed from basal ice-sheet melt, derived from local bedrock (Stea *et al.* 1992).

4.1.3 Bedrock Geology

The bedrock geology consists of the North Mountain Formation, which is part of the Fundy Group. The bedrock is a tholeiitic plateau basalt formed in the Jurassic Period of the Mesozoic Era, approximately 202 million years ago. Digby Neck was formed from two thick lava flows, with an intervening erodible layer (Keppie 2000).

4.1.4 Hydrogeology/Groundwater

Two major water-bearing bedrock formations are identified in the Study Area: the North Mountain Formation and the Blomidon Formation, both of the Fundy Group. The North Mountain Formation, located in the northern majority of the Study Area, is comprised of both igneous and metamorphic rocks including volcanic basalt, tuff and ryholite. The Blomidon Formation, along the southern perimeter of the Project area, is comprised of sedimentary sandstone, coal, siltstone, shale and conglomerates of lacustrine, deltaic and aeolian origin.

The North Mountain Basalt is the primary groundwater aquifer in the Digby Neck area. Aquifer permeability in the North Mountain Basalt formation, comprised of the upper, middle and lower flow units, is associated with fracture zones along the contacts between individual flows, and the contacts between each unit. The upper unit of the Formation is extremely permeable, and precipitation recharges through the vertical fractures to the middle unit. The recharge water is intercepted by a series of sub-horizontal basalt layers that comprise the middle unit, and the groundwater follows discontinuous flow paths towards locations where the fractures outcrop near surface. At these outcroppings, springs may form, flowing for several weeks to months until the recharged groundwater storage is exhausted. Due to the layered nature of the basalt flows, several “perched”

water tables may be encountered by drilled wells. The highest well yields are expected from the highly fractured bottom zones of the upper flow unit and from the horizontal fracture zones between the individual flows of the middle flow unit.

Aquifer permeability in the Blomidon formation is primarily associated with thin sandstone beds and lenses and to a lesser extent from joints in siltstones and shales. Groundwater seeps may form on cliffs where the more permeable beds and joints may be exposed, or along the contact between the Blomidon sandstone and the North Mountain basalt.

Water supplies within the Study Area are generally derived from individually drilled wells. According to the Nova Scotia Well Log Database of logs for wells constructed between 1940 and 2007, wells within the Study Area are generally installed in either weathered basalt or sandstone. Some wells intersect the sand and gravel deposits in Gulliver's Cove. The majority of wells are for individual domestic potable use. One well field for spring water production is located within the Study Area; however this well field is not currently active. A summary of the pertinent well properties included in these logs is presented in Table 4.1.

Table 4.1 Summary of Water Wells Records Within the Study Area

	Well Depth (m)	Casing Length (m)	Estimated Yield (Lpm)	Water Level (m)	Overburden Thickness (m)	Drilled Date (yr)
Minimum	22.9	6.1	4.5	0.9	0	1953
Maximum	166.1	30.5	1877.5	32.0	25.9	2007
Average	59.7	16.2	221.6	10.6	12.9	1996
Geomean	51.0	14.3	83.7	7.9	9.5	1995
Number	46.0	45.0	46.0	26.0	10.0	46

Source: NS Well Logs Database (NSE 2008)

Groundwater wells constructed in the North Mountain Formation of the Fundy Group are typically moderately yielding and produce excellent quality water with parameters typically meeting the Health Canada Guidelines for Canadian Drinking Water Quality (Health Canada 2006). Groundwater circulation in the North Mountain Formation is typically rapid and contact with the resistive igneous rock is only along planes and fractures. The groundwater from this formation is therefore typically low in total dissolved solids, iron and hardness.

Groundwater wells constructed in the Blomidon Formation can be expected have low to moderate yield and produce moderate quality groundwater. Calcium bicarbonate and calcium sulphate presence contributes to higher total dissolved solids and hardness than in the North Mountain Formation aquifer. Groundwater typically meets Health Canada Guidelines for Canadian Drinking Water Quality (Health Canada 2006).

Domestic wells are scattered throughout the Study Area, coinciding with existing roads and structures. There are reportedly no dug wells in the vicinity of the Project activities, and all drilled wells draw groundwater from bedrock formations. Proposed turbine construction activities are greater than 500 m from any likely domestic well location. The precise location of nearby wells and any specific mitigative measures, if necessary, will be determined as part of preconstruction surveys.

4.2 Aquatic Environment

The following section describes the aquatic environment on site including the aquatic habitat and aquatic species. Watercourses will be avoided to the extent possible. If construction is necessary in or near watercourses, mitigation measures to reduce soil erosion and downstream sediment transport are proposed to ensure the protection of fish and fish habitat. Consultation with NSE and DFO will be required in the event that a watercourse needs to be crossed by a new road and/or an existing crossing requires upgrading. Figures 4.1a and 4.1 b show the location of watercourses within the Study Area.

4.2.1 Aquatic Habitats

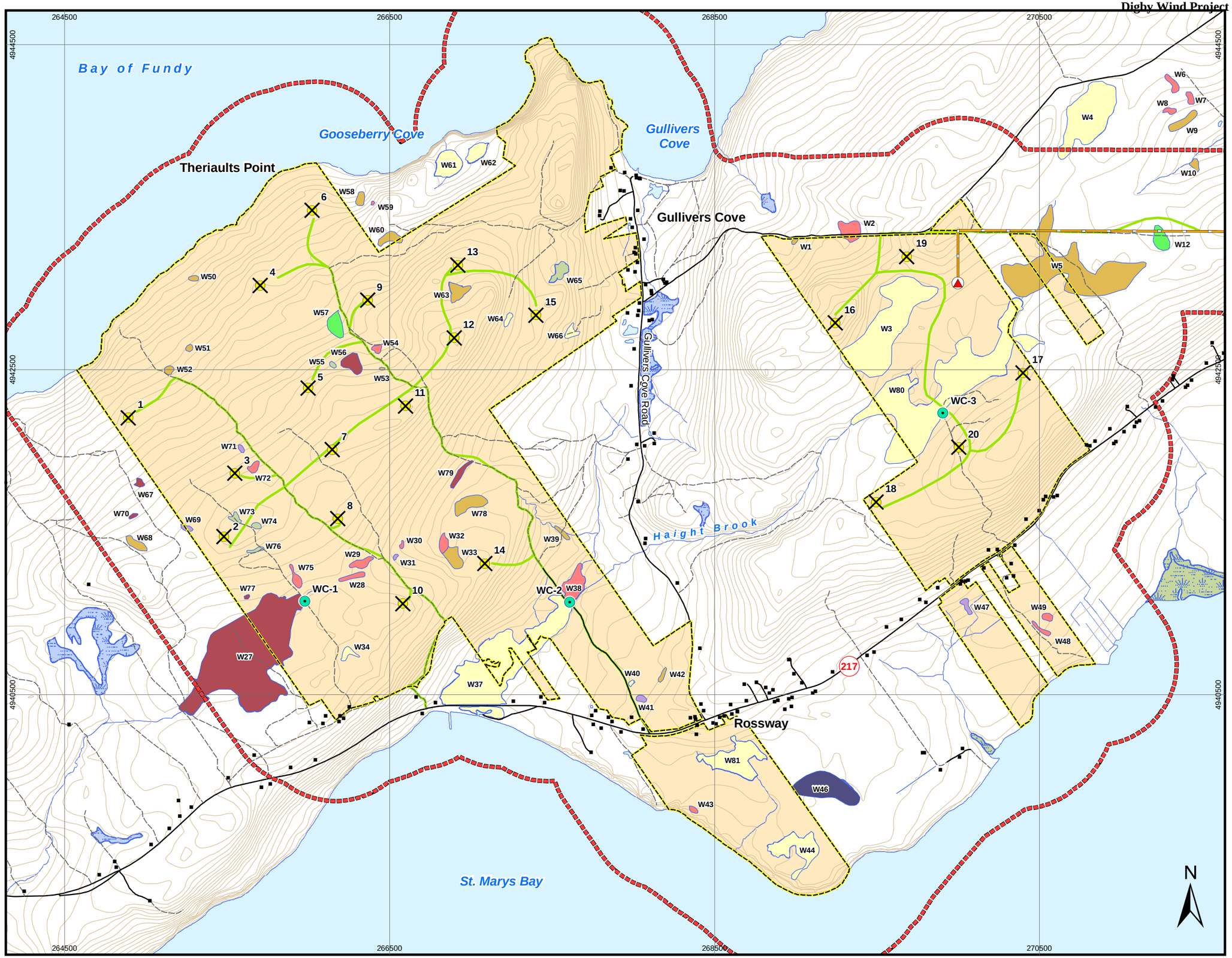
Multiple watercourses run through the Study Area, based on 1:10 000 mapping. Aquatic field surveys in September 2008 were undertaken to assess potential crossing locations identified, based on existing roads in the Study Area. Based on the existing road network, it was anticipated that turbine access roads could require three watercourse crossings in the Study Area (to be determined during final surveys and final design). Two of the crossings would occur on Haight Brook, with a third on an unnamed tributary to St Mary's Bay.

On September 27, 2008, two Jacques Whitford Stantec Limited aquatic specialists conducted a field survey of the Haight Brook and the unnamed tributary to St Mary's Bay at the proposed crossing locations to assess their general condition and categorize their potential for fish habitat. Identification and preliminary evaluations of Haight Brook and the unnamed tributary were based on 1:10 000 mapping and air photos.

The habitat assessments were conducted based on internal Jacques Whitford Stantec Limited sampling protocol, which is a derivative of the Canadian Aquatic Biomonitoring Network (CABIN) protocol published by Environment Canada (Reynoldson *et al.* 2007). Sampling protocol was also derived from the Ontario Benthos Biomonitoring Network (OBBN; Jones *et al.* 2005). The assessments consisted of identifying physical units (*i.e.,* riffles, pools, and runs), instream cover, substrate composition, stream depth and width, overhead cover, and water quality at three transects along a 200 m section of the watercourse: one transect at the proposed crossing location, one 100 m downstream of the proposed crossing and one 100 m upstream. Water quality measurements were taken in-situ with a handheld Yellow Springs Institute (YSI) water quality multimeter. Determination of fish species in the Study Area was completed utilizing a Smith Root Model 12 backpack electrofisher on a 75 m section of the Haight Brook; species are discussed in Section 4.2.1. Photographs were taken along the stream to document habitat (see Appendix B).

Based on 1:10 000 mapping it is estimated that the proposed transmission line route will require crossing five watercourses. It is anticipated that the transmission line poles will be located to avoid interaction with these watercourses. If it is determined during final survey and design that avoidance is not possible, the appropriate approvals will be sought from NSE and DFO.

The following sections provide additional detail on the characteristics of the water crossings surveyed. Discussions focus on the assessment of aquatic habitat at the wind farm site which could potentially be impacted by access road construction. Additional data will be obtained as necessary should watercourse alteration applications be required (*i.e.*, if watercourses are unavoidable during detailed design).



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Figure 4.1a

DIGBY WIND POWER PROJECT

Watercouses and Wetlands (Site Area)

Watercourses and Wetlands

- Watercourse Assessment Site
- Watercourse
- Freshwater Wetland (NSDNR)
- Saltmarsh (NSDNR)
- Wetland (NSTDB)
- Waterbody

JWSL Identified Wetlands (2001 Air Photo Interpretation)

- Coniferous Treed Swamp
- Deciduous Treed Swamp
- Fresh Marsh
- Low Shrub Swamp
- Mixedwood Treed Swamp
- Shallow Water Wetland
- Treed Bog
- Tall Shrub Swamp
- Wetland Complex

Project Components

- Proposed 69 kV Substation
- Proposed Turbine Location
- Proposed Transmission Route Nov. 28-08
- Proposed Turbine Access Road
- Study Area
- Proposed Site Development Area

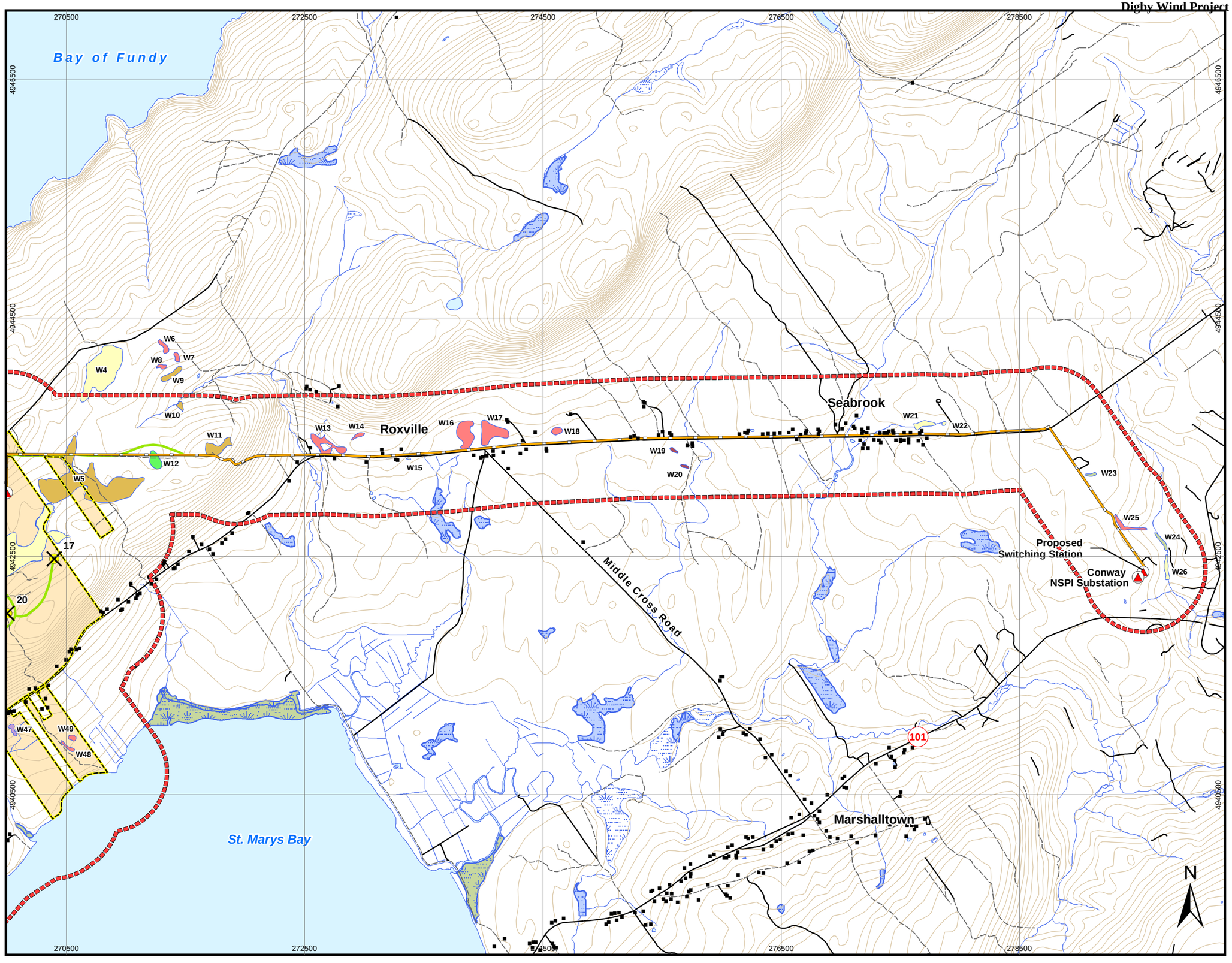
0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec



SKYPOWER

Figure 4.1b

DIGBY WIND POWER PROJECT

Watercouses and Wetlands
(Transmission Line Route)

Watercourses and Wetlands

- Watercourse Assessment Site
- Watercourse
- Freshwater Wetland (NSDNR)
- Saltmarsh (NSDNR)
- Wetland (NSTDB)
- Waterbody

JWSL Identified Wetlands (2001 Air Photo Interpretation)

- Coniferous Treed Swamp
- Deciduous Treed Swamp
- Fresh Marsh
- Low Shrub Swamp
- Mixedwood Treed Swamp
- Shallow Water Wetland
- Treed Bog
- Tall Shrub Swamp
- Wetland Complex

Project Components

- Proposed 69 kV Substation
- Proposed Turbine Location
- Proposed Transmission Route Nov. 28-08
- Proposed Turbine Access Road
- Study Area
- Proposed Site Development Area

0 400 800 1,200 1,600

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:30,000
Date: April 2009
Project No.: 1030972.01

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Unnamed Tributary to St. Mary's Bay – WC-1

The unnamed tributary to St. Mary's Bay (referred to as WC-1) is a first order perennial stream with the headwaters (no defined channel) immediately upstream of the potential crossing (refer to Photo 1 in Appendix B). Flow was not detectable at the time of the survey; substrate was primarily composed of small to large pebble (5-50 mm in diameter), interspersed with gravel (2-5 mm in diameter). Upstream of the proposed crossing, flow from the headwaters is impeded by the roadway and diverted to the existing culvert, into which it converges. This creates a defined channel approximately 0.50 m wide and 0.10 m deep for 30 m downstream of the culvert before the channel dissipates into a wetland. A small pool was present 10 m downstream of the proposed crossing and provides an area of heavy cattail (*Typha sp*.) growth. Riparian vegetation was predominately scrubland, dominated by alders and woody growth less than 2 m in height. The land use surrounding the crossing may historically, as well as presently, act as a quarry for general fill.

Water quality was indicative of a watercourse with low flow and stagnant conditions. Dissolved oxygen was low at 4.15 mg/L (39.1%), which is outside the CCME range for the protection of aquatic life (6.5-9.0 mg/L). Specific conductivity and pH were also slightly low but were representative of typical levels found in inland waters of Nova Scotia. This watercourse would not be considered potential fish habitat. There is a lack of connectivity to a fish bearing watercourse, as downstream of the channel a wetland serves as an interruption to fish passage. It is likely that the culvert installation increased water velocity immediately downstream of the road such that substrate scouring and bank erosion occurred and resulted in the development of a channel downstream of the culvert where none existed before. In addition to the lack of connectivity, dissolved oxygen concentrations are inadequate to sustain aquatic fauna. Physical characteristics for WC-1 are summarized in Table 4.2.

Table 4.2 Summary of Water Quality and Channel Characteristic for Site WC-1

Crossing[1]	Location (NAD83, Z20T)	Wetted Width (m)	Bankfull Width (m)	Average Depth (m)	Maximum Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	D.O. (%)	Conductivity (µs/cm)
WC-1 Unnamed Tributary	0265978E, 4941075N	0.49	0.64	0.07	0.09	12.54	6.11	4.15	39.1	79

[1] All measurements and calculations were taken at the Right of Way of the anticipated road crossing.

West Haight Brook – WC-2

West Haight Brook is a second order perennial stream, which flows into St Mary's Bay through the Rossway seawall (refer to Photos 2-6 in Appendix B). At the proposed crossing, a culvert is presently installed under a private road (refer to Photo 6 in Appendix B). Upstream of the proposed crossing the channel narrows from 1.70 m to 0.94 m; the narrowest section of the reach surveyed occurs above the fork where a tributary of equal size joins with Haight Brook upstream of the proposed crossing.

The brook runs through two distinct riparian zones. The upstream zone consists of scrubland with stands of mature deciduous and coniferous trees. This riparian vegetation provides shade to 75-100 % of the brook upstream of the proposed crossing. Downstream of the proposed crossing the vegetation changes into pastureland with meadows extending to 100 m from each bank, resulting in canopy cover being reduced to 0-25%. Substrate varies along the assessment area ranging from silt/sand in the downstream section to large cobble at the upstream reach. The variance in substrate size can be attributed to decreased flow velocity downstream as the watercourse widens and slope decreases. This allows the smaller particles held in suspension to fall out of the water column during high flow events. Also of note, in the upper reach multiple pools and gravel beds exist, which are prime habitat resources for salmonid spawning. The dissolved oxygen concentration was 9.61 mg/L (89.6%) at the time of the survey. Conductivity and pH are higher than in WC-1 and all water quality measurements taken are within their respective CCME guidelines for the protection of aquatic life.

WC-2 exhibits diverse fish habitat as is evidenced by the habitat survey results and the variety of fish species captured during electrofishing. Haight brook is connected to a fish bearing watercourse (St. Mary's Bay), and suitable physical habitat exists for both small and large bodied fish.

Physical characteristics for WC-2 are summarized in Table 4.3.

Table 4.3 Summary of Water Quality and Channel Characteristic for Site WC-2

Crossing[1]	Location (NAD83, Z20T)	Wetted Width (m)	Bankfull Width (m)	Average Depth (m)	Maximum Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	D.O. (%)	Conductivity (µs/cm)
WC-2 West Haight Brook	0267609E, 4941068N	1.70	2.44	0.24	0.29	12.12	6.71	9.61	89.6	145

[1] All measurements and calculations were taken at the Right of Way of the anticipated road crossing.

East Haight Brook – WC-3

This crossing (0269887E, 4942276N) is located in a wet area, potentially above the headwaters of the Haight Brook (refer to Photo 7 in Appendix B). No watercourse was present at the location at the time of the survey.

4.2.2 Freshwater Fish

The Digby Neck region of Nova Scotia is unique in its fish populations as there is a lack of freshwater connectivity to the remainder of Nova Scotia, thus there is an absence of any purely freshwater species (Nova Scotia Museum 2006). As identified above, only one site within the Project Area (WC-2) interacted with a freshwater aquatic environment with the potential to bear fish. The results presented below reflect the findings of a backpack electrofishing survey carried out at West Haight Brook, site WC-2.

The results of electrofishing indicate the presence of multiple fish species in the Haight Brook. No fish were observed or are anticipated to inhabit the unnamed tributary to Saint Mary's Bay at the location of the proposed crossing (WC-1). The unnamed tributary does not provide adequate flow, connectivity, habitat, or water quality in the area of the proposed crossing to support fish, as described above. Table 4.4 provides information on the species caught while electrofishing in the Haight Brook within the vicinity of the proposed road crossing; total numbers caught and mean fork length are also provided.

Table 4.4 Fish Catch Results (WC-2)

Fish Species	Number caught	Mean Fork Length (cm)
Brook Trout (*Salvelinus frontinalis*)	4	14.2
Fourspine stickleback (*Apeltes quadracus*)	1	4.2
Ninespine stickleback (*Pungitius pungitius*)	10	5.2
American eel (*Anguilla rostrata*)	8	11.4

Brook trout, a game fish, is one of the more popular choices for anglers in the Atlantic Canada sport fishery. Brook trout tend to occur in cool, clear, well oxygenated streams and lakes; spawning generally occurs in the headwaters or shallows of spring fed streams with gravel beds and riffles (Scott and Crossman 1998). The disturbed state of the water in the riffle allows for increased oxygenation/mixing of the water column. Sea run brook trout populations are also present in Nova Scotia which is likely what is present in the Haight Brook. These anadromous populations are born in freshwater redds (gravel spawing areas) and migrate to the Atlantic Ocean where they stay close to shore within large estuaries.

The stickleback family (Gasterosteidae) includes two species caught during the fish survey (ninespine, and fourspine). Ninespine species inhabit salt, brackish, and fresh water. The fourspine stickleback is typically considered marine although, as in this case, have been known to inhabit freshwater; both species tend to occur in shallow areas of streams and estuaries (Scott and Crossman 1998). Sticklebacks are tolerant of a range of water conditions (*e.g.,* salinity) and can be found in shallow, turbid waters not considered favourable by other species.

American eels are a member of the Anguillidae family and were found within Haight Brook. The species is catadromous (live in fresh water, spawn in salt water) and as such can be found in lakes, streams, rivers and estuaries, depending on the lifecycle stage of the individuals. The American eel has been designated a "species of special concern" by COSEWIC. While it has not been listed under the *Species at Risk Act* (SARA*)* by DFO at this time, it is likely that the species will be listed (and therefore protected) in the future.

4.3 Terrestrial Environment

The terrestrial environment section details the flora and fauna, including any species of special conservation concern, which may be present within the Study Area.

4.3.1 Habitats

The Project Area is mostly forested but does support other habitats including wetlands, abandoned agricultural land, disturbed habitats and sea cliffs. Table 4.5 lists the habitats present in the Project Area and the areas of each habitat type. Figure 4.2a presents the distribution of habitats in the wind farm site development area while Figure 4.2b presents the distribution of habitats along the proposed transmission line route.

Table 4.5 Habitat Types found in the Project Area

Habitat Type	Area (ha)	Proportion of Total Habitat Area (%)
Softwood Forest	388	33.3
Mixedwood Forest	237	20.3
Hardwood Forest	9.53	0.82
Natural Stand	22.8	1.96
Treated Stand	22.7	1.95
Clear-cut	333	28.6
Dead Stand	0.80	0.07
Tall Shrub Thicket	43.7	3.75
Old Field	1.75	0.15
Agriculture	44.1	3.78
Barrens	1.50	0.13
Beach	1.19	0.10
Cliff, Dunes, Coastal Rock	3.16	0.27
Gravel Pit	3.33	0.29
Road Corridor	0.75	0.06
Urban	7.97	0.68

Table 4.5 Habitat Types found in the Project Area

Habitat Type	Area (ha)	Proportion of Total Habitat Area (%)
Wetland	44.1	3.78
Inland Water	0.01	0.001

Forests in the Study Area consist mainly of softwood stands (388 ha, 33% of the Project area) and mixedwood stands (237 ha, 20% of the Project area). Mixedwood stands are mostly found along the Bay of Fundy coast along well drained ridge crests (Figure 4.2a). These stands are dominated by red maple (*Acer rubrum*), yellow birch (*Betula allegheniensis*), red spruce (*Picea rubens*), and balsam fir (*Abies balsamea*).

Softwood stands are most frequently encountered at lower elevations particularly in areas where soils are imperfectly drained or in areas that have been used for agriculture in the past. Areas that have been previously cleared for agriculture support stands composed mainly of white spruce (*Picea glauca*) and balsam fir. Red spruce (*Picea rubens*) and balsam fir are the dominant species in stands that have not developed on abandoned agricultural land.

Much of the Project Area (333 ha, 29%) has been harvested for timber in the last twenty years. Most of the harvesting appears to have occurred within the last five years. The presence of old woods roads suggests that timber harvesting has been conducted in the area for many decades. The intact forested areas are secondary growth forests with species composition typical of mainland Nova Scotia. Vascular plant diversity, based on vascular plant surveys conducted in 2008 and an Atlantic Canada Conservation Data Center Search for the area, is considered moderate (refer to Section 4.3.2).

Wetland habitat is not particularly abundant in the overall Study Area owing to the rolling topography. A total of 65 wetlands are present in the Project Area. These wetlands comprise 44 ha (4%) of the Project area. Most wetlands are small but a few large wetlands are present mainly at the southern and eastern ends of the Study Area which are situated at the bases of long slopes. Most wetlands in the Study Area are tall shrub dominated swamps dominated by speckled alder (*Alnus incana*) or mixedwood treed swamps characterized by a cover of red maple, white ash (*Fraxinus americana*), balsam fir and black spruce (*Picea mariana*). Some bog habitat is present in the southern portion of the Study Area and salt marsh and brackish marsh habitat is present near the southwestern corner of the Study Area (refer to Section 4.3.3 for more information on wetlands).

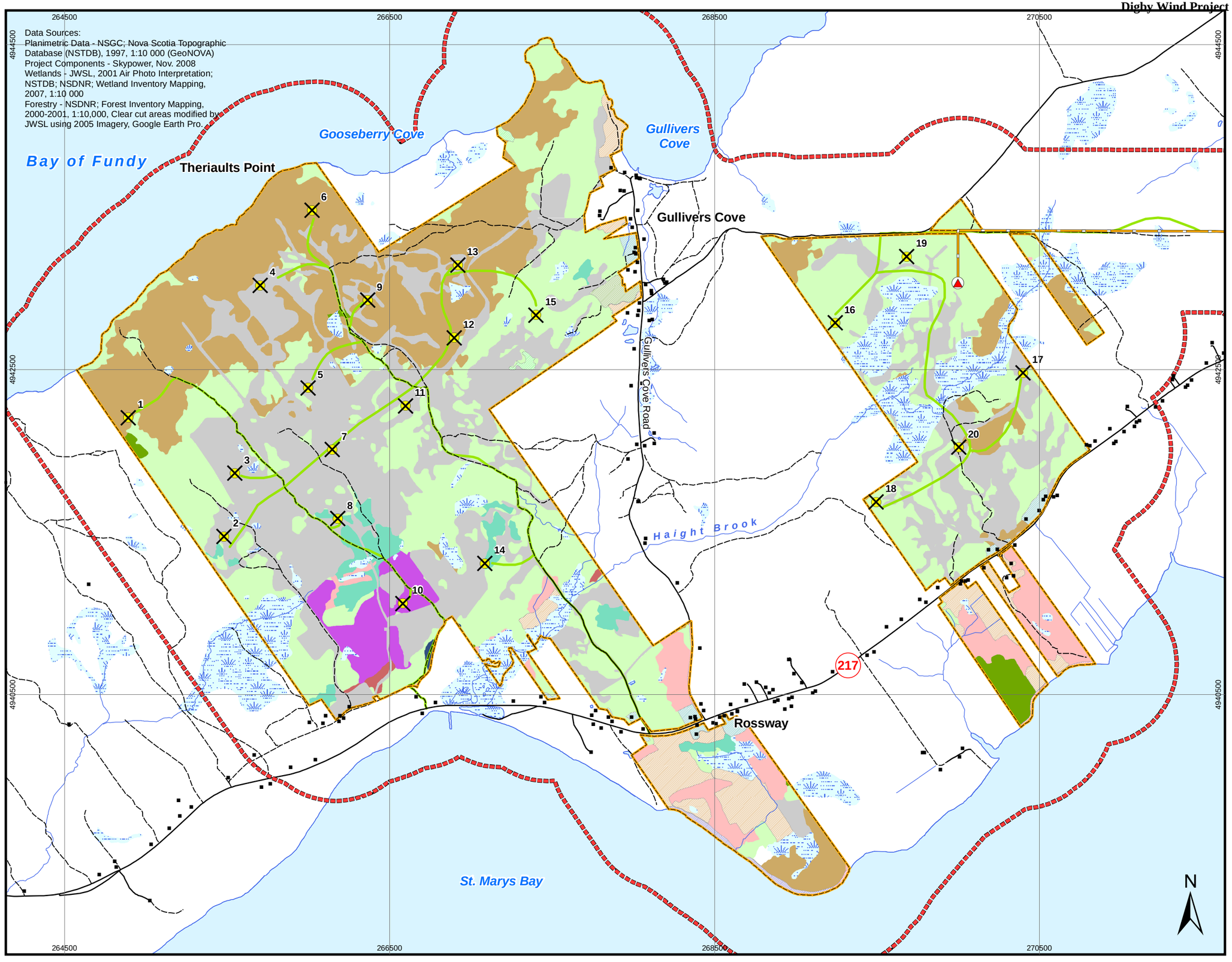


Figure 4.2a

DIGBY WIND POWER PROJECT

Habitat Map

Wind Farm Site

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Study Area
- Proposed Site Development Area
- Watercourse
- Wetland
- Waterbody

Main Forested Land Cover

- Softwood - 75% softwood species
- Mixedwood - 74-26% softwood species
- Hardwood - < 25% softwood species

Other Forested Land Cover

- Natural Stand
- Treated
- Old Field
- Dead
- Tall Shrub Thicket
- Clear Cut

Non-Forested Land Use

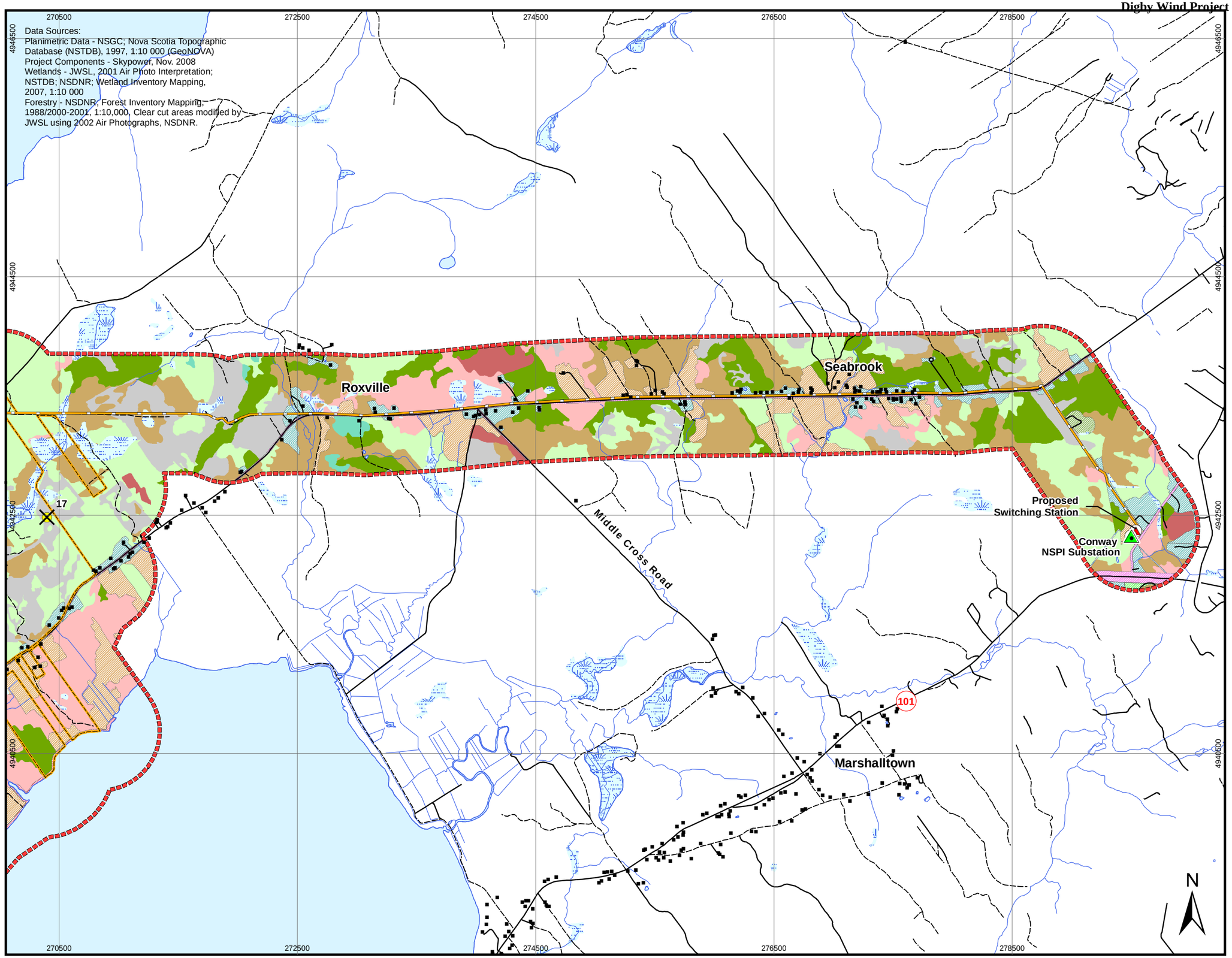
- Cliff, Dunes, Coastal Rock
- Barren
- Agriculture
- Urban
- Beach
- Gravel Pit
- Road Corridor

0 300 600 900 1,200

Meters

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec



SKYPOWER

Figure 4.2b

DIGBY WIND POWER PROJECT

Habitat Map

Transmission Line

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Existing NSPI Sub- Station
- Proposed Transmission Route Nov. 28-08
- Study Area
- Proposed Site Development Area
- Watercourse
- Wetland
- Waterbody

Main Forested Land Cover

- Softwood - 75% softwood species
- Mixedwood - 74-26% softwood species
- Hardwood - < 25% softwood species

Other Forested Land Cover

- Natural Stand
- Old Field
- Tall Shrub Thicket
- Clear Cut

Non-Forested Land Use

- Barren
- Agriculture
- Urban
- Beach
- Gravel Pit
- Powerline Corridor
- Road Corridor

0 300 600 900 1,200

Meters

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:30,000
Date: April 2009
Project No.: 1030972.01

Stantec

Forty-four hectares of active agricultural land is present in the southern part of the Project Area along the shores of St. Mary's Bay. Old field habitat is present at various locations in the Project Area but is most frequently encountered along public roads where agricultural activity has persisted the longest. Approximately 2 ha of old field habitat is present in the Project Area. Tall shrub thickets composed mainly of speckled alder and green alder (*Alnus viridis*) are present at a number of locations where old fields have begun to revert to forest. These stands comprise 44 ha (4%) of the Project Area.

Sea cliffs are present along the northern and southern margins of the Study Area. The highest cliffs are present along the northern margin. These areas have high potential to harbour rare plant species, however, since this habitat type will not be affected by construction and operation of wind turbines, no sampling was conducted in this habitat type.

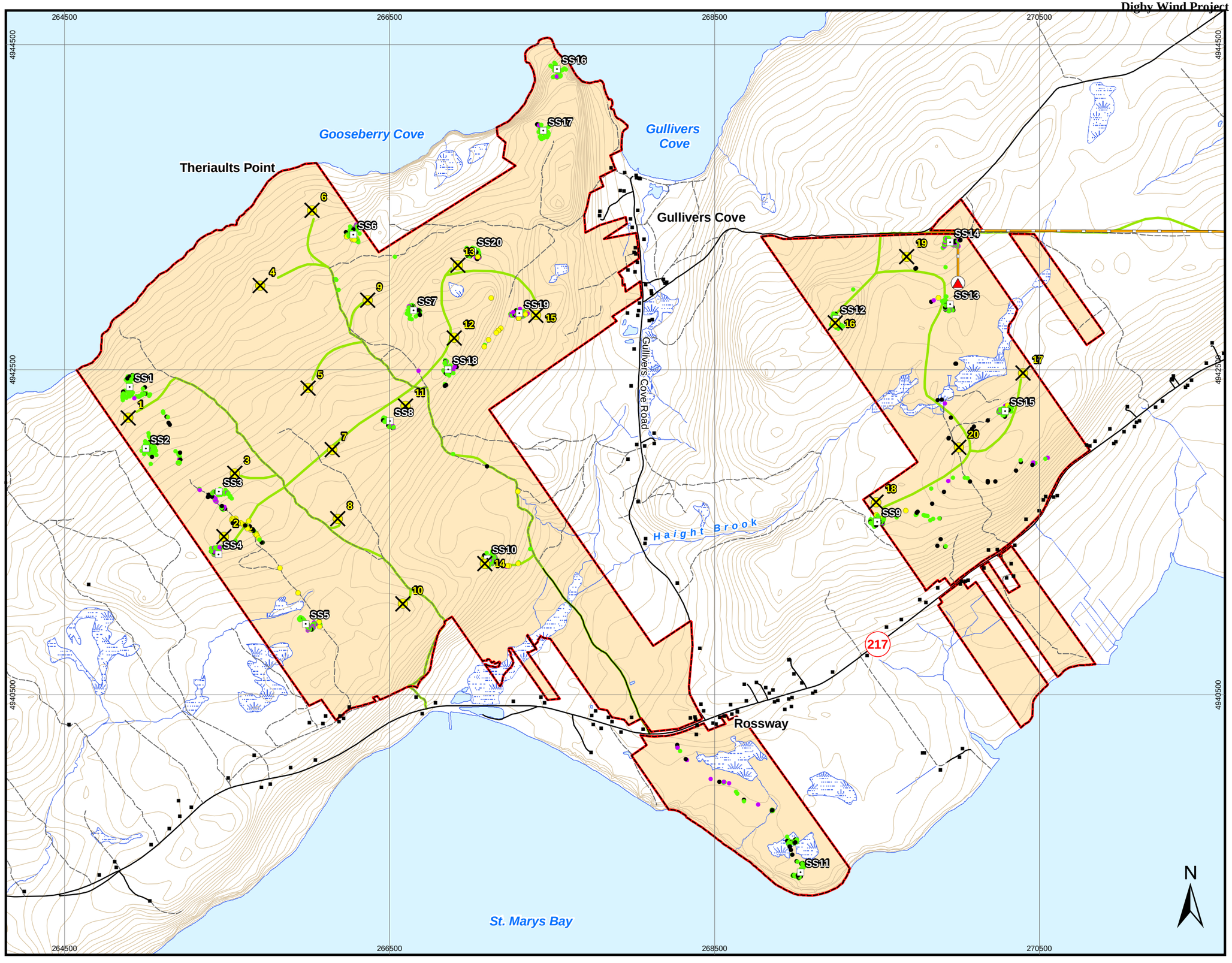
4.3.2 Rare Plants and Species Richness

Rare plants and floral species richness in the Study Area was described using a combination of desktop and field surveys. Prior to conducting field surveys, aerial photography of the site was reviewed to determine the types and distribution of various habitats within the area. The air photo interpretation exercise was used to assist in a rare plant modeling exercise.

The rare plant modeling exercise was performed to determine the likelihood of presence of rare or sensitive plants within the Study Area. As part of the modelling exercise, all records of vascular plant species listed by the Nova Scotia Department of Natural Resources (NSDNR) as at risk (Red listed) or sensitive to human activities or natural events (Yellow listed) (NSDNR 2007) within a radius of 100 km of the Project site were compiled by means of an Atlantic Canada Conservation Data Centre (ACCDC) data search. The habitat requirements of these species were compared to the habitat descriptions compiled for the Study Area to determine if suitable habitat was present for these species. In instances where appropriate habitat was present for a particular species, that species was considered to be potentially present and the suitable habitat in the Study Area was identified as a target for field surveys. The phenology and ease of identification of each of the species potentially present in the area was also incorporated into the model in order to determine the best times to conduct the field surveys. Based on the results of the habitat model, 20 Red and 29 Yellow-listed species could potentially be present in the Study Area. Table C1 in Appendix C lists these species and their habitat preferences.

Vegetation surveys were conducted by experienced Jacques Whitford Stantec Limited botanists on June 3 to 7, and August 12 to 13, 2008. Figure 4.3 shows the survey sites (SS) relative to the current proposed turbine layout.

The June and August survey periods were sufficient to capture the flowering periods of all but five of the red and yellow listed plants identified in the model. During these early surveys, flowering green ash (*Fraxinus pennsylvanica*), round-leaved liverwort (*Hepatica nobilis*) and silky willow (*Salix sericea*) were not encountered. However, all of these species were readily identified by the botanists based on their fruit and vegetative characteristics. Case's ladies' tresses (*Spiranthes casei*) and yellow nodding ladies'-tresses (*Spiranthes ochroleuca*) both flower in September. These species could be present in the Study Area but were not detected. Habitats where these species would be most likely to be found would include disturbed areas such as woods roads, disturbed portions of abandoned pasture, ditches, and skidder ruts.



SKYPOWER

Figure 4.3

DIGBY WIND POWER PROJECT

Terrestrial Plant Survey Results

Survey Observations

ACCDC Ranking

- Undetermine
- Exotic
- Green
- Yellow

Project Components

- Survey Site Location (Previous Turbine Layout - May, 2008)
- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Transmission Route Nov. 28-08
- Proposed Turbine Access Road
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec

All species of vascular plants encountered during the surveys were identified and their population status in Nova Scotia was determined through a review of the species status reports prepared by NSDNR, ACCDC, and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A list of the 334 vascular plant species found on the site is presented in Appendix C. Species richness in the Study Area is relatively high. This is attributable mainly to the large size of the Study Area as well as the presence of forest stands in a variety of successional stages. The Study Area has been subjected to a substantial amount of disturbance in the form of past agricultural activity and more recently large scale timber harvesting. These disturbances have contributed to increased species richness by allowing ruderal species (*i.e.,* species growing in poor, disturbed land) to become established. Many of these ruderal species are non-native plant species that have become established in Nova Scotia following European settlement of the area. Sixteen percent of the species recorded in the Study Area are non-native species. This proportion of non-native species richness is similar to levels observed in other areas Nova Scotia that have a history of European occupation.

The plant species composition of the Study Area suggests a moderately productive site. Species characteristic of very fertile sites were not present, and species such as ericaceous shrubs that are abundant on infertile acidic sites were not well established in the Study Area.

Two of the species identified as potentially present in the Study Area by the rare plant modelling exercise were found on the property during the field surveys: Swan sedge (*Carex swanii*) and American pennyroyal (*Hedeoma pulegioides*). Both of these species are Yellow listed by NSDNR indicating that the Nova Scotia population is considered to be sensitive to human activities and natural events. ACCDC lists Swan sedge as S2? indicating that it is believed to be rare in Nova Scotia but there is some uncertainty regarding its population status. American pennyroyal is listed as S2S3 by ACCDC indicating that the species is considered to be rare to uncommon in Nova Scotia.

Swan sedge was noted at 20 locations in the Study Area including 11 of the 20 survey sites. Between 1 and 20 clumps of Swan sedge were found at these locations. This species was found mainly in young clearcuts where there was little overhead plant cover. A few plants were found in mature mixedwood forest, however, they were growing near the edge of a recent clearcut and the plants may have derived sufficient insolation from side lighting from the clearcut. The information collected during the field survey suggests that Swan sedge is widely distributed and relatively abundant in the Study Area. It can be expected to be encountered in recently harvested areas throughout the Study Area.

American pennyroyal was recorded at 36 locations in the Study Area, largely in the western portion. Several thousand plants were encountered during the field survey. American pennyroyal was found growing on disturbed sandy or gravelly sites generally along woods roads. It was also found in a gravel pit, along skidder trails in light soil and in heavily disturbed areas in clearcuts. Like Swan sedge, this species appears to be relatively abundant and widely distributed throughout the Study Area. It tends to be associated with linear features such as roads more so than Swan sedge.

Four species that have been listed by NSDNR as status “Undetermined” were encountered during the field survey including Appalachian polypody (*Polypodium appalachianum*), Hickey’s clubmoss (*Lycopodium hickeyi*), narrow-leaved sundrops (*Oenothera fruticosa*), and New England Blackberry (*Rubus setosus*). Status Undetermined indicates that there is insufficient information available to assess the population status of a particular species. For all four of these species the uncertainty regarding the population status of the species in Nova Scotia derives from confusion regarding the taxonomy of these species.

Until recently, Appalachian polypody and Hickey’s clubmoss were considered to be varieties of common species. Appalachian polypody was a variety of rock polypody (*Polypodium virginianum*) while Hickey’s clubmoss was a variety of tree clubmoss (*Lycopodium obscurum*). In addition, these new species are difficult to distinguish from the species that they were originally varieties of, making it more difficult to assess the population statuses of the new species. Until a sufficient number of new records of these species have been compiled or old specimens have been re-examined, the general status ranks of these two species will remain as undetermined.

The status of narrow-leaved sundrops is uncertain due to the possibility that some or all of the population is derived from a non-native population. New England blackberry has an undetermined status due to the fact that blackberry species hybridize frequently making it difficult to assign specimens to species. In addition the taxonomy of the genus Rubus has undergone substantial changes in recent years creating considerable confusion regarding the population statuses of many species in this genus.

Appalachian polypody was found at one location in the Study Area at SS16 near Gulliver's Cove. A small population of this species was found growing on an exposed boulder. Cliff faces and boulders are the typical habitats for this species. The current turbine layout does not include any turbines in this area.

Hickey's clubmoss was found in a small remnant stand of mature mixedwood forest found on a steep slope at SS18 (south of Turbine 12). Hickey's clubmoss occurs in a variety of forest types in Nova Scotia although it is most frequently encountered in second growth mixedwood and deciduous forests.

Narrow-leaved sundrops were found at 12 locations in the Study Area during the field surveys. The number of plants encountered was estimated to be approximately 50 plants. This species is generally associated with old fields, the edges of thickets and along the edges of roads. It is typically found on dry or sandy soils. In the Study Area, narrow-leaved sundrops were found along the edges of woods roads in the eastern half of the Study Area (Figure 4.2).

New England blackberry typically grows on open or poorly drained soils in disturbed areas. In the Study Area it was found at one location along the edge of a woods road at the western end of the Study Area.

Four species were encountered during the field surveys that are listed as uncommon by ACCDC but are considered to be secure (Green listed) in Nova Scotia by NSDNR. These include panicled hawkweed (*Hieracium paniculatum*) deer-tongue witchgrass (*Dichanthelium clandestinum*), Pennsylvania blackberry (*Rubus pensilvanicus*), and arrow-leaved violet (*Viola sagitatta*).

Panicled hawkweed generally grows in mixed or dry deciduous forest. It is most frequently associated with oak. In the Study Area it was found in a recent clearcut at SS8 (Turbine 11).

Deer-tongue witchgrass is typically associated with rich alluvial soils in thickets along rivers. In the Study Area it was found at two locations (SS6 and SS7) in the northern portion of the Study Area growing in recent clearcuts.

Pennsylvania blackberry is typically found in thickets, the edges of woods and in clearings. In the Study Area it was found growing on the banks of a drainage ditch in old field habitat at SS11.

In Nova Scotia, arrow-leaved violet is typically found growing on dry soils in woods, clearings and fields. Its distribution in Nova Scotia is focused mainly in the Annapolis Valley. Arrow-leaved violet was found at eight locations in the Study Area (Figure 4.2). Most plants were found growing in cracks in bedrock outcrops and along woods roads.

Follow-up plant surveys will be conducted in 2009 to assist with micrositing of turbines and access roads.

4.3.3 Wetlands

The distribution and abundance of wetlands in the Study Area was determined through a review of the Nova Scotia Wetland Atlas database and air photo interpretation. Air photo interpretation, using 1:10 000 scale colour air photos taken in 2001, was conducted within the properties that comprise the wind farm site and within a 200 m buffer extending on either side of the proposed transmission line route. This exercise was conducted by a wetland ecologist familiar with the Project area and experienced in delineating wetlands. Wetlands were identified using topographic location and the physiognomy of the plant communities. A conservative approach was used for delineating the wetlands in order to capture transitional wetland habitat such as treed swamps that are often present at the edges of wetlands. These swamps are often difficult to detect on air photos since they are similar in appearance to adjacent upland forest habitat. This conservative approach increases the probability

of misclassifying terrestrial habitat as wetland habitat but also reduces the likelihood of missing wetland habitats that are present or underestimating the sizes of wetlands in the Project Area.

Wetlands detected during the air photo interpretation were classified using the Canadian Wetland Classification System (National Wetlands Working Group Canada 1987). This system categorizes wetlands into five general types, bogs, fens, marshes, swamps, and shallow water wetlands based on characteristics of vegetation, substrate and hydrology. In the Canadian Wetland Classification System, modifiers are used to further define the wetland. These include wetland morphological descriptors and vegetation descriptors. Only vegetation descriptors were used as modifiers for wetlands detected using air photo interpretation since vegetation type was visible on the air photo but morphological features such as the presence of streams or springs were not always visible. In instances where more than one wetland type was present in a particular wetland, the wetland was classified as a wetland complex.

The air photo interpretation exercise revealed the presence of 65 wetlands in the Project Area (Figure 4.1a and 4.1b). Wetland types present included low shrub bog, treed bog, coniferous treed swamp, deciduous treed swamp, mixedwood treed swamp, tall shrub swamp, low shrub swamp, fresh marsh, salt marsh, brackish marsh, and shallow water wetland (refer to Appendix D, Table D1). The most abundant wetland types in the Study Area are tall shrub swamp (present in 37% of wetlands), mixedwood treed swamp (present in 21% of wetlands) and fresh marsh (present in20% of wetlands). In regards to total area of wetland by wetland type, wetland complexes, coniferous treed swamp and mixedwood treed swamp accounted for 54% of the wetland area. Wetland complexes consist of mixtures of various wetland types. Most of the largest wetlands in the Project Area were wetland complexes (Wetlands 3, 37, 44, 80, and 81). This is to be expected since the larger wetland basins provide a wide variety of hydrological, morphological and fertility conditions that can promote the development of various wetland types within the same basin.

Most wetlands in the Project Area are relatively small; 71% of the wetlands are less than one hectare in size. Eight wetlands are between one and two hectares and 11 wetlands are greater than two hectares in size. The largest wetlands are located in the southern and western parts of the Project Area (Wetlands 3, 5, 27, 37, 44, 46, 80 and 81) where large areas of relatively flat terrain are present which allows poorly drained conditions to develop. Wetlands are scattered about the southwestern part of the Project Area where there is greater relief however, these wetlands tend to be small.

Each of the wetland types present in the Project Area is discussed below, followed by a description of wetland functions.

4.3.3.1 Wetland Types

Bogs

Bogs are peatlands in which the water table is situated at or near the surface. The rooting zone is typically isolated from nutrient rich groundwater resulting in the development of an acidic and nutrient impoverished environment that promotes the growth of sphagnum moss. Sphagnum moss is effective at scavenging available cation nutrients which it replaces with hydrogen ions to maintain an ionic balance. This further increases the acidity of the wetland which greatly reduces decomposition rates leading to the accumulation of peat. Bogs are uncommon in the Study Area and are restricted to three of the 65 wetlands (Wetlands 44, 46 and 80). They are typically restricted to flat low lying areas where groundwater discharge is limited.

Low shrub bog and treed bog are the bog types that are present in the Project Area. Low shrub bog is typically found in the centers of the bogs where conditions are wetter and particularly nutrient deficient. These areas also represent an earlier stage in plant community succession on the bog. The dominant species of this bog type are sphagnum moss (*Sphagnum* spp.), sheep laurel (*Kalmia angustifolia*), pale laurel (*Kalmia polifolia*), leatherleaf (*Chamaedaphne calyculata*), and rhodora (*Rhododendron canadense*).

Treed bog is typically found around the landward margin of the bogs. These areas represent a later stage in plant community succession on the bog and are also situated close enough to sources of groundwater to be somewhat more fertile than the center of the bog. This bog type differs from the low shrub bog mainly in the

presence of an open tree canopy composed mainly of stunted black spruce (*Picea mariana*) and American larch (*Larix laricina*).

Swamps

Swamps are mineral wetlands or peatlands with standing water or water flowing slowly through pools or channels. The water table is generally at or near the surface of the swamp. There is internal water movement from the margin of the swamp or from other sources of mineral enriched waters. If peat is present, it consists mainly of well-decomposed wood, underlain at times by sedge peat. The vegetation typically consists of a dense cover of trees or shrubs, herbs and some mosses.

Five types of swamp are present in the Project Area including: mixedwood treed swamp; coniferous treed swamp; deciduous treed swamp; tall shrub swamp; and low shrub swamp. Mixedwood treed basin swamps situated in areas of moderate fertility in Nova Scotia such as the Project Area are characterized by a tree canopy dominated by red maple (*Acer rubrum*), balsam fir (*Abies balsamea*) and black spruce. The shrub understory of this wetland type is typically composed largely of speckled alder (*Alnus incana*), black holly (*Ilex veticillata*) and mountain holly (*Nemopanthus mucronata*).

Coniferous treed basin swamps in southwestern Nova Scotia typically have a tree layer composed largely of black spruce and balsam fir with scattered tamarack (*Larix laricina*) and red maple. The shrub understory is similar in species composition to mixedwood treed basin swamp.

Deciduous treed basin swamps are characterized by a tree canopy composed largely of red maple and white ash (*Fraxinus americana*). The shrub layer is typically dominated by a mixture of speckled alder, red maple saplings, narrow-leaved meadowsweet (*Spiraea alba*), and black holly.

Tall shrub basin swamps typically have a diffuse tree canopy composed largely of red maple, white ash, balsam fir, and black spruce. The shrub understory consists of a moderately dense shrub layer dominated by speckled alder, black holly and narrow-leaved meadowsweet.

Low shrub swamp is typically found in very wet areas and often forms a transition zone between marsh habitats and tall shrub swamp. The shrub layer is typically dominated by narrow-leaved meadowsweet , sweet bayberry (*Myrica gale*) and leatherleaf. Stunted speckled alder are often mixed in with these species.

Marshes

Marshes are mineral wetlands or peatlands that are periodically inundated by standing or slow flowing water. Surface water levels generally fluctuate seasonally. During drier periods declining water levels may expose areas of matted vegetation or mud flats. The surface waters are typically rich in nutrients. The substrate is usually mineral material although well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation, bordering wet meadows and peripheral bands of shrubs or trees.

Fresh marsh, salt marsh and brackish marsh are marsh types present in the Study Area. Fresh marsh habitat occurs in a variety of locations including riparian areas, anthropogenic (human-made) basins, seepage tracks and at the landward edge of brackish marshes. Plant species composition is highly variable depending on the hydrology and successional status of the marsh. Marshes found along streams often support a dense sward of blue-joint reedgrass (*Calamagrostis canadensis*). Fresh marshes that have developed in anthropogenic basins or in disturbed wetland habitat typically support a mixture of graminoid species including broad-leaved cat-tail (*Typha latifolia*), cottongrass bulrush (*Scirpus cyperinus*) and rushes (*Juncus* spp.). Most fresh marshes support a sparse shrub layer composed mainly of speckled alder and narrow-leaved meadowsweet.

Salt marsh is restricted to Wetland 37, a large wetland complex located on the southern edge of the Project Area. It occurs along the southern half of the wetland where seawater regularly enters the wetland from St. Mary's Bay. The vegetation of this wetland type is characterized by a dense grass sward dominated by saltwater cordgrass (*Spartina alterniflora*) and salt-meadow cordgrass (*Spartina patens*).

Brackish marsh occurs on the landward side of the salt marsh habitat in areas that are only occassionally inundated by seawater. Brackish marsh vegetation is dominated by a mixture of grasses, sedges, bulrushes, and rushes. Some of the more abundant species include freshwater cordgrass (*Spartina pectinata*), chaffy sedge (*Carex paleacea*), soft-stem bulrush (*Scirpus validus*), and black-grass rush (*Juncus gerardii*).

Shallow Water Wetlands

Shallow water wetlands are characterized by the presence of open expanses of shallow water that are less than 2 m deep in summer and occupy greater than 75% of the surface area of the wetland. Shallow water wetlands typically support a heavy growth of submerged aquatic plants such as pondweeds (*Potamogeton* spp.) or floating leaf aquatic plants such as yellow pond-lily (*Nuphar variegata*) and American water-lily (*Nymphaea odorata*). Shallow water wetlands are uncommon in the Project Area and are generally restricted to anthropogenic basins such as fire ponds and impoundments.

4.3.3.2 Wetland Functions

Wetlands provide a number of functions including water flow moderation, groundwater recharge, shoreline and erosion protection, climate regulation, water quality treatment, nutrient and organic export, carbon sequestration and storage, and biological productivity and support for biodiversity. In instances where wetlands are adversely affected by a development, the functions associated with the affected wetland must be assessed as part of the wetland functional analysis. The wetland functional analysis is used to determine the functional attributes of the potentially affected wetland so that its value can be assessed. This assessment is then used to first determine whether permission to alter the wetland can be granted and second to determine what wetland functions must be recreated as part of a wetland compensation program, should permission to alter the wetland be granted.

SkyPower has committed to avoiding wetlands to the extent possible through detailed design of the Project components. While it was not feasible to conduct wetland functional analyses on all 65 wetlands located within the Project Area, in the event that the Project is likely to affect wetland habitat, site specific wetland functional analyses will be conducted by a qualified wetland ecologist for the potentially affected wetlands in the summer of 2009, prior to any wetland disturbance. These analyses would be used to support application for Water Approvals for wetland alteration.

The following provides general observations of the functionality of wetlands in the Project Area, based on aerial photography and general knowledge gained from the terrestrial field surveys.

Water Flow Moderation

Watercourses in the Study Area are short so the magnitude of potential flooding is low. Haight Brook is the longest watercourse in the Study Area and has the greatest potential for flooding. Two large wetlands (Wetlands 5 and 80) are located at the headwaters of this stream. These wetlands have potential to moderate stream flow by slowing the flow of water and by temporarily storing surface water.

Groundwater Recharge

The ability of wetlands to contribute to groundwater recharge is difficult to assess. However, it is possible that some of the small wetlands situated in perched basins near the tops of hills could contribute to local groundwater recharge. The importance of this function in these wetlands would depend on their location. Wetlands such as Wetlands 74 and 76 which lie on slopes facing inhabited areas to the south would have more value than wetlands such as Wetlands 56 and 57 which are located on slopes that are uninhabited and drain into the sea.

Shoreline and Erosion Protection

Some wetlands such as coastal salt marshes and riparian swamps provide effective protection from shoreline erosion. These wetlands are able to absorb energy from waves, tides and flowing water without experiencing extensive damage to vegetation or wetland substrates. Wetland 37 is the only wetland in the Project Area that

is likely to provide this function. It is a wetland complex with a salt marsh component that borders on St. Mary's Bay. The portion of Wetland 37 located south of Highway 217 would be the area most heavily impacted by storm surges, large waves and possibly ice scour. This portion of the wetland is outside of the Project Area and would not be affected by the Project. The northern end of Wetland 37 could be affected by the Project if it is necessary to widen the woods road that crosses the wetland. This is the most quiescent part of the wetland and partial infilling of the wetland in this area would not be expected to adversely affect the ability of the wetland to provide shoreline and erosion protection.

Climate Regulation

Evapotranspiration of water from wetland vegetation and evaporation of water from the surface of the wetland can help to cool areas adjacent to the wetland. The ability of the wetland to perform this function is related to the size of the wetland and the types of vegetation present as well the area of exposed surface water. Marshes and swamps typically have high rates of evapotranspiration while bogs typically have low rates of evapotranspiration. Swamps and marshes are the most abundant wetland types in the Project Area so this may be an important wetland function for many of the wetlands present.

Water Quality Treatment

Some wetlands are quite effective at removing a variety of contaminants from surface water. This includes uptake of nutrients by plants and microbes, conversion of soluble metals to insoluble forms, degradation of organic chemicals, and deposition of solids. In instances where contaminant degradation is mediated by microbes, highly productive wetlands such as marshes and swamps typically perform better than unproductive wetlands such as bogs. The ability of a wetland to facilitate water quality treatment is dependent on various factors including the degree of channelization of flow through the wetland, degree of water flow through the substrate, the amount of oxygen in the water, and water temperature. The value of this function is dependent on two factors which include the ability of the wetland to perform and whether or not the wetland currently performs this function. It is likely that marshes and swamps in the Project Area have the capacity to facilitate water quality treatment; however, the Project is located in a relatively uncontaminated area so most wetlands probably do not currently perform this function. Possible sources of contaminants in the Project Area would include sediment inputs from woods roads and nutrient inputs from agricultural areas and septic fields. As such, wetlands (particularly marshes and swamps) located down gradient from woods roads, farms and houses would have the greatest potential to be performing this function.

Nutrient and Organic Export

Wetlands can be sources of nutrients and organic matter for downstream aquatic ecosystems. Peatlands such as bogs that are located at the headwaters of streams can export substantial amounts of organic matter although they typically act as sinks for nutrients. Productive wetlands such as marshes and swamps can also act as nutrient sinks but may export organic matter seasonally when vegetation senesces, dies and decomposes. Salt marshes can be particularly important in providing organic matter to adjacent marine ecosystems. Most wetlands found in the Project Area that are hydraulically linked to downstream freshwater or marine ecosystems can be expected to provide this function to varying degrees. The importance of the function would be related to the size of the wetland and the ability of nutrients and organic matter to flow through the system.

Carbon Sequestration and Storage

Wetlands can act as both sinks and sources for green house gases. Peatlands such as bogs and fens can be important carbon sinks by storing large volumes of organic matter in the form of peat. Marshes and swamps that remain saturated throughout the year also tend to accumulate peat and also act as carbon sinks. Wetlands with large seasonal water level fluctuations such as experienced by many marshes are typically poor at sequestering carbon since exposure of the substrate to air during draw down periods promotes rapid decomposition of organic matter deposited in the sediment. In the Project Area, wetlands contain bogs elements such as Wetlands 44, 46 and 80 as well as the salt marsh component of Wetland 37 would be

expected to function highly in regards to carbon sequestration. The larger swamps such as Wetlands 3, 5, 27, and 81 would also be expected to function highly in this regard.

Biological Productivity and Support for Biodiversity

Wetlands provide habitat for a wide variety of plants and animals. Some wetlands are highly productive and support very high numbers of species or particularly high abundances of a few species. Other wetlands provide uncommon habitat types that support rare species that cannot survive in other habitats. The value of a wetland in regards to biological productivity and biodiversity cannot be accurately assessed without conducting site specific surveys; however, there are some general patterns that can be used to help identify wetlands that may have high functionality in regards to biological productivity and biodiversity. Typically, larger and more fertile wetlands support larger numbers of species and are more productive. Uncommon habitat types tend to support greater numbers of rare species than common habitat types. Hostile environments often support highly specialized species that cannot persist in more benign environments and are therefore rare or geographically restricted in their range. Based on these assumptions, several wetlands in the Study Area can be expected to support high species richness, have high potential to support rare species or be highly productive. Wetlands that have high potential to support rare species include Wetlands 37, 44, 46, and 80. Wetlands that have high potential to have high species richness include Wetlands 3, 5, 27, 37, 44, and 81. Wetlands likely to be highly productive would include Wetlands 21, 37 and 80.

4.4 Birds and Other Wildlife

4.4.1 Birds

The Study Area contains land features that may concentrate birds including shorelines, cliffs, and ridges. The Project Area itself is predominantly forested (60% of wind farm site), although approximately 34% of the site is characterized as disturbed (*e.g.,* clear cut, agriculture, gravel pit, roads) (refer to Section 4.3.1 for more information on habitats in the Project Area).

Information on the distribution and abundance of birds in the Study Area was derived from field surveys, publicly available documents and other sources. The methodologies and results of desktop and field studies conducted in support of the Project are described in the following sections.

4.4.1.1 Desktop Studies

An important source of information is the Maritimes Breeding Bird Atlas (MBBA) database (Erskine 1992 and updates), which contains a summary of bird distribution and abundance across the Maritime Provinces of Canada. The MBBA data was used to provide a general inventory of breeding birds in the vicinity of the Study Area. The MBBA also provides a list of bird species of special conservation concern which may be present in the Study Area. The Study Area includes parts of two Maritime Breeding Bird Atlas (MBBA) map squares: 20KQ64 and 20KQ74. In the first breeding bird atlas (1986-1990) (Erskine 1992), there was no data collected in square 20KQ64, and the limited efforts from the first three years of the second breeding bird atlas (2006-2010) have only revealed two species with a probable breeding status: Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni*) and Alder Flycatcher (*Empidonax alnorum*). Neither species is considered to be of conservation concern in Nova Scotia and neither species was recorded during the bird surveys conducted in the Study Area for the Project.

In the first breeding atlas there were 90 bird species possibly, probably, or confirmed breeding in square 20KQ74, and in the initial years of the second breeding atlas, 38 bird species have been identified as possibly, probably, or confirmed breeding in this square. To-date, observations for the second breeding atlas have not revealed any breeding species that were not recorded in 1986-1990.

According to MBBA data, species observed or heard singing in suitable nesting habitat are classified as possible breeders. Species exhibiting the following behaviours are classed as probable breeders:

- courtship behaviour between a male and female;

- birds visiting a probable nest site;
- birds displaying agitated behaviour; and
- male and female observed together in suitable nesting habitat.

Species are confirmed as breeding if any of the following items or activities were observed:

- nest building or adults carrying nesting material;
- distraction display or injury feigning;
- recently fledged young;
- occupied nest located; and
- adult observed carrying food or fecal sac for young.

A review of the ACCDC database was conducted to obtain a list of provincially rare or sensitive bird species found within a 100 km radius of the Project Area. ACCDC provides information on species and ecological communities that require consideration for their conservation (ACCDC 2007). The ACCDC listing and ranking system is useful since it provides a georeferenced outlook on rare or sensitive species and habitats. The ACCDC list, however, is generated on a radius that is considered to be in excess of the ecological footprint of the Project. A model was therefore employed by the Study Team to determine the likelihood of the presence of the ACCDC ranked bird species within the Project Area. Likelihood of presence was determined by crosschecking the habitat requirements of the ACCDC listed species with the habitat description within the Study Area. Table E1 in Appendix E presents the results of the ACCDC search and related modelling exercise.

The model identifies four species of conservation concern that could be present within the Study Area, namely: Peregrine Falcon (*Falco peregrines anatum*), Northern Goshawk (*Accipiter gentilis*), Long-eared Owl (*Asio otus*), and Harlequin Duck (*Histrionicus histrionicus*).

4.4.1.2 Field Surveys

A pre-construction (baseline) bird monitoring program was conducted by a local naturalist experienced in bird identification between November 2007 and October 2008. The scope of the monitoring program and the survey protocol used was based on previous protocols developed in consultation with the Canadian Wildlife Service (CWS), as well as Environment Canada's Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (Environment Canada 2007). Bird surveys conducted included fall and spring migration surveys, breeding bird surveys and surveys of overwintering bird activity in the Project Area. The monitoring protocol and summary of survey results are provided in Appendix E. Weather conditions recorded during each site visit are included in Table E2 of Appendix E.

Breeding Birds

Breeding surveys, consisting of point counts and standardized area searches, were conducted for this assessment in June, July, and early August of 2008. A total of nine breeding bird surveys were conducted over this period, with each survey lasting 4 hours; this exceeded requirements of the proposed protocol (refer to Appendix E) which provided only two surveys. A total of 56 bird species were recorded during these surveys (refer to Table E3 in Appendix E).

A variety of raptors were recorded in the Study Area during the breeding season, including Broad-winged Hawk (*Buteo platypterus)*, Red-shouldered Hawk (*Buteo lineatus)* Red-tailed Hawk (*Buteo jamaicensis)*, Rough-legged Hawk (*Buteo lagopus*) Sharp-shinned Hawk (*Accipiter striatus)*, Turkey Vulture (*Cathartes aura)*, Merlin (*Falco columbarius)*, and Peregrine Falcon (*Falco peregrinus anatum)*. Breeding activity could not be confirmed for any of these raptors, with the highest confirmed breeding status for any of these species determined to be "Probable" (Peregrine Falcon). No raptor nests were found in the Study Area.

Red-shouldered Hawk is considered an accidental species in Nova Scotia and is not likely to be breeding in the province. Turkey Vultures have not been recorded as breeding in Nova Scotia but are regularly observed in southern Nova Scotia suggesting that they may already nest in the province. Rough-legged Hawks regularly winter in Nova Scotia and immature birds occasionally spend the summer in the province. The Rough-legged Hawk observed during the breeding bird surveys was probably a non-breeding bird. In the Maritime Breeding Bird Atlas for square 20KQ74, the breeding status for Red-tailed Hawk is listed as possible, and that of Broad-winged Hawk is listed as probable.

A single Peregrine Falcon was observed in June 2008 during vegetation surveys in the Study Area. This species is ranked provincially as “red” and listed as “Threatened” under the *Species at Risk Act*. This species has been recorded by the Brier Island Bird Monitoring Station as occurring on Brier Island between May and October, noting that the number of Peregrines occurring at Brier Island has been increasing steadily over the last 15 years (L. Laviolette, pers. comm. 2009). The bird noted during the June vegetation survey was observed near a cliff face on the headland just west of Gulliver’s Cove. The bird was agitated and circled the observer several times before leaving. This evidence would suggest that there may have been a nest nearby although none was observed.

Notable observations among other bird groups included two species of conservation concern: the Boreal Chickadee (*Parus hudsonicus*), a “yellow” listed species (NSDNR 2007) with three individuals noted during the breeding bird surveys; and the Canada Warbler (*Wilsonia canadensis,)* ranked “yellow” provincially (NSDNR 2007) and “threatened” by COSEWIC (COSEWIC 2008) with only one individual recorded during the breeding season.

The Boreal Chickadee occurs almost entirely in coniferous forests, but is found to a lesser extent in mixed woodlands. The forest habitats utilized by Boreal Chickadees are often damp, well-shaded coniferous woods (Tufts 1986). The Canada Warbler uses a wide range of deciduous, coniferous and mixed forests, with a well-developed shrub layer and a structurally complex forest floor. It is most abundant in moist, mixed forests. It also occurs in riparian shrub forest on slopes and in ravines, in stands regenerating after natural and anthropogenic disturbances and in old-growth forests with canopy openings and a well-developed shrub layer (COSEWIC 2008).

As indicated on Figures 4.3a and 4.3b, these habitats do exist in the Study Area, although given the small numbers recorded during the surveys and the extent of fragmented habitat in the Study Area, it is not anticipated that the Project Area provides important habitat for these species. However, given the variety of raptors observed, the probable breeding status of the Peregrine Falcon in the Study Area and the updated turbine layout and transmission line, follow-up breeding bird surveys will be conducted in June 2009 prior to construction.

Wintering Birds

The abundance and diversity of wintering birds is largely dictated by weather conditions, time of year, available habitat and the biological cycle of each species. Owls, crossbills, and finches dramatically fluctuate in numbers depending upon conditions elsewhere in their ranges. As a result, one may find many individuals of a certain species in one winter and none the next winter.

Wintering bird surveys consisted of standardized area searches at various locations on the study site, conducted monthly for 4 hours. Table E4 in Appendix E summarizes the results from six wintering bird surveys conducted between November 2007 and April 2008. A total of 527 individuals of 30 species were detected over the course of the six surveys.

The most abundant species observed included the Common Redpoll (*Carduelis flammea*) (122 individuals), Black-capped Chickadee (*Parus atricapillus)*, Herring Gull (*Larus argentatus*), Cedar Waxwing (*Bombycilla cedrorum*), and Common Eider (*Somateria mollissima*). Flock sizes were generally quite low, with the exception of Common Redpolls, which were observed in two large flocks in December, and fairly large flocks of Herring Gulls observed in November and December. Birds were most abundant in November and

December, accounting for approximately 70% of the observed individuals during the winter surveys. This was due in part to the large flocks of Common Redpolls observed in December.

Bird species of conservation concern observed in the Study Area during the winter include the Boreal Chickadee and the Harlequin Duck (*Histrionicus histrionicus)*. Boreal Chickadees were observed during five of the six surveys conducted, with a total of 10 individuals being observed. Two Harlequin Ducks were observed during the December survey. Harlequin Ducks are known to winter in parts of the Bay of Fundy and sightings are not uncommon during this time of year. It is expected that this species would not be using the Project Area, but the adjacent marine environment.

Although they will occasionally range across the general area, most of the landbirds that linger in the Study Area during the winter remain close to vegetation cover, which provides shelter, food, and protection from predators. The Project Area does not provide important wintering habitat for birds, and provides foraging habitat similar or lower in quality to that present elsewhere in the Digby Neck area.

Spring Migration

Ten spring migration surveys were conducted between mid-April and the end of May. The surveys consisted primarily of standardized area searches, and were 4 hours in duration. Surveys were conducted once a week during the shoulder period for spring migration and twice a week during the core migration period.

There was a total of 53 species of birds observed during the spring monitoring period, totalling 1,235 individual birds (refer to Table E5 in Appendix E for a summary of spring migration survey results). The majority of birds observed were recorded as flying or residing below 50 metres. The most frequently recorded birds were White-throated Sparrow (*Zonotrichia albiocollis*), Dark-eyed Juncos (*Junco hyemalis*), Black-throated Green Warblers (*Dendroica virens*), Yellow-rumped Warblers (*Dendroica coronata*), and Black-capped Chickadees (*Parus atricapillus*). These species also demonstrated the largest flock sizes relative to the other species observed, although all but one flock of these species were less than 40 individuals. Waterfowl observations were rare, while five species of waterbirds were observed.

Species of conservation concern that were observed during spring migration included three yellow-listed species: Common Loon (*Gavia immer*), Boreal Chickadee (*Parus hudsonicus*), and Gray Jay (*Perisoreus canadensis*) (NSDNR 2007). Common Loons were observed on three separate occasions, totalling 28 individuals, and were observed flying past the site rather than utilizing the site. One Boreal Chickadee was observed on the site in April, and was observed at less than 50 m height. Five Gray Jays were observed over the course of three separate sightings, flying over the site. Turkey Vultures (*Cathartes aura*), an accidental bird species in Nova Scotia, were observed flying over the site on six separate occasions during the spring migration surveys.

There is no evidence of a migratory peak of passage in any of the species or groups (refer to Appendix E).

Fall Migration

Ten fall migration surveys were conducted between late-August and the end of October. The surveys consisted primarily of standardized area searches, and were 4 hours in duration. Surveys were conducted once a week during the shoulder period for fall migration and twice a week during the core migration period (*i.e.,* the first three weeks of September).

There was a total of 57 species of birds observed during the fall migration surveys, totalling 1,199 individual birds (refer to Table E6 in Appendix E). The most frequently recorded birds were White-winged Crossbills (*Loxia leucoptera*), Purple Finches (*Carpodacus purpureus*), Dark-eyed Juncos, American Robins (*Turdus migratorius*), and Herring Gulls (*Larus argentatus*). These species also generally demonstrated the largest flock sizes relative to the other species observed, with the largest flock being a group of 72 Purple Finches. No waterfowl were observed during fall migration, while seven species of waterbird, and six species of raptors were observed.

Species of conservation concern that were observed during fall migration include two yellow-listed species (Common Loon and Gray Jay) and a number of accidental species that are rarely observed in Nova Scotia. A group of four Common Loons was observed on one occasion in October, and two Gray Jays were observed on one occasion in September. Several accidental species were observed, including Pine Warbler (*Dendroica pinus*), Red-bellied Woodpecker, (*Melanerpes carolinus*), Cattle Egret (*Bubulcus ibis*), and Turkey Vultures. These species are not of particular concern to the Project, as they are species that are not commonly found in the area or in Nova Scotia, and are not known to breed in the area or in Nova Scotia.

Likewise with the spring migration, the counts generally show no evidence of major peaks of arrival or departure. Neither was there evidence of major raptor flights over the Study Area during the fall migration period.

Survey Summary

As indicated in Appendix E (McLaren 2009), the survey data suggests that the Project Area is not a major "corridor" or stopover site for waves of migrants arriving or leaving the province. The counts generally show no evidence of major peaks of arrival or departure of the sort observed every spring and autumn on Brier Island, where on some days many hundreds of sparrows, warblers, and other species can be observed near North Point light station. Neither was there evidence of major raptor flights over the Study Area whereas hundreds of Broad-winged Hawks are observed on Brier Island in fall. However, the absence of birds in the study area during the observation period does not preclude birds in nightly transit through the area. It may be that the degraded upland habitat, while suitable for nesting species like seed-eating sparrows and attractive to cone-feeding species (good counts of Purple Finches. White-crossbills, Purple Finches) is not very suitable for insect-fueled night-migrants like flycatchers, vireos, warblers, and *Catharus* thrushes. Post-construction surveys will be used to verify bird use and mortality rates.

4.4.2 Mammals

4.4.2.1 Overview

Nova Scotia is home to 57 species of terrestrial mammal (Davis and Browne 1996). The mammal fauna of Nova Scotia has been altered dramatically since the arrival of Europeans. A number of species have been extirpated, such as the caribou (*Rangifer tarandus*) and the wolf (*Canis lupus*), due to habitat destruction, human encroachment and hunting (Davis and Browne 1996; Banfield 1974). Others species, such as the white-tailed deer *(Odocoileus virginianus)* and coyote *(Canis latrans)*, appear to have benefited from human disturbance, and are relatively recent arrivals to the province (Davis and Browne 1996). The abundant mammal species are generally mobile and widespread in Nova Scotia, and the mammal fauna of the province has not been delineated into distinct communities (Davis and Browne 1996). However, a number of mammal species native to Nova Scotia currently have restricted ranges and exist in disjunct populations.

Information regarding the presence of mammals, including rare species, and sensitive mammal habitat within the Study Area was derived from existing data sources, a review of data for the area obtained from ACCDC and field surveys which were conducted in June and August of 2008.

Habitat types in the Study Area are described in Section 4.3.1. Given the types of habitat present in the Study Area, it can be expected to support a variety of mammal species characteristic of forested and open habitats. However, given the fairly heavily disturbed nature of the habitats and the close proximity of human habitation, it is unlikely that mammal species characteristic of remote areas or large tracts of mature forest such as American Marten (*Martes americana*) and Fisher (*Martes pennanti*) would be present. A discussion with the regional NSDNR biologist confirmed there are no records of these species in the Digby Neck area and that suitable habitat for these species is not likely present (P. MacDonald, pers. comm. 2009).

Evidence of the presence of mammals was collected during the field surveys. This included visual sightings, distinctive calls, tracks, scat, dens, lodges and other distinctive spoor that could be used to identify mammals. A total of 11 mammal species were detected during the field surveys including white-tailed deer, coyote, red fox (*Vulpes vulpes*), American black bear (*Ursus americanus*), racoon (*Procyon lotor*), red-backed vole

(*Clethrionomys gapperi*), woodland jumping mouse (*Napaeozapus insignis*), porcupine (*Erithizon dorsatum*), eastern chipmunk (*Tamias striatus*), American red squirrel (*Tamiasciurus hudsonicus*), and varying hare (*Lepus americanus*) (Table 4.6). None of these species are rare or sensitive to human activities. Table 4.6 also presents a list of mammals that are expected to make use of habitats in the Study Area. All of these species are relatively common in the province; however, two species-- little brown bat (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*) -- are Yellow listed by NSDNR indicating that they are sensitive to human activities and natural events. This general status designation is attributable to the fact that these bats gather in large numbers in a limited number of caves and abandoned mines to hibernate. This concentration of their populations places them at higher risk. These species are discussed in more detail in the following text.

Table 4.6 Mammal Species Recorded in and/or Likely to Occur in the Study Area

Common Name	Binomial	Habitat	NSDNR Ranking	ACCDC Ranking
Little Brown Bat	*Myotis lucifugus*	In summer they inhabit forests, and inhabited areas. Natal colonies often established in houses. In winter they hibernate in caves and abandoned mines.	Yellow	S4
Northern Long-eared Bat	*Myotis septentrionalis*	In summer they inhabit forested areas. In winter they hibernate in caves and abandoned mine shafts.	Yellow	S2
Star-nosed Mole	*Condylura cristata*	Lowlying woods, meadows, marshes, lake and stream banks.	Green	S5
Masked Shrew	*Sorex cinereus*	Wide variety of habitats including forest, fields, wetlands and seashores. Prefers areas with high humidity.	Green	S5
Smoky Shrew	*Sorex fumeus*	Mature deciduous forest and under cover objects along stream banks.	Green	S5
American Water Shrew	*Sorex palustris*	Lakeshores, stream banks and marshes. Can be found in forest habitat in close proximity to shores.	Green	S5
Short-tailed Shrew	*Blarina brevicauda*	Hardwood forest, high humidity and loose humus.	Green	S5
White-tailed Deer	*Odocoileus virginianus*	Forested habitat in various stages of succession. Also wetlands, agricultural land, suburban areas and seashores.	Green	S5
River Otter	*Lutra canadensis*	Rivers, lakes and coastal marine habitats.	Green	S5
Ermine	*Mustella erminea*	Inhabit a wide range of habitats including coniferous and mixedwood forest, stream margins and lake shores.	Green	S5
American Mink	*Mustela vison*	Near waterbodies.	Green	S5
Striped Skunk	*Mephitis mephitis*	Forests, river valleys and agricultural areas.	Green	S5
Bobcat	*Lynx rufus*	Swamps, woodlots, second growth forest and agricultural areas.	Green	S5
Coyote	*Canis latrans*	A wide variety of habitats including forested areas, agricultural areas, wetlands, barrens, and suburban areas.	Green	S5

Table 4.6 Mammal Species Recorded in and/or Likely to Occur in the Study Area

Common Name	Binomial	Habitat	NSDNR Ranking	ACCDC Ranking
Red Fox	*Vulpes vulpes*	Agricultural areas, lakeshores, river valleys, natural clearings.	Green	S5
American Black Bear	*Ursus americanus*	Coniferous or deciduous regions, swamps, barrens, and berry patches.	Green	S5
Racoon	*Procyon lotor*	Forested areas near watercourses, river valleys, trees in grasslands.	Green	S5
Meadow Vole	*Microtus pennsylvanicus*	Wet meadows, grasslands, salt marshes, abandoned fields, prairies, vacant lots, edges and openings of forest.	Green	S5
Red-backed Vole	*Clethionomys gapperi*	Mainly found in coniferous forest but also occur in deciduous forest. Typically found near sources of water such as streams, springs and bogs.	Green	S5
Southern Bog Lemming	*Synaptomys cooperi*	Bogs, grassy marshes, damp mixed forest	Green	S3/S4
Deer Mouse	*Peromyscus maniculatus*	Found in a wide variety of dry habitats including forests and grasslands.	Green	S5
White-footed Mouse	*Peromyscus leucopus*	Dry deciduous forest.	Green	S5
Woodland Jumping Mouse	*Napaeozapus insignis*	Forested habitat along the shores of streams, springs and lakes.	Green	S5
Meadow Jumping Mouse	*Zapus hudsonius*	Moist grassland, grassy stream banks, marsh borders, alder-willow borders, low fields, edges of forests, and fence rows.	Green	S5
Muskrat	*Ondatra zibethicus*	Lakes, rivers, ponds, and marshes.	Green	S5
Beaver	*Castor canadensis*	Slow-flowing streams, lakes, rivers, and marshes.	Green	S5
Porcupine	*Erethizon dorsatum*	Deciduous and coniferous regions, farmland.	Green	S5
Eastern Chipmunk	*Tamias striatus*	Dry hardwood forest, hedgerows, fences, stone piles, gardens.	Green	S5
Red Squirrel	*Tamiasciurus hudsonicus*	Boreal coniferous forest, eastern hardwood deciduous forest, mixed forests, urban areas with trees.	Green	S5
Varying Hare	*Lepus americanus*	Forests, swamps, riverside thickets.	Green	S5

4.4.2.2 Rare, Sensitive and at Risk Mammals

According to ACCDC, the moose (*Alces americanus*), American Marten (*Martes americana*), fisher (*Martes pennanti*), eastern pipistrelle (*Pipistrellus subflavus),* Southern Flying Squirrel (*Glaucomys volans*), and northern right whale (*Eubalaena glacialis*) have been reported within a 100 km radius of the Study Area. The northern right whale is listed as Endangered under the federal *Species at Risk Act* (SARA). The mainland moose population in Nova Scotia is listed as Endangered under the Nova Scotia *Endangered Species Act* as is the American Marten. Fisher, southern flying squirrel and eastern pipistrelle are Yellow listed by NSDNR indicating that the Nova Scotia populations of these species are sensitive human activities and natural events. In addition to these species several other Yellow listed bat species have been recorded within 100 km of the Study Area,

including red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), little brown bat (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*).

Northern right whales are found at the mouth of the Bay of Fundy in areas where plankton is abundant. The Project does not have a marine component and will not introduce any toxic material into the Bay of Fundy so there will be no interaction with this species.

The mainland moose population in southern Nova Scotia is focused mainly in the Lake Rossingnol area. The nearest ACCDC record is approximately 50 km from the Project area. Suitable moose habitat is present within the Project Area and this species is capable of ranging widely over the landscape so there is some potential for it to be present. The presence of moose can be easily determined by means of tracks, feces and evidence of winter browsing. No moose sign was encountered during the various field surveys conducted in the Study Area suggesting that this area is not regularly used by moose.

American Marten are typically found in mature conifer or mixedwood forest. In Nova Scotia, two distinct populations have been identified, one in the Cape Breton highlands and one in southernwestern Nova Scotia. It is believed that the mainland American Marten population is largely derived from New Brunswick American Martens that were released in Kejimkujik National Park. The current distribution of this population is believed to extend into southern Digby County and does not include the Study Area. In addition, the Study Area has been subjected to extensive forest harvesting in recent years which would render it as poor American Marten habitat. As such, it is unlikely that the Project would interact with American Marten.

Fisher prefer habitat containing large expanses of mature mixedwood forest, particularly areas containing abundant prey and suitable denning sites such as hollow trees. Fisher were extirpated from Nova Scotia by the early 1920s but were reintroduced in southwestern Nova Scotia and central Nova Scotia. The two reintroductions were successful; however, the eastern population, located within Cumberland, Colchester and Pictou Counties has reestablished much more successfully than the southwestern population which occupies the central portion of southwestern Nova Scotia. As mentioned earlier, the Study Area has been extensively logged in recent years and does not provide good fisher habitat. In addition, the Study Area is located outside of the area of southwestern Nova Scotia believed to be occupied by fisher. As such, it is unlikely that the Project would adversely affect fisher populations.

Southern flying squirrels require mature hardwood or mixedwood forest containing mast crop producing trees such as oak and beech as well as plentiful snags in which to establish dens (usually in woodpecker holes). The known distribution of southern flying squirrels encompasses the central portion of southern Nova Scotia extending from Wolfville to the Tobeatic Wildlife Management Area. The nearest known location is approximately 20 km east of the Project area near Bear River. The Study Area is unlikely to provide suitable habitat for southern flying squirrels for several reasons. Firstly, most of the Study Area has been subjected to forest harvesting and few large intact stands of hardwood or mixedwood forest remain. Secondly, mast producing trees such as northern red oak (*Quercus rubra*) and American beech (*Fagus grandifolia*) which provide winter food for southern flying squirrels are uncommon in the Study Area.

All bat species native to Nova Scotia are considered to be sensitive to anthropogenic disturbance. However, the risk of bat collision with wind turbines is generally greater for migrating bats than for resident breeding, commuting or foraging bats, which generally forage between 1-10 m above ground level and seldom above 25 m, thus avoiding turbine blades (Erickson *et al.* 2002). Migratory bat species such as the red bat, hoary bat, and silver-haired bat may be present in the Study Area. These migratory bats are found across North America, but there have been few accounts of these species in the province.

Digby Neck is a well known migration route for birds and it is likely that it would provide a migration route for migratory bats as well. Broders *et al.* (2003) investigated this possibility by conducting trapping and echolocation surveys on Brier Island (located at the southern end of Digby Neck) during the spring, summer and autumn in 2001. Similar surveys were also conducted at an inland site away from expected migration routes (Kejimkujik National Park) and at another potential migratory landfall site (Bon Portage Island). During the study very little migratory bat activity was recorded with migratory species comprising only 0.02% of all of

the echolocation sequences recorded. At Brier Island migratory bat activity consisted of two echolocation sequences identified as hoary bat that were recorded on the night of September 11, 2001. These data suggest that migratory bat species are not abundant in Nova Scotia and that Digby Neck is not heavily used by migratory bat species. Broders *et al.* (2003) also concluded that records of migratory bat species in Nova Scotia represent extralimital occurences.

Three non-migratory bat species are regularly encountered in Nova Scotia including little brown bat, northern long-eared bat and eastern pipistrelle. Little brown bats are found in both forests and human-dominated landscapes (Jung *et al.* 1999; Broders and Forbes 2004). The northern long-eared bat is found in forest habitats (Broders *et al.* 2003; Broders and Forbes 2004). Eastern pipistrelles roost in trees and in buildings. They prefer to forage over open water rather than under the forest canopy. Broders *et al.* (2003) recorded the presence of little brown bat and northern long-eared bat at Brier Island but did not record any eastern pipistrelles. However, they recorded relatively large numbers of eastern pipistrelles at Kejimkujik. These data would suggest that little brown bat and northern long-eared bat are the species most likely to be present in the Study Area. These species are unlikely candidates for high mortality due to wind turbines based on their low flight paths. Yet, non-migratory bats may have increased sensitivity during the winter months when regional populations congregate into a few hibernation locations. Disturbance at these sites can potentially result in the deaths of large numbers of bats. In addition, the presence of a nearby hibernaculum site could result in seasonal increases in bat abundance as bats leave the hibernaculum in the spring and return to it in the autumn.

The Nova Scotia Abandoned Mine Openings Database was used to identify potential hibernaculum sites near the Study Area. One possible hibernaculum site has been identified approximately 7 km west of the Project area near Centreville. This abandoned iron mine known as the Johnson Pit has a 5.5 m deep shaft. It is not known if the mine is occupied by hibernating bats. Given the distance from the Johnson Pit to the Project site, it is unlikely that any onsite activities would cause disturbance to bats that might be hibernating in the mine. If the mine serves as a hibernaculum, there is some potential for elevated numbers of bats to be present in the Study Area during the spring and autumn as regional populations leave and return to the hibernaculum.

4.4.3 Reptiles and Amphibians

4.4.3.1 Overview

Amphibians and reptiles are normally treated together as herpetiles. There are 22 terrestrial and freshwater herpetile species recorded from Nova Scotia. The herpetofauna of Nova Scotia is relatively sparse when compared to adjacent mainland areas of the continent, mostly because of the difficulty of post-glacial colonization of this peninsula and a relatively harsh climate.

Information regarding the herpetofauna in the Project area was obtained from existing information sources (*e.g.,* ACCDC 2007; Gilhen 1984; Gilhen and Scott 1981; and Scott 1994) and field surveys. Eight herpetile species were encountered during the field surveys including green frog (*Rana clamitans melanota*), pickerel frog (*Rana palustris*), wood frog (*Rana sylvatica*), northern spring peeper (*Pseudacris crucifer crucifer*), American toad (*Bufo americanus americanus*), yellow spotted salamander (*Ambystoma maculatum*), redback salamander (*Plethodon cinereus*), and maritime garter snake (*Thamnophis sirtalis pallidula*) (Table 4.7). None of these species is considered to be rare or sensitive to human activities in Nova Scotia. Table 4.7 also lists herpetile species that can be expected to occur in the Study Area.

Table 4.7 Herpetile Species Recorded in and Likely Occur in the Study Area

Common Name	Binomial	Habitat	NSDNR Ranking	ACCDC Ranking
Maritime garter snake	*Thamnophis sirtalis pallidula*	Woods, meadows, marshes, lakes, farmlands, edges of developed areas and stream banks; wide ranging.	Green	S5
Ringneck Snake	*Diadophis punctatus edwardsii*	Most commonly encountered in deciduous and mixedwood forest particularly near the shores of ponds, lakes, and streams. Also found near the edges of bogs, fields, pits and roads.	Green	S5
Red-bellied Snake	*Storeria o.occipitomaculata*	Prefer open habitats such as roadsides, grassy heaths, clear-cuts, abandoned gravel pits and the shores of lakes, ponds and streams	Green	S5
Eastern smooth green snake	*Liochlorophis vernalis borealis*	Grassy and shrubby areas along the shores of watercourses, fields, and lawns in suburban areas.	Green	S5
Leopard frog	*Rana pipiens*	Forages in terrestrial habitats such as fields, woodlands and roadside ditches; breeds in the shallows of lakes and ponds.	Green	S5
Wood Frog	*Rana sylvatica*	Damp woodlands, particularly in deciduous and mixed woods; breeds in roadside ditches and ephemeral pools.	Green	S5
Pickerel Frog	*Rana palustris*	Agricultural areas, lakeshores, river valleys, natural clearings; breeds in ponds and small streams.	Green	S5
American Toad	*Bufo a. americanus*	Flexible habitat requirements; breeds in shallows of lakes, ephemeral pools, small streams.	Green	S5
Northern Spring Peeper	*Psendacris c. crucifer*	Forested areas near watercourses; breeds in standing water, often where there is dense submerged plant debris.	Green	S5
Red-spotted Newt	*Notophthalmus v. viridescens*	Red eft larval stage lives in damp deciduous, coniferous or mixed woodlands for approximately two years. Adults and aquatic larval stage live in ponds, vegetated coves of lakes and sluggish streams.	Green	S5
Yellow-spotted salamander	*Ambystoma maculatum*	Inhabits coniferous, deciduous and mixed woodlands adjacent to aquatic breeding sites; breeds in ponds and vegetated coves, in lakes and vegetated sluggish streams.	Green	S5
Red-backed salamander	*Plethodon cinereus*	Woodland areas; breeds under rocks or in decaying tree stumps. The larval stage occurs within the egg and the young hatch as juveniles.	Green	S5

4.4.3.2 Rare, Sensitive and at Risk Herpetiles

The ACCDC database search identified three rare or endangered herpetile species that have been recorded within a 100 km radius of the Project; including wood turtle (*Glyptemys insculpta*), Blanding's turtle (*Emydoidea blandingi*) and northern ribbon snake (*Thamnophis sauritus septentrionalis*).

The wood turtle is listed as vulnerable under the Nova Scotia *Endangered Species Act*. It is also listed under *SARA* as a species of special concern. No wood turtles were encountered during field surveys. Wood turtles are

almost invariably associated with streams, creeks, and rivers and the adjacent rich intervale forest and shrub communities, as well as with the meadows and farmland terrestrial habitat associated with these watercourses. Streams with sand and/or gravel bottoms are preferred, but rocky streams are used occasionally. Wood turtles may wander some distance from watercourses during summer foraging, but characteristically remain within linear home ranges. These home ranges are 1 to 6 ha in size and are centred on a suitable river or stream where non-vegetated or sparsely vegetated sandy beaches and banks serve as nesting sites. Natural nesting sites consist of sandy river beaches, but may also include select disturbed sites, such as railway grades and roadsides. Some turtles may travel considerable distances up small tributaries that lack suitable nesting sites and hibernacula during the summer months that offer good foraging opportunities. These smaller streams may serve as dispersal corridors between populations on different river systems.

The Study Area does not provide good wood turtle habitat. The Study Area is surrounded on three sides by seawater and only small streams are present. The lack of large rivers limits the availability of suitable nesting and hibernaculum sites. In addition, the Study Area is located outside of the known range of wood turtles in Nova Scotia. The nearest population is in the Annapolis Valley. As such, it is unlikely that wood turtles would be present in the Study Area.

Blanding's turtle is listed as endangered under both *SARA* and the Nova Scotia *Endangered Species Act*. This species is typically found in still-water streams, swamps, marshes and bogs in south central Nova Scotia. Blanding's turtles prefer water bodies with slow flowing water and muddy bottoms that support dense aquatic vegetation. Between early June and early July female Blanding's turtles move to gravelly or sandy lake shores to lay their eggs. In the fall, Blanding's turtles move to aquatic habitats where they hibernate underwater. The Study Area contains no suitable Blanding's turtle habitat. Slow portions of Haight Brook could provide summer foraging habitat and hibernation habitat; however, there are no lakes in the area that would provide suitable beach nesting sites. The Study Area is also located outside of the known range of the Blanding's turtle. As such, it is unlikely that this species would be found in the Study Area.

Northern ribbon snake is listed as a threatened species under *SARA* and the Nova Scotia *Endangered Species Act*. This species is associated with sluggish streams, marshes, swamps, bogs and lake shores. Northern ribbon snakes are typically found within 30 m of open water. They prefer areas that have a heavy cover of aquatic vegetation that provides cover for them and the amphibians and small fish that they feed on. Some potential northern ribbon snake habitat is present in the Study Area particularly along Haight Brook and along the southern lowland portion of the Study Area where ponds and sluggish streams are more plentiful. The Study Area is located outside of the known range of northern ribbon snake in Nova Scotia and as such the probability that this species is present in the Study Area is low.

4.5 Atmospheric Environment

The following section describes the climate and air quality of the site.

4.5.1 Climate

Weather data was acquired from the Annapolis Royal meteorological station, which is located approximately 35 km east of the Project site. Based on Environment Canada climate normals or averages for the period of 1971-2000, the average annual temperature in the region is 7.1ºC, with the average daily maximum and minimum being 11.5ºC and 2.7ºC, respectively. The warmest period during the year is typically from June to August (daily mean of 17.4ºC), while the coldest period is between December and February (daily mean of -3.3ºC). The site's close proximity to the coast allows for the ocean to have a temperature moderating effect, which also allows for Nova Scotia's coastal regions to have a significantly longer frost-free season in comparison to inland localities.

According to 1971-2000 precipitation data at the Annapolis Royal station, precipitation occurs approximately 140.6 days per year and averages approximately 1,209 mm of precipitation throughout the year, where 85% is rain and the remainder is snow. Overall, late spring and early summer are the foggiest time of year in

southwestern Nova Scotia, with an average of 118 days of fog per year recorded at Yarmouth which is located approximately 86 kilometers south of the Study Area (Environment Canada 2008).

4.5.2 Air Quality

A network of ambient air monitoring stations is set up throughout the province to measure ambient concentrations of various air contaminants. The closest air quality monitoring station to the Study Area is located at Kejimkujik National Park. However, only ozone is monitored at this location. The next closest ambient air quality monitoring stations to the Project site include Yarmouth, Halifax, Aylesford Mountain, and Kentville. A list of the contaminants monitored at each of these locations, their distance to the Project Area, and annual averages is presented in Table 4.8.

Table 4.8 Various Ambient Air Monitoring Stations Located Near the Study Area

Monitoring Station	Contaminant	Approximate Distance from Project (km)	Annual Averages	
			2005	2006
Kejimkujik	O_3 (ppb)	50	32	31
Yarmouth	O_3 (ppb)	100	27	27
Aylesford Mountain	O_3 (ppb)	105	33	35
Kentville	O_3 (ppb)	112	23	20
Halifax	SO_2 (ppb)	175	6	6
	CO (ppm)		0.5*(10 months)	0
	NO_2 (ppb)		16*(7 months)	16
	O_3 (ppb)		13	21
	$PM_{2.5}$ (µg/m^3)(TEOM)		5*(9 months)	4*(9 months)
	$PM_{2.5}$ (µg/m^3) (BAM)		NA	7*(6 months)
	$PM_{2.5}$ (µg/m^3)(Dichot)		NA	8*(9 months)
	PM_{10} (µg/m^3)(Dichot)		NA	14*(9 months)

* - Annual mean calculated over the number of months indicated.

NA - Data Not Available
Reference: Environment Canada, 2008

Based on monitoring results from the most recently published National Air Pollution Surveillance (NAPS) Network ambient air quality monitoring reports for 2005 and 2006 (Environment Canada 2008), the following general conclusions can be made:

- The monitored concentrations of particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) at the Halifax monitoring station have generally been low.
- None of the monitored concentrations of carbon monoxide exceeded the 1-hour or 8-hour objectives (35,000 µg/m^3 and 15,000 µg/m^3, respectively).
- None of the monitored concentrations of nitrogen dioxide exceeded the 1-hour or Annual objectives (400 µg/m^3 and 100 µg/m^3, respectively).
- None of the monitored concentrations of sulphur dioxide exceeded the 1-hour or 24-hour objectives (900 µg/m^3 and 300 µg/m^3, respectively).
- In 2005 and 2006 the ambient air quality 1-hour objective for ozone of 82 ppb was not exceeded at any of the monitoring stations.

Given the fact that there is no ambient air monitoring station located on or in the immediate vicinity of the Project site, that there is limited data available from the ambient air monitoring station at Kejimkujik National Park, and that the Halifax ambient air monitoring stations include emissions from industrial activities (which is not characteristic of the Digby County), it can be reasonably estimated that the Study Area is representative of a rural environment where all contaminant concentrations would meet the Ambient Air Quality Objectives

4.6 Socio-economic Conditions

4.6.1 Population

The Project is located in Gulliver's Cove in Digby County, Nova Scotia. Population statistics for Digby County from the 2006 census are summarized in Table 4.9 below.

Table 4.9 Population statistics for the County of Digby

Population and Dwelling Counts	County of Digby
Population in 2006	18,992
Population in 2001	19,548
2001 to 2006 population change (%)	-2.8
Total private dwellings	9,905
Population density per square kilometer	7.6
Land area (square km)	2,515

Source: Statistics Canada 2006 Census

Digby County has experienced population decline from 2001 to 2006. The 2006 population of Digby County was distributed fairly evenly across various age groups with the age ranges 40-44, 45-49 50-54 and 55-59 being significantly higher than other age ranges. The median age of the population was 45.2, which is slightly older than the provincial median of 41.8. Approximately 19.1% of the population was over the age of 65, which is somewhat higher than the province's statistic of 15.1%. Approximately 5.8% of the population identified as Aboriginal, while 3.2% identified as foreign-born (Statistics Canada 2008a).

4.6.2 Health, Industry, and Employment

The Town of Digby was developed as an active fishing and lumber-producing community by United Empire Loyalists from New York and New England in 1783 (Town of Digby 2008). While fishing and forestry remain dominant forms of work, Digby has evolved into a popular tourist attraction.

Table 4.10 illustrates the participation in local industry for Digby County. Tourism likely falls into the category of "Other Services", as it is not specifically listed by Statistics Canada. The relatively high numbers of people working in "Other Services" and "Retail Trade" reflect the county's tourism industry. Note that the largest industry in the county remains as "Agriculture and Other Resource-Based Activities". Health care, education, construction and business services are other significant industries in the county, with at least 8% of the labour force working in each of these sectors.

Table 4.10 Local Industries in Digby County

Industry	Digby County		
	Total	Male	Female
Total – Experienced Labour Force 15 Years and Over	9,285	4,910	4,380
Agriculture and Other Resource-Based Industries	1,665	1,330	335
Construction	605	560	50
Manufacturing	1,360	910	450
Wholesale Trade	230	180	55
Retail Trade	1,195	435	765
Finance and Real Estate	230	70	160
Health Care and Social Services	900	115	785
Educational Services	795	255	540
Business Services	850	470	380
Other Services	1,440	585	855

Source: Statistics Canada 2008a

Digby County is under the jurisdiction of the Southwest Health Authority. Health care services are provided by the Roseway, Yarmouth and Digby General Hospitals.

In 2005, 15,270 residents of Digby County, 15 years of age or more, earned an income (from either full time or part time jobs). The median income for all persons working was $18,602, which is below the provincial median of $22,815. For those in Digby who had full-time work all year-round, median earnings were $28,736, which is still well below the provincial average of $36,917 (Statistics Canada 2008a).

Based on the 2006 census, the unemployment rate for Digby County is 12.9%, which is slightly higher than the provincial unemployment rate of 9.1%. Overall, Digby labour force indicators have improved significantly since 1996, when the unemployment rate was 18.9% (Statistics Canada 2008b).

4.6.3 Recreation and Tourism

Digby is famous for its delicious scallops, spectacular vistas of the Annapolis Basin, and the incredible tides of the Bay of Fundy in Digby Harbour. Annual scallop festivals, excellent whale watching, and the Digby Pines Golf Resort and Spa are popular tourist attractions. The town of Digby offers a variety of accommodations, cafes, restaurants, shops, and a full service marina (Town of Digby 2008). The Digby Neck area primarily provides scenic training experiences that focus on the coastal view of the area as well as offering birding, seal viewing and whale watching opportunities, particularly on Long Island and Brier Island off the tip of Digby Neck. Within the Study Area, there is an outdoor adventure company (Fundy Adventures) and rental oceanview cottage (Gulliver's Retreat) on Gulliver's Cove Road.

The number of visitors counseled at the Digby Visitor Information Centre each year can be used as an indicator of tourism activity in the area. In 2004, 20,300 people visited the Centre, compared to 16,800 people in 2005, 16,500 in 2006, and 16,100 in 2007 (Nova Scotia Department of Tourism, Culture and Heritage 2008a). Despite a noticeable drop in numbers between 2004 and 2005, visits to the centre have remained similar, with slight decreases over time.

The Nova Scotia Department of Tourism, Culture and Heritage has calculated preliminary estimates for the economic impact of tourism in the province by county. Table 4.11 presents this data for Digby County from 2004 to 2007.

Table 4.11 Estimated Economic Impacts of Tourism in Digby County

Year	2004	2005	2006	2007
Revenues	$40,370,000	$35,300,000	$37,690,000	$35,740,000
Taxes				
Federal	$2,700,000	$2,300,000	$2,300,000	$2,200,000
Provincial	$3,000,000	$2,700,000	$2,800,000	$2,700,000
Municipal	$700,000	$600,000	$700,000	$600,000
Total Taxes	$6,400,000	$5,600,000	$5,800,000	$5,500,000
Employment				
Direct Jobs	800	700	700	600
Indirect Jobs	300	200	300	200
Total Jobs	1,000	900	900	900
Direct FTEs	400	300	300	300
Indirect FTEs	100	100	100	100
Total FTEs	500	400	400	400
Payroll				
Direct Payroll	$11,200,000	$9,800,000	$10,500,000	$9,900,000
Indirect Payroll	$4,600,000	$4,000,000	$4,300,000	$4,000,000
Total Payroll	$15,800,000	$13,800,000	$14,700,000	$14,000,000

Source: Nova Scotia Department of Tourism, Culture and Heritage 2008b.

While the total estimated revenue from tourism for Digby County has decreased from 2004 to 2007, it remains a significant contribution to the economy, particularly with respect to local employment. I

Informal recreational activities within the Study Area appear to take advantage of the logging road network. Evidence of recreational vehicle use (*i.e.,* ATVs) and hunting activities were noted during field surveys in the Study Area.

4.6.4 Land Use

The Study Area is located in the Municipality of Digby, west of the Town of Digby, and spans Digby Neck from north to south. The Study Area is characterized as a rural area with forestry, agriculture and fishing activities providing the economic base for the area. Land use in the Study Area is predominantly resource-based and residential. Gulliver's Cove hosts a few small business operations including an emu farm, dulse company, greenhouse and a rental oceanview cottage (Gulliver's Retreat). The presence of old woods roads indicates that timber harvesting has been conducted in the Study Area for many decades. Some of this harvesting appears to have occurred in the last five years. Abandoned agricultural land is present at various locations but is more prevalent along the public roads. Residences are located along Highway 217 and Gulliver's Cove Road, which bisect the Study Area.

Recently, tourism has become a more significant contributor to the local economy. The Municipality has two areas that are subject to Municipal Planning Strategies and Land Use By-laws, The Conway Area and The Well Field Protection Area (Municipality of Digby 2008). These two areas are adjacent to the Town of Digby in the northeastern part of the municipality. The balance of the Municipality is unregulated from a land use perspective (Municipality of Digby 2008).

4.6.5 Property Values

In 2006, there were 9,905 dwellings in Digby County, of which 6,530 were owned and 1,500 were rented. Approximately 66% of the dwellings in Digby County were constructed before 1986. The average value of a home in 2006 was $130,862, approximately $27,138 less than the provincial average (Statistics Canada 2008a).

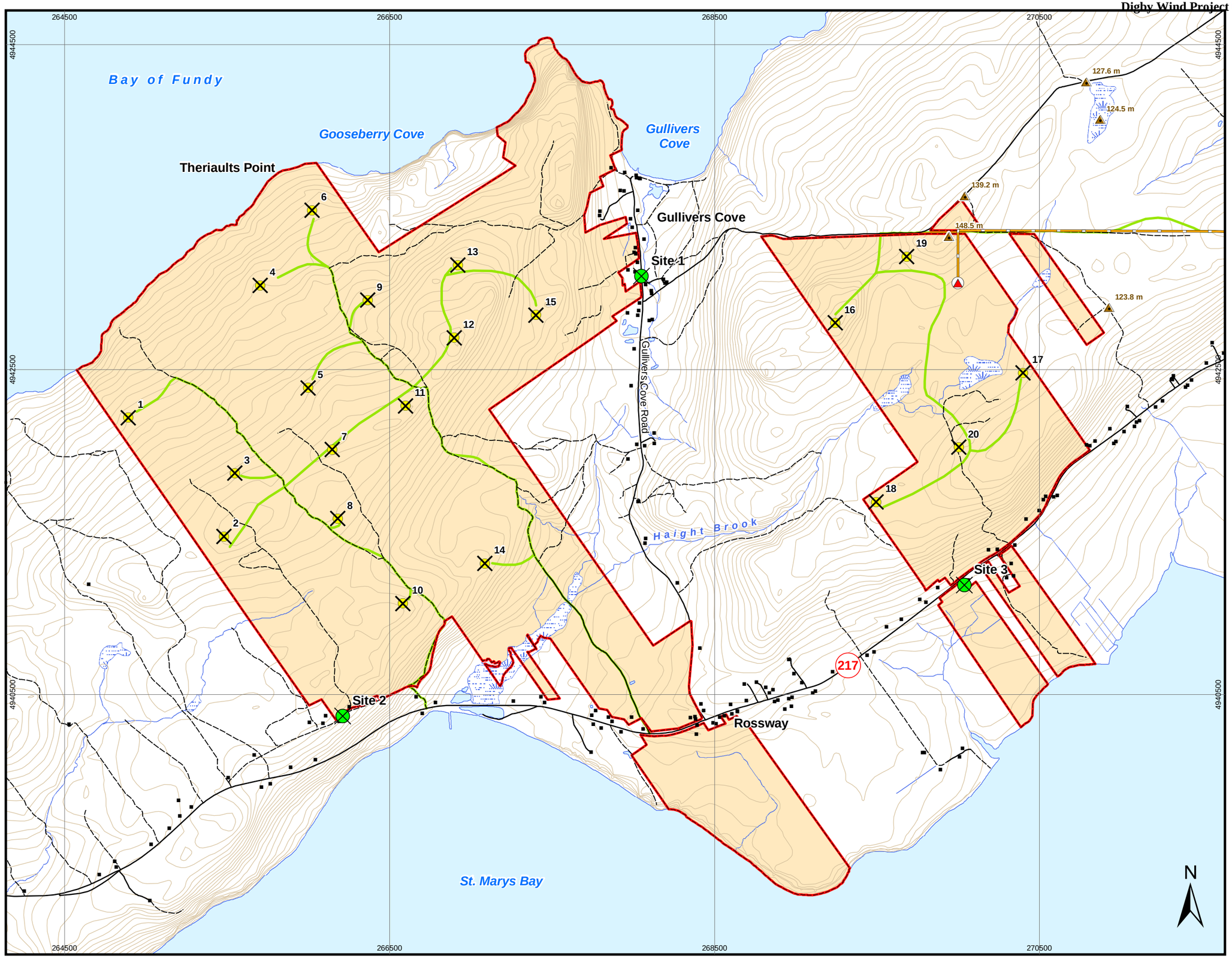
4.6.6 Acoustic Environment

The existing acoustic environment within the Study Area was determined by performing baseline sound pressure level monitoring at three sites. The noise monitoring sites selected represent some of the nearest residential areas to the proposed Project site (refer to Figure 4.4).

The baseline study was conducted using a Larson Davis Model 824 Type 1 integrating sound pressure level meter and a Quest Model 2900 Type 2 integrating sound pressure level meter. These instruments average the energy level of sound over a selected period of time and express it as an equivalent sound pressure level, L_{eq}, in dB_A (A-weighted decibels). In this study, each measurement session consisted of one-minute readings logged over a 24-hour period to establish variation over time. The logged values were then used to calculate hourly L_{eq} values (1-hour L_{eq}) and day (L_D) (7:00 to 19:00), evening (L_E) (19:00 to 23:00) and night (L_N) (23:00 to 7:00) equivalent sound pressure levels.

The collected data are representative of the existing conditions during the monitoring periods and includes cumulative environmental effects due to contributions from traffic and any other substantial sources of noise at the baseline noise monitoring sites, including those that are natural (*i.e.,* wind in trees, birds, and animals).

The calculated 1-hour L_{eq} values for each baseline noise monitoring site are presented in Table 4.12.



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Figure 4.4

DIGBY WIND POWER PROJECT

Baseline Noise Monitoring Sites

- Baseline Noise Monitoring Station

Project Components

- Proposed 69 kV Substation
- Proposed Turbine Location
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Spot Elevation
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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Table 4.12 Measured 1-Hour Baseline Sound Pressure Levels

Time	Site 1	Site 2	Site 3	NSE Guideline
15:00	-	-	-	65
16:00	57	38	-	65
17:00	48	38	48	65
18:00	47	37	45	65
19:00	56	36	44	60
20:00	54	44	46	60
21:00	**65**	41	41	60
22:00	**65**	34	38	60
23:00	**62**	30	34	55
0:00	**58**	27	36	55
1:00	**56**	28	29	55
2:00	53	36	33	55
3:00	55	41	26	55
4:00	**57**	45	36	55
5:00	49	40	45	55
6:00	49	40	40	55
7:00	49	47	47	65
8:00	49	37	46	65
9:00	53	37	45	65
10:00	50	40	45	65
11:00	49	38	46	65
12:00	48	40	46	65
13:00	46	44	46	65
14:00	47	50	47	65
15:00	49	48	50	65
16:00	50	-	48	65

Note: Bold indicates an exceedance of the NSE Guidelines

There were several exceedances of the NSE Noise Guidelines (1989) for evening (L_E), and night time (L_N) periods for Site 1, Gulliver's Cove (refer to Table 4.12). An analysis of the digital sound recording taken during the 24-hour noise monitoring session indicated the presence of sounds from several different animal species, including:

- chorus of Northern Spring Peeper (*Pseudacris crucifer*);
- dawn chorus of assorted song birds; and
- buzzing of the common bumblebee (*Bombus sp.*)

4.6.7 Heritage Sites, Archaeological Sites and Other Cultural Resources

The assessment of archaeological potential for the site considered both prehistoric and historic period resources. Archaeological potential modeling for prehistoric era sites is based largely on the identification of landscape features which are either known to have attracted past habitation or land use, or which appear to have potential for attracting human use. These features include the availability of potable water, suitability for habitation (*e.g.,* ground conditions), proximity to desirable resources (such as workable stone), and proximity to water transportation routes, coastal areas, portage routes and food supplies. A desktop archaeological assessment was completed by professional archaeologist Laird Niven with results summarized below.

4.6.7.1 Historical Background

While there are very historic areas close to Digby Neck, it wasn't really until the late Eighteenth Century and the influx of United Empire Loyalists that the Digby Neck area became settled. The original town lots, as laid out by Charles Morris, stop just short of the Study Area, although there is a large triangular grant just east of Gulliver's Cove. This doesn't mean the Loyalists didn't settle in the area, however, as the first muster roll at Gulliver's Cove took place between June 1 and 6, 1784. While the Acadians did not seem to be attracted to the area in large numbers, the 1784 Charles Morris survey plan indicates an area near the inlet west of Rossway that was "settled by French Acadians", referring to post-Expulsion reoccupation (Dawson 1988). Oliver Robichaud settled near Rossway around 1764 (Province of Nova Scotia 2009). Although no deed research was conducted, it seems certain that settlement in the Loyalist period and later would have taken place along the road between the communities of Rossway and Gulliver's Cove. There is no evidence that this area was ever more than sparsely settled.

4.6.7.2 Previous Archaeology

There is no record of previous archaeology work being done within the Study Area.

4.6.7.3 Archaeological Potential

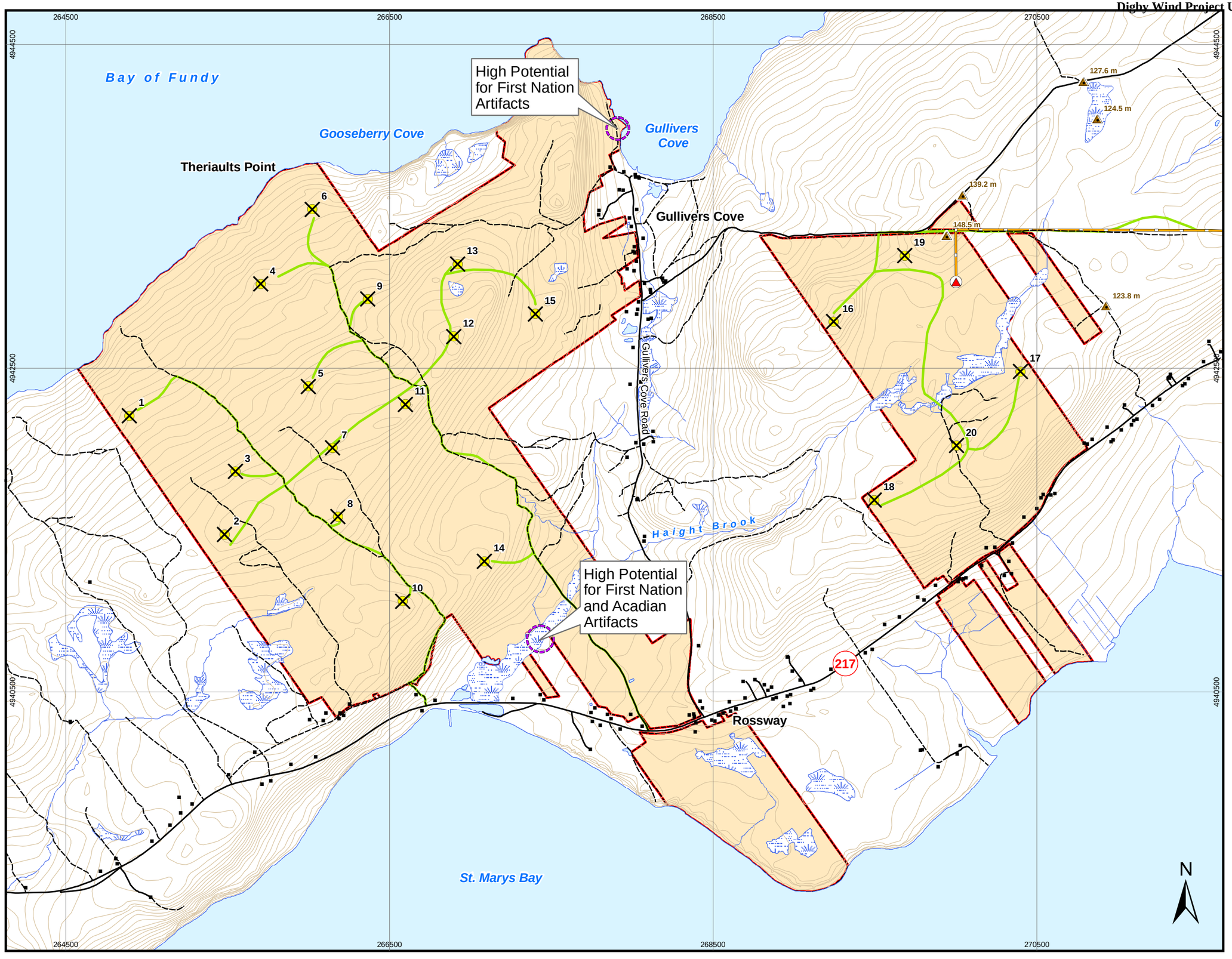
First Nations

The Digby Neck area has many natural resources that would have attracted Mi'kmaq settlement from very early times. There is some evidence, for example, that the Archaic peoples were using the exposed shelves of the Bay of Fundy to hunt large sea mammals like walrus (Tuck 1984). The beach at Gulliver's Cove would have been a significant feature, particularly if seals were known to have used it as a place to pup. It would have also been one of the only places to land canoes in the area. The St. Mary's Bay side of the Study Area would have been more sheltered and would also have provided access to both the Bay of Fundy and the interior of the province. The small inlet and stream west of Rossway may have provided many resources for the Mi'kmaq and would also have been a sheltered landing spot.

In summary, there are at least two areas near the Study Area, Gulliver's Cove and the inlet west of Rossway, which should be considered as having a high potential for containing First Nation's archaeological resources (refer to Figure 4.5).

Historic

The historic potential of the Study Area should be considered as high for the areas near the inlet west of Rossway and Gulliver's Cove. While the majority of the relatively sparse historic occupation would have been along the road that leads between the two settlements, there is documentary evidence for post-Expulsion Acadian settlement near Rossway and Loyalist settlement near Gulliver's Cove (Dawson 1988).



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Figure 4.5

DIGBY WIND POWER PROJECT

Areas of High Archaeological Potential

- Area of High Archaeological Potential

Project Components

- Proposed 69 kV Substation
- Proposed Turbine Location
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Spot Elevation
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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4.6.7.4 Summary

The preliminary background research indicates that the areas around Gulliver's Cove and Rossway have a high potential for containing both First Nations and historic period archaeological resources. It is recommended that archaeological follow-up work be considered based on final design and layout of Project infrastructure and proximity to areas deemed to have high potential for First Nation's archaeological resources. Such work could include more in-depth background research, a pedestrian survey of the high potential areas, possibly, sub-surface testing and/or monitoring of high potential areas subject to excavation**.**

4.6.8 Land and Resources Used for Traditional Purposes by Aboriginal Persons

The closest First Nations to the Study Area is the Bear River First Nation which has reserve land approximately 25 km from the Study Area. SkyPower has commissioned the Confederacy of Mainland Mi'kmaq (CMM) to conduct a Mikmaq Ecological Knowledge Study (MEKS) to determine traditional and current use of lands for traditional purposes. It is anticipated that preliminary results will be available in May and July with the final report completed in September 2009. It is noted that the lands to be used for the Project are all privately owned (*i.e.,* no Crown lands involved).

4.6.9 Transportation Infrastructure

The Study Area receives little traffic other than movements of local residents and occasional visits by tourists and other outdoor enthusiasts. The site is approximately 8 km from Highway 101. Middle Cross Road, Route 217 (Evangeline Trail) and Culloden Road comprise the key transportation network expected to be used for transport of materials to the site. It is anticipated that the current road network (outside of onsite turbine access roads) will not require upgrades to accommodate construction traffic.

4.6.10 Safety Issues

Lands within the Study Area could present safety issues (*e.g.,* steep cliffs). Construction and decommissioning activities associated with the wind farm may present some safety challenges with respect to these hazards and routine hazards associated with construction activities. In the operational phase, safety issues such as potential for ice throw must be considered in the context of local populace and public access issues. All safety issues will be addressed with the appropriate design and mitigation measures (*e.g.,* setbacks, restricted access, public notification).

4.6.11 Visual Landscape

The Project site is located primarily on a forested ridge. Vertical relief within and around the Study Area is created by small woodlot fragments and natural areas associated with ravines, residential yards and farm buildings.

A visual landscape assessment was conducted for the Project. This assessment was completed with the use of a computerized simulation that superimposed wind turbine images, which are located and scaled to size, onto a photograph of an existing view in the area for the purpose of creating a realistic representation of the proposed wind farm from a specific view.

Further information and viewshed photographs on the area's visual landscape are presented in Section 5.2.1.5).

5 ENVIRONMENTAL ASSESSMENT AND RESIDUAL EFFECTS

The following section describes the potential interactions between the proposed Digby Wind Power Project and the biophysical and socio-economic environment, and includes: an assessment of potential cumulative environmental effects; an assessment of the effects of the environment on the Project; and the potential effects of accidents and malfunctions.

The structure of this chapter follows that recommended by NRCan in their 2003 guidance document "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act*" (NRCan 2003). The potential effects are described for the construction, operation and decommissioning phases of the Project and suggested mitigation is presented to reduce or eliminate these potential effects. The potential interactions between the Project and the environment are summarized, as are the proposed mitigation measures to reduce or eliminate residual (or net) effects.

Table 5.1 summarizes the potential interactions between the Project and VECs.

Table 5.1 Potential Interactions Between the Project and Valued Environmental Components

Project Activities	Valued Environmental Components													Section
	Soil	Water Quality	Aquatic Environment	Terrestrial Vegetation	Wetlands	Birds & Other Wildlife	Archaeological/ Cultural Resources	Land Use	Local Community	Visual Aesthetics	Noise	Recreation and Tourism	Safety	
Construction														
Surveying and Siting	X					X								5.1.1
Land Clearing	X	X	X	X	X	X	X				X			5.1.2
Road Construction/Modification	X	X	X	X	X	X	X	X	X		X			5.1.3
Delivery of Equipment						X			X		X			5.1.4
Temporary Storage Facilities	X	X	X	X		X	X				X			5.1.5
Foundation Construction	X	X	X			X	X	X			X			5.1.6
Tower and Turbine Assembly	X					X					X			5.1.7
Electrical Cabling Installation (Interconnection from Turbines to Substation)	X	X	X			X	X	X			X			5.1.8
Substation Construction	X	X	X			X	X	X			X			5.1.9
Installation of Transmission Line (to Power Grid)	X			X		X	X	X						
Fencing/Gates														
Parking Lots														
Operation														
Operation & Maintenance						X		X	X	X	X	X	X	5.2
Decommissioning														
Turbine and Ancillary Equipment Removal	X	X	X			X		X			X			5.3.1

Table 5.1 Potential Interactions Between the Project and Valued Environmental Components

Project Activities	Valued Environmental Components													Section
	Soil	Water Quality	Aquatic Environment	Terrestrial Vegetation	Wetlands	Birds & Other Wildlife	Archaeological/ Cultural Resources	Land Use	Local Community	Visual Aesthetics	Noise	Recreation and Tourism	Safety	
Removal of Power Line	X	X	X			X		X			X			5.3.2
Site Remediation/ Reclamation	X	X	X			X		X			X			5.3.3
Accidents and Malfunctions														
Accidents and Malfunctions	X	X	X			X		X	X				X	5.4

5.1 Project Construction Activities – Environmental Effects

The following sections describe the main construction activities and the potential effects associated with each activity. All activities associated with the Project construction, including equipment maintenance and refueling, will be controlled through standard mitigation to ensure that there is a low impact associated with construction of the Project. The construction zone of impact will be localized within the Study Area, including the RoW for the distribution and transmission lines.

Overall, potential environmental impacts will be mitigated using the following standard practices:

- limit access to the turbine site via an established access road, where possible;
- keep the size of access roads to the minimum required for the safe transportation of construction equipment;
- flag/fence areas with valued environmental features (*e.g.,* wetlands), and exclude construction activities from within these identified areas to the extent practical;
- whenever practical, time clearing activities to periods when the ground surface is best able to support construction equipment (winter or dry season) to prevent rutting and to avoid clearing during sensitive ecological periods events, such as breeding seasons for resident birds (*i.e.,* May to August); and
- upon clean-up, replace topsoil stored on-site and re-vegetate areas that were temporarily cleared, where possible, with native seed mixtures or with a mix of species similar to those on adjacent lands to restore affected lands to their previous condition.

The remainder of this section focuses on the individual phases of construction and operation, and details the potential environmental effects associated with each.

5.1.1 Surveying and Siting Operations

The siting of the wind turbines was initially carried out using computer software analyzing meteorological data. This software, however, does not account for areas that are environmentally sensitive, and site visits by a biologist were conducted and combined with existing mapping data to identify environmental constraints.

Subsequent to the 2008 bird, terrestrial and aquatic field surveys, some turbine locations were changed as a result of stakeholder input and addition of Project lands. While this has resulted in some discrepancy between field data availability and Project footprint, SkyPower recognizes that additional site specific surveys may be required prior to construction activities to identify potential environmental constraints (*e.g.,* rare plants) at turbine locations not previously surveyed in order to assist with micrositing of infrastructure. Prior to construction, land surveyors will conduct a site visit to identify the exact location of each turbine on foot. Survey stakes will be used to mark each turbine site, temporary workspace, substation site and access road construction. These areas will be surveyed, as appropriate, by a qualified biologist to survey the area for rare and sensitive environmental features *(i.e.,* rare plants, wetlands) and recommendations will be made to avoid these constraints to the extent possible. Table 5.2 summarizes the potential environmental effects of surveying and siting activities.

Geotechnical testing will be undertaken at the turbine sites. This will require access by testing equipment and may require limited, localized brush removal to permit equipment operation. Geotechnical testing will be undertaken by qualified operators and supervised by an attending engineer. Existing right-of-ways (RoWs) will be used where possible and the equipment will not traverse watercourses or wetlands, and is expected to have minimal environmental effects.

Table 5.2 Potential Effects of Surveying and Siting Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Visitors will remain within relevant areas, both in-vehicle and on-foot and will aim to preserve the site's natural areas.	3	1	1/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project footprint. The area to be subject to this disturbance has been previously disturbed by human presence (*e.g.,* forestry) and disturbance will be reversible.
Terrestrial Vegetation	Limited vegetation removal	▪ Minimize vegetation removal ▪ Avoid wetlands and watercourses ▪ Best environmental practices for geotechnical testing	1	1	1/1	R	2	Highly localized vegetation removal for equipment access will avoid sensitive ecological features and sites will be restored as part of post construction site restoration

1 Note

Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2

Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g,* affecting a whole stock, population or habitat outside the range of natural variation.

Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.

Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.

Reversibility R = reversible, I = irreversible.

Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

The net effects of siting and surveying activities will be spatially limited to certain areas within the Project footprint, as well as temporally limited to within the siting and surveying visits. Overall the level of impact will be **minimal** and **not significant**, especially considering that in the area birds and wildlife already experience a certain level of sensory disturbance due to ongoing forestry and quarrying activities and associated human presence. Vegetation removal will be minimal and sensitive ecological features will be avoided. It should be noted that this phase is very important in ensuring that the overall Project is carried out with the least possible disturbance to birds and wildlife by precisely identifying sensitive habitats within or near areas proposed for disturbance. Where possible, micrositing of infrastructure will also take into consideration connectivity of landscape to maintain potential corridors for wildlife migration through the area. Appropriate construction work zones will be chosen, to the extent practical, in order to limit the degree of disturbance.

5.1.2 Land Clearing

The lands within the Study Area are primarily wooded with evidence of past and current forest operations. Land clearing and vegetation removal will be required for the construction of access roads, installation of poles for interconnection cables, turbine foundation construction and the construction of the substation. However, this will require only minimal alteration for the majority of the Study Area land as existing RoWs are being used to the extent practical. Table 5.3 summarizes the potential environmental effects of land clearing activities.

Table 5.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Ensure that overall disturbance is limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act* (MBCA).	2	1	2/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project footprint. The area to be subject to this disturbance is forested land and effects associated with sensory disturbance will be reversible.
	Habitat alteration and loss	▪ Habitat loss may be mitigated by only clearing the land necessary for construction activities and by limiting the overall land disturbance to within designated workspaces. ▪ Upon completion of construction and/or decommissioning, habitat will be restored	2	1	2/1	I	2	Although some habitat loss will be considered irreversible (i.e., 20 years), this “irreversible” habitat loss will be limited in geographic extent and magnitude and will ultimately be restored after Project decommissioning. Project design has attempted where feasible to make use of existing roads and cleared areas. The area

Table 5.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		to the extent possible. ▪ Areas of significance (*e.g.,* nesting sites) will be avoided, to the extent possible.						of habitat that will be altered due to land clearing activities for access roads, turbines and the substation will be a very small proportion of what is available therefore the impact will be minimal.
	Mortality	▪ In order to reduce the potential of bird mortality, land clearing and construction activities will be performed in compliance with the *Migratory Birds Convention Act*. ▪ Seasonal avoidance of the breeding season for most bird species is the preferred mitigation, but if this is not possible a contingency plan (*e.g.,* nest survey and avoidance of active nests), will be developed in consultation with NSDNR and CWS.	2	1	2/1	I	2	Land clearing activities mirror current forestry operations in the study area. Due to timing of activities, it is predicted that there will be no residual effect on bird mortality. If clearing must be conducted during the breeding season for most birds, a contingency plan will be implemented to ensure compliance with *MBCA.*
Soils and Vegetation	Soil erosion and compaction	▪ Limit access to the turbine sites via established access roads, where possible. ▪ Size of access roads will be kept to the minimum required for the safe construction, operation and decommissioning of the equipment. ▪ Whenever practical, clearing activities will be conducted during periods when the ground surface is best able to support construction equipment (winter or dry season).	2	1	2/1	R	2	Implementation of mitigation measures will ensure that soil quality within the Project Area will be preserved, and no residual effects will exist.

Table 5.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		▪ Replace/re-introduce topsoil stored on-site to enable the reclamation of land to its original condition.						
	Loss of plant species of conservation concern	▪ Follow-up vegetation surveys will be conducted to assist with micrositing of turbines and access roads. ▪ Prior to construction, digital waypoint files for "Red", "Yellow" and "Undetermined" species identified during field surveys will be provided to NSDNR. ▪ Where Plant Species of Conservation Concern are encountered, avoidance to the extent possible will be considered, especially where there may be a threat to the regional population. Where avoidance is not possible, additional mitigative measures will be developed in consultation with NSE and NSDNR.	2	1	2/1	R	2	Follow-up vegetation surveys will be conducted to assist with micrositing of turbines and access road layouts. Mitigation for species of conservation concern encountered within the Project footprint will ensure there is no significant residual environmental effect on Plant Species of Conservation Concern.
Wetlands	Loss of wetland area and/or function	▪ Avoid all wetlands, where practical. ▪ If wetland impact is unavoidable, a functional analysis of the wetland will be conducted and regulatory approval of the proposed alteration will be obtained prior to construction.	1	1	2/1	R	2	Follow-up surveys will be conducted, if necessary, to confirm the presence/ absence of wetland within the Project footprint and to conduct a functional analysis of the wetland habitat were avoidance is not feasible. Any loss of wetland habitat will be compensated to ensure no net loss of wetland function.

Table 5.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Water Quality/ Aquatic Environment	Surface water contamination	▪ Watercourses will be avoided to the extent possible. ▪ If alteration of watercourses is required, regulatory approval of the proposed alteration will be obtained prior to construction. ▪ All activities, including equipment maintenance and refuelling, will be controlled or done off-site to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. ▪ Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks. ▪ A contingency plan for accidental spills will be developed for the Project.	2	1	2/1	R	2	By following mitigation measures, adverse interactions with surface water quality and fish habitat will be minimized and no significant residual effects will result.
	Sediment loading	▪ Watercourses will be avoided to the extent possible. ▪ Land clearing and construction near watercourses should occur between June and September 30 where practical. ▪ Temporary erosion and sediment control measures, silt fence, straw bales (etc.) will be	2	1	2-3/1	R	2	By following mitigation measures, negative interactions with surface water quality and fish habitat in the Project Area will be minimized and no significant residual effects are predicted.

Table 5.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. ▪ Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.						
Noise	Increases to sound levels due to the transportation and operation of clearing equipment	▪ Nearby residents will be advised of significant sound generating activities and these will be scheduled to create the least disruption to receptors. ▪ Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. ▪ Construction equipment will have mufflers. ▪ Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	2/1	R	2	Increased sound levels caused by land clearing will be temporary in nature and will be caused by activities conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Archaeological and Cultural Resources	Disturbance	▪ Areas of significance will be avoided, to the extent possible. ▪ If ground disturbance is necessary in areas of medium or high archaeological potential, these activities will be monitored by a licensed	2	1	2/1	R	2	Local areas of high archaeological potential identified near the Study Area are not anticipated to be impacted by the Project. Follow-up surveys will be conducted if necessary and a contingency plan will be

Table 5.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		archaeologist. ▪ An Archaeological Contingency Plan will be developed. ▪ In the event that an archeological heritage resource is discovered, work in the immediate area will stop and the appropriate authorities will be contacted.						implemented. No significant residual effects to archaeological and cultural resources are anticipated.

1 Note

Geographic Extent	1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
Magnitude	1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g,* affecting a whole stock, population or habitat outside the range of natural variation.
Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
Reversibility	R = reversible, I = irreversible.
Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

The amount of clearing for the Project is minimal due to the use of existing access roads to the extent possible and placement of turbine locations in existing harvested areas. Considering the footprint of the turbine locations and substation, along with access roads, it is estimated that approximately 4.5% of the total Project Area will be affected by Project infrastructure, although as stated above, much of this 4.5% has already been disturbed so this is a conservative estimate of vegetation to be cleared. Eleven out of 18 habitat types (refer to Table 4.5) will be affected by the development. Three of these habitat types comprise 93% of the habitat that will be affected including clear-cut (26 ha, 50%), softwood forest (13 ha, 25%) and mixedwood forest (10 ha, 18%). This reflects the relative abundance of these habitats on the local landscape except that clear-cuts are represented more frequently due to the fact that turbines and access roads will be preferentially placed in clear-cuts.

The effective mapping and avoidance of natural habitat hosting vascular plant species of conservation concern during facility layout design, including site-specific vegetation and wetland surveys (if required), micrositing of turbines and ancillary structures and infrastructure, use of existing access roads and cleared areas to a large extent, and successful restoration measures during the Project's construction, operation and decommissioning stages, will not likely result in significant environmental effects to native habitat from the Project. If wetland or watercourse alterations cannot be avoided, all necessary regulatory approvals will be obtained prior to the disturbance.

The preliminary background research indicates that the areas around Gulliver's Cove and Rossway have a high potential for containing both First Nations and historic period archaeological resources. Archaeological follow-up work will be considered based on final design and layout of Project infrastructure and proximity to areas deemed to have high potential for First Nation and Historical archaeological resources. The MEKS results may also provide guidance on follow-up work. Such work could include more in-depth background research, a pedestrian survey of the high potential areas, possibly, sub-surface testing and/or monitoring of high potential areas subject to excavation. Mitigation strategies for all identified heritage resources will be designed by the archaeologist in consultation with appropriate regulatory agencies.

The net effects of clearing activities will be spatially limited to certain small areas within the Project footprint. Overall the level of impact will be **minimal** and **not significant**, especially considering that the area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing forestry activities and associated human activities. Standard mitigation measures to protect terrestrial resources, aquatic resources, archaeological resources and humans from increased sound levels and direct disturbance (including habitat compensation, if required) will be adequate to effectively reduce or eliminate residual effects.

5.1.3 Road Construction/Modification

To the extent possible, existing access roads will be used, and upgraded where required. Access roads will be surveyed and staked/flagged. The roads are based on a proposed layout at this time and may require alterations as the Project proceeds. Roads on the wind farm site will be approximately 11 m wide to accommodate maintenance vehicles and equipment for repairs/replacements. In special cases if difficult turns are required, roads may be wider than 11 m. Construction roads will be designed to accommodate the crane types that will be required to erect the wind turbine generators and towers. Roads will be constructed by placing a layer of geogrid on the native soil, followed by layers of compacted shale or sandstone with a screened stone topping. Once Project construction is complete, the construction roads will be removed and the topsoil replaced across approximately three-quarters the width, leaving single lane tracks to allow access to the turbines for maintenance purposes.

Temporary improvements in roads may be necessary in some areas to enable access to the site by articulated (multi-axle) trucks carrying the turbine components, the largest component of which is the nacelle. These improvements may include widening the turning radius of the corners by adding fill to the ditches. None of these modifications are expected to be permanent and the corners will be remediated.

Watercourses and wetlands will be avoided to the extent possible. In the event that a watercourse crossing is required, culverts will be designed and installed in consultation with NSE and DFO and in accordance with applicable regulations and conditions of approval. Wetland alteration, if required, will be in accordance with applicable regulations and conditions of approval including compensation planning.

The potential environmental effects associated with road construction (including culvert installation, if required) includes impacts to birds and other wildlife, water quality/aquatic environment, noise levels, archaeological/cultural resources, land use and traffic. Table 5.4 summarizes the potential environmental effects of road construction/modification activities.

Table 5.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Ensure that overall disturbance is limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act*.	2	1	2/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project footprint..
	Habitat loss/alteration	▪ Habitat loss may be mitigated by only clearing the land necessary for construction activities and by limiting the overall land disturbance to within designated workspaces. ▪ Upon completion of construction and/or decommissioning, habitat will be restored to the extent possible.	2	1	2/1	I	2	Habitat loss will be considered to be irreversible (*i.e*., 20 years) but the area of habitat that will be altered due to access road construction will be a very small proportion of what is available, and therefore the impact will be minimal.
	Mortality	▪ In order to reduce the potential of bird mortality, land clearing and construction activities will be performed in compliance with the *Migratory Birds Convention Act (e.g.,* outside of critical time periods for breeding birds). If this is not possible, a contingency plan will be implemented in consultation with NSDR and CWS (see Section 5.1.2).	2	1	2/1	I	2	It is predicted that there will be no residual effect on bird mortality.
Soils and Vegetation	Soil erosion and compaction	▪ Access to the turbine sites will be limited to established access roads, where possible. ▪ The size of access roads will be kept to the minimum required for the safe construction, operation and	2	1	2/1	R	2	Implementation of mitigation measures will ensure that soil quality within the Project area will be preserved, and no residual effects will exist.

Table 5.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		decommissioning of the equipment. ▪ Whenever possible, clearing activities will be timed for periods when the ground surface is best able to support construction equipment (winter or dry season). ▪ Compacted soil will be reclaimed as required.						
	Loss of plant species of conservation concern	▪ Follow-up vegetation surveys will be conducted, if necessary. ▪ Prior to construction, digital waypoint files for "Red", "Yellow" and "Undetermined" species identified during field surveys will be provided to NSDNR. ▪ Where Plant Species of Conservation Concern are encountered, avoidance to the extent possible will be considered, especially where there may be a threat to the regional population. Where this is not possible, additional mitigation will be developed in consultation with NSE and NSDNR.	2	1	2/1	R	2	Follow-up vegetation surveys will be conducted to confirm vegetation and habitats in the Project footprint, if necessary. Mitigation for species of conservation concern encountered within the Project footprint will ensure there is no significant residual environmental effect on Plant Species of Conservation Concern.
Wetlands	Loss of wetland area and/or function	▪ Avoid all wetlands, where possible. ▪ If alteration of wetlands is required, functional analyses of the potentially affected wetlands will be conducted and regulatory approval of the proposed alteration will	1	1	2/1	R	2	Follow-up wetlands surveys will be conducted if necessary to confirm the absence of wetland within the Project footprint. Any loss of wetland habitat will be compensated to ensure no net loss of wetland function.

Table 5.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		be obtained prior to construction.						
Water Quality/ Aquatic Environment	Surface water contamination	▪ Watercourses will be avoided to the extent possible. ▪ All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. ▪ Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks. ▪ A contingency plan for accidental spills will be developed for the Project.	2	1	2/1	R	2	No residual effects are expected.
	Sediment loading	▪ Watercourses will be avoided to the extent possible. ▪ If watercourse alterations are required, they will be done in consultation with NSE/DFO and in accordance with regulatory requirements. ▪ Instream work will occur between June and September 30 where possible, unless otherwise approved by NSE. ▪ Temporary erosion and sediment control	2	1	2/1	R	2	No residual effects are predicted.

Table 5.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		measures, silt fence, straw bales (etc.) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. ▪ Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established. ▪ Visual assessments will be completed in a quarterly basis and after a severe storm event to ensure effectiveness of erosion and sedimentation control.						
	Surface water flow	▪ Watercourses will be avoided to the extent possible. ▪ Access roads constructed across existing watercourse that require a culvert will follow standard industry practice, installing culverts of sufficient size to accommodate expected maximum flows within the watercourse. ▪ A Water Approval will be obtained for all required watercourse crossings and the conditions of approvals will be followed.	2	1	2/1	R	2	No residual effects are expected.
	Fish mortality	▪ Watercourses will be avoided to the extent	2	1	2/1	I	2	No residual effects are expected given these

Table 5.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		possible. ▪ Watercourse crossings, where required, will occur between the period of June 1 to September 30 unless otherwise approved by NSE ▪ Where possible, culverts will be installed during low flow periods. If water is present, watercourses will be dammed and flow will be preserved through water pumps. In this case, a biologist would be on site to facilitate fish rescue within the dammed area. ▪ Where fish bearing streams must be crossed (*e.g.,* culvert installation) DFO will be consulted regarding possible requirements for authorization under the *Fisheries Act.*						mitigation measures.
Noise	Increases to sound levels due to the transportation and operation of clearing equipment	▪ Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. ▪ Construction equipment will have mufflers. ▪ Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	2/1	R	2	Residual effects are expected to be minimal, as discussed in Table 5.2.
Archaeological and Cultural Resources	Disturbance	▪ Areas of significance will be avoided to the extent possible.	3	1-2	2/1	R	2	No residual effects are expected.

Table 5.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		▪ Additional follow-up work may be required depending on final design and layout.						
Land Use	Reduction of forested land	▪ Existing forest roads will be used as access roads to the extent possible. ▪ New access roads will be constructed to minimize the Project footprint.	3	2	2/1	R	2	The area of forested land that will be lost due to access road construction will be a very small proportion of what is available and therefore the impact should be minimal.
Local Community	Hazards and/or inconveniences to forestry operations, and informal recreational activity (e.g,. ATV operations, hunting)	▪ Road construction schedule will consider planned forestry operations in the area to ensure required access is maintained	3	1	2/1	R	2	There may be minor delays to unscheduled land use activities, however these will be of short duration. The impact is therefore predicted to be minimal. Safety issues are addressed in Section 5.2.1.7.

1 Note

Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2

Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.

Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.

Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.

Reversibility R = reversible, I = irreversible.

Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

The construction of access roads on individual landowner's private property will comprise a relatively small portion of the Study Area, and thereby should not jeopardize species habitat. The Proponent will take advantage of existing access roads and upgrade those as necessary. Sensory disturbance and habitat loss/alteration for birds and other wildlife will be temporary in nature and not significant. Culverts will be installed according to all regulatory requirements and wetland alteration will require regulatory approvals including, compensation to ensure no net loss of function. Upon completion of construction, and after consulting with the appropriate landowners, SkyPower intends to reclaim property access roads, if the landowner is in agreement, thereby limiting any long-term impacts. Overall it is anticipated that with implementation of the above-stated mitigation measures, the environmental impact associated with access road construction and modification activities will be **minimal** and **not significant**.

5.1.4 Delivery of Equipment

Currently, traffic patterns in and around the Project Area, are largely related to forestry operations. With the exception of its boundary roads, the Project Area receives very little traffic other than movements of local residents and occasional visits by tourists and other outdoor enthusiasts.

The trucks used for the heavy loads have multiple axles, with the potential to add more, and have steering capability at the back end, allowing them to turn corners much tighter than trucks without such rear steering capability. A large mobile crane will also be required, approximately the size of a standard semi-trailer.

A detailed transport study will be undertaken to determine the appropriate routes and means for the equipment to be delivered to the site. It is anticipated that the current road network (outside of onsite turbine access roads) will not require upgrades to accommodate construction traffic.

Approvals for transporting these materials will be sought from the provincial transportation departments. As the turbine components are oversized, a Special Move Permit and any associated approvals will be obtained through the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) for heavy load transport.

The tower sections, the nacelles, and rotor parts will be moved to each turbine site within the Project Area by flatbed truck and placed into an exact position for picking using cranes. One flatbed truck will be used for each of the three tower sections. In addition, a flatbed truck will be used for the nacelle, and one flatbed truck will be required to transport each of the three rotor blades. An additional three truckloads will be required for the rotor hub, small parts and the erection equipment for each turbine. This site preparation will require approximately ten people for five days for each turbine. All the equipment at the site will be cleaned using a pressure washer and biodegradable truck wash.

There is the possibility for impacts to local sound levels and traffic due to the transportation of materials. In addition, the potential increase in sound levels may cause sensory disturbance to birds and other wildlife. Table 5.5 summarizes the potential environmental effects of activities associated with the delivery of equipment to the site.

Table 5.5 Potential Effects of Delivery of Equipment

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Delivery vehicles will remain on designated roads.	3	1	1/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project footprint. The area to be subject to this disturbance is forested land however disturbance will be reversible.
Noise	Increase in sound levels	▪ Equipment will be delivered between 7:00	3	2	1/1	R	2	Increased sound levels caused by delivery of equipment will be

Table 5.5 Potential Effects of Delivery of Equipment

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary.						temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Local Community	Hazards and/or inconveniences to traffic	▪ A detailed transport study will be undertaken to determine the appropriate routes and means for the equipment to be delivered to the site; however no modifications to existing roads are expected at this time. ▪ A Special Move Permit and any associated approvals will be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport.	2	1	1/1	R	2	No significant impact on road use is expected.

Note 1 Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2

Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.

Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.

Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.

Reversibility R = reversible, I = irreversible.

Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

It is anticipated that with implementation of the above-mentioned mitigation measures, the residual effects of the delivery of equipment will be **minimal** and **not significant**. Traffic is relatively low along the potential access routes and therefore it is unlikely that there will be a significant inconvenience to local motorists or emergency services.

5.1.5 Temporary Storage Facilities

Temporary storage facilities/equipment lay-down will comprise a small portion of the Project Area, and should not jeopardize species habitat. Sensory disturbance and habitat loss/alteration for birds and other wildlife will be temporary in nature and not significant. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing forestry activities and associated human activities. Upon completion of construction, the temporary storage facilities will be removed and the ground will be remediated to its previous use. The environmental effects of temporary storage facilities are principally due to land clearing and delivery of equipment, and are discussed in Sections 5.1.2 and 5.1.4. Overall it is anticipated that with the implementation of the above-stated mitigation measures, the environmental impact associated with the temporary storage facilities will be **minimal** and **not significant**.

5.1.6 Foundation Construction

Foundations of turbines and substations will leave a small footprint on the landscape that will last the extent of the Project's life. Excavation of soils and installation of the engineered foundations have the potential to interact with several environmental components. Environmental components that potentially could be impacted as a result of foundation construction include birds and other wildlife, soils, water quality/aquatic environment, land use, noise and archaeological/cultural resources. Table 5.6 summarizes the potential environmental effects of activities associated with foundation construction.

Table 5.6 Potential Effects of Foundation Construction

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Overall disturbance will be limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act*	3	1	1/2	R	2	Sensory disturbance may cause habitat avoidance but it is likely to be temporary in nature, small in magnitude and restricted to the Project footprint. The area to be disturbed is primarily forested land however disturbance will be reversible.
	Habitat loss	▪ The footprint for excavation will be restricted to the minimum required for the safe and proper installation of the turbine/substation foundation.	2	1	1/2	R	2	The area of habitat that will be lost due to foundation construction will be a very small proportion of what is available. Therefore the impact will be minimal.
	Mortality	▪ Construction activities will be performed in compliance with the *Migratory Birds Convention Act*.	2	1	1/2	I	2	It is predicted that there will be no residual effect on bird mortality.
Soils	Soil disturbance and erosion	▪ Topsoil and subsurface soils will be separated and stored on-site to be replaced appropriately after the pouring of the concrete foundation. When the soils are stored they will be covered with a tarp or otherwise protected from erosion and runoff.	2	1	1/2	R	2	By implementing these standard mitigation measures, the residual effect on soils will not be significant and will have a minimal level of impact.
Water Quality/ Aquatic Environment	Surface water contamination	▪ Watercourses will be avoided to the extent possible. ▪ All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent	2	1	1/1	R	2	No residual effects are predicted.

Table 5.6 Potential Effects of Foundation Construction

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. ■ Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks. ■ A contingency plan for accidental spills will be developed for the Project.						
	Sediment loading	■ Land clearing and construction will not take place in the immediate vicinity of a watercourse. Temporary erosion and sediment control measures, silt fence, straw bales (etc.) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. ■ Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.	2	1	1/1	R	2	No residual effects are predicted.
Land Use	Reduction of forested land	■ Turbines and substations, with their relatively small footprint on the land, have been sited with consideration	2	2	1/2	R	2	The area of forested land that will be lost due to foundation construction will be a very small proportion of what is

Table 5.6 Potential Effects of Foundation Construction

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		for the potential impact to existing land uses.						available and will be situated to minimize disturbance to existing forestry operations. Due to the limited footprint, its reversibility after decommissioning and small proportion of land to be directly impacted by foundation construction, the residual effect is expected to be minimal.
Noise	Increases to sound levels due to operation of equipment	▪ All internal combustion engines will be fitted with appropriate muffler systems. ▪ Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	1/2	R	2	Increased sound levels caused by foundation construction will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Archaeological and Cultural Resources	Disturbance	▪ Areas of significance will be avoided to the extent possible.	3	1	1/2	R	2	No residual effects are predicted.

1 Note
Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
Reversibility R = reversible, I = irreversible.
Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

The foundations will comprise a relatively small portion of the Project Area land, and thereby their presence, while permanent, should not jeopardize species habitat. Sensory disturbance for birds and other wildlife will be temporary in nature. Upon completion of construction, the ground surrounding the foundations will be restored. Overall, it is anticipated that with the implementation of the above-stated mitigation measures, the residual effects associated with foundation construction will be **minimal** and **not significant**.

5.1.7 Tower and Turbine Assembly and Installation

The tower comes in three sections that will be assembled on site. The rotor blade system, consisting of three blades and a hub, will also be assembled on site, attached to the generator and lifted into place at the top of the tower by a large hydraulic crane. This will require approximately ten people for three days per turbine. An additional 1-2 days will be required to install the remainder of the turbine assembly. Control and switching equipment will be placed on each turbine pad by a crane. A large crawler crane with a hydraulic crane will be used to install each tower section. Each tower section will be lifted and secured with bolts to the section below, followed by the nacelle secured to the top tower section. Finally, the assembled rotor will be lifted and attached to the nacelle.

This phase of construction could potentially have impacts on birds and other wildlife, soils and vegetation, and sound levels. Table 5.7 summarizes the potential environmental effects of activities associated with tower and turbine assembly and installation.

Table 5.7 Potential Effects of Tower and Turbine Assembly and Installation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Overall disturbance will be limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act*.	3	1	2/1	R	2	Sensory disturbance likely will be temporary in nature, small in magnitude and restricted to the Project area. The residual effect is considered minimal.
Soils	Soil compaction and contamination	▪ Trucks and equipment will remain in designated workspaces. ▪ Whenever possible, delivery will be timed for periods when the ground surface is best able to support construction equipment (winter or dry season). ▪ Compacted soil will be reclaimed as required.	3	1	2/1	R	2	No residual effects are expected.
Noise	Increases to sound levels due to the transportation and operation of equipment	▪ Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. ▪ All internal combustion engines will be fitted with appropriate muffler systems. ▪ Noise abatement	3	2	2/1	R	2	Increased sound levels caused by equipment assembly and installation will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect

Table 5.7 Potential Effects of Tower and Turbine Assembly and Installation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		equipment, in good working order, will be used on all heavy machinery used on the Project.						is considered not significant.

1 Note Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2

Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.

Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.

Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.

Reversibility R = reversible, I = irreversible.

Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Sensory disturbance for birds and other wildlife will be temporary in nature, and not significant. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing forestry activities and associated human activities. Compacted soil will be remediated and reclaimed as appropriate, and measures will be in place to decrease the likelihood of this occurring. Overall it is anticipated that with the implementation of the above-stated mitigation measures, the residual effects associated with the tower and turbine assembly and installation will be **minimal** and **not significant**.

5.1.8 Interconnection from Turbine to Substation

Above-ground 34.5 kV electrical cables will be installed running from each turbine to the on-site substation, largely following existing linear disturbances (*i.e.,* access road system).

Potentially affected environmental components include birds and other wildlife, soils, water quality/aquatic environment, noise, land use and archaeological/cultural resources. Table 5.8 summarizes the potential environmental effects of activities associated with interconnection of the turbine and substation.

Table 5.8 Potential Effects of the Interconnection from Turbines to Substation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	■ Overall disturbance will be limited to designated workspaces, and be performed in compliance with the *Migratory Birds Convention Act*. ■ Mitigation recommended by the Avian Power Line Intervention Committee (1994, 1996) will be considered to minimize effects of overhead distribution lines.	3	1	2/1	R	2	Sensory disturbance likely will be temporary in nature, small in magnitude and restricted to the Project area. The residual effect is considered minimal.
Soils	Compaction and contamination – via heavy equipment	■ Topsoil will be stored on-site for future use in restoring the land to its original condition. ■ Standard erosion and sediment control measures will be implemented as required.	3	1	2/1	R	2	No residual effects are expected.
Water Quality/ Aquatic Environment	Surface water contamination	■ Watercourses will be avoided to the extent possible; overhead lines preclude the need for in-stream work. ■ All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse.	2	1	2/1	R	2	No residual effects are expected.
	Sediment loading	■ Watercourses will be avoided to the extent possible. ■ Temporary erosion and sediment control measures, silt fence, straw bales (*etc.*) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized.	2	1	2/1	R	2	No residual effects are expected.

Table 5.8 Potential Effects of the Interconnection from Turbines to Substation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		■ Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.						
Noise	Increases to sound levels due to the transportation and operation of equipment	■ Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. ■ All internal combustion engines will be fitted with appropriate muffler systems. ■ Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	2/1	R	2	Increased sound levels will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Land Use	Reduction of forested land	■ Existing forest and access roads built earlier in the construction schedule will be used to install the collection system.	3	1	2/1	R	2	Provided these mitigation measures, and considering the temporary and reversible nature of this effect over a small spatial scale, no residual effects are expected.
Archaeological and Cultural Resources	Disturbance	■ Areas of significance will be avoided to the extent possible.	3	1	2/1	R	2	No residual effects are expected.

1 Note
Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
Reversibility R = reversible, I = irreversible.
Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Overall it is anticipated that, with the implementation of the above-mentioned mitigation measures, the residual effects of the collection system installation will be **minimal** and **not significant**.

5.1.9 Substation Construction

The substation will contain transformers to convert the voltage from 34.5 kV to 69 kV, which is required for connection to the proposed transmission lines. Topsoil excavated from the substation site will be re-distributed to adjacent lands. Substation equipment will be installed within the 0.25 ha fenced yard that will be surfaced with gravel. Since this will be a high voltage area, similar to all transformer substations, it will be surrounded by a high locked fence to prevent accidental access to the high voltage equipment.

The effects associated with substation construction are principally due to the construction of the foundation, as discussed in Section 5.1.6. Potentially affected environmental components as a result of the construction of the substation for this Project include birds and other wildlife, soils, water quality/aquatic environment, noise, land use and archaeological/cultural resources. Proposed mitigation measures and discussion regarding residual effects of substation construction are discussed in Section 5.1.6.

The substation will have a footprint that is relatively small compared to the Project Area. Given appropriate mitigation measures, the small spatial scale and footprint of the substation, and the temporary nature and reversible nature of many of the interactions with the environment, the residual effects associated with substation construction will be **minimal** and **not significant**.

5.1.10 Transmission Line to Power Grid

A 69 kV transmission line will link the Project from the onsite substation to the NSPI substation in Conway. Approximately 10.6 km of aboveground pole-mounted 69 kV distribution line will be installed along the RoW of Route 217 to link the project to the Conway substation and the provincial power grid.

Potentially affected environmental components include soil, vegetation, birds and other wildlife, archaeological/cultural resources, land use and noise. Table 5.9 summarizes the potential environmental effects of activities associated with the installation of the transmission line to the power grid.

Table 5.9 Potential Effects of the Installation of Transmission Line to the Power Grid

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Overall disturbance will be limited to designated workspaces, and be performed in compliance with the *Migratory Birds Convention Act*.	3	1	2/1	R	2	Sensory disturbance likely will be temporary in nature, small in magnitude and restricted to the Project area. The residual effect is considered minimal.
Soils/Vegetation	Compaction and contamination – via heavy equipment	▪ Topsoil will be stored on-site for future use in restoring the land to its original condition. ▪ Standard erosion and sediment control measures will be implemented as required.	3	1	2/1	R	2	No residual effects are expected.
Noise	Increases to sound levels due to the transportation and operation of equipment	▪ Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. ▪ All internal combustion engines will be fitted with appropriate muffler systems. ▪ Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	2/1	R	2	Increased sound levels will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Land Use	Reduction of forested land	▪ Existing RoWs will be used to the extent possible.	3	1	2/1	R	2	This activity will be localized and have reversible effects; no residual effects are expected.
Archaeological and Cultural Resources	Disturbance	▪ Areas of significance will be avoided to the extent possible.	3	1	2/1	R	2	No residual effects are expected.

Table 5.9 Potential Effects of the Installation of Transmission Line to the Power Grid

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	

1 Note
Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
Reversibility R = reversible, I = irreversible.
Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Overall it is anticipated that, with the implementation of the above-mentioned mitigation measures, the residual effects of the transmission line installation will be **minimal** and **not significant**.

5.1.11 Fencing/Gates

With the exception of the substation, the need for fencing or gates is not anticipated for the Digby Wind Power Project, therefore environmental effects and mitigation are not discussed.

5.1.12 Parking Lots

The need for a parking lot is not anticipated for the Digby Wind Power Project therefore environmental effects and mitigation are not discussed.

5.2 Operational Activities – Environmental Effects

The environmental components that may be adversely affected by the operation of the Digby Wind Power Project include land use, local community, recreation, visual aesthetics, ambient sound levels, birds and other wildlife and health and safety. In addition, its operation may raise certain health and safety issues, both for Project personnel and landowners. Table 5.10 provides a general overview of these components and associated impacts. The remainder of Section 5.2 describes these interactions and potential effects in greater detail.

Table 5.10 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds	Sensory disturbance	▪ None required.	3	2	5/6	R	2	It is anticipated that sensory disturbance during Project operations may cause birds to change their flight patterns in order to avoid the towers and rotating blades. This will serve to reduce the number of bird collisions.
	Mortality	▪ Lighting will be the minimum allowed by Transport Canada for aeronautical safety, and white strobe lights (CL-865) may be used with the minimum intensity and flashes per minute allowable. The turbines for this Project will be built using tubular steel towers, as some data indicate that lattice towers encourage perching by raptors during hunting and, as a result, may put these birds at risk of collisions. ▪ A bird and bat monitoring program will be developed in consultation with NSDNR and CWS. Based on the results of the program, necessary modifications to mitigation plans and/or wind farm operations will be undertaken.	3	2	5/6	I	2	Given existing information from operating wind energy facilities elsewhere in North America, it is anticipated that fatalities due to avian collision with wind turbines will not cause significant bird fatalities, either of sensitive species or large numbers of birds. Post-construction monitoring will be implemented to confirm that the effect of the Project on bird populations is not significant.
Other Wildlife	Sensory disturbance	▪ None required.	3	2	5/1	R	2	Studies of game animals in western North America (*e.g.,* Anderson *et al.* 1999) have shown that species are either unaffected by wind energy facilities, given their small footprint and the preservation of existing

Table 5.10 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								land use, or that they can readily adapt to the presence of wind turbines. At this site, habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when on-site human activities are less frequent and would occur on a short-term basis.
	Mortality	▪ Post-construction monitoring (*e.g.,* bat monitoring) will direct the need and form of further post-construction mitigation measures. ▪ A bird and bat monitoring program will be developed in consultation with NSDNR and CWS. Based on the results of the program, necessary modifications to mitigation plans and/or wind farm operations will be undertaken.	3	2	5/1	I	2	Based on existing information from monitoring programs elsewhere in North America, it is anticipated that the impact of wind farm operations on bat mortality will not be significant. However, post-construction monitoring will be implemented to confirm this expectation. The risk of bat collisions is greater for migrating bats than for resident breeding, commuting or foraging bats. Therefore, post-construction monitoring will be conducted in the fall in order to correspond to migration activities by migratory species and the movement of resident species to hibernacula.
Land Use	Disruption to undeveloped woodlands or infrastructure	▪ The Project has been designed to minimize impacts to the local land use. No mitigation, therefore, is required as no significant impacts are predicted.	2	2	5/1	R	2	The effect of wind turbines on undeveloped woodlands is negligible with only a small portion of the available land required for wind turbines, ancillary equipment and access roads.
Local Community	Effect on local economy	▪ Local residents will be employed to the extent possible during the	4	1	5/6	R	2	A positive residual effect would be realised by the operation of the Project,

Table 5.10 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		construction, operation and decommissioning of the Project.						through increases in employment opportunities, increases in private spending due to an influx of Project personnel, and an increase in the municipal tax base.
	Effect on property values	▪ None required	4	1	5/6	R	2	Existing information indicates that property values are not adversely affected by the construction and operation of wind farms.
Recreation and Tourism	Effect to tourism and recreation	▪ None required.	4	2	5/6	R	2	The Project is expected to have a minor positive effect on tourism and recreation in the Study Area.
Visual	Change to visual landscape	▪ Turbines will be all of the same type and model, and will be painted light grey to reduce reflection. ▪ Screening opportunities for adjacent residences through tree planting or other measures may be considered where post-construction evaluation indicates a legitimate concern.	4	2	5/6	R	2	Given the viewing distances and sparse population, the visual impact will not be significant. Some landowners within the Study Area will have views of the wind turbines from the residences, but many views will be obstructed by terrain, existing vegetation and distance.
	Lighting	▪ Lighting will be the minimum allowed by Transport Canada to ensure the appropriate level of aeronautical safety.	4	2	5/6	R	2	Given the viewing distance of approximately greater than 500 m, the presence of these lights will not place excessive nighttime visual pollution within several kilometers of the Study Area.
	Shadow flicker	▪ None required.	3	2	5/1	R	2	Modeling of shadow flicker indicates there are minimal potential visual impacts at the locations throughout the Project area caused by shadow flicker due to the limited duration and distance of visibility under "ideal" viewing conditions as well as the presence of existing

Table 5.10 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								vegetation which would effectively mitigate potential negative impacts. A registry will be created to document complaints of shadow flicker. When a complaint or complaints of shadow flicker are received from a receptor located within 1,000 m of the turbine, shadow flicker will be monitored from that receptor. Information collected from the shadow flicker monitoring will be used will be used to develop further mitigation, if warranted.
Noise	Increases to sound levels	▪ None required.	3	2	5/6	R	2	Modelling of predicted sound levels caused by the operation wind turbines indicated that all the receptors within the Project area are expected to receive sound exposures from the proposed wind farm within acceptable sound limits. As a result, any increase in sound levels due to the operation of the Project will be not significant.
Health & Safety	Electromagnetic fields (EMFs)	▪ None required.	2	2	5/1	R	2	The strength of the EMF from equipment within the substation, such as transformers, decreases rapidly with increasing distance. Beyond the substation, the EMF produced by this equipment is typically indistinguishable from background levels. Similarly, the EMF produced by the equipment within the turbines will be very weak, reduced not just

Table 5.10 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								by distance, but also by objects such as trees and other objects that conduct electricity. Overall the EMF is not anticipated to have any negative results on human health and safety.
	Infrasound energy	▪ None required.	2	1	5/1	R	2	There is no evidence that the wind turbine technology proposed for this Project presents any potential problems related to the generation of infrasound energy.
	Ice throw	▪ During construction and operation activities, access to the wind turbine facility will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. ▪ During site visits, vehicles will be parked up-wind of the turbines. ▪ During operation, access to the wind turbine sites will be restricted to authorized personnel only.	3	1	5/1	R	2	Due to the distance to the nearest residence, a minimum of approximately 600 m, it is extremely unlikely that ice throw would present a risk to landowners. Furthermore, there are only a few days a year where ice could potentially form on turbines based on the right combination of air temperature, wind speed and moisture in the air. For maintenance personnel, the potential of ice throw presents a greater risk to health and safety. With the implementation of the mitigation measures proposed herein, the risk of injury and property damage will be reduced.

1 Note

Geographic Extent: 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2

Magnitude: 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.

Duration: 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.

Frequency: 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.

Reversibility: R = reversible, I = irreversible.

Ecological Context: 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects

5.2.1 Wind Turbine Operation

The following sections discuss the potential effects of the operation of the Project on the biophysical and socio-economic environment.

5.2.1.1 Effects on Birds

Environment Canada's "Wind Turbines and Birds – A Guidance Document for Environmental Assessment" and "Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds" (Environment Canada 2007a and 2007b) were applied during the pre-construction surveys and environmental assessment of Project impacts on birds.

In particular, Tables 1 to 3 of Environment Canada (2007a) were consulted to identify the sensitivity, facility size, and level of concern. According to the criteria identified in the aforementioned tables, the facility would be considered Medium, but is considered to have an overall very high sensitivity due to the presence of landform structures in the Study Area (shoreline, ridge) and presence of a SARA-listed species (*i.e.*, Peregrine Falcon) . As a result, the level of concern for this Project would be Very High. Table 5.11 identifies the information that Environment Canada would expect to be considered for projects with a High or Very High level of concern.

Table 5.11 Questions for Consideration as per Environment Canada (2007a)

Question	Answer
Identify the species that breed and winter at the site and in the surrounding area, and indicate their relative abundance.	See Section 4.4.1 and Appendix E.
Identify any species at risk, including species listed under the *Species at Risk Act (SARA),* provincially or territorially designated species, species designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or species designated as priority species by the ACCDC, Partners in Flight (PIF) or the CWS.	See Section 4.4.1 and Appendix E. The *SARA*-listed Peregrine Falcon was observed in the Project Area during one field visit.
Identify bird colonies (note species, size, location).	No bird colonies have been identified during pre-construction surveys. According to Lock *et al.* (1994), the nearest seabird colony to the site is a Double-crested Cormorant colony (69 breeding pairs identified in 1987) on Bear Island, approximately 18 km away.
Identify raptors, shorebird concentrations.	See Section 4.4.1 and Appendix E.
Identify species that give aerial flight displays.	Aerial flight displays are predicated on breeding. With the exception of the Turkey Vulture which are known to roam along Digby Neck, no raptors were recorded consistently during breeding season and were not confirmed breeding in the Study Area (refer to Section 4.4.1 and Appendix E). It is expected that the raptors recorded during the surveys use the Project Area only infrequently and are therefore not likely to be demonstrating aerial flight displays in this area. Raptors and other species that give aerial flight displays are indicated in Table E3 in Appendix E.
Identify the species that congregate at significant migration staging areas at or near the site.	The Project Area does not appear to be a major staging or stopover site for migration (see Section 4.4.1 and Appendix E).
Identify the species that frequently migrate through or near the area.	See Section 4.4.1 and Appendix E.

Table 5.11 Questions for Consideration as per Environment Canada (2007a)

Question	Answer
Identify the species that commute (*i.e.,* between breeding and foraging habitats) through or near the area, as compared to other locations within the region.	See Section 4.4.1 and Appendix E.
What habitat types occur on the site and in the surrounding area?	See Section 4.4.1 and Figure 4.2.
Do these habitats typically support habitat-sensitive or habitat specialist species, *e.g.,* forest-interior species, grassland species, or shrubland species?	The Project Area does not provide valuable habitat for bird species compared to other areas in the region (*e.g.,* lowland areas at the head of St. Mary's Bay). Due to the fragmentation that has already occurred in the Study Area, much of the forested habitat is considered edge habitat.
What is the relative density of breeding birds in these habitats?	See Section 4.4.1 and Appendix E.
What breeding or migrating birds do these habitats typically support?	See Section 4.4.1 and Appendix E.
How much of each habitat type or function will be lost or altered as a result of this development?	The Project footprint will be primarily on recently logged lands and only a very small proportion of the area within the Study Area will be altered (less than 4.5%). The area is heavily logged and Project infrastructure locations (including access roads) will maximize use of cleared lands. Three habitat types comprise 93% of the habitat that will be affected including clear-cut (26 ha, 50%), softwood forest (13 ha, 25%) and mixedwood forest (10 ha, 18%). This reflects the relative abundance of these habitats on the local landscape except that clear-cuts are represented more frequently due to the fact that turbines and access roads will be preferentially placed in clear-cuts.
What topographical features, such as islands, peninsulas, and ridges, are located on or near the site that may influence bird activity and movement?	Project site is situated on Digby Neck spanning the full width of the peninsula from the Bay of Fundy to St. Marys Bay.
What is the expected amount and type of human presence (vehicles, pedestrians, tourism, etc.) at the site at different times of the year, during and following construction?	See Section 2 for information on Project traffic. The area is already subjected to human disturbance as a result of forestry, agriculture and quarry operations.
What are the relevant meteorological data, such as wind speed, wind direction and visibility (*e.g.,* number of days during migration period with visibility <200 m or cloud bases <200 m) for the site?	See Appendix E.
If a bird colony is located within 5 km of the Project area, or if a nationally recognized site occurs within 1 km, do individual birds pass through the proposed turbine locations as part of their daily movements? What proportion of the colony does this represent?	No bird colonies are known to occur within 5 km of the Project area, nor is there a nationally recognized site within 1 km. According to Lock *et al.* (1994), the nearest seabird colony to the site is a Double-crested Cormorant colony on Bear Island, approximately 18 km away.
Do raptors breed at the site or within 1 km of the site? If so, what species are present and how close do they nest to the proposed facility?	No raptors were confirmed breeding at the site, nor were any raptor nests observed. However, a few species were considered possible breeders based on observations made during breeding bird surveys, including Red-tailed Hawk, Broad-winged Hawk, and Sharp-shinned Hawk. The Peregrine Falcon may be considered a probable breeder in the Study Area (refer to Section 4.4.1 and Appendix E).

Table 5.11 Questions for Consideration as per Environment Canada (2007a)

Question	Answer
If the site is recognized by local experts as having bird habitat that is locally important, how much of this habitat would be lost or altered by the proposed Project?	The Project Area is not considered to have bird habitat that is locally important. The majority of Project lands have already been impacted by forestry, agriculture or quarry operations.
If the site contains land features (islands, ridges, shorelines, peninsulas, areas of open water in winter, etc) that may concentrate birds on migration, while staging, or in winter: Do birds concentrate at this site during any of the seasons mentioned above?	The Project Area includes steep cliffs and ridges and is adjacent to the shoreline for the Bay of Fundy and St. Mary's Bay. As indicated in Section 4.4.1 and Appendix E, the survey data generally shows no evidence of large concentrations of birds in the Project Area.
If the site is recognized by CWS or local experts as regionally or locally important to birds, how does the number and diversity of birds that use the site in the season of interest compare to other locations in the region or province? How much habitat would be lost or altered by the proposed Project?	Although Digby Neck itself is considered to be an important bird migration corridor, no such importance has been identified for the Project area itself (refer to Appendix E). The habitat included in the Project Area is not regionally or locally important to birds. The Project Area is characterized primarily by fragmented forest habitat of little value compared to other locations in the region or province. Less than 4.5% of the habitat in the Project Area is expected to be directly impacted by Project construction.
If large numbers of birds may commute through or near the area during the day, what is the height and direction of this movement, and how does this relate to the proposed Project design and turbine locations?	Refer to Section 4.4.1 and Appendix E.
If large numbers of birds stage in or near (within 1 km of) the area, are there any activities taking place nearby that could potentially disturb birds (for example by causing large numbers of birds to take off and fly directly overhead), thereby resulting in collisions with wind facility structures?	There is no evidence of large numbers of birds staging within 1 km of the Project Area.
What is the frequency of dense fog (visibility <200m) and low cloud bases (<200m) at the site during the spring and fall bird migration periods?	See Appendix E.
If aerial flight display species occur at the site: ▪ How many individuals might be affected by the proposed wind farm? ▪ How significant is the site for these species (*i.e.,* is it one of the few sites in the region or province with this species)? ▪ What proportion of these species' local habitat would be close to the facility, and what is the likelihood that birds will be displaying in close proximity to turbine blades?	Refer to Section 4.4.1 and Appendix E. Aerial flight displays are predicated on breeding. With the exception of the Turkey Vulture which are known to roam along Digby Neck, no raptors were recorded consistently during breeding season and were not confirmed breeding in the Study Area (refer to Section 4.4.1 and Appendix E). It is expected that the raptors recorded during the surveys use the Project Area only infrequently and are therefore not likely to be demonstrating aerial flight displays in this area.

The potential environmental effects resulting from Project-related activities on birds include sensory disturbance and mortality. Section 4.4.1 provides detailed information on the breeding, wintering and migrating birds of the Project Area and the broader regional area.

Sensory Disturbance

Sensory disturbance of birds may occur during all phases of the Project as a result of on-site human activities such as surveying, clearing, trenching, turbine assembly, equipment operation, site inspections and site decommissioning. A certain level of sensory disturbance to birds in the area has already resulted from ongoing agricultural and forestry activities and associated human presence. The operation of the wind turbines may also result in visual and auditory disturbance of wildlife, including birds. Breeding birds may avoid habitat within a zone surrounding the immediate Project footprint, although sensitivity is species-specific (Kingsley and Whittam 2005). Many species will not avoid habitat near rotating wind turbines, as has been noted by James (2003) and James and Coady (2003), but other species show a reduction in breeding densities near turbines (Johnson *et al.* 2000). Habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when human presence on-site is less frequent and typically of short duration.

The flight behaviour of birds may be influenced by Project development. Operation of the turbines may affect bird movements through the partial obstruction of regular flight paths. Certain species (*e.g.,* waterfowl) appear to exhibit avoidance behaviour when flying close to an operating wind farm, while others do not appear to be influenced by the presence of a wind farm (James 2003; Kingsley and Whittam 2005). Breeding birds at Pickering, Ontario, do not appear to be disrupted by the 1.8 MW operating turbine, and birds continue to nest and move within the area as before (James 2003). Most diurnal migrants fly at low altitude, within 40 m of the ground, and are unlikely to be significantly disturbed by the wind turbines or associated facilities. At night, migrants fly well above the height of the wind turbines, typically greater than 150 m above the ground, and are thus also unlikely to be disturbed by the Project. However, visual or auditory features that cause bird avoidance may have a constructive effect in that birds will be less likely to accidentally collide with turbines.

Mortality

A possible effect of this Project on birds is mortality due to collisions with the operating wind turbines. Indeed, there is a perception that wind turbines cause a great many bird deaths, and it has been highlighted by regulatory agencies and non-governmental agencies as an issue that needs to be addressed. General information about bird-turbine collisions is presented below.

Kingsley and Whittam (2005) provide a detailed review of available information regarding turbine-related bird fatalities in North America and elsewhere. Numerous studies during the last 20+ years have been conducted to estimate bird mortality at wind farms, from a single turbine or small wind farms such as the present proposal, to larger wind farms with thousands of wind turbines (Gill *et al.* 1996; Erickson *et al.* 2001; Percival 2001). This level of study effort is principally due to the circumstances at one large site in California, Altamont Pass, which alerted industry, government and the public to potential bird mortality at wind-farms. Thousands of wind turbines installed in the early 1980s at Altamont Pass were shown to cause high raptor (hawks, eagles and falcons) mortality. Collisions with the turbine structures were the primary cause of death, although electrocution and wire collisions also played a part (Orloff and Flannery 1992). These raptor fatalities triggered an increase in scrutiny of potential wind farm developments, which has led to the development of monitoring protocols and a substantial amount of data on bird use and mortality at proposed and existing wind farms.

Despite these early studies in California, very few raptors have been found killed at other North American wind farms (Erickson *et al.* 2001, Kingsley and Whittam 2005). Songbirds are the most frequent casualties of wind farms in North America, and tend to collide with wind turbines more frequently during migration. Breeding birds appear to adapt to the presence of wind turbines near their nesting and/or foraging areas and avoid collision (Erickson *et al.* 2002; James 2003; James and Coady 2003; Kingsley and Whittam 2004). Songbirds can make up anywhere from 10% to 90% of the overall bird fatalities, depending on the location of the wind turbine site (Erickson *et al.* 2001). Excluding California, 78% of bird casualties at wind farms in the United States tend to be of migratory species (Kingsley and Whittam 2004). Many of these collisions occur at night, when individuals may be attracted to lit structures and collide with transmission wires, turbine towers or other structures in a wind farm.

The recent findings at a West Virginia wind farm, where 27 birds were killed by colliding with a substation and the three wind turbines closest to the substation on a foggy night during May 2003, are probably attributable to the sodium vapour lights of the substation, which, combined with the very low visibility and the presence of the wind farm on a rise in elevation, may have caused this rare mortality event (Kerlinger 2003). No fatalities were found at any of the other 41 wind turbines of the wind farm, located further away from the substation and its sodium vapour lights (Kerlinger 2003). Indeed, single night fatality events of this magnitude are not known to have occurred at any other North American wind farm.

Although fatalities occur at wind energy facilities, the number of fatalities is generally small. This is especially noticeable when compared to bird fatalities caused by other sources, such as communication towers, roads and buildings. Erickson *et al.* (2001) compared estimates of bird mortality caused by different human sources in the United States, and estimated that an average of 2.19 birds per turbine, or between 10,000 and 40,000 birds, are killed each year. Compared to other sources, such as buildings (98-980 million birds killed each year), communication towers (4-50 million birds killed each year) and vehicles (60-80 million birds killed each year), the mortality caused by wind turbines is significantly less (Erickson *et al.* 2001). Each house in North America kills on average between 1 and 10 birds each year, and tall buildings kill many more (Dunn 1993, Kingsley and Whittam 2005). Additionally, Kingsley and Whittam (2005) indicate that the effects are small compared to the millions of birds that travel through existing wind power developments in the U.S. each year. This has been noted for two sites in Washington and one site in Minnesota, where conservative estimates of mortality, using surveillance radar and carcass surveys to determine passage rates and fatality rates, respectively, are less than 0.01% of birds passing through each wind farm (Erickson 2003). In Canada, existing wind farms in Alberta were included in a research study examining the movement of nocturnal migrant birds (and bats) using radar and sound recording technology. This research, conducted during the fall of 2004, compared the behaviour and abundance of birds and bats between operating wind farms and comparable sites without wind turbines. Millikin (2005) estimated that approximately 0.02% of the individuals (birds and bats combined) observed on radar may have resulted in a collision with a turbine. Furthermore, this research identified that these nocturnally migrating birds exhibited avoidance behaviour, with individuals reducing their speed and increasing their flight height to avoid the turbines (Millikin 2005). Nocturnal bird studies were not conducted as a part of the Project.

Overall, the findings of the studies discussed above indicate that bird fatalities caused by wind turbines are very low in the majority of cases (Erickson *et al.* 2001; Percival 2001; Erickson *et al.* 2002; Kingsley and Whittam 2005). However, it is important to reduce or eliminate fatalities to the extent possible, and it is important to understand what factors may increase the collision risk of birds at a wind farm. A number of factors may influence the potential for bird-turbine interactions that lead to bird kills, including weather and lighting, landscape features, turbine design, facility design and bird abundance and behaviour. These are described further in the following discussion.

Weather and Lighting

When conditions are clear, there is low likelihood that birds will collide with wind turbines (Crockford 1992; Kingsley and Whittam 2005). However, low visibility (<200 m) may cause nocturnal migrants to fly at lower altitudes, and lights may attract individuals (Jones and Francis 2003; Kingsley and Whittam 2005). Birds may be attracted to red visibility beacons or other lighting associated with turbine structures. Lighting that attracts birds can increase the probability of bird-turbine collisions and result in kills. Environment Canada recommends that white strobe lights be used on towers at night and that their number and light intensity be minimized. It is also recommended that the number of flashes per minute be minimized within allowable parameters. Lighting for this Project will be based on the standards and requirements of Transport Canada, with the intent to install the minimum amount of lighting required. Medium Intensity White Flashing Omnidirectional Obstruction Lighting will be utilized at the top of turbines (CL-865), with short flash durations and the ability to emit no light during the “off phase” of the flash (*e.g.* as allowed by strobes and modern LED lights). These lights will operate at the minimum intensity (day: 7,500 candela, night: 750 candela), minimum flash duration (0.1 – 0.25 second/flash), and the longest duration between flashes (40 flashes/minute) allowable by Transport Canada’s CAR Standard 621.19.

Lighting elsewhere within the Project will be the minimum necessary for safety. Final lighting selection will be determined in consultation with Transport Canada.

Turbine Design

Turbine height is believed to be a strong influence on the likelihood of collision with taller structures having an increased risk of collision, while structures below 150 m cause minimal mortality (Kerlinger 2000; Crawford and Engstrom 2001; Kingsley and Whittam 2005). Migratory birds typically fly at altitudes greater than 150 m such that structures lower than 150 m in height do not usually obstruct migratory bird movements or result in bird mortality (Kingsley and Whittam 2005). The turbines of the Project will be 80 m in height and the blade length will be approximately 38.5 m. As a result, the greatest height of the turbines will be below 150 m. At this height, the turbines are not predicted to obstruct the movements of most migratory birds that frequent the region or to increase risk of material collision. Furthermore, results from a research project in Alberta indicate that migrating birds will modify their flight paths to increase in flight height when approaching an operating wind farm (Millikin 2005).

The nature of the support structure on which the rotor blades are mounted may also influence bird-turbine collisions. Wind turbines can be mounted on either a lattice structure or tubular steel towers. Limited information is available to identify the preferred support structure although some data indicate that lattice towers encourage perching by raptors during hunting and, as a result, may put these birds at risk of collisions. As such, the turbines for this Project will be built using tubular steel towers.

Facility Design

The scale of the wind farm has a direct influence on the potential for bird-turbine collisions. Facilities of 100 turbines or more are thought to more likely have a greater effect in terms of bird mortality due to the increased number of vertical obstacles (potential collision hazards) in the landscape (Environment Canada 2005). The Project will consist of a maximum of 20 turbines and will not be of a size that should cause concern for elevated collision risk.

Bird Abundance and Behaviour

When considering the results of the avian pre-construction monitoring program, the vast majority of birds observed during the study were flying less than 50 m of the ground, which roughly corresponds to the air space below the turbine blade sphere (*i.e.,* below where the turbine blades would be turning).

In general, the area does not seem to be a major staging or stopover area for migrating birds or for birds traveling over the Study Area to get to some other location. The spring and fall migration counts generally show no evidence of major peaks of arrival or departure like that observed in other parts of the region (*i.e.,* Brier Island).

Although species of conservation concern were recorded in the Study Area, it is unlikely that any are at risk of collision, due to the very low use of the site by these species, the general absence of habitat suitable within the Project footprint for their breeding or staging, and the expected low number of fatalities overall, based on previous studies undertaken elsewhere in North America. As a result, no specific mitigation measures or monitoring programs have been identified to address potential effects to species of conservation concern.

Potential Impact and Mitigation

Evidence from wind farms in North America and elsewhere, as noted above, suggests that bird collisions are likely to occur but are in very low numbers, and the potential for significant bird kills is low. The results of the pre-construction bird survey program and collection of existing data indicate that the bird use of the Project Area does not cause any concern with regards to increasing risk of collision, disturbance or habitat alteration. However, there are further mitigation and monitoring measures that will help reduce effects to bird populations.

Breeding bird surveys will be conducted in the Project Area in June 2009 to confirm breeding status, particularly that of the Peregrine Falcon, and will include the transmission line corridor which was not included in the 2007-2008 surveys.

Construction on-site will occur outside of the breeding season to the extent possible to avoid contravention of the *Migratory Birds Convention Act*. If clearing activities cannot be scheduled to avoid the breeding season for most birds (May to August), then a biologist on-site will identify nests within or immediately adjacent to work areas, and flag them for avoidance during construction.

Mitigation for distribution lines will consider techniques recommended by the Avian Power Line Intervention Committee (1994, 1996). This mitigation may include:

- Line visibility should be increased by bird flappers or other bird-flight diverters, and, where possible/feasible, increasing the size of the wire (to larger than 230 kV).
- Lines should not be built over water or other areas of high bird concentrations.
- Small lightning shield wires should be eliminated where lines cross wetlands.
- Lines should be placed as close to trees as is practical and below the level of tree tops wherever possible.
- To prevent the electrocution of large birds such as raptors and cranes, lines should be designed with adequate space between conductors to prevent a bird from simultaneously touching two phases.

To determine the accuracy of the predicted environmental effects and ensure all mitigation measures are successful, post-construction monitoring will be conducted and will be developed in consultation with CWS and NSDNR. Monitoring will include bird use and mortality surveys, to be conducted at a frequency to be determined though consultation with CWS. With respect to mortality surveys, typically searches include a 40 m radius around each turbine and will be developed as per the “Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds” (Environment Canada 2007b). Additionally, as a part of the monitoring protocol, searcher efficiency trials will be conducted and may include spring scavenger impact trials if required by Environment Canada, to correct for these potential influences on the carcass monitoring. The length of the post-construction bird monitoring program will be determined in consultation with CWS and NSDNR although it is expected that two years of monitoring may be required. The detailed protocol and subsequent results of the post-construction monitoring will be used to assess the success of the mitigation measures in consultation with Environment Canada and NSDNR. In turn, this may lead to other mitigation being suggested using the available options at the time.

Taking into account the mitigation measures, there likely will be residual effects of the Project on the area’s birds. In general, sensory disturbance will be infrequent, temporary in nature, reversible, small in magnitude and restricted to the Project Area given the mitigation measures proposed. Residual effects of sensory disturbance are not predicted to be significant. Fatalities as a result of colliding with structures within the Project will be irreversible, but they are expected to be infrequent and minor in magnitude and in geographic extent. It is unlikely that mortality will affect birds at a population level. As a result, the residual effect of this mortality is not considered to be significant.

5.2.1.2 Other Wildlife

Other wildlife species of the Project area include mammals, reptiles and amphibians. Most species are year-round residents of the Project area and adjacent lands, although certain local or long-distance migrations of some species occur. Potential environmental effects of the Project on wildlife include habitat alteration, mortality and sensory disturbance.

Sensory Disturbance

Wildlife sensory disturbance may occur as a result of on-going human activity on-site as well as visual and auditory disturbance related to the operation of the turbines. Sensitivity of wildlife to disturbance varies by species and life-stage.

Human presence (noise, sight and smell) and vehicles may disturb wildlife. During operation of the wind-farm, Project-related vehicles and personnel will be in the vicinity of wind turbines on a regular basis for ongoing maintenance. It is likely that some disturbance of diurnal wildlife will occur during operation and maintenance of the Project. Bats are unlikely to be affected by human presence as they are nocturnal and the majority of human presence will occur in the Project Area during the day. Although there is the potential for limited human presence induced disturbance to wildlife, significant adverse effects are not predicted for several reasons. First, the Project Area has a high degree of existing human disturbance (*i.e.,* forestry activities) and thus wildlife species have either become acclimatized to some degree of human disturbance or have already left the area. Second, disturbance will be intermittent and generated noise will be of low levels (*i.e.,* human speech and vehicle noise). Third, no rare or at-risk wildlife species were reported as breeding in the Project area. In order to further reduce the severity effects of human disturbance on wildlife, worker presence on-site should be minimized and limited to designated work areas. In addition, all Project-related vehicles will be maintained to minimize noise and no idling will be permitted. In consideration of existing conditions and suggested mitigation no significant adverse effects are predicted on wildlife due to human presence during operation and maintenance.

The operation of the wind turbines may also result in visual and auditory disturbance of wildlife. However, studies in the western United States have shown that there has been no significant effect of the construction and operation of wind farms on big game (Strickland and Erickson 2003), indicating that species are either unaffected by these developments, given their small footprint and the preservation of existing land use, or that they can readily adapt to the presence of wind turbines. At this site, habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when human presence on-site is less frequent and would occur on a short-term basis.

Mortality

Mortality of wildlife has the potential to occur during all phases of Project development. During construction and decommissioning, there is a small chance that small mammals may be harmed as a result of limited site clearing and through the use of heavy equipment for moving materials on and off the Project site. However, additional potential for mortality relates to interactions between operating wind turbines and bats. Bats have been identified as animals with the potential to be affected by wind energy facilities, as measured by numbers of carcasses found during surveys at wind farms in the United States and Canada. The remainder of this section describes the issue of bat mortality at wind farms in more detail, places the issue in the Nova Scotia context and provides background to the assessment.

Bat Turbine Collisions

Given the ability of bats to navigate in darkness, to avoid large obstacles and detect small insects in the air using echolocation, it is interesting that bats would be found to collide with wind turbines and other tall structures. However, this is indeed the case. Bat collision mortality has been identified to occur with a number of tall structures including lighthouses, buildings, power lines, communication towers and wind turbines. Bat collision with human structures appears to be an infrequent occurrence, but it has the potential to be of concern, as discussed below.

The first report of bat fatalities at a wind farm was by Hall and Richards (1972). Over four years, 22 White-striped Mastiff-Bats (*Tadarida australis*) were found at the base of turbines at an Australian wind farm. Since then, bat fatalities have been reported at several wind farms in the United States and at one wind farm in Alberta (Brown and Hamilton 2002, Erickson *et al.* 2002, Johnson *et al.* 2002). Reports prepared by Erickson *et al.* (2002) and Johnson *et al.* (2002) provide excellent summaries of data available from a number of studies in the United States. These summaries show that the majority of bat fatalities at wind farms in the United States occur

in late summer and early fall, presumably during southward migration. Of the 536 bat collision fatalities included by Erickson *et al.* (2002), nearly 90% of all the fatalities occurred from mid-July through mid-September, with over 50% in August (Erickson *et al.* 2002), peaking during the first two weeks. Most fatalities were of migratory tree bats with Hoary Bats being by far the most numerous, comprising approximately 61.7% of all fatalities. Additionally, 17.2% of the fatalities were of Eastern Red Bats and 7.1% were Silver-haired Bats. Small numbers of dead Big Brown Bat, Little Brown Bat, and Eastern Pipistrelle were also found during these studies.

Studies appear to support the belief that most fatalities are of bats during fall migration. For example, relatively large populations of bats were documented breeding in close proximity to wind farms at Buffalo Ridge, Minnesota and Foote Creek Rim, Wyoming, yet very few fatalities were recorded during the summer (Erickson *et al.* 2002). The four-year study at Foote Creek Rim determined that the majority of bats were killed in August, with the remaining carcasses found between June and September. Hoary Bats made up approximately 80% of the casualties at this site, with other species consisting of Little Brown Bats, Silver-haired Bats and Big Brown Bats (Johnson *et al.* 2002). Collisions have been reported from turbines located in crop fields, pastures and prairie, away from habitat typically used by foraging bats. Instead, the timing of documented mortality coincides well with the seasonal migration of bats, and most collisions involve these migratory species rather than resident species.

Based on the timing of spring migration (Koehler and Barclay 2000), spring migrations of Hoary, Eastern Red and Silver-haired bats are most likely to occur in May. Despite these movements, very few collision fatalities have been found in the spring at wind farms in the United States. Of 536 recorded bat collision fatalities at wind farms across the United States, only two were killed in May (Erickson *et al.* 2002). Collision data collected from other types of structures also support these findings. For example, of 50 dead Eastern Red Bats collected at a building in Chicago, 48 were found in the fall and two in the spring (Timm 1989). It is not clear why spring migrants collide with wind turbines far less frequently than fall migrants. Behavioral differences between migrating hoary bats in the spring and fall may influence collision risk, as suggested by Johnson *et al.* (2002). These differences have been reported in Florida, where autumn migration occurred in waves, whereas the spatial distribution of bats during spring migration appears to be far more scattered (Zinn and Baker 1979).

With the exception of Buffalo Mountain and Mountaineer, studies from wind farms are reporting relatively small numbers of casualties in line with the Klondike study, even taking into consideration carcass removal and searcher efficiency. Table 5.12 summarizes bat fatality data at a number of wind farms in the U.S. Many facilities reported few bat fatalities. As an example, and including factors correcting for carcass removal and searcher efficiency, only 19 bat collisions were recorded at the Klondike Wind Project in Oregon, consisting of 16 turbines, during a one-year study (Johnson *et al.* 2003). The 16 turbines at this open field site are 1.5 MW turbines with a blade sweep approximately 30-100 m above the ground. The six bats actually found at the wind farm were three Hoary Bats that had collided during September, a Silver-haired Bat found in May and two decomposed *Myotis* bats found in June. Based on the estimate of 19 bat collisions at the facility during the year, the average rate of collision is 1.2 bat fatalities per turbine per year (Johnson *et al.* 2003). With the possible exception of Mountaineer (see below), there is no current evidence that suggests populations are affected by wind farm mortality, despite the low population growth rates exhibited by most bats (excluding the Hoary Bat; see Bat Conservation International 2001). The principal factors adversely affecting bat populations are predation and habitat alteration/destruction, not collision with wind turbines or any other human structure (Bat Conservation International 2001).

Table 5.12 Estimated Bat Collision Fatality Rates at United States Wind Farms

Wind Resource Area	Bat Mortalities per Turbine per Year	Correction	Reference
Klondike, Oregon (16 - 1.5 MW turbines)	1.2	Adjusted for search biases	Johnson *et al.* 2003
Buffalo Ridge, Minnesota (Phases II & III)	2	Adjusted for search biases	Johnson *et al.* 2003

Table 5.12 Estimated Bat Collision Fatality Rates at United States Wind Farms

Wind Resource Area	Bat Mortalities per Turbine per Year	Correction	Reference
(281 – 750 kW turbines)			
Northeastern Wisconsin (31 – 660 kW turbines)	4.3	-	Howe *et al.* 2002
Foote Creek Rim, Wyoming (72 – 600 kW and 33 – 700 kW turbines)	1.3	Adjusted for search biases	Johnson *et al.* 2000, Young *et al.* 2001, Gruver 2002
Buffalo Mountain, Tennessee (3 – 660 kW turbines)	28.5	-	Nicholson 2003
Vansycle, Oregon (38 – 660 kW turbines)	0.7	Adjusted for search biases	Erickson *et al.* 2000
Lake Benton, Minnesota (354 - 660 kW turbines)	0.1 - 2.0	Adjusted for search biases	Johnson *et al.* 2003
Mountaineer Wind Energy Centre, West Virginia (44 - 1.5 MW turbines)	9.1	-	Lindsay and Kearns 2003
Nine Canyon, Washington (37 - 1.3 MW turbines)	3.2	Adjusted for search biases	Erickson *et al.* 2003

A more recent study proves to be an exception, in that large numbers of bats have been found to collide with wind turbines. At the Mountaineer Wind Energy Centre on Backbone Mountain, West Virginia, approximately 400 bats were found killed by 44 turbines during the first year of its operation (Lindsay and Kearns 2003). Of the 232 that were identified to the species level, most of the bats killed were Eastern Red Bats and Hoary Bats (Lindsay and Kearns 2003). Taking into consideration observer effort and carcass removal by scavengers, researchers have estimated that more than 1000 bats were killed at the site during a six week period (Bat Conservation International 2001). This is the greatest number of bats reported killed at any wind farm. The reasons why so many bats have been killed at the Mountaineer site are poorly understood but may include its siting at a high elevation within the Appalachian Mountains.

Bats are being killed at wind farms, or at least some wind farms, but the factors putting them at risk of colliding with wind turbines are unknown. Without a clear understanding of what would place bats at risk of collision, it is difficult to predict the frequency of bat-turbine collisions. For example, Erickson *et al.* (2002) report on several instances where bats were observed foraging very close to turbines without being struck by the turbine blades. This is further complicated by a lack of understanding of bat ecology, especially on migration, and the paucity of data on abundance and movement of bats at multiple spatial scales (continent-wide, provincial, regional) that could provide context for pre-construction surveys.

Barotrauma

Recent research indicates that turbine collisions account for only about half of bat fatalities. A recent study by the University of Calgary reports that barotrauma is the cause of death in a high proportion of bats found at wind energy facilities. Barotrauma involves tissue damage to air containing structures (*i.e.,* lungs) caused by rapid or excessive air pressure change. In this case, it is believed that air pressure change at turbine blades causes expansion of air in the lungs not accommodated by exhalation, therefore resulting in lung damage and internal hemorrhaging (Baerwald *et al.* 2008).

Impact Assessment and Mitigation

Pre-construction bat surveys at the proposed Digby Wind Power Project were not undertaken due to the inability to be able to evaluate the significance of the site for bat migration, due to a lack of knowledge of what numbers of bats exist in and migrate through or within Nova Scotia, and the inability to be able to predict impact if site-specific data existed. As indicated in Section 4.4.2.2, there are no known bat hibernaculae in the Project Area. A possible hibernaculum site (abandoned mine shaft) is located approximately 7 km from the Project Area.

SkyPower is committed to monitoring the Project during its first year of operation to identify if bats are being killed, and will be prepared to adopt post-construction mitigation measures should there be a need. There are currently no guidelines in Nova Scotia for monitoring bat populations, in part due to the lack of good baseline data. In the absence of these guidelines, post-construction monitoring protocols and mitigation measures, should monitoring in the first year of operations deem them necessary, will be developed in consultation with NSDNR. Monitoring will include fall bat mortality surveys to be conducted at a frequency to be determined though consultation with regulators. Typically searches include a 40 m radius around each turbine. Additionally, as a part of the monitoring, searcher efficiency trails will be conducted and may include spring scavenger impact trials if required, to correct for these potential influences on the carcass monitoring. Bat mortality surveys will be conducted in conjunction with bird mortality surveys as required. The results of the post-construction monitoring will be used to assess the success of the mitigation measures in consultation with NSDNR and other biologists, which may lead to other mitigation being suggested using the options available at the time. At this stage, the level of impact is considered **low** and **not significant**. These surveys are discussed further in Section 6.

5.2.1.3 Land Use

As indicated in Section 4.5.4 of this report, the majority of the land required for Project development is forested land which has historically been subjected to forestry activities. The effect of wind turbines on undeveloped lands within the Project area is negligible with only a minor portion of land use required to house turbines and their ancillary equipment. There is also agricultural land (primarily pasture) within the Study Area, although Project infrastructure is not proposed to be sited on these lands. Cattle grazing, which occurs in the southwestern part of the Study Area is not predicted to be affected by Project activities. Experience has shown wind farms to be a compatible land use with agriculture (CanWEA 2001). The U.S. Department of Energy has indicated that wind turbines have minimal effects on farming and ranching operations. They indicate that turbines have a small footprint so crops can grow and livestock can graze right up to the base of the turbine (U.S. Department of Energy 2004). Land use impacts associated with construction and operation of the Project will be negligible since it will not impair or impact current land uses, change land use patterns, or be incompatible with existing uses. The residual impact to existing land use is considered to be **minimal** and **not significant**.

5.2.1.4 Property Values

Prior to 2003, there was a general lack of empirical data assessing the impact of wind energy facilities on the economic value of properties whether within a wind farm or within site of a wind farm. However, Sterzinger *et al.* (2003) undertook such a study, statistically testing whether the perception that property values are negatively affected by wind farms is true or false. For their study, Sterzinger *et al.* (2003) compiled data on every U.S. wind energy development commissioned between 1998 and 2001 that was of a capacity of 10 MW or greater. Property sales records for the area within 5 miles (8 km) of the wind farm were collected for the three years prior to commissioning and the three years following commissioning, to determine if there was a difference between pre-construction and post-construction property sales. For comparison, sales records were also collected for the same time period from communities comparable to that included for each wind farm. A total of 10 wind power projects were analysed, including two projects from New York, two projects in Pennsylvania and one project in Vermont (Sterzinger *et al.* 2003).

Overall, property values increased with the same rate in wind farm communities within 8 km of a wind farm compared to similar communities without wind farms (Sterzinger *et al.* 2003). Nine of the ten projects showed a greater increase in property values after commissioning compared to the period prior to commissioning, and when looking at the rate of increase in property values after commissioning of the wind farm, communities near a wind farm actually had greater increases to property values than those without a nearby wind farm (Sterzinger *et al.* 2003). These findings indicate that there is no support for the notion that the development of wind farms decreases property values.

Further assessment of the potential impact of wind farms on property values was conducted by ECONorthwest (2002). For this assessment, interviews were conducted with tax assessors from 13 counties in the United States for which wind farms had been developed during the previous 10 years. Based on these interviews with unbiased and trained assessors of property values, ECONorthwest (2002) concluded that there is no loss of value for those residential properties with views of wind turbines (*i.e.,* views of wind turbines do not negatively impact property values).

A report conducted by the Renewable Energy Policy Project (REPP 2003) concluded that, based on a study of nine different communities from across the United States, property values of homes within a wind farm's viewshed were not harmed by the construction and operation of the wind energy facility. To the contrary, for the majority of the projects analyzed, property values actually rose more quickly in the viewsheds than in comparable communities outside of the viewsheds (REPP 2003). Furthermore, statistical evidence does not support the idea that property values within the viewshed of wind farms suffer or perform poorer than in comparable regions (REPP 2003). This statistical analysis is supported by a literature review conducted as part of the REPP (2003) study.

The Environmental Review Report for the Wolfe Island Wind Project near Kingston, Ontario (CREC 2007) also includes a comprehensive review of literature on property value studies conducted in Australia, Denmark, United Kingdom, the United States, and Canada. These studies consistently reported a neutral or positive effect on property values (CREC 2007).

The proposed Digby Wind Power Project is located in a rural setting, and is surrounded by a mix of forested and agricultural lands and residential properties. The Project has the potential to represent a long-term land use, which may have the effect of promoting some stability in land values. It is conceivable that the value of specific properties could even rise as a result of an increase in the potential for tourist related commercial activities in this area. It is predicted that impacts on property values as a result of the wind farm are likely to be negligible.

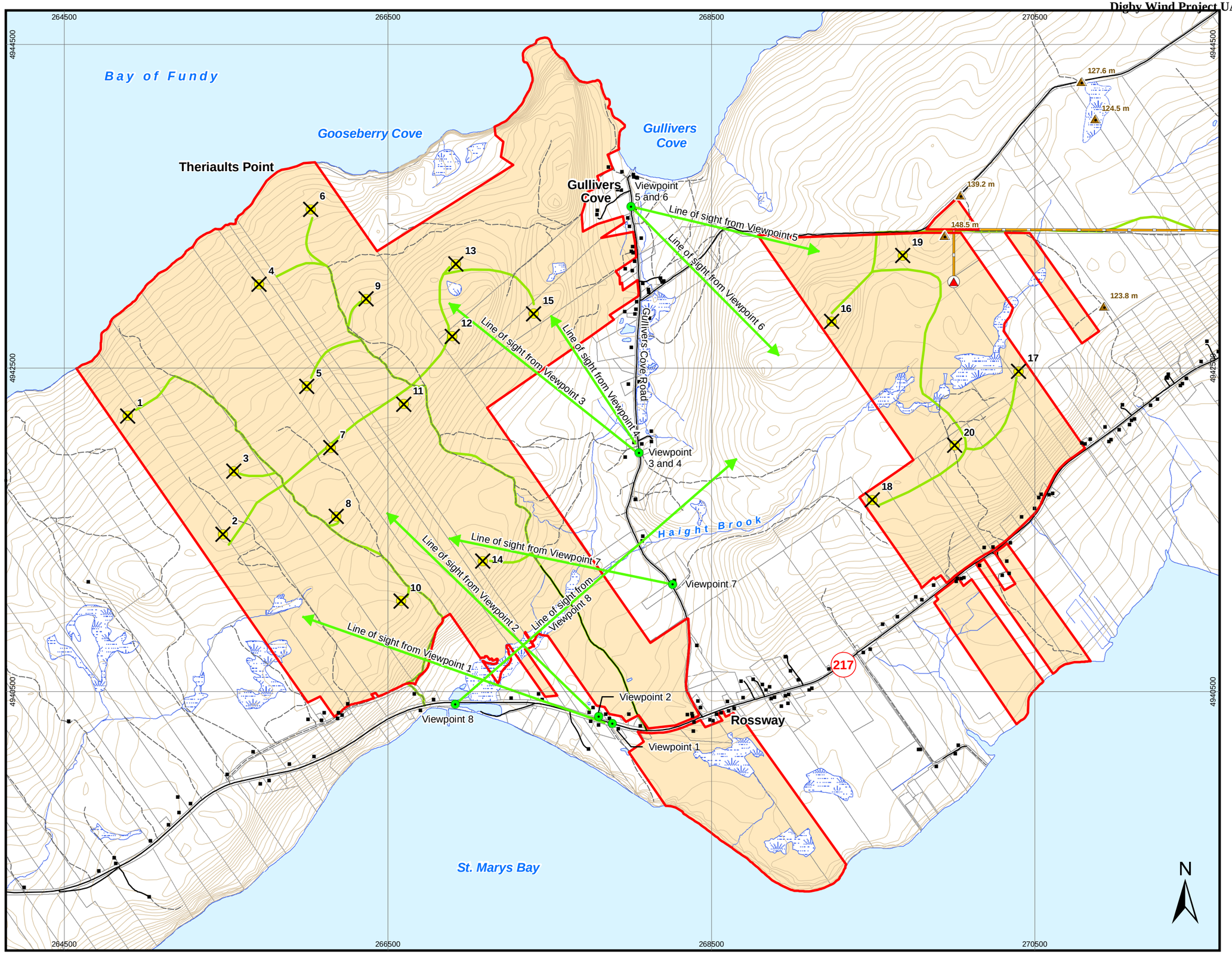
5.2.1.5 Visual Impacts

Due to the importance of assessing the potential impact to the area's visual aesthetics, a visual impact assessment was completed. The following section summarizes the visual assessment with respect to the photo montage analysis and shadow flicker analysis that were conducted.

Viewsheds

Jacques Whitford Stantec Limited used the photo montage module from the EMD WindPro 2.4 to render all photo montages for the assessment. A photo montage is a photograph taken in the field from a specific location with the proposed wind farm turbines superimposed to scale. It is a graphical representation of what the constructed wind farm could potentially look like upon completion from a particular vantage point. Figure 5.1 shows the viewing locations selected for the assessment (*i.e.,* location from which photographs were taken) and Figures 5.2-5.9 show the simulated results.

The turbines are designed to rotate and be oriented in rows facing the prevailing wind direction at any given time. The towers themselves will be light grey and made out of rolled steel. The housing at the top of the tower, which contains the generator, is fiberglass and will also be light grey. The base of the tower is approximately 4.6 m across, while the height of the turbine towers will be approximately 80 m, with rotor blades that are approximately 38.5 m long.



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Figure 5.1

DIGBY WIND POWER PROJECT

Photo Montage Viewpoint Locations

Photo Montage
- Viewpoint Location
- View Direction

Project Components
- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features
- Building
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland (NSTD)
- Waterbody
- Property Boundary

0 300 600 900 1,200
Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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Figure 5.2

View from Viewpoint 1 Looking West

Digby Wind Power Project

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Figure 5.3

View from Viewpoint 2 Looking North

Digby Wind Power Project

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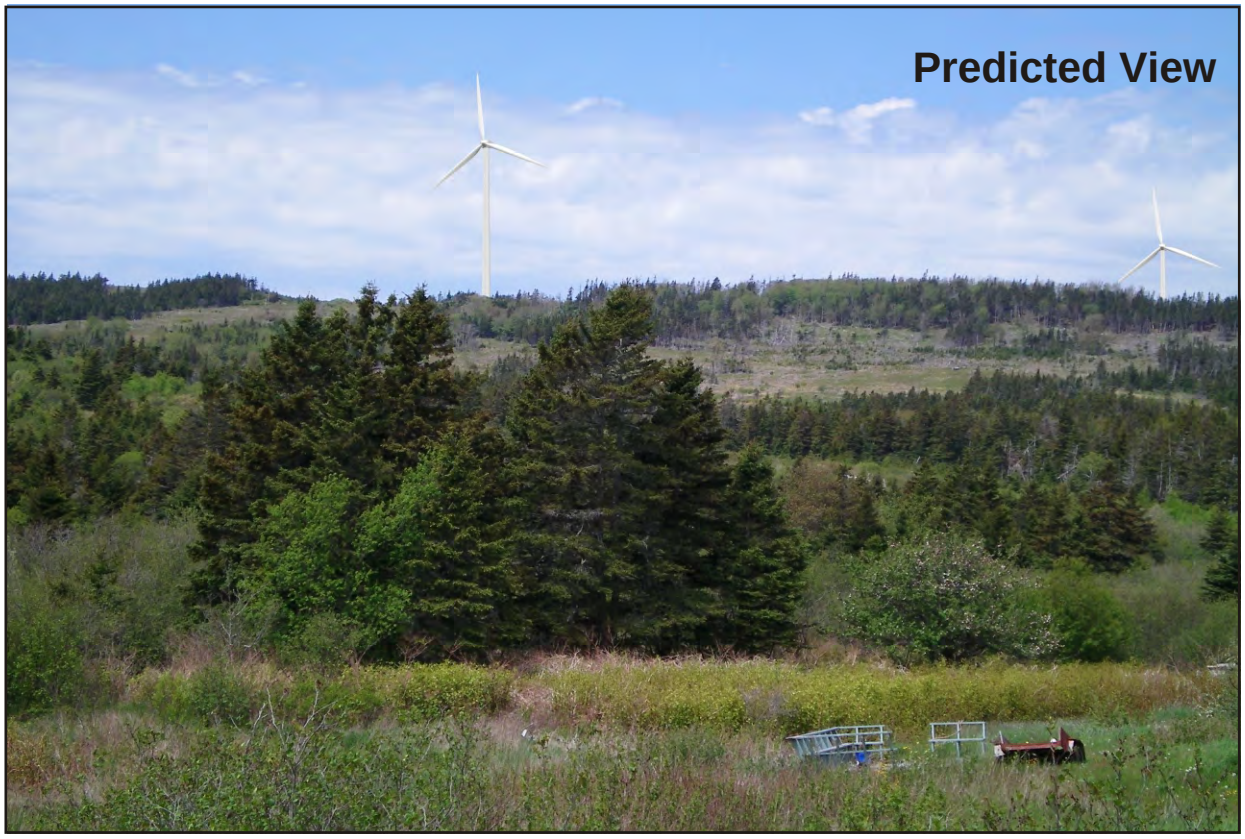




Figure 5.4

View from Viewpoint 3 Looking North West

Digby Wind Power Project

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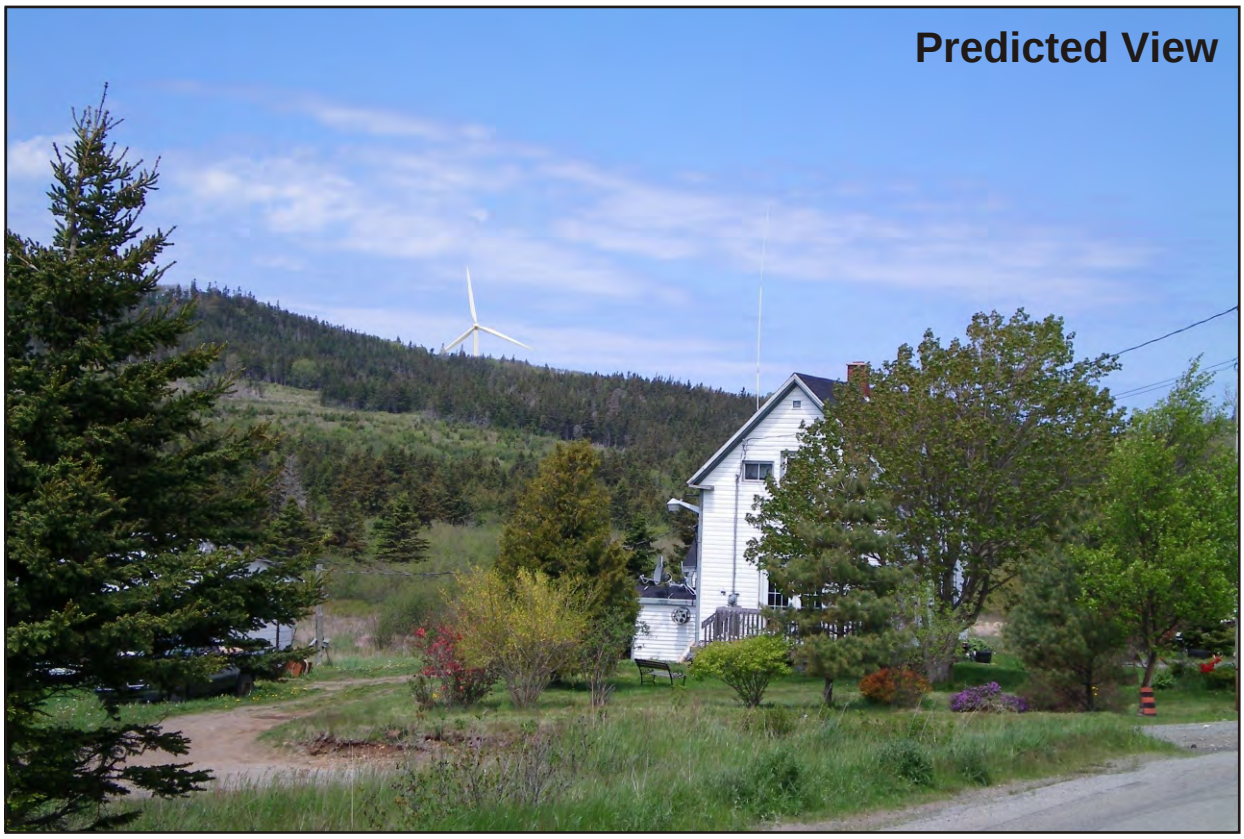




Figure 5.5

View from Viewpoint 4 Looking North West

Digby Wind Power Project

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Figure 5.6

View from Viewpoint 5 Looking East

Digby Wind Power Project

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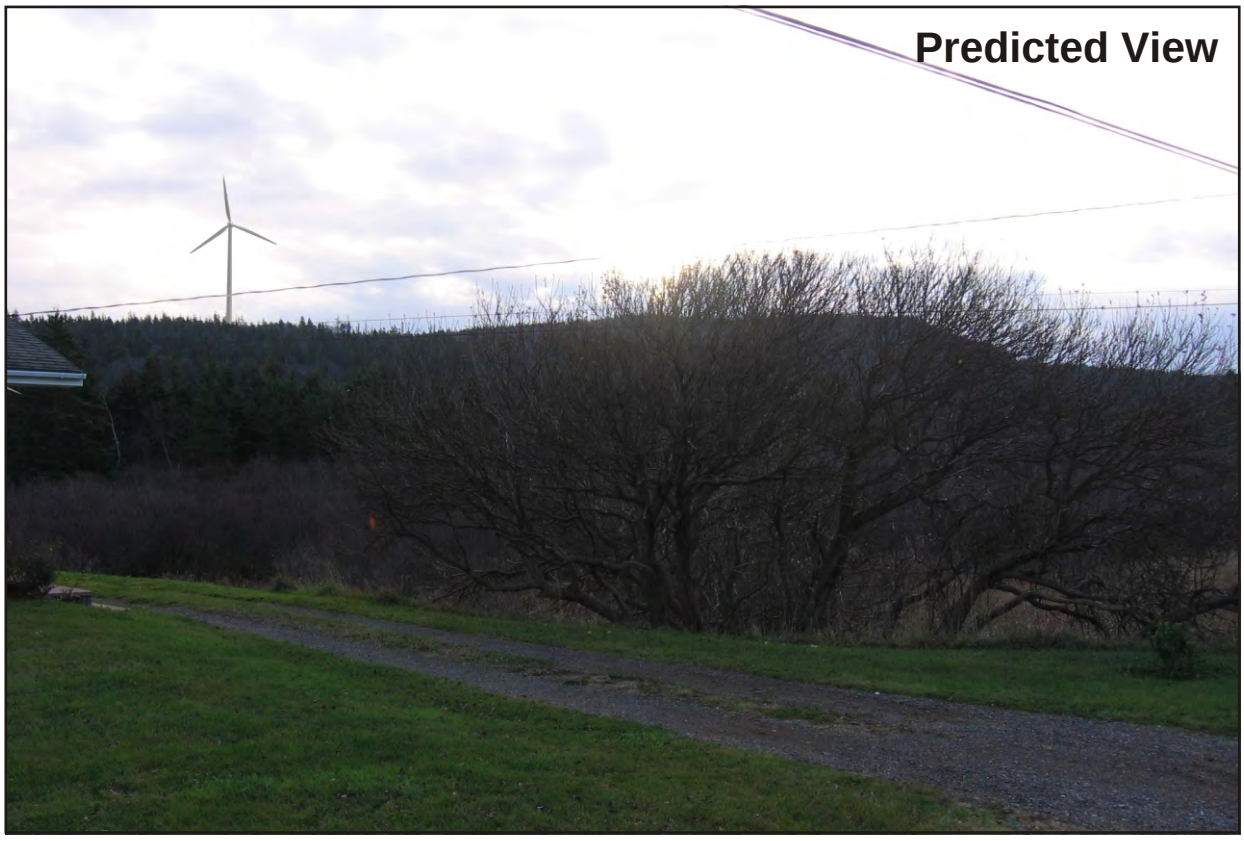




Figure 5.7

View from Viewpoint 6 Looking South East

Digby Wind Power Project

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Figure 5.8

View from Viewpoint 7 Looking West

Digby Wind Power Project

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Figure 5.9

View from Viewpoint 8 Looking North East

Digby Wind Power Project

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Lighting

The wind turbine generators will be lit to meet the requirements of Transport Canada's Canadian Aviation Regulations (CAR) 621.19. Lighting will be the minimum required to ensure the appropriate level of aeronautic safety and white strobe lights (CL-865) may be used with the minimum intensity and flashes per minute allowable.

The viewing distances from the locations analyzed in this report indicate that all of the residences within the Study Area will be greater than 600 m from the nearest wind turbine. Given the viewing distance of greater than 600 m combined with steep terrain, the presence of these lit towers will not place excessive nighttime visual pollution in the Study Area.

Shadow Flicker

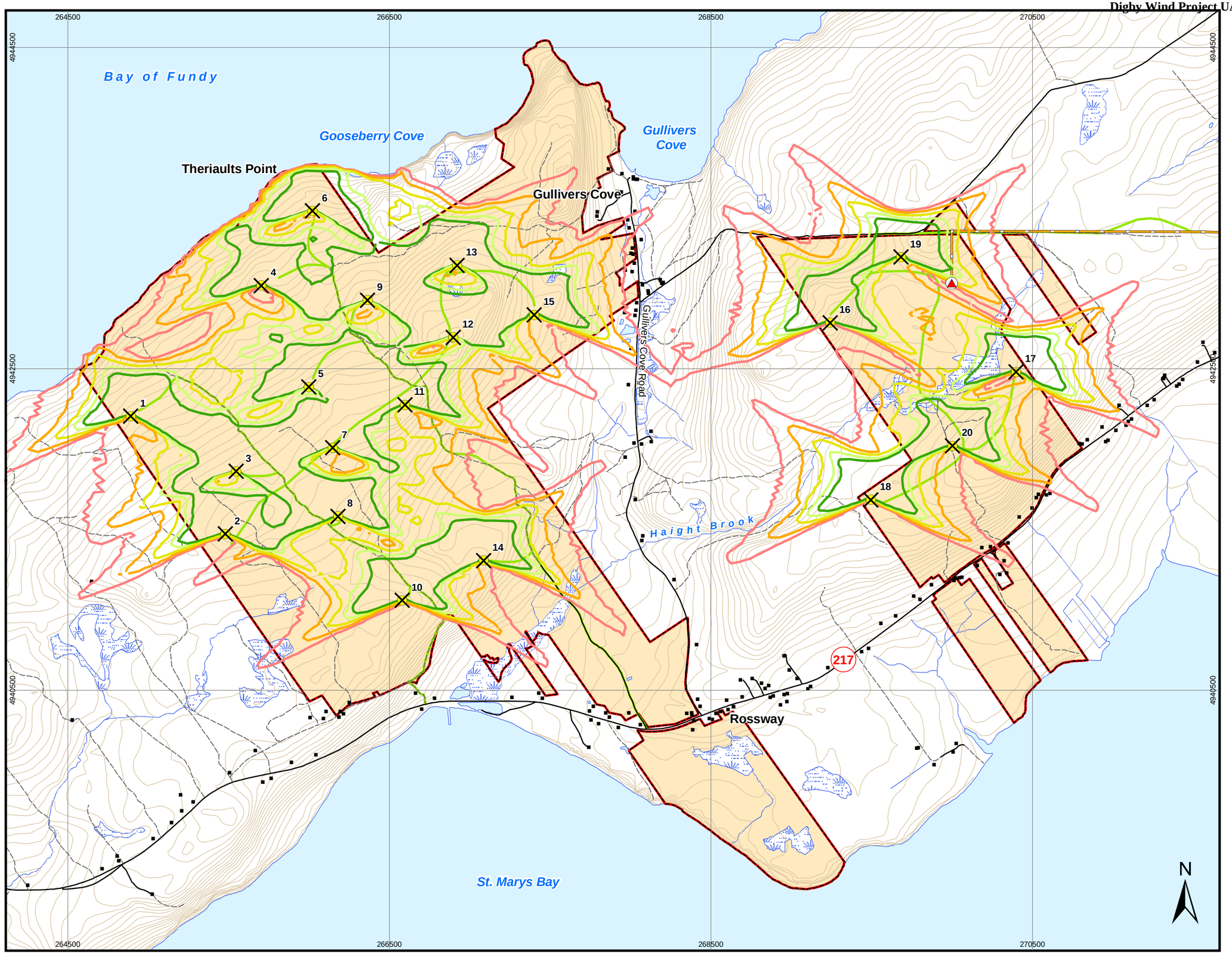
Shadow flicker caused by wind turbines is defined as alternating changes in light intensity due to the moving blade shadows cast on the ground and objects (including through windows of residences). There are obstacles such as terrain and vegetation which are located between the wind turbine and a potential shadow-flicker receptor, hence shadow-flicker will be either significantly reduced or eliminated at such receptors.

The modeling software WindPro 2.4 by EMD (Denmark) was used to model potential shadow flicker within the area. The model calculated the duration of shadow flicker various receptors receive within a year, given a number of assumptions. The model assumes a worst-case scenario, with the following conditions: the sun is fully shining all year (no clouds or fog), the absence of natural obstacles (no trees or terrain to block exposure), the rotor plane is perpendicular to the sun (biggest shadows), and the rotor is always turning (causing shadow movements). These assumptions therefore result in an overestimation of actual impacts. As a demonstration of the level of overestimation, the modeling software assumes approximately 4,000 hours of sun, while Canadian Climate Normals data (1961-1980) for the nearest weather station recording bright sunshine (Yarmouth) reports approximately 1,800 hours of sunshine per year.

Nova Scotia has no set regulatory limits for exposure to shadow flicker, however the industry commonly uses 30 hours per year as a limit to reduce nuisance complaints. Calculations of shadow flicker for all nearby residences, given a worst-case scenario as described above, determined that no residence will experience shadow flicker for more than 30 hours per year and approximately nine residences would experience shadow flicker for between 1 and 30 hours per year (Figure 5.10).

A registry will be created to document complaints of shadow flicker. When a complaint or complaints of shadow flicker are received from a receptor located within 1,000 m of the turbine, shadow flicker will be monitored from that receptor. Information collected from the shadow flicker monitoring will be used will be used to develop further mitigation, if warranted.

No mitigation measures are required for the residential receptors evaluated for the visual impact assessment. The residual effect of the Project on the area's visual aesthetics is considered to be **low** but **not significant**.



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Figure 5.10

DIGBY WIND POWER PROJECT

Shadow Flicker

Shadow Flicker (Hrs/Year)
- 15
- 30
- 50
- 75
- 100

Project Components
- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features
- Building
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200
Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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5.2.1.6 Noise Impacts

Noise can be simply defined as "unwanted sound". Sound level limits are identified on an A-weighted decibel scale (abbreviated as dBA), which is generally accepted to reflect how humans perceive sound. Conversation in close quarters is usually at a sound level of 50 to 60 dBA and an alarm clock may emit sound to levels of approximately 80 dBA. Presently, the province of Nova Scotia does not have set sound level limits specific to wind turbine operations. In response to the growth of wind energy development in Ontario, the MOE identified the need to provide guidance as to how to apply their technical documents to wind turbines, and produced their technical document "Interpretation for applying MOE Technical Publications to Wind Turbine Generators" in 2004. This guidance was considered during the development of a noise impact assessment for the Digby Wind Power Project, completed by Jacques Whitford (see Appendix E).

Wind turbine generators produce sound through a number of different mechanisms which can be categorized into mechanical and aerodynamic sound sources. The major mechanical components including the gearbox, generator and yaw motors each produce their own characteristic sounds, including sound with tonal components. Other mechanical systems such as fans and hydraulic motors can also contribute to the overall sound emissions. Mechanical sound is radiated at the surfaces of the turbine, and by openings in the nacelle casing. Mechanical issues involving yaw motor supports or power train design can result in anomalous sounds such as periodic booming or tonal sounds.

The interaction of air and the turbine blades produces aerodynamic sound through a variety of processes as air passes over and passed the blades. The sound produced by air interacting with the turbine blades tends to be broadband sound, but is amplitude modulated as the blades pass the tower, resulting in a characteristic ‘swoosh’. Generally, wind turbines radiate more sound as the wind speed increases.

The manufacturer’s predicted operational sound levels were combined with background sound data obtained from receptor locations surrounding the Project site to obtain a more accurate representation of the potential sound levels at the selected receptor locations. Sound modelling was conducted using CadadA version 3.7, which includes the calculation methodology of the International Organization for Standardization (ISO) *Standard 9613 – Attenuation of Sound during Propagation Outdoors* (ISO 9613). Local terrain was considered in modelling. Sound resulting from construction activities was modeled. Sound power level data provided by the manufacturer were used to model operational sound at the selected receptors. Predicted sound levels at receptors increased with increasing wind speed due the fact that the sound power level of the wind turbine generators also increased with increasing wind speed.

The study results presented in Appendix E show that sound levels at the receptor locations are primarily dominated by existing background sound levels and not by the predicted sound produced from operations of the Digby Wind Power Project. Therefore, it is not expected that the Project will have a significant impact, with respect to sound, on nearby receptors.

Although there is no recommended setback distance, the nearest receptor is no closer than 600 m from any turbine. In addition, routine maintenance of the wind turbines and associated equipment will be conducted as recommended by the manufacturer to ensure the turbines operate efficiently and do not produce additional noise.

Provided these mitigation measures are followed, the potential residual effect of the Project on noise is considered to be **minimal** and **not significant**.

5.2.1.7 Recreation and Tourism

As indicated in Section 4.6.3, the Digby Neck and Islands area attracts tourists, particularly those interested in nature tours. It is expected that tourists travelling through the Study Area might be attracted to the Project and possibly tourism to the area could even increase as a result of the Project, as judged by the numbers of tourists that regularly visit existing wind power projects in Atlantic Canada. For example, North Cape Wind Farm in Prince Edward Island has become a tourist destination, attracting 60,000 visitors per year. The

government has a restaurant gift shop at the site. The restaurant gift shop employs 20 people from mid-May to the end of October (CanWEA 2006). In the case of the Digby Wind Farm, where the Project is located on privately owned lands and viewing will be limited from adjacent public roads, the same level of tourism interest is not anticipated.

In a research study conducted in Scotland, 43% of respondents said a windfarm would have a positive effect on their inclination to visit the project area (Argyll), an area of high landscape value. About the same proportion of respondents said it would make no difference, while less than 8% felt it would have a negative effect (MORI Scotland 2002). In this particular study, the main aspect of the area that tourists found of particular interest was the “beautiful scenery and views”, not unlike tourists who may choose to visit the Study Area of Gulliver’s Cove. When asked whether the presence of wind farms in Argyll made any difference to the likelihood of them visiting the area, 91% of respondents indicated that it made no difference (MORI Scotland 2002). The Digby Project is not anticipated to have an adverse effect on the tourism industry (including recreational operations in Gulliver’s Cove), but may in fact have a minor positive effect.

With respect to informal recreational use of lands, the Project will, to the extent possible, maximize use of existing access roads in the area. In accordance with landowner agreements, access will be controlled so as to discourage trespass on private lands. Therefore the Project is not expected to increase recreational vehicle use in the area and trespass on private lands.

Visual and sound effects that could be experienced by tourists in the area are discussed Section 5.2.1.5 and 5.2.1.6, respectively.

The potential residual effect of the Project on tourism and recreation is considered to be **minimal** and **not significant**.

5.2.1.8 Health and Safety Issues

Safety issues are typically associated with construction and decommissioning activities associated with the wind farm. However, safety issues must also be considered as they pertain to the operational phase and the potential interaction with the local population and public access issues. Health and safety concerns related to shadow flicker, electromagnetic fields (EMFs) and ice throw are issues that have been raised by the public at other projects in Canada, and are considered here. The following sections provide a discussion on the potential environmental effects associated with electromagnetic fields, infrasound and ice throw, and general health and safety issues.

Shadow Flicker

Concerns have been raised about the potential for wind turbines to cause epileptic seizures as a result of shadow flicker. As discussed in Section 5.2.1.5, shadow flicker is caused by the rotating blades of the turbines interrupting sunlight causing flicker. Individuals diagnosed with photosensitive epilepsy (approximately 0.03% of the population) are at risk for seizures caused by flickering light at certain frequencies. Photosensitive epileptic patients are most sensitive to flickering light at 5-30 Hz, although some report sensitivity as low as 3 Hz or as high as 60 Hz (Epilepsy Action 2007). At 3 Hz or below, the cumulative risk of inducing a seizure is about 1.7 per 100,000 of the photosensitive population (Harding *et al.* 2008). At maximum rotational speeds, most turbines flicker at a frequency below 3 Hz. In particular, the GE 1.5sle model to be used in the Digby Wind Power Project, would create flicker at a frequency of 1.02 Hz at a maximum rotational speed of 20.4 revolutions per minute (RPM). It is therefore concluded that shadow flicker effects would represent, at worst, a visual annoyance, rather than a health impact (refer to Section 5.2.1.5 for a discussion of shadow flicker visual effects).

Electromagnetic Fields

Electromagnetic fields (EMFs) created by the operating wind farm will be localized and become weaker with distance. The strength of the EMF from equipment within the substation, such as transformers, decreases rapidly with increasing distance. Beyond the substation, the EMF produced by this equipment is typically

indistinguishable from background levels. Similarly, the EMF produced by the equipment within the turbines will be very weak, reduced not just by distance, but also by objects such as trees and other objects that conduct electricity. Previous studies have shown that magnetic field levels as a result of the cable distribution system are a fraction of those found in household appliances such as hairdryers, blenders or televisions (National Institute of Environmental Health Sciences 2002). As a result, there is no evidence that the proposed Project will present any human health effects related to EMFs.

Infrasound

Recently there has been concern for the potential of wind turbines to generate infrasound and the potential for infrasound to result in health effects. Infrasound is defined as wave phenomenon with the physical nature as sound, but with frequencies below the range of human hearing (HGC 2006). A recent study commissioned by the Canadian Wind Energy Association (CanWEA) demonstrated that while wind turbines are capable of generating infrasound, the levels of infrasound near the wind turbine are similar to ambient infrasound levels extant in the natural environment. The study also found no evidence of adverse health effects due to infrasound from wind turbines (HGC 2006).

There is no evidence that the current wind turbine technology proposed for this Project presents any potential problems related to the generation of infrasound energy. Furthermore, research in Alberta has identified that wind turbines may reduce infrasound by extracting energy from the wind, thus reducing the amount of infrasound generated by strong winds (Hepburn 2005). It is also worth noting that there are no turbines located closer than 600 m to a residence in the Study Area.

Ice Throw

Accumulation of ice on the turbine blades is possible during the winter months with extreme weather events and likely limited to a few days per year (based on the right combination of air temperature, wind speed and moisture in the air). Falling ice and the throwing of ice therefore present a hazard to on-site personnel during maintenance and operation of the wind turbines.

Falling ice from an immobile turbine does not differ from other tall structures. The potential ground area affected by falling ice depends largely on the blade position and prevailing wind speed but could be in the range of 40-60 metres (Finnish Meteorological Institute 2000). Ice throw distance depends on a variety of factors including turbine specifications, wind speed and geometry and mass of the ice fragment itself. Conservative modelling studies have shown ice throw distance would be expected to be between 15 m and 100 m taking these various factors into account (Finnish Meteorological Institute 2000).

The wind turbines are engineered to sense an unbalanced condition of the blades if the turbine blades have a build-up of ice on them. The wind turbines will not operate in this unbalanced condition as it could create damage to the turbine. Considering the limited opportunity for occurrence as well as the limited area potentially affected, the hazard of ice fall and ice throw is not considered a common hazard. Nonetheless, measures will be taken to protect workers and the general public.

During construction and operation activities, access to the wind turbine facilities will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. During site visits, vehicles will be parked up-wind of the turbines. Access will be controlled so as to discourage trespassing on private lands.

Health and Safety

Health and safety issues typically associated with construction and operational activities are a priority for SkyPower. During construction and operation activities, access to the wind turbine facility will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. The Contractor will be required to have a safety manual in place prior to construction activities. With the implementation of these mitigation measures, **no residual effects** are anticipated.

5.2.1.9 Electromagnetic Interference

A potential effect of a wind farm is interference with radioelectric signals, such as television, radio, cellular telephone, microwave transmission and radar. The Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWEA) have provided proponents with a Coordination Contact List of all systems and agencies potentially affected by electromagnetic interference in the *Technical Information and Guidelines on the Assessment of the potential Impact of Wind Turbines on Radio Communication, Radar and Seismoacoustic Systems* (April 2007) document. In order to determine possible wind turbine effects on radio communication services or radar systems in the Digby Area, SkyPower submitted letters to each stakeholder on the Coordination Contact list informing them of the proposed turbine locations and turbine specifics. To date, five responses have been received; the Canadian Coast Guard and the Canadian Broadcasting Corporation/Radio-Canada have requested that SkyPower undertake a detailed interference study in accordance with the RABC/CanWEA guidelines.

Satellite television and radio, cable television and AM and FM radio signals should not be affected by the operation of the Digby Wind Power Project. However, a complaint resolution system will be in place to record and investigate complaints regarding telecommunications interference. Mitigation will be conducted on a case by case basis pending results of the investigation.

5.2.2 Maintenance Activities

The wind turbines will be visited approximately once every three months for routine servicing. Furthermore, the facility will include a sophisticated wind energy oriented Supervisory Control and Data Acquisition (SCADA) data analysis program, as well as alarm and notification protocols. With such a system, faults can be instantly detected and addressed, operations can be monitored, equipment performance can be analyzed, trend analyses can be performed and long-term records maintained. For service-oriented visits the site will be accessed via light trucks. Although sensory disturbance to wildlife is possible, it will be short in duration, infrequent, in a small geographic area and will not be noticeable above the existing disturbance created by existing and ongoing forestry activities.

5.3 Decommissioning Activities

Well-designed and constructed wind energy facilities may be operated for decades. SkyPower expects individual wind turbines to perform for up to 25 years without significant repair or replacement. Transformer facilities, electrical cabling and substation facilities are designed for at least a 50 year life span. Individual wind turbines may be replaced or repaired as their useful life comes to an end, or if more efficient and cost-effective technology becomes available. SkyPower makes commitments regarding decommissioning to the landowners on whose land the equipment is placed.

Upon a decision to decommission a single wind turbine or the entire wind farm, all equipment above ground, including towers, nacelles, transformers and controllers will be removed. Wind turbines that are operational and have market value would be carefully removed using a crane, essentially in a reverse process to assembly and installation. The resale value of such equipment would cover the cost of removal in such a case. A market for good, used wind turbines has developed in North America, and a number of wind turbines installed in Alberta in the early 1990s originated from the U.S. used wind turbine market.

5.3.1 Removal of Turbine and Ancillary Equipment

Wind turbines that are no longer operational may also be removed by crane, but with less attention to preserving individual components, labelling them and storing them. Inoperative wind turbines have high salvage value. Steel and copper components are easily recycled, and there is a ready market for such materials. The remaining materials are primarily fibreglass and plastic. These may be sold to recycling facilities, or crushed and deposited in landfill sites. Experience in the U.S. with decommissioning of wind turbines has shown that the salvage value of wind turbines typically exceeds the costs of decommissioning (Gipe 1995).

Other above-ground equipment in the wind farm, including transformers and wiring, has a ready market in either used equipment sales or in salvage. Transformers will be simply removed and sold. Wiring will be removed and sold to metal salvage companies.

Environmental components that potentially could be impacted as a result of turbine and ancillary equipment removal include soils, water quality/aquatic environment, birds and other wildlife, land use, and noise. Table 5.13 summarizes the potential environmental effects of activities associated with removal of turbine and ancillary equipment.

Table 5.13 Potential Effects of Turbine and Ancillary Equipment Removal

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	▪ Overall disturbance will be limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act.*	3	1	1/2	R	2	Sensory disturbance may cause habitat avoidance but it is likely to be temporary in nature, small in magnitude and restricted to the Project footprint.
Soils	Soil disturbance and erosion	▪ Soils around the excavation will be disturbed but will be managed to minimize erosion and runoff.	2	1	1/2	R	2	By implementing these standard mitigation measures, the residual effect on soils will not be significant and will have a minimal level of impact.
Water Quality/ Aquatic Environment	Surface water contamination	▪ Watercourses will be avoided to the extent possible. ▪ All activities, including equipment maintenance and refueling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. ▪ Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and	2	1	1/1	R	2	No residual effects are predicted.

Table 5.13 Potential Effects of Turbine and Ancillary Equipment Removal

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		watercourse banks. ■ A contingency plan for accidental spills will be developed for the Project.						
	Sediment Loading	■ Construction/ decommissioning will not take place in the immediate vicinity of a watercourse. Temporary erosion and sediment control measures, silt fence, straw bales (etc.) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. ■ Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.	2	1	1/1	R	2	No residual effects are predicted.
Land Use	Remediation of land	■ The small footprint will be disturbed but remediated in accordance with landowner agreements.	2	2	1/2	R	2	Due to the small proportion of land to be directly impacted by foundation construction/ decommissioning and its reversibility after decommissioning, the residual effect is expected to be minimal.

Table 5.13 Potential Effects of Turbine and Ancillary Equipment Removal

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Noise	Increases to sound levels due to operation of equipment	▪ All internal combustion engines will be fitted with appropriate muffler systems. ▪ Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	3	2	1/2	R	2	Increased sound levels caused by foundation construction will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance, the residual effect is considered negligible and the level of impact will be minimal.

1 Note
Geographic Extent 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
Magnitude 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
Duration 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
Frequency 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
Reversibility R = reversible, I = irreversible.
Ecological Context 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

5.3.2 Removal of Power Line

Power poles and cabling will be removed and recycled/disposed of as required. Environmental components that potentially could be impacted as a result include soils, water quality/aquatic environment, birds and other wildlife, land use, and noise. Refer to Table 5.13 for a summary of the potential environmental effects of activities.

5.3.3 Site Remediation/Reclamation

Wind energy facilities do not use or produce harmful waste products. There is no need for concern about residual toxic chemicals or exhaust products. Aside from normal recovery of lubricants from the gearbox and yaw mechanism, decommissioning activities are not required for waste. Lubricants will not contain any PCBs. Site remediation/reclamation will be conducted in accordance with landowner agreements and in accordance with the applicable regulations at the time. Environmental components that potentially could be impacted as a result include soils, water quality/aquatic environment, birds and other wildlife, land use, and noise. Refer to Table 5.13 for a summary of the potential environmental effects of activities.

5.4 Accidents and Malfunctions

The plans described below are expected to mitigate any potential accidents and malfunctions that may occur. Therefore, the level of impact is considered **low** and **not significant**.

5.4.1 Corporate Environmental, Safety & Health Management Plan

An Environmental, Safety & Health (ESH) Management Plan will be developed and implemented to ensure that environmental, safety and health requirements are consistently met throughout the Project, specifically throughout the construction and operating phases. The ESH Management Plan will be developed in conjunction with Project contractors, and shall be at all times in strict compliance with all applicable Provincial and local requirements.

SkyPower will ensure that the construction and operation contractors will be duly certified by the appropriate safety associations. As part of the ESH Management Plan, the elements of an Environmental, Safety & Health Management System (ESH-MS) for the Project will include:

- Safety Management Statement, which shall clearly articulate the health and safety objectives and commitment to continually improve the effectiveness of the ESH-MS;
- Safety System Manual, which shall define the scope of the ESH-MS and describe the structure of the ESH-MS;
- Safety Project Plans, which shall explain the strategy and approach to be used in managing activities critical to delivery of work, containing as a minimum
    - Worksite Hazard Assessment Plan;
    - Fall Protection Plan;
    - Safety Emergency Response Plan, and
    - Safety Orientation and Education Plan;
- Safety Project Procedures, which shall contain where necessary documented procedures to ensure specific tasks will be successfully completed to a consistent level satisfying all the requirements of the agreements;
- Safety Records, which will establish and maintain safety records to provide evidence of conformity to agreements, applicable certification requirements and ESH-MS requirements;
- Accident and Incident Investigation, which shall contain a documented process to investigate, document and report all accidents and incidents, to be carried out by suitably trained personnel, and where corrective or preventative action is required, such action will be fully documented and completed;
- Joint Environmental, Safety & Health Committee, which shall consist of one or more members from each of various work groups to ensure all personnel have representation, members of which will receive appropriate training and meet monthly;
- Personal Protective Equipment, which shall assess worksites for hazards and establish the requirements for appropriate personal protective equipment, communicate such requirements to involved personnel and worksite visitors;
- Internal Auditing, which shall contain documented process to confirm compliance with ESH-MS processes, and identify necessary corrective / preventative actions; and
- Continual Improvement, which will initiate measures to continually the ESH-MS and the delivery of the work, to be implemented by a designated Environmental, Safety & Health Manager.

5.4.2 Emergency Response Planning

SkyPower will develop an emergency response plan for the unlikely event of a site emergency during any phase of the Project. The emergency response plan will include a report form and a map of the Project site, showing the most direct route from the site to an emergency resource such as a hospital. All on-site personnel and contractors will be required to complete a site safety and emergency response orientation prior to the start of pre-construction and construction activities. Prior to operation, SkyPower will provide specialized equipment and training to local fire department for rescue needs within the Project.

5.4.3 Project Environmental Protection Plan

SkyPower will prepare a Project-specific Environmental Protection Plan (EPP) that will be used on-site during all construction, operation and maintenance activities. The EPP will be written in construction specification format and will include the recommended mitigation measures in this EA report, as well as industry-accepted construction practices. The EPP will be used by the construction contractor and by all operations and maintenance workers during the life-of-the-Project.

5.5 Effects of the Environment on the Project

The following section outlines the effects of the environment on the Project, which includes climatic fluctuations and extreme events that are likely to occur in the Project area.

5.5.1 Climatic Fluctuations

Several aspects of the potentially changing climate have been considered, and must continue to be monitored during the lifetime of the Project. The potential rise of sea level is one such concern. The siting of the wind turbines on the high grounds in the area essentially removes the turbines themselves from this risk. Further protecting the Project, the infrastructure for transmission of the power is located such that it is safe from any foreseeable rise in sea level. Near the coast, the village of Gulliver's Cove may be at some risk, but this road is not required for access to the turbines.

The turbines are designed to have a safe upper working limit for windspeeds. As the frequency of storms increases, particularly the strong late summer hurricanes that are anticipated to retain strong windspeeds as tropical depressions as they move up the coast, there would be an associated increase in the frequency of conditions exceeding the safe operating envelope for the turbines. During such conditions, the turbines are halted and generation suspended until safe working conditions occur again. The lost generation due to the marginal increase in storm frequency is a relatively small quantity of generation time; that is, it is not anticipated to significantly negatively affect the economic viability of the Project. Similarly, any change in the frequency of freezing rain, or blade-icing conditions, is not anticipated to significantly affect operating times, and the monitoring instruments in place will allow the physical risk to the turbines to be managed effectively.

5.5.2 Extreme Events

Weather events that put wind turbines at risk include icing conditions, particularly freezing rain, lightning, and extreme winds. Although Nova Scotia has fewer lightning storms than, for example, central Canada, the lightning protection must, and will, be designed to cope with accepted industry standards. Freezing rain is an operations issue. Blade specifications are sufficient to cope with foreseeable icing loads, but it is possible that an event that exceeds this level could be encountered. In such an event, the turbine would have been halted, and the damage would be confined to the immediate vicinity of the turbine base, should ice falling, or structural damage occur.

The wind turbines will be the highest features in the surrounding landscape, and therefore it is necessary that a lightning protection system be incorporated into each turbine. For the Project, each turbine blade material is fibreglass-reinforced epoxy resin with integral lightning protection supply. Each blade and each turbine tower are grounded to prevent adverse effects from lightning strikes. Additional grounding rods can be installed at

each turbine site. Most effects from a lightning strike would be dissipated. If lightning struck the generator at the top of the tower, serious damage could occur and the generator may be damaged.

The generator is designed to automatically shutdown at wind speeds that exceed 25 m/s. The turbine tower is designed to withstand excessive wind speeds. Comprehensive geotechnical work at each site will enable for proper design of wind turbine foundation. Extreme wind conditions are used as a parameter in this design.

In the event of a lightning strike that hits a wind turbine generator, severe damage could occur and a new generator may need to be installed. However, it is highly unlikely that lightning would hit a wind turbine generator accurately enough to severely damage it. Taking into consideration the design features that will be used in the Project, a significant environmental effect is unlikely to occur as a result of extreme weather events.

5.6 Cumulative Effects

Subsection 16(1)(a) of *CEAA* requires that every screening of a project include an assessment of the "cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out".

The evaluation of cumulative environmental effects follows five steps:

- Step 1- Identify environmental effects resulting from Project-related activities.
- Step 2- Identify other projects or activities that could interact with Project-related environmental effects.
- Step 3- Exclude environmental effects of other projects or activities that are not likely to act in combination with the environmental effects of the Project.
- Step 4- Identify the likely cumulative environmental effects that could result from the interaction of Project-related environmental effects with other past and future projects and activities.
- Step 5- Evaluate the significance of likely cumulative environmental effects.

Under *CEAA*, an environmental assessment must determine whether the project under review adds to the combined adverse effects of past, existing and imminent projects and activities. Specifically, the assessment determines the degree to which a single project is contributing to the total cumulative effects of human activities and developments in the region.

A critical step in any environmental assessment is determining what other projects or activities have reached a level of certainty (*i.e.,* will be carried out) such that they are required to be considered.

It is helpful to consider the clarification provided by the Joint Review Panel for the Express Pipeline Project in Alberta. Following an analysis of subsection 16(1)(a) of *CEAA*, the Joint Review Panel determined that certain requirements must be met for the Panel to consider cumulative environmental effects:

- there must be a measurable environmental effect of the project being proposed;
- that environmental effect must be demonstrated to interact cumulatively with the environmental effects from other projects or activities; and
- it must be known that the other projects or activities have been, or will be, carried out and are not hypothetical (NEB and CEA Agency 1996).

Furthermore, the Joint Review Panel indicated that it is an additional requirement that the cumulative environmental effect is *likely* to occur, that is, there must be some *probability*, rather than a mere possibility, that the cumulative environmental effect will occur. These criteria were used to guide the assessment of cumulative environmental effects of the proposed Project.

Environmental effects resulting from Project-related activities were identified and assessed in Sections 5.1 to 5.4. The evaluation of cumulative environmental effects is warranted for several environmental components discussed in these sections, namely birds and other wildlife, visual impact, noise and economic development.

This section outlines cumulative environmental effects that may result from the Project in combination with other projects or activities that have been or will be carried out, within the regional area. For the purposes of this cumulative effects assessment, the regional area is defined as Digby County.

5.6.1 Past, Present and Future Projects/Activities in the Regional Area

There is not a lot of industrial development within or surrounding the Study Area There are two other wind turbines in the vicinity of the Study Area, but no proposed wind farms at this time. Renewable Energy Services Limited (RESL) operates an 800 kW wind turbine approximately 8-10 km northeast of the Project Area near Digby. Vector Wind Energy/Springhill operates a 900 kW wind turbine in Tiverton Riverhurst, approximately 35 km from the Project Area.

Activities that would be expected to potentially interact cumulatively with the Project include the land use activities in and around the Study Area, including forestry, agriculture, and quarrying (*e.g.,* private gravel/sand pits). These activities have occurred in the past thereby influencing the current landscape and will continue to occur in the future (thereby overlapping temporally with the Project) and would have effects on bird and other wildlife, visual impact, noise and economic development that could potentially interact cumulatively with the effects predicted for the Digby Wind Power Project.

5.6.2 Interactions between Projects/Activities and Description of Cumulative Environmental Effects

Identifying potential cumulative effects is considered through a comparison of the temporal and spatial scope of the additional projects identified in the regional area. A qualitative assessment of these interactions is undertaken in the following section, using experience and professional opinion of the study team. Spatially, those projects that are within the regional area are considered to be relevant. Temporally, those projects that have existed in the past, exist presently, or are likely to exist in the near future are considered relevant.

5.6.2.1 Birds and Other Wildlife

Past and ongoing forestry and agricultural activities in the regional area has resulted in a loss of forest and wetland habitat and the active forestry of much of the Study Area has reduced the area of contiguous mature forest habitat. The Project is not expected to result in additional loss of high quality habitat or expected to contribute to the cumulative environmental effects of human activities on wildlife habitat.

Wildlife mortality, specifically bird and bat mortality, is a residual environmental effect associated with the proposed Project. Bird and bat mortality may also occur as a result of collisions with overhead power lines, vehicles and buildings resulting in a cumulative effect. Historical evidence (see Section 5.2.1.5) has shown that wind turbines typically do not kill large numbers of birds and bats compared with other structures. It is therefore unlikely that the incremental contribution of the Digby Wind Power Project to bird and bat mortality will affect these species on a population basis causing adverse cumulative effects. Bird surveys did not reveal extensive use of the site by species of conservation concern making it also unlikely that rare species would experience significant cumulative effects. A post-construction bird and bat monitoring program will confirm these predictions. As a result, the cumulative effects of this Project with other activities on birds and other wildlife is deemed to be **not significant.**

5.6.2.2 Visual Impact

The development of the Project, taken into consideration with forest harvesting activities, existing and future power lines, could be considered a further visual obstruction. However, since the landscape has already been influenced by human activities, the visual effect of the Project is incremental. As a result, the cumulative effect of this Project with the other existing structures in the landscape is deemed to be **not significant**.

5.6.2.3 Noise

Acceptable sound levels are expected to be produced by the Digby Wind Power Project. Although forestry and quarrying activities would create noise, they are not expected to generate sound levels above acceptable levels to nearby receptors. The Project is expected to only result in an incremental increase in sound and is considered to be **not significant**.

5.6.2.4 Economic Development

This Project will continue to contribute to the community through job creation for local contractors. It is estimated that the Project will provide 15 to 30 new or existing jobs during the construction phase, four new or existing jobs during the operation and maintenance phase, and two to ten new or existing jobs during the decommissioning phase. In addition, the Project will provide significant tax revenues and income for landowners. These increases in employment and economy will have a cumulative benefit for economic development in the region.

5.6.2.5 Summary

With the adherence to mitigation presented in this report, in addition to compliance with regulatory requirements (including terms and conditions of approval), the residual environmental effects of the Project, including cumulative effects, are predicted to be **not significant**.

5.7 Summary of Potential Environmental Impacts

A summary of recommended measures for managing and mitigating effects of the Project, based on the preceding analysis, is provided in Table 5.14.

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
Birds and Other Wildlife	Construction & Decommissioning	Sensory disturbance	• Visitors will remain within relevant areas, both in-vehicle and on- foot and will aim to preserve the site's natural areas. • Ensure that overall disturbance will be limited to designated workspaces and performed in compliance with the *Migratory Birds Convention Act*. • Delivery vehicles will remain on designated roads.
		Habitat loss/alteration	• Habitat loss may be mitigated by only clearing the land necessary for construction activities and by limiting the overall land disturbance to within designated workspaces. • Upon completion of construction and/or decommissioning, habitat will be restored to the extent possible. • Areas of significance (*e.g.,* nesting sites) will be avoided, to the extent possible.
		Mortality	• In order to reduce the potential of bird mortality, land clearing and construction activities will be performed in compliance with the *Migratory Birds Convention Act (e.g.,* outside the critical time periods for breeding birds). If this is not possible during detailed layout surveying activities, a biologist, in consultation with NSDNR and CWS, will prepare and implement a monitoring and mitigation plan for breeding activity which may include: the identification nests within or immediately adjacent to work areas, and flaging them for avoidance during construction, to the extent possible.
	Operation	Sensory disturbance	• None required.
		Mortality	• To reduce the potential for increased bird fatalities due to collision with wind turbines, several decisions were made in the planning of the wind farm. The turbines to be used extend no higher than 120 m above the ground thus avoiding the flight height of nocturnally migrating landbirds. Lighting will be the minimum allowed by Transport Canada for aeronautical safety, and white strobe lights (CL-865) may be used with the minimum intensity and flashes per minute allowable. The turbines for this Project will be built using tubular steel towers, as some data indicate that lattice towers encourage perching by raptors during hunting and, as a result, may put these birds at risk of collisions. Post-construction monitoring will direct the need and form of further post-construction mitigation measures • A bird and bat monitoring program will be developed in consultation with NSDNR and CWS. Based on the

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			results of this program, necessary modifications to mitigation plans and/or wind farm operations will be undertaken.
Soils and Vegetation	Construction & Decommissioning	Soil erosion and compaction	• Limit access to the turbine sites via established access roads, where possible. • Size of access roads will be kept to the minimum required for the safe construction, operation and decommissioning of the equipment. • Whenever possible, clearing activities will be timed to periods when the ground surface is best able to support construction equipment (winter or dry season). • Replace topsoil stored on-site to enable the reclamation of land to its original condition. • Compacted soil will be reclaimed as required. • Topsoil will be stored onsite for future use in restoring the land to its original condition • Standard erosion and sediment control measures will be implemented as required. • Topsoil and subsurface soils will be separated and stored on-site to be replaced appropriately after the pouring of the concrete foundation. When the soils are stored they will be covered with a tarp or otherwise protected from erosion and runoff.
		Loss of plant species	• Follow- up vegetation surveys will be conducted where necessary. • Prior to construction, digital waypoint files for “Red”, “Yellow” and Undetermined” species identified during field surveys will be provided to NSDNR. • Where Plant Species of Conservation Concern are encountered, avoidance to the extent possible will be considered, especially where there maybe be a threat to the regional population.
Wetlands	Construction & Decommissioning	Loss of wetland area and/or function	• Avoid all wetlands, where possible. • Conduct functional analyses and obtain regulatory approval for wetland alteration as required, including compensation to ensure no net loss of function.
Water Quality/ Aquatic Environment	Construction & Decommissioning	Surface water contamination	• Watercourses will be avoided to the extent possible • If alteration of watercourses is required, regulatory approval from NSE of the proposed alteration will be obtained prior to construction. • All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. • Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks. • A contingency plan for accidental spills will be developed for the Project.

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
		Sediment loading	• Watercourses will be avoided to the extent possible. • If watercourse alterations are required, they will be done in consultation with NSE/DFO in accordance with regulatory requirements. • Instream work will occur between June and September 30 where possible unless otherwise approved by NSE. • Temporary erosion and sediment control measures, silt fence, straw bales (etc.) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. • Visual assessments will be completed on a quarterly basis and after severe storm events to ensure effectiveness of erosion and sedimentation controls. • Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.
		Surface water flow	• Watercourses will be avoided to the extent possible. • Access roads constructed across existing watercourse that require a culvert will follow standard industry practice, installing culverts of sufficient size to accommodate expected maximum flows within the watercourse. • A Water Approval will be obtained for all required watercourse crossings and the conditions of approvals will be followed.
		Fish mortality	• Watercourses will be avoided to the extent possible. • Watercourse crossings, where required, will occur between the period of June 1 to September 30 unless otherwise approved by NSE • Where possible, culverts will be installed during low flow periods. If water is present, watercourses will be dammed and flow will be preserved through water pumps. In this case, a biologist would be on site to facilitate fish rescue within the dammed area.
Noise	Construction & Decommissioning	Increases in sound levels due to the transportation and operation of clearing equipment	• Nearby residents will be advised of significant sound generating activities and these will be scheduled to create the least disruption to receptors. • Heavy equipment will be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. • Construction equipment will have mufflers. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.
	Operation	Increase sound levels	• None required.
Tourism	Construction & Decommissioning	Effect on tourism (	• None required.
	Operation	Effect on tourism and recreation	• None required.
Visual	Operation	Change to visual	• Turbines will be all of the same type and model, and will

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
		landscape	be painted light grey to reduce reflection. • Screening opportunities for adjacent residences through tree planting or other measures may be considered where post-construction evaluation indicates a legitimate concern.
		Lighting	• Lighting will be the minimum allowed by Transport Canada to ensure the appropriate level of aeronautical safety.
		Shadow flicker	• None required.
Archaeological and Cultural Resources	Construction	Disturbance	• Areas of significance will be avoided to the extent possible. • Additional follow-up work may be required depending on final design and layout. • Upon discovery of an artifact, work will be stopped in the immediate area and the appropriate authorities will be contacted.
Land Use	Construction	Reduction of forested land	• Existing forest roads will be used as access roads to the extent possible • New access roads will be constructed to minimize the Project footprint. • Turbines and substations, with their relatively small footprint on the land, have been sited with consideration for the potential impact to existing land uses • Existing logging and access roads built earlier in construction schedule will be used to install the collection system. • Existing RoWs will be used to the greatest extent possible.
	Operation	Disruption to undeveloped woodlands or infrastructure	• The Project has been designed to minimize impacts to the local land use. No mitigation, therefore, is required as no significant impacts are predicted.
Health and Safety	Operation	Electromagnetic Fields (EMFs)	• None required.
		Infrasound energy	• None required.
		Ice throw	• During construction and operation activities, access to the wind turbine facility will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. • During site visits, vehicles will be parked up-wind of the turbines. • Warning signs will be posted at the perimeter of the Project area, discouraging trespassing on private lands.
Local Community	Construction	Hazards and/or inconveniences to forestry operation	• Road construction schedule will consider planned forestry operation in the area to ensure required access is maintained. • No modification to existing roads expected • A Special Move Permit and any associated approvals will

Table 5.14 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport.
	Operation	Effect on local economy	• Local residents will be employed to the extent possible during the construction, operation and decommissioning of the Project. • Municipal taxes will be remunerated, thus increasing the local tax base, which could be used to increase funding of local municipal initiatives.
		Effect on property values	• None required

6 FOLLOW-UP AND MONITORING

SkyPower is committed to conducting monitoring activities to address residual environmental effects with a high level of concern or uncertainty. While it is anticipated that the residual environmental effects of the Digby Wind Power Project will not be significant, an Environmental Management Plan (EMP) and corresponding Environmental Protection, Monitoring, and Contingency Plans will be developed to address potential issues and concerns. In addition, there are site-specific pre-construction follow-up measures which SkyPower is committed to in order to assist with micrositing of turbine and access road locations, refine mitigation as required, and support environmental regulatory approvals as required (*e.g.*, Water Approvals). The level of information contained in this EA Registration is considered sufficient to confidently predict the significance of residual Project-related environmental effects (including cumulative effects).

6.1 Pre-Construction Surveys and Approvals

As discussed in Section 4.4.1, if deemed necessary, SkyPower is committed to conducting a second breeding bird survey in the Project Area (including wind farm site and transmission line) to supplement existing data. This survey will be conducted in June 2009 and will be conducted by a qualified birder familiar with Environment Canada (CWS) bird survey protocols. This data will be provided to CWS and will be used to refine Project siting as required.

As part of the detailed surveying and siting process, a follow-up vegetation survey may be conducted to confirm appropriate siting of Project. It is anticipated that in the event that a species of conservation concern is identified, the specific footprint of the infrastructure (*e.g.,* turbine foundation, transmission pole) can be adjusted to avoid this constraint and/or additional site specific mitigation plans can be developed.

Watercourses and wetlands will be avoided to the greatest extent practical. Where these features are unavoidable, approval will be sought from NSE and DFO as appropriate for alteration. Follow-up watercourse and/or wetland functional analyses will be conducted as required to complete applications for approval. Habitat compensation planning, if required, will be done in consultation with NSE and/or DFO to ensure no net loss of function/habitat.

Archaeological follow-up work will be considered based on final design and layout of Project infrastructure and proximity to areas deemed to have high potential for First Nation's archaeological resources. The MEKS may also provide guidance on archaeological follow-up. Such work could include more in-depth background research, a pedestrian survey of the high potential areas, possibly, sub-surface testing and/or monitoring of high potential areas subject to excavation. This work would be done by a professional archaeologist in consultation with the Nova Scotia Museum (NSM).

6.2 Follow-up and Monitoring Programs

The following section provides a brief overview of the Project follow-up and monitoring measures to be implemented to support construction and operations activities.

The EMP is generally overseen by the Operations Manager, but all Project personnel will be trained in their specific requirements towards its implementation. Training will include the safe handling of hazardous materials and petroleum products, compliance with WHMIS, proper use of on-site firefighting equipment, and an environmental orientation prior to initiating on-site work.

The Environmental Protection Plan (EPP) is a key component of the EMP, and will be developed for both the Construction and Operations phases of the Project. The EPP for the construction period aims to reduce the environmental impact during construction activities and consists of environmental protection measures for routine activities associated with the construction of the Project; contingency procedures in the event of an erosion control failure, fuel and hazardous material spill, fire and/or encounter of archaeological and heritage resources; environmental monitoring, inspection and reporting requirements; a list of applicable permits, approvals and authorizations; and a key contact list. The EPP for the operating period aims to reduce the environmental impact of the operation activities and consists of guidelines for equipment maintenance activities;

the safe storage, handling, and disposal of petroleum, oils and lubricants (POL); and the safe storage, handling and disposal of hazardous materials.

Environmental Monitoring is a key component of the EMP. Table 6.1 outlines the Environmental Monitoring Programs that will be in place for the Digby Wind Power Project.

The last aspect of the EMP is the Contingency Procedure Plan, which consists of a detailed response system in the event of the accidental release of POLs or other hazardous materials. Aspects of the plan include environmental concerns; personnel training; prevention measures; response-action plan, and a spill clean-up resource list.

Table 6.1 Environmental Monitoring Programs (Operations)

Component	Method	Timing	Response-Action Plan
Sound	In response to noise complaints, if any occur, SkyPower would measure ambient sound levels and wind speed at selected residential receptors. The sound and wind data will then be combined to produce a plot of background ambient sound pressure levels versus wind speed.	In response to noise complaints, if any occur.	If the ambient sound levels at any residential receptors are higher than existing allowable limits, a report shall be filed with the NSE with the particulars of the concern, the suspected source, and any remedial actions taken or to be taken to resolve the concern. If the noise exceedance is related to equipment wear, the maintenance schedule will be adjusted to account for this and minimize the potential for a reoccurrence.
Shadow Flicker	A registry will be created to document complaints of shadow flicker. In the event of a complaint, shadow flicker will be monitored from that receptor using photographs, and/or video recording at the appropriate time of day and year. Anecdotal information about shadow flicker will be collected from nearby residences.	Shadow flicker will be monitored as required during operation of the turbine. If required, it will be conducted once during the summer and once during the winter.	When a complaint or complaints of shadow flicker are received from a receptor located within 1,000 m of the turbine, shadow flicker will be monitored from that receptor. Information collected from the shadow flicker monitoring will be used will be used to develop further mitigation, if warranted.
Bird and Bat Mortality	Bird and bat carcass monitoring will be performed within a 40 m radius of each selected turbine. The fatality rate will require correction for scavenger removal of carcasses and field observation abilities of surveyors. The monitoring program will be confirmed with Environment Canada (CWS) and NSDNR.	It is expected that monitoring of bird mortality will be conducted during the two years year following wind farm commissioning, with emphasis placed on surveying during peak spring and fall migration of birds and fall migration of bats.	It is likely that two years of monitoring will be conducted for bats and birds, to be determined in consultation with NSDNR and CWS
Aesthetics and Visual Impacts	A registry will be established to record both negative and positive comments on the aesthetics and	Photographs will be taken at least once after the turbines become	Information collected from the aesthetics and visual impact monitoring will be used to develop further mitigation, if required.

Table 6.1 Environmental Monitoring Programs (Operations)

Component	Method	Timing	Response-Action Plan
	visual impact of the wind turbines. Media comment on the wind turbines will also be collected and documented. If required, photographs will be taken of the turbine locations from a minimum of two vantage points.	operational. The comment registry will be maintained and media comment will be collected throughout the operation of the Project.	
Electromagnetic Interference	A complaint resolution system will be in place to record and investigate complaints regarding telecommunications interference.	In response to interference complaints, if any occur.	Mitigation will be conducted on a case by case basis pending results of the investigation.

7 STAKEHOLDER CONSULTATION AND ABORIGINAL ENGAGEMENT

Public consultation is an integral part of the environmental planning process and plays a key role in addressing potential public concerns identified in early stages of the Project. Public consultation is a requirement under NSE's "The Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document" (NSEL 2007, updated 2008) and is a step in the environmental registration process.

Consultation activities have included the initial public announcement of the Project by SkyPower and NSPI in Rossway (May 2008), a public Open House (November 2008), meetings with stakeholders including local landowners and municipal representatives and various informal meetings, phone calls and letters. The following sections present further details on those opportunities given to the public and reviewing agencies for comment. Supporting documentation is provided in Appendix A. The public will continue to be consulted in future phases of development. During the EA review process, additional issues may be raised by the public and the public will be invited to submit written comments on the proposed Project and information contained in the EA document during the EA registration phase.

7.1 Community Consultation

An Open House public meeting was held on November 17, 2008 from 5:00 pm to 8:00 pm at the Rossway Community Centre. The session was attended by more than 30 people. The intent of the Open House session was:

- to encourage dialogue between members of the Project team in attendance and the general public and stakeholders;
- to enable the public and stakeholders to obtain Project information;
- to view information on the proposed site and turbine locations; and
- to participate in the environmental and socio-economic assessment process.

The session was advertised in the provincial edition of the Chronicle Herald newspaper.

During the Open House, representatives from Skypower Corp., Scotian WindFields Inc., and Jacques Whitford Stantec Limited were present to answer questions and to document any issues related to the Project. All attendees were encouraged to sign-in and they were provided with a folder of information titled "Wind Energy 101 Know the Facts" which included a project overview handout as well as corporate information and general information including a CD presentation on harnessing wind energy (see Appendix A). Attendees were encouraged to complete a feedback form prior to leaving the session. The session was informal and consisted of a series of poster storyboards and handouts which included information on:

- a map of the proposed project area with the latest turbine layout;
- specifications of the proposed wind turbines;
- information on the construction and installation process;
- project schedule;
- general information on noise;
- corporate information on the proponent; and
- information on the environmental assessment and regulatory approval process.

Copies of the information panels listed below (Table 7.1) and the exit questionnaire are included in Appendix A.

Table 7.1 Information Panels Presented at the Open House

Public Open Houses	
▪ Corporate Information	▪ Potential Issues of Concern (*e.g.,* birds and noise)
▪ Community Engagement Process	▪ Benefits of Wind Energy
▪ Project Description (including site maps)	▪ EIA Process and Key Valued Environmental Components
▪ Technical Information (including the basics of a wind turbine and typical construction activities)	▪ Visual Impact Montages
▪ Regulatory Approval Process	▪ Contact Information

Few issues of concern were raised by the general public at the open house (verbally or via the exit/feedback form). The written comments received during the public information session are summarized below in Table 7.2.

Table 7.2 Issues Raised at the November 17, 2008 Open House

Issue/ Comment	SkyPower Response
General Comments	
Thought it would be somebody speaking and answering	The purpose of the community information session was to provide the most up-to-date information on the proposed project, as well as, to field any questions from the local community in an unrestricted atmosphere. The community information session process, as mandated by Federal Environmental Assessment, through the *Canadian Environmental Assessment Act*, was strictly followed and all of the priorities were met. The objective of the community information session is an opportunity to hear comments, support and concerns regarding the project in a proactive fashion. It is an opportunity to reach and instigate one-on-one dialogue with local residents. For any additional open houses in the area, we will take your suggestion into consideration.
Why windfarm in the middle of the community? Concerned about decommissioning. Not opposed to wind, opposed to way developed – not informed all along.	The area has a superior wind resource, close proximity to existing transportation infrastructure and community support for the Project. The land is immediately rehabilitated and brought back to previous conditions. SkyPower is committed to consulting with the community of Digby. To date, SkyPower representatives have introduced the proposed the Digby Wind Power Project to various parties, including participating landowners, neighbouring landowners, NSPI and the Digby municipal government representatives, and have received overwhelming support. We look forward to working with the entire community as our Project continues to develop.
Would like information from residents living close to existing wind	There were residents present at the open house that

Table 7.2 Issues Raised at the November 17, 2008 Open House

Issue/ Comment	SkyPower Response
farms in Canada. How have these people adjusted? What benefits have there been to the local municipality? Have always been interested in Wind power. Need a forum where people can present their concerns. Bring ordinary citizens in from areas that have existing wind farms to answer the concerns re: strobe effect, noise pollution, set backs and benefits.	currently have turbines on their property in the Digby area. These residents were inviting open house participants to their homes to view the turbines and answer any questions they may have. Wind farms provide a new tax revenue stream for local municipalities, which can be used for the benefit of all. Thank you for supporting wind power. For any additional open houses that we will have in the area, we will take your suggestions into consideration.
Good Presentation – What I expected. Lots of experts to answer questions	Thank you for your continued support on the Project.
Could talk to people involved with the project and ask a lot of questions. I think a session with a seated audience and a question period (one question at a time and a MC in charge) would be a great format for a session which would keep all attendants at the same level of information.	For any additional open houses in the area, we will take your suggestion into consideration.
Would like to see a sit down and listen to questions and answer. You should stress that David Suzuki is "pro" wind power – People see the name and believe! Some are uneducated and take what they hear from others who lived in cities as gospel and educated. When it is only a personal opinion, Educate and show them how long the meters are from here to a windmill-show them!	For any additional open houses in the area, we will take your suggestions into consideration. Thank you for your continued support on the Project.
This end of the province (Digby County) has shown such negativity on any new industry, progress, *etc.,* for all the years (30) I have been here. I hope you succeed.	We look forward to working with the entire community as our Project continues to develop. Thank you for your continued support on the Project.
No final location of sites yet. Neutral at this point and support green energy.	The turbine layout for the Project will be finalized once we consult the municipality, the landowners and the community of Digby. Thank you for supporting green energy.
600 meters not far enough	Typically, rules and regulations in Canada and the United States say that separation distances (known as "setbacks") for turbines from dwellings are approximately 500 to 600 metres. Generally, these are considered more than adequate setbacks for dwellings.
Are you going to move the one in the Gulliver's Cove in the back of 600 meters further away from houses? Suggested 1.5 miles from homes.	The turbine layout for the project will be finalized once we consult the municipality, the landowners and the community of Digby.

Table 7.2 Issues Raised at the November 17, 2008 Open House

Issue/ Comment	SkyPower Response
	Many local governments not only in Nova Scotia, but across Canada do not have specific wind planning and permitting protocols. Therefore, most local municipalities rely on "Best Practices" undertaken in other jurisdictions. These "Best Practices" are supported by the Canadian Wind Energy Association (CanWEA) (2007). Typically, rules and regulations in Canada and the United States say that separation distances (known as "setbacks") for turbines from dwellings are approximately 500 to 600 metres (m). Generally, these are considered more than adequate setbacks for dwellings.
Lights at night the first thing you see on the horizon	CanWEA worked with Transport Canada and others (pilot association, Canadian Wildlife Service, etc) to develop standard that addressed wide range of concerns. As with all tall structures, turbines must be lit according to Transport Canada standards. Lighting has to provide sufficient warning to pilots, not attract birds, and not hinder night sky viewing. Current requirements are for single red flashing lights on turbines around the perimeter of the wind farm.
Most of the communities long term residents are all for this project.	Thank you for your continued support on the Project. We look forward to working with the entire community as our Project continues to develop.
I am in support of this project. It will bring economic growth to the community, while also providing clean power.	Thank you for supporting the Project.

Additional stakeholder and community outreach initiatives are planned for the Spring and Summer of 2009 including the launch of a Project website, mailout of community newsletter, meeting with municipal council, door-to-door community outreach program and a public open house.

SkyPower will also develop and implement a community liaison and issues resolution program for Project construction and operation. This program will include company contacts as well as an issues resolution procedure for community members to identify issues of concern. The procedure will document the issue and action taken to resolve and/or improve the situation. The liaison program will also provide regular Project updates to community members and interested stakeholders through various methods (*i.e.*, website, mailouts, community meetings, *etc*).

7.2 Municipal Planning Process

SkyPower representatives have consulted with the Municipality of the County of Digby on various occasions during Project planning including a presentation to council on November 10, 2008, prior to the public open house.

At the request of the Council, a Planning Advisory Committee (PAC) has drafted a proposed Municipal Planning Strategy (MPS) and Land Use Bylaw (LUB) for the Regulation of Wind Turbine Development in the Municipality of the District of Digby (Draft 2009). The MPS and LUB are currently undergoing public review and they have yet to be reviewed by Council for decision. To date, Council has given no indication of their position on the PAC proposal. Under the proposed MPS and LUB, a development permit may only be issued for a utility scale wind development if Council has entered into a development agreement with the developer. Council must hold a public hearing to obtain public input before Council can enter into an agreement. The development agreement must be in compliance with criteria presented in Policies 11 and 12, including but not limited to submission of a visual impact study, noise impact study and decommissioning and reclamation plans.

Under current municipality requirements, the Project requires a building permit from the municipality to proceed. In accordance with these requirements, and in the absence of a definitive timeframe for the adoption of the draft MPS/LUB proposed by the PAC, SkyPower submitted an application for a building permit in February 11, 2009, and the permit was subsequently issued on February 16, 2009. Since the building permit was issued prior to the Notice of Intent to Adopt Planning Documents (the MPS and LUB) was published, and with construction on the Project expected to commence within 12 months from the issuance of the building permit, the Project is a non-conforming structure and non-conforming land use under the *Municipal Government Act*. A non-conforming structure or non-conforming land use (*i.e.,* structure or land use that does not meet the applicable requirements of an MPS or LUB) may continue to exist even though they do not meet the requirements contained in the Planning Documents. It is worth noting that the studies and plans referenced as requirements in the draft MPS and LUB are being conducted as part of the provincial/federal approval process for the Project, therefore the Project will essentially meet the intentions of the draft MPS/LUB.

7.3 Regulatory Consultation

Various regulatory and other agencies were consulted early in the planning process to provide input into the Project and the process, and advice in terms of likely approvals and considerations for environmental assessment.

To date, the following agencies have been contacted by SkyPower and/or the Jacques Whitford Stantec Limited Study Team:

- CEA Agency;
- CWS;
- NSE;
- NS Aboriginal Affairs;
- NSDNR; and
- NRCan.

With respect to federal coordination, a project initiation meeting was held at the CEA Agency on November 6, 2008. To date, the Project has one known trigger under *CEAA* due to the application for federal funding under NRCan's ecoEnergy for Renewable Power (EERP) program. This process has been started for the Project with the Notice Project Application (Step 1), as approved by NRCan on September 7, 2007; the ecoENERGY Registration Number for this Project is #5911-S17-2. Under the new Terms and Conditions of this EERP, NRCan will be identified as a "Responsible Authority" (RA) for the Project once Step 2 (the Technical Project Information (TPI) package has been submitted and approved and a Contribution Agreement has been fully

executed. It is currently unknown if other federal agencies such as Environment Canada, Transport Canada, Health Canada and Department of Fisheries and Oceans have an interest either as a RA or expert department in the review of the Project under *CEAA*; however there are no obvious *CEAA* triggers besides the federal funding.

A draft environmental assessment was submitted for regulatory review and comment and distributed by NSE to relevant provincial and federal agencies. Comments received were taken into consideration in preparing the final EA Registration document. SkyPower will continue to work regulatory agencies to develop appropriate follow-up measures (*e.g.*, post-construction monitoring) and submit applicable permit applications.

7.4 First Nation and Aboriginal Engagement

The Project site consists of privately held land used primarily for forestry and residential uses; there is no known traditional use by First Nation people. Letters containing general project details were sent to the Confederacy of Mainland Mi'kmaq (CMM), the Assembly of Nova Scotia Chiefs, Annapolis Valley First Nations and Bear River First Nations in November of 2008 to solicit comments or concerns. In addition, there have been ongoing discussion between SkyPower and Bear River First Nation.

In February 2009 SkyPower commissioned an MEKS for the Project. The MEKS will identify land and resource use which is of particular importance to the Mi'kmaq people with respect to the Digby Wind Power Project and will also seek to identify and document ecological knowledge which may be significant to the Project. It is anticipated that preliminary results will be available in May and July with the final report completed in September 2009. Results of the MEKS will be provided to NSE and the KMK as they become available.

On April 3, 2009, SkyPower attended, an informal session with NSE, Aboriginal Affairs and representatives from the Mi'kmaq Rights Initiative (KMK). This meeting allowed SkyPower to provide an overview of the Project and obtain feedback on issues scoping relative to Aboriginal issues. First Nation and Aboriginal communities will also be invited to review and comment on the EA report during the EA registration process.

8 CONCLUSION

The Digby Wind Power Project is expected to provide clean energy for more than 10,000 homes annually in the Digby area. The Project will result in displacement of burning fossil fuel with an expected avoidance of greenhouse gas emissions of approximately 66,000 tonnes of carbon dioxide, as well as tonnes of sulphur dioxide and nitrogen oxide. The Digby Wind Power Project will therefore be an important component of Nova Scotia's commitment to renewable energy and reduction of air emissions from energy combustion.

Based on the results of this EA, the study team has concluded that the Digby Wind Power Project is unlikely to cause significant adverse residual environmental effects. The following section summarizes key points from the EA in justification of this conclusion.

The Project will result in physical disturbance of approximately 52 ha of land including development of access roads, turbine foundations and substation construction. This represents approximately 4.5% of the total Project Area, much of which has been previously disturbed (*e.g.,* forestry activities). Existing logging roads will be upgraded and used for turbine access. Sensitive features including watercourses, wetlands, plant species of conservation of concern, and areas of high archaeological potential will be avoided to the greatest extent practical or possible. Where avoidance is not practical nor possible, detailed mitigation will be developed and all required permits will be obtained prior to construction. Follow-up surveys will be conducted if necessary at areas to be disturbed based on final design which will allow for precise mitigation planning to minimize localized environmental effects on sensitive habitats.

Installation of the proposed Digby Wind Power Project will be completed in approximately 9 months of on-site work limiting the period of potential disturbance to residents and wildlife associated with increased vehicle traffic and human activity. Construction activities will be scheduled where practical to minimize environmental effects (*i.e.,* to prevent rutting and to avoid significant life history events such as breeding season for most bird species). Remediation of disturbed surface areas will be undertaken as soon as possible after construction is complete, and the conditions of affected land will be remediated to approximate pre-construction conditions in accordance with landowner agreements. The residual environmental effects associated with Project construction are therefore predicted to be **minimal** and **not significant**.

Effects associated with Project operation are also predicted to be **minimal** and **not significant**. Operation of the wind farm will result in minimal adverse effects to birds and other wildlife. While turbines present a potential collision hazard to birds and bats, this fairly low relative to other tall structures. Bird and bat collisions are expected to be infrequent considering the topography of the area, observed flying patterns, distribution of habitat, and low collision rates documented at other wind farms in the United States and Canada. Post-construction monitoring will be conducted in consultation with Environment Canada and NSDNR. This information will be used for future planning and develop mitigation if required. Any other disturbances to birds and other wildlife (*e.g.,* sensory disturbance) will be minimal, of short duration, reversible and on a local scale.

Operation of the facility will not result in production of air emissions. Sound levels and visual effects (*e.g.,* shadow flicker) will be within acceptable standards. The visual landscape of the region will be altered by the presence of wind turbines; while some receptors will have a clear view of the turbines, many of the homes close to the viewshed will be unable to see the wind farm due to topography and forest cover. Screening opportunities through tree planting or other measures will not likely be warranted but may be considered where post-construction assessment indicates a legitimate concern.

Existing land use (*i.e.,* residential, recreational, resource use) can continue during operation of the Project. A number of positive effects will also be realized. Landowners who are leasing their land for the Project will receive direct financial benefits from facility installation and operation, and the county will receive substantial revenue through property taxes, which will benefit county residents in turn. The Project will offer employment and revenue to local workers, and tourism may actually increase as a result of the operation of the wind farm.

Appropriate and effective mitigation measures have been recommended for the proposed Digby Wind Power Project to eliminate or minimize effects that may have been associated with the development. Any residual net adverse environmental effects are predicted to be **not significant** based on the results and conclusions of this EA.

9 SIGNATURE

This report presents details on the EA of the proposed Digby Wind Project, conducted in accordance the *Canadian Environmental Assessment Act*, following the "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act*" (NRCan 2003). "The Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document" (NSEL 2007, updated 2008) was used to satisfy the requirements of provincial registration. Overall, the residual effects of the project are not significant and are acceptable, based on a balanced assessment against all of the screening criteria and the results and conclusions of the EA.

This EA was completed for SkyPower by Jacques Whitford Stantec Limited. The names and credentials (CVs) of all primary and secondary investigators are presented in Appendix G. Specifically, and on behalf of SkyPower and Jacques Whitford Stantec Limited, the report was prepared and reviewed by the following:

Richard Guttman

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Heather Giddens

Heather Giddens, MES

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11 APPENDICES

Appendix A Public Consultation Materials

Appendix B Aquatic Survey Photographs

Appendix C Flora Lists

Appendix D Wetland Data

Appendix E Avian Field Program Information

Appendix F Noise Impact Study

Appendix G CVs of Study Team Members

APPENDIX A

PUBLIC CONSULTATION MATERIALS

DIGBY WIND PROJECT

Project Overview

Project developer Scotian Windfieds Partners Corp. (SWPC), which is a partnership between Nova Scotia-based community economic development organization Scotia Windfields Inc., and Toronto-based renewable energy developers SkyPower Corp., is proposing to construct and operate a 30-megawatt wind power facility. The wind power facility will consist of twenty 1.5MW wind turbine generators with a 34.5 kV sub-surface collection system connected to a new substation, on land located in Gulliver's Cove, Digby County, Nova Scotia. The proposed Project is referred to as the Digby Wind Project, ("the Project").

One of the main purposes of this Project is to supply the Nova Scotia electrical system with an additional source of renewable energy. The proponents were successful respondents to Nova Scotia Power's August 31, 2007 request for proposals for renewable energy. They have formally executed a 20 year power purchase agreement with the utility.

The proponents for the proposed Project will use the GE 1.5sle turbines for this Project. The Project will consist of 20, 1.5 MW wind turbine generators. The following ancillary facilities are also considered part of the Project:

- 34.5 kV collection lines (to link the wind turbines to the substation);
- 1667 MW Pad transformers located beside each turbine
- Substation (to step up the electric output from 34.5 kV to 69 kV);
- Maintenance and control building(s);
- Access roads; and
- Crane pads and construction roads for assembly of wind turbines.

Wind energy is associated with few environmental impacts compared with other sources of energy. The following have been identified as potential issues of concern for the Project and will be addressed in the environmental assessment: wildlife habitat with a particular focus on birds; historical resources; noise; and socio-economic issues.

Anticipated Regulatory Process

Scotian Windfield Inc. and Skypower are undertaking an environmental assessment of the Project that will satisfy the requirements for a joint federal-provincial screening level environmental assessment pursuant to the *Canadian Environmental Assessment Act* (CEAA) and the Nova Scotia *Environment Act*. Field work to support the environmental assessment process is ongoing. A full year of bird surveying is ongoing at the proposed site (November 2007 to October 2008) in accordance with a protocol developed in consultation with the Canadian Wildlife Service. In addition, terrestrial wetland and aquatic surveys have been undertaken.

Schedule

Anticipated key schedule milestones include:

- Preliminary conceptual planning for the project began in 2007;
- Public open houses and stakeholder consultation in the fall 2008;
- Submission of environmental assessment Fall 2008;
- Target construction completion near the end of 2009.



Patricia Bishop, president of the Kings County Federation of Agriculture, surveys her organic vegetable farm near Port Williams. Some farmers want a land trust established to protect valuable farmland. *(GORDON DELANEY / Valley Bureau)*

Food for thought

Some farmers look to establish trust to protect valuable farmland

By **GORDON DELANEY**
Valley Bureau

STARRS POINT — Some farmers are eyeing a unique way to protect valuable farm land from being gobbled up by development, while helping themselves at the same time.

"This has been a challenge for a long time," said Patricia Bishop, president of the Kings County Federation of Agriculture, in an interview at Taproot Farms near Port Williams, one of the farms she owns and operates with husband Josh Oulton.

"What tools do we have to preserve agricultural land if we want to? We don't really have any."

Ms. Bishop grew up on a large farm and is passionate about preserving agricultural land for future generations. She said it's time for farmers, citizens and government to get together to talk about the issue.

"We have a really good strong municipal planning strategy, but that's being challenged quite regularly," said Ms. Bishop, who has run for municipal council on the issue. She was defeated by the incumbent by a slim eight votes.

The issue of disappearing farm land is a pressing one in Kings County, the mostly heavily farmed region in the province. Once the backbone of the economy, farming is giving way to industry, housing and commercial development.

While farming is still the most important industry in the area, increasing costs and low returns have forced some farmers to sell valuable agricultural land because they can get more money for it from developers than they can by farming it.

The county's municipal planning strategy sometimes protects the best farm land from development. But council is under increasing pressure to amend or change by-laws to allow more development, especially near urban areas like Wolfville and Port Williams.

A case in point is a proposed new Marriott Hotel on farm land in Greenwich, where farmers have been fighting for years to get their land rezoned so they can sell it for more money.

There is also pressure in Weston, north of Berwick, where a golf course and another proposed housing development have caused bitter rivalries between those who want economic growth and those who are trying to preserve the rural way of life.

In Port Williams, there is a battle over 120 hectares of farm land that the village wants rezoned for development, despite opposition from those who want it to remain farm land.

The frustration was summed up recently by Kings Councillor Wayne Atwater, who said he was reluctant to support any new developments involving farm land.

"Most of us are tired of getting beaten up over agricultural land," he said at a recent council meeting.

The federation has planned an all-day meeting later this month to discuss the idea of establishing a land trust, where farmers would be paid from a fund that would allow them to reinvest in their businesses and to continue farming while saving the land for future generations.

"It won't fit everybody's needs ... but it gives us something to work towards," said Ms. Bishop. "I'm not an expert on land banking, but the people we've invited to the meeting are."

Peter Elderkin, a longtime Greenwich farmer who has battled to have his land rezoned, said he supports a land trust, as long as farmers don't pay for it.

"It's the right approach, as long as farmers get fair market value for their land," he said, adding that a trust won't preserve all the farm land, but may work in some cases and certain areas.

Mr. Elderkin said farmers wouldn't be in the position of having to sell their land for development if they had a decent income.

"If the farmers were getting an income, the amount of farmland on the market would be dramatically reduced."

Workplace safety law doesn't cover volunteers

By **MONICA GRAHAM**

Volunteers may work as hard as any paid employee, but they aren't in a workplace as far as the provincial government is concerned.

That means the October fall from a Tatamagouche church roof that fatally injured a Prince Edward Island man is not governed by Nova Scotia occupational health and safety law, said Jacqueline May, a spokesperson for the Labour Department.

Patrick Joseph Gaudet died at the Queen Elizabeth II Health Sciences Centre in Halifax after sustaining head injuries in a five-metre fall from scaffolding to a concrete surface.

Ms. May said recently that if a person doesn't receive money for services, then there are no employees at the site and it is not a workplace as defined by the law.

The provincial Volunteer Services Act and Volunteer Protection Act, both administered by the Justice Department, aim to protect volunteers from lawsuits arising from the free services they offer, but do not protect their physical safety, she said.

In its last budget, the province announced plans for an insurance program for volunteers and not-for-profit organizations, Nova Scotia Health Promotion and Protection spokesperson Sue Mckeage said Friday.

The department, which is responsible for volunteerism, is working with the insurance industry to provide sustainable, affordable, and accessible coverage for volunteers and the organizations they serve, said Ms. Mckeage. By April, 2009, a single contact point within government will provide support and clear insurance information to volunteers, she said.

Habitat for Humanity, which relies on volunteers to build homes for those who need them, requires that volunteers have their own insurance, which is available through the organization's plan and costs $5 per person, said Halifax build co-ordinator Anna Connolly.

The organization also has a committee to deal with the safety, health, and environment of the volunteers who offer their services and a policy that ensures they receive safety training and appropriate equipment.

(mgraham@herald.ca)

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NOTICE OF COMMUNITY INFORMATION SESSION • DIGBY WIND FARM PROJECT

To support the Government of Nova Scotia and Nova Scotia Power's renewable energy targets, SkyPower in partnership with Scotian WindFields, are working together to bring your community a cleaner and brighter future. We are developing a 30 MW wind farm (20 turbines) in the Municipality of Digby that will provide a source of clean green power to Nova Scotia's energy supply mix.

We are hosting a community information session on:

Monday, November 17, 2008
Gullivers Cove Community Centre, RR#4, Digby B0V 1A0
5:00pm to 7:00pm

At this community information session, we will provide an overview of our plans including the proposed location of the wind farm, visual simulations of the turbine layouts and information on our environmental assessment.

We are interested in hearing any comments or concerns that you may have about this project.

With the exception of personal information, all comments will become part of the public record for the Environmental Impact Statement Report.

Please contact one of the following project team members if you have any questions or comments or wish to obtain more information on the project or notification of the Community Information Session:

Barry Zwicker President and CEO Scotian WindFields (902) 488-7125	David Patterson Associate, Project Development SkyPower Corp. (902) 529-0377	Grace Pasceri Community Relations Manager SkyPower Corp. (416) 979-4625

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For only $2, you and your family can get in the holiday spirit and help provide a Christmas dinner for a needy family by wearing a red nose during The Chronicle Herald Holiday Parade of Lights.

Proceeds from the sale of red noses will go to The Goodfellows' Club to assist in their Christmas meal program.

Watch for our staff volunteers selling red noses prior to the start of The Chronicle Herald Holiday Parade of Lights in downtown Halifax this Saturday at 6:00 p.m.

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ABOUT SKYPOWER

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Over **100** employees, advisors & consultants

Over **200** wind and solar projects under development in Canada, U.S., India and Panama.

+ 11,000 MW of nameplate capacity under development.

Development rights for over **6 million** acres under development across Canada





SKYPOWER ADVANTAGE

- Canada's largest renewable energy developer with proven expertise in wind and solar projects
- Secured over 500 MW of wind turbines and 25 MW of solar panels ready for project placement
- Experience and qualifications dealing with all levels of government, utilities, First Nations and communities
- SkyPower focuses on development partnerships involving local corporations, landowners, communities and First Nations as value added development partners
- Eastern Canada Experience: Wind project under construction for 27 MW in progress, completion by end of 2008



SKYPOWER DEVELOPMENT EXPERIENCE

SkyPower has secured over 400 MW of Power Purchase Agreements for Renewable Energy projects in Canada.



Wind Power

- 8 Contracts with Ontario Power Authority (OPA) totaling 72 MW
- 201 MW PPA with Hydro Quebec
- 30 MW PPA with Nova Scotia Power
- 27 MW PPA with Newfoundland and Labrador Hydro
- International projects under development in India and the U.S.

Solar Power

- 9 Contracts signed with OPA totaling 88.12 MW
- First Solar Farm under construction in Ontario (19MW)
- Additional 190 MW under development in Ontario
- Projects under development internationally

Hydro Power

- 83.5 MW project under development in Panama

SCOTIAN WINDFIELDS

Scotian WindFields Inc. was formed in January 2007 as a result of an agreement between eight Nova Scotian community-owned renewable energy companies formed under the CEDIF initiative

- Partnered with SkyPower for 30MW project in Digby
- 10 Power purchase agreements for inside the fence projects in Nova Scotia
- Over 1000 panels of solar hot water systems under development
- Over 20,000 acres of land for future wind energy projects in NS and NB
- Partner in recent Ontario announcement for ten 15MW biomass to energy projects



PROJECT TEAM

Scotia WindFields Partners Corp. (“SWPC”)

SWPC is a partnership between SkyPower Corp.

- Leading independent renewable energy developer in Canada

- Scotian WindFields Inc., a Nova Scotia based, owned and operated company that develops renewable energy projects through wind, solar and biomass applications



BENEFITS OF WIND

- Wind energy is clean. It does not produce any air pollution
- Wind energy is completely renewable, highly reliable and very efficient
- Wind energy reduces our contribution to global climate change
- 1 turbine offsets the equivalent of removing 600 passenger vehicles off the road
- It would take 100,000 trees, approximately 25 years to offset the same amount of carbon dioxide that 1 wind turbine would displace in its lifetime







Digby Project Overview

- 30 MW Power Purchase Agreement with Nova Scotia Power
  - Will assist in meeting the Renewable Energy Standards set by Nova Scotia's Department of Energy
- 20 GE turbines
- Expected construction in 2009
- Project planned to be in service at the end of 2009
- Approximately 2800 acres of privately owned land
- Close proximity to existing transportation infrastructure
- Superior wind resource

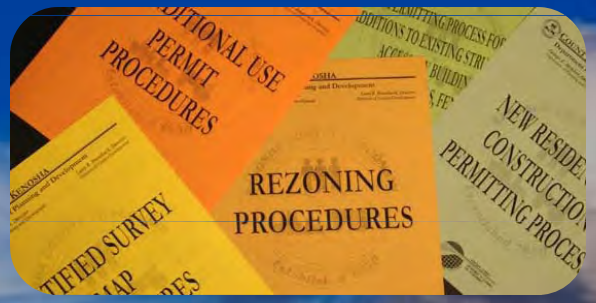


COMMUNITY ENGAGEMENT

- Consultation with the local community is an important part of the development process

- The Partners are committed to ongoing communication with council, community and all stakeholders:
  - July, 2007, early engagement of Digby Municipal Council
  - May 14, 2008, PPA Announcement in Digby
  - November 17, 2008, community information session at Gullivers Cove Community Centre
  - November to January 2008, distribution of community information packages providing relevant information on wind power





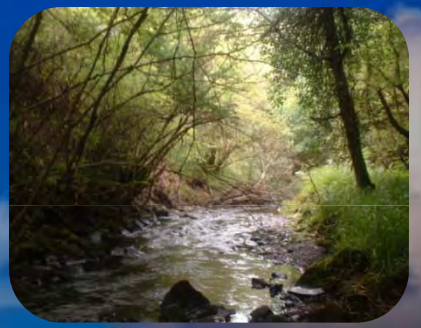


ENVIRONMENTAL PERMITTING

Jacques Whitford has been hired to complete the environnemental impact assessment.

- Jacques Whitford is recognized as a leader in providing environmental services to the wind energy industry in Canada.
- Unparalleled multi-sector experience allows Jacques Whitford to focus on impact assessments on the issues that truly matter and employ the most effective methodologies.
- Expertise and experience has been applied to hundreds of environmental assessments, biophysical surveys and geotechnical assessments across Canada.





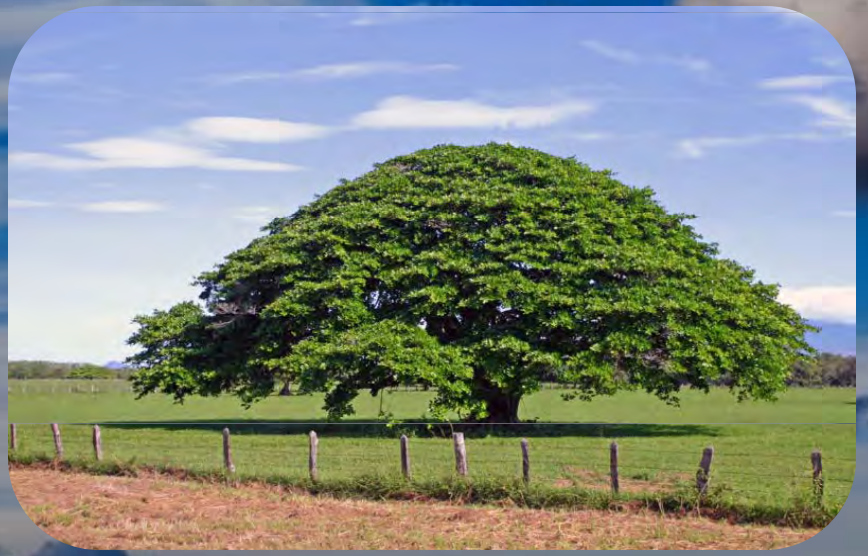


ENVIRONMENTAL ASSESSMENT PROCESS

- A number of studies are presently underway to satisfy Natural Resources Canada and Nova Scotia Environment's requirements for wind power project environmental impact assessment.



- Some of these studies include:
  - Noise models
  - Visual simulations
  - Shadow flicker models
  - Vegetation surveys
  - Bird and wildlife surveys



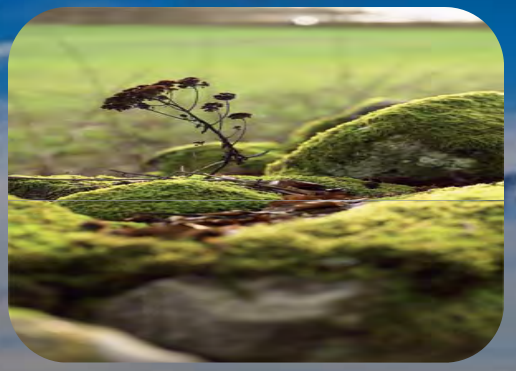
ENVIRONMENTAL ASSESSMENT PROCESS

Key components of the environmental impact assessment include:

- Physical environment
  - Groundwater and hydrogeology
  - Surface water resources
  - Archaeological resources
- Biological environment
  - Wildlife and habitats (including birds and bats)
  - Wetlands and aquatic environments
  - Vegetation
  - Sensitive species and habitats
- Socio-economic assessment
  - Noise model
  - Visual simulation
  - Shadow flicker analysis







ENVIRONMENTAL ASSESSMENT PROCESS

- A full year of bird surveys has been completed (November, 2008) , based on a protocol developed in consultation with the Canadian Wildlife Service.
  - The results are presently being compiled.



- Work on other components of the environmental impact assessment is underway.



- The environmental assessment report will be submitted to regulators in December 2008.
- Any comments or concerns regarding the environmental impact assessment should be directed to the Proponent or Jacques Whitford (contact information provided at sign in desk). Your input is greatly appreciated.



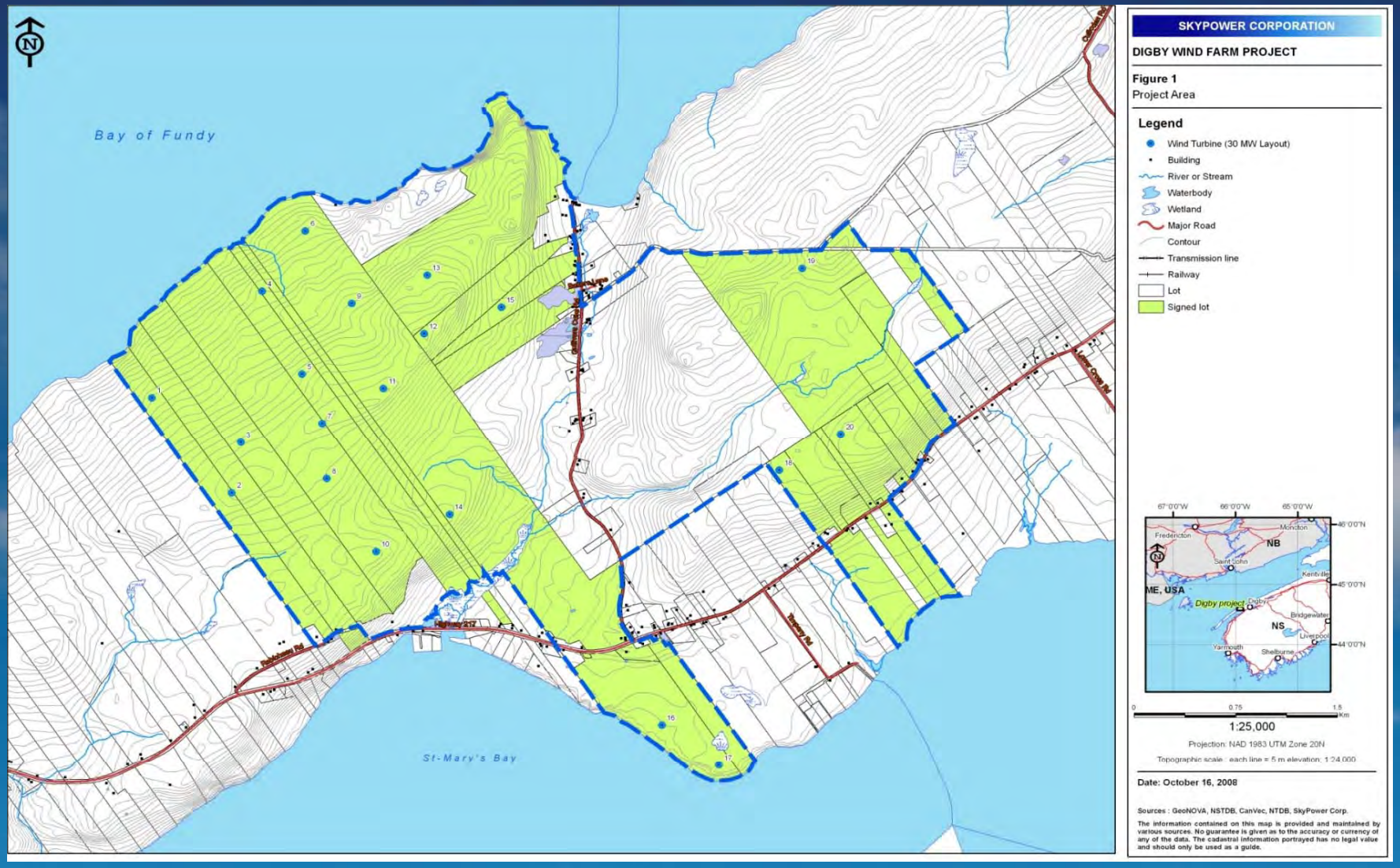
SOUND

- The evolution of wind farm technology over the past decade has rendered mechanical sound from turbines almost undetectable with the main sound being the swoosh of the blades passing the tower.
- Compared to everyday sound sources, turbines are quiet.
- Sound modeling is being used proactively to determine tower locations that avoid sound impacts on nearby residences.



Decibel levels are not added linearly but logo logarithmically.
(60 dBA does not add up to 120. 60 dBA = 63 dBA)

PROPOSED DIGBY TURBINE LAYOUT



CONCLUSION

- Digby 30 MW wind project
  - Will assist in meeting the Renewable Energy Standards set by Nova Scotia's Department of Energy
  - Strong winds
  - Completed wind studies
  - System Impact Study currently underway
  - Strong local landowner support
  - Committed to local content where possible
  - Environmental Assessment underway and to be completed by Q4 2008





Digby Wind Farm: View from View point 1 - Looking West



ORIGINAL PHOTO



MAP



TECHNICAL DATA

PHOTOGRAPH-VIEW POINT:

Photograph Number:	1
Date Photograph was taken:	Spring 2008
Coordinate system:	NAD 1983 UTM Zone 20N
Easting:	267888
Northing:	4940301
Elevation:	25m ASL
View Direction:	West

WIND TURBINES USED:

Model:	GE 1.5sle
Height of nacelle-mid point:	61.4m
Rotor Diameter:	77m

SIMULATION:

Total Number of Wind Turbines:	20
Total Number of Visible Turbines:	4
Closest Visible Turbine:	Approx. 1.5km
Furthest Visible Turbine:	Approx. 2.7km

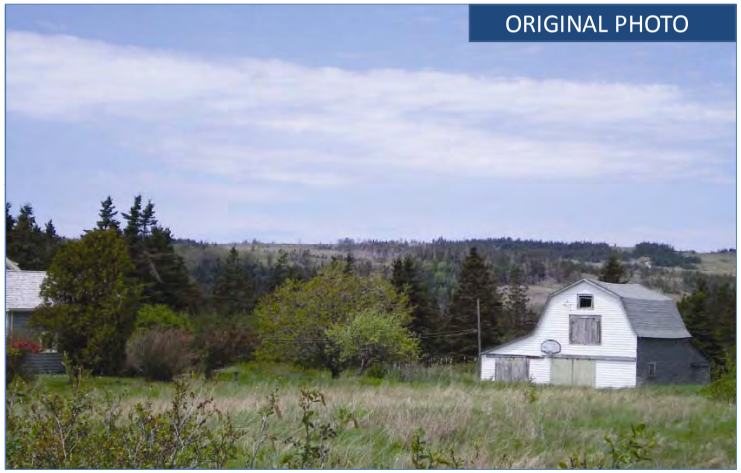
Date: November 17, 2008

Jacques Whitford | Scotian WindFields Community Owned. Naturally. | SKYPOWER

Digby Wind Farm: View from View point 2 - Looking North West



ORIGINAL PHOTO



MAP



Date: November 17, 2008

TECHNICAL DATA

PHOTOGRAPH-VIEW POINT:

Photograph Number:	2
Date Photograph was taken:	Spring 2008
Coordinate System:	NAD 1983 UTM Zone 20N
Easting:	267805
Northing:	4940346
Elevation:	22m ASL
View Direction:	Northwest

WIND TURBINES USED:

Model:	GE 1.5sle
Height of nacelle-mid point:	77m
Rotor Diameter:	61.4m

SIMULATION:

Total Number of Wind Turbines:	20
Total Number of Visible Turbines:	4
Closest Visible Turbine:	Approx. 1.2km
Furthest Visible Turbine:	Approx. 2.3km

Digby Wind Farm: View from View point 3 - Looking North West



ORIGINAL PHOTO



MAP



Date: November 17, 2008

TECHNICAL DATA

PHOTOGRAPH-VIEW POINT:

Photograph Number:	3
Date Photograph was taken:	Spring 2008
Coordinate System:	NAD 1983 UTM Zone 20N
Easting:	268054
Northing:	4941977
Elevation:	33m ASL
View Direction:	Northwest

WIND TURBINES USED:

Model:	GE 1.5sle
Height of nacelle-mid point:	77m
Rotor Diameter:	61.4m

SIMULATION:

Total Number of Wind Turbines:	20
Total Number of Visible Turbines:	2
Closest Visible Turbine:	Approx. 1.1Km
Furthest Visible Turbine:	Approx. 1.4Km

Digby Wind Farm: View from View point 4 - Looking North



ORIGINAL PHOTO



MAP



Date: November 17, 2008

TECHNICAL DATA

PHOTOGRAPH-VIEW POINT:

Photograph Number:	4
Date Photograph was taken:	Spring 2008
Coordinate system:	NAD 1983 UTM Zone 20N
Easting:	268054
Northing:	4941977
Elevation:	33m ASL
View Direction:	North

WIND TURBINES USED:

Model:	GE 1.5sle
Height of nacelle-mid point:	77m
Rotor Diameter:	61.4m

SIMULATION:

Total Number of Wind Turbines:	20
Total Number of Visible Turbines:	1
Closest Visible Turbine:	Approx. 1.1 km
Furthest Visible Turbine:	Approx. 1.1 km

APPENDIX B

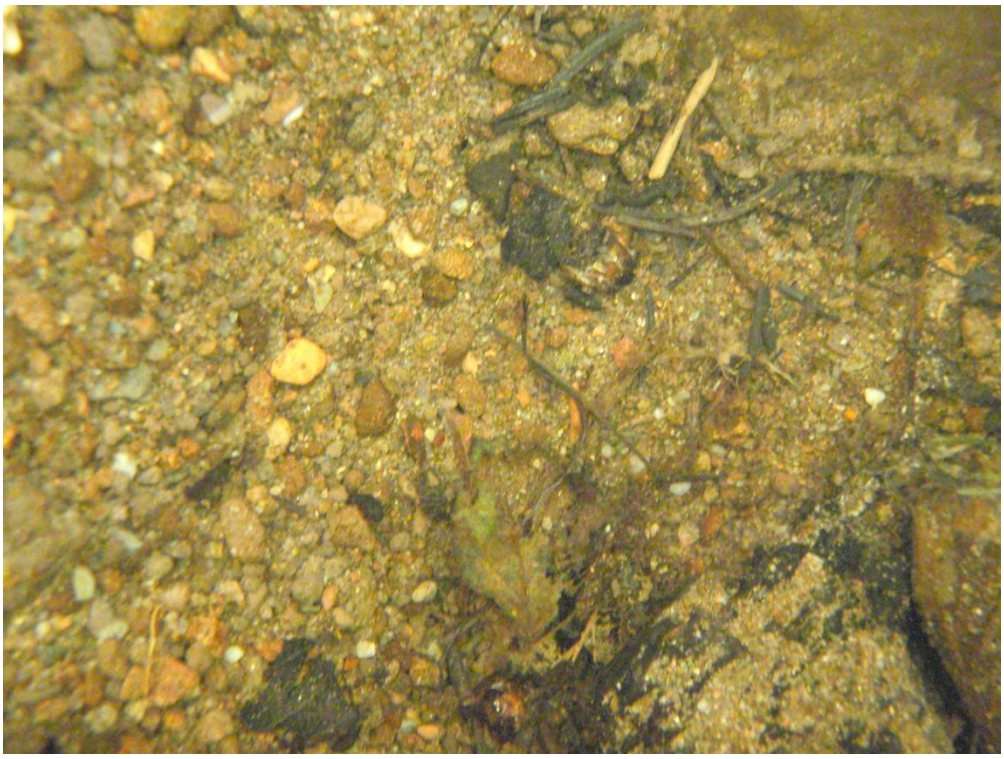
AQUATIC SURVEY PHOTOGRAPHS



Photograph 1: WC-1 Channel immediately downstream of existing culvert



Photograph 2: Channel downstream of the proposed crossing on WC-2 (Haight Brook)



Photograph 3: Substrate at transect of WC-2 (Haight Brook)



Photograph 4: Upstream transect with cobble substrate on WC-2 (Haight Brook)



Photograph 5: Downstream transect with sandy-silt substrate on WC-2 (Haight Brook)



Photograph 6: WC-2 (Haight Brook) culvert downstream looking upstream



Photograph 7: Proposed crossing location WC-3, upstream of headwaters of Haight Brook

APPENDIX C

FLORA LISTS

TABLE C1 Rare and Sensitive Plant Species Potentially Present in the Study Area

Scientific Name	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	COSEWIC Rank
Carex digitalis	Slender Wood Sedge	Dry, sandy woodlands.	Not given for NS	S1	RED	-
Carex hystericina	Porcupine Sedge	Swamps, swales, and along brooks.	June to October	S1S2	RED	-
Carex ormostachya	Necklace Spike Sedge	Hardwood stands.	Not given for NS. Possibly late May to July	S1	RED	-
Conopholis americana	Squaw-Root	Associated with oaks and other decidous trees.	April to July	S1S2	RED	-
Eupatorium dubium	Joe-Pye Thoroughwort	Rocky shores, swamps and damp thickets.	August and September, can be identified when not in flower	S2	RED	-
Fraxinus pennsylvanica	Green Ash	Near lakes or ponds, or in other low-lying areas.	Flowers in May	S1	RED	-
Galium boreale	Northern Bedstraw	The edges of woods and in grassy places, such as pastures.	Flowers June to August	S2	RED	-
Galium obtusum	Blunt-Leaf Bedstraw	Boggy swales and wet thickets.	May to July	S1	RED	-
Goodyera pubescens	Downy Rattlesnake-Plantain	Woodland and thickets. Usually found in dry or moist coniferous or mixed woods, often in a sandy substrate with oak or white pine.	July and August	S1	RED	-
Hepatica nobilis var. obtusa	Round-Leaved Liverleaf	Dry, usually mixed deciduous forest.	Early May	S1	RED	-
Hypericum majus	Larger Canadian St. John's Wort	Wet or dry open soil.	July to September	S1	RED	-
Lobelia spicata	Pale-Spiked Lobelia	Dry fields.	Not given for NS	S1S2SE	RED	-
Selaginella rupestris	Ledge Spike-Moss	Dry, exposed rocks and sandy soils.	July to October	S1	RED	-
Silene antirrhina	Sleepy Catchfly	Habitats include dry gravelly prairies, hill prairies, barrens, glades, rocky bluffs, pastures and abandoned fields, and areas along railroads and roadsides.	Late spring to mid-summer	S1	RED	-
Solidago hispida	Hairy Goldenrod	Woods and forest edges.	Summer and fall	S1?	RED	-
Spiranthes casei var. casei	Case's Ladies'-Tresses	Acid, sandy soils, roadsides and open barrens.	September	S1	RED	-
Spiranthes lucida	Shining Ladies'-Tresses	Alluvial soils and rocky shores. Thickets and meadows.	Flowers early July	S2	RED	-
Thuja occidentalis	Northern White Cedar	Lakesides and swamps or old pastures.	Can be identified throughout the year	S1S2	RED	-
Carex laxiflora	Loose-Flowered Sedge	Damp clearings and open rocky woods.	Not given for NS	S1	RED	-
Carex wiegandii	Wiegand's Sedge	Boggy and peaty soils, conifer and alder swamps.	Matures in summer	S3	RED	-
Arabis drummondii	Drummond Rockcress	Usually on dry slopes and talus, but occassionally in more fertile locations at lower elevations.	May to July	S2	YELLOW	-
Asplenium trichomanes	Maidenhair Spleenwort	Damp shaded cliffs, and talus slopes. Acidic rock such as granite, basalt and sandstone.	Can be identified without sprangia	S2	YELLOW	-
Calamagrostis stricta ssp. stricta	Northern Reedgrass	Around lakes and bogs, wet cliff faces, and landward edges of saltmarshes.	Flowering time not given, summer	S1S2	YELLOW	-
Cardamine parviflora var. arenicola	Small-Flower Bitter-Cress	Dry woods, shaded or exposed ledges, and in sandy soils.	April to August	S2	YELLOW	-
Carex atratiformis	Black Sedge	Along riverbanks, moist cliffs, and associated rock crevices.	Summer	S3	YELLOW	-
Carex capillaris	Hair-Like Sedge	Seepy, exposed slopes of cliffs.	Summer	S3	YELLOW	-
Carex houghtoniana	A Sedge	Sandy soils and roadside banks.	Seeds (perigynia) required for identification. Can be identified from May through September	S2?	YELLOW	-
Carex swanii	Swan Sedge	Boggy pastures, dry peaty barrens, forests, clearings, and the edges of woods.	Early summer	S2?	YELLOW	-
Conioselinum chinense	Hemlock Parsley	Swamps, mossy coniferous woods or swales, and seepy slopes near the coast.	August to October	S2S3	YELLOW	-
Eleocharis ovata	Ovate Spikerush	Muddy shores and ditches.	Flowers/Fruit May to October	S2?	YELLOW	-

TABLE C1 Rare and Sensitive Plant Species Potentially Present in the Study Area

Scientific Name	Common Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	COSEWIC Rank
Epilobium coloratum	Purple-Leaf Willow-Herb	Low-lying ground, springy slopes and similar locations.	July and October. Seeds required for identification	S2?	YELLOW	-
Erigeron philadelphicus	Philadelphia Fleabane	Old fields, meadows, and springy slopes.	Flowers June to August	S2	YELLOW	-
Fraxinus nigra	Black Ash	Low ground, damp woods and swamps.	May and June. Can be identified without flowers	S3	YELLOW	-
Goodyera repens	Dwarf Rattlesnake-Plantain	Under conifers, growing with very few other plants.	Flowers July and August	S2S3	YELLOW	-
Hedeoma pulegioides	American Pennyroyal	Stony till and upland pastures, throughout northern part of NS. Near seashores occasionally.	August	S2S3	YELLOW	-
Hudsonia ericoides	Golden-Heather	Dry, rocky, and sandy barrens. Recently disturbed areas or on open sandy soils.	Late May to early July	S2	YELLOW	-
Hypericum dissimulatum	Disguised St. John's-Wort	On shores and damp open areas.	Not provided	S2S3	YELLOW	-
Piptatherum pungens	Slender Mountain-Ricegrass	Dry woods and clearings in sandy soils.	May and June	S2	YELLOW	-
Poa glauca	White Bluegrass	Cliff crevices, on shelves, and talus slopes.	July and August. Can be identified post flowering until early October	S3	YELLOW	-
Polygala sanguinea	Field Milkwort	Poor or acidic fields, damp slopes, and open woods or bush.	Late June to October	S2S3	YELLOW	-
Pyrola minor	Lesser Wintergreen	Characteristic of mature coniferous woods in northern Cape Breton.	Flowers in July and August	S2	YELLOW	-
Salix sericea	Silky Willow	Low thickets and stream banks.	Late March to early May	S2	YELLOW	-
Spiranthes casei	Case's Ladies'-Tresses	Acid, sandy soils, roadsides and open barrens.	September	S2	YELLOW	-
Spiranthes casei var. novaescotiae	Case's Ladies'-Tresses	Acid, sandy soils, roadsides and open barrens.	September	S2	YELLOW	-
Spiranthes ochroleuca	Yellow Nodding Ladies'-Tresses	Characteristic of the driest sand barrens in southwestern counties. Also near rivers and in dry habitats such as roadsides and fields.	September to October	S2	YELLOW	-
Symphyotrichum boreale	Boreal American-Aster	Gravelly soil of lake beaches, along streams and the edges of bogs.	August and September	S2?	YELLOW	-
Symphyotrichum undulatum	Wavy-leaf American-Aster	Old fields and the edges of thickets.	August and September	S2	YELLOW	-
Dichanthelium linearifolium	Slim-Leaf Witchgrass	Dry sandy soils.	July to October	S2?	YELLOW	-
Piptatherum canadense	Canada Mountain-Ricegrass	Dry sandy soils.	Not provided	S2	YELLOW	-

Likely on Site Key:

- No= No suitable habitat, likelihood of occurrence negligible
- Unlikely= Unlikely to occur on site and if present would be in areas peripheral to turbine sites not likely to be affected by their emplacement with suitable erosion control measures during installation
- Possible= These species could have some potential to be present but were not noted and would only be expected from the salt marshes beyond the dykes or in a small deep slough along the east side of the Project area or in the peripheral oldfield and moist meadow areas to the south of the Project area.

Key to species rankings:

- ACCDC Ranking
  S1: Extremely rare. S2: Rare. S3: Uncommon. S4: fairly common. S5: Secure. S#S#: A range between two consecutive numeric ranks. Denotes range of uncertainty about the exact rarity of the element (e.g., S1S2). B: Breeding. SH: Historical and suspected to be still extant. SU: Unrankable: Possibly in peril throughout its range in the province, but status uncertain; need more information. SX: Extinct/Extirpated: Element is believed to be extirpated within the province. S?:Unranked: Element is not yet ranked. SZ: Zero occurrences: Not of practical conservation concern in the province, because there are no definable occurrences, although the species is native and appears regularly. NZ: Long distance migrants whose occurrences during their migrations are too irregular (in terms of repeated visitation to the same locations) or transitory.
- NSDNR Ranking
  Red: Known to be or thought to be at risk. Yellow: Sensitive to human activities or natural events. Green: Not believed to be sensitive, or at risk. Not Assessed: Known or believed to be present in Nova Scotia but yet unassessed. Undetermined: Insufficient data exists to determine status. Exotic: Introduced as a result of human activity.
- COSEWIC Ranking
  Endangered: Species facing imminent extirpation or extinction. Threatened: Species likely to become endangered if limiting factors are not reversed. Special Concern: Species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. Data Deficient: A category that applies when the available information is insufficient to resolve a wildlife species' eligibility for assessment or to permit an assessment of the wildlife species' risk of extinction. Not at Risk: Species that has been evaluated and found to be not at risk of extinction given the current circumstances.

Atlantic Canada Conservation Data Centre Species Rank Definitions	
S1	Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.
S2	Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.
S3	Uncommon throughout its range in the province, or found only in a restricted range, even if abundant at some locations. (21 to 100 occurrences).
S#S#	Numeric range rank: A range between two consecutive numeric ranks. Denotes uncertainty about the exact rarity of the species (*e.g.*, S1S2)
S#?	Inexact or uncertain ranking.
Nova Scotia Department of Natural Resources General Status Ranks	
Red	Known to be or thought to be at risk.
Yellow	Sensitive to human activities or natural events.

Source: ACCDC 2007; NSDNR 2007

Table C2 Flora Observed at the Project Area by Survey Site

Scientific Name	Common Name	ACCDC Rank	NSDNR Rank	General	SS 1	SS 2	SS 3	SS 4	SS 5	SS 6	SS 7	SS 8	SS 9	SS 10	SS 11	SS 12	SS 13	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20
Abies balsamea	Balsam Fir	S5	GREEN	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Acer pensylvanicum	Striped Maple	S5	GREEN	X	X	X				X	X						X		X	X				X
Acer rubrum	Red Maple	S5	GREEN	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X
Acer saccharum	Sugar Maple	S5	GREEN	X	X	X	X										X					X		X
Acer spicatum	Mountain Maple	S5	GREEN		X		X				X						X		X		X			X
Achillea millefolium	Common Yarrow	S5	GREEN			X		X				X	X	X				X						
Agalinus pururea var. neosctica	Nova Scotia False-Foxglove	S4	GREEN	X											X									
Agrimonia striata	Woodland Agrimony	S5	GREEN															X						
Agrostis capillaris	Colonial Bentgrass	SE	EXOTIC	X			X	X	X		X	X	X	X				X		X		X	X	
Agrostis gigantea	Black Bentgrass	SE	EXOTIC																					X
Agrostis hyemalis	Rough Bentgrass	S5	GREEN	X			X		X	X	X	X	X	X	X	X	X	X	X			X		X
Agrostis perennans	Perennial Bentgrass	S4S5	GREEN					X	X				X				X							
Agrostis stolonifera	Spreading Bentgrass	S5SE	GREEN	X						X														
Alchemilla filicaulis	Thin-Stem Lady's-Mantle	SE	EXOTIC						X															
Alnus incana	Speckled Alder	S5	GREEN	X					X								X							
Alnus viridis	Green Alder	S5	GREEN	X			X	X	X	X			X	X	X		X	X		X	X		X	
Amelanchier sp.	Shadbush	n/a	n/a		X				X					X										
Ammophila breviligulata	American Beachgrass	S5	GREEN	X																				
Anaphalis margaritacea	Pearly Everlasting	S5	GREEN	X		X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Anthoxanthum odoratum	Sweet Vernal Grass	SE	EXOTIC	X			X	X	X	X	X	X	X	X				X		X			X	
Apocynum androsaemifolium	Spreading Dogbane	S5	GREEN	X																				
Aquilegia vulgaris	European Columbine	SE	EXOTIC	X																				
Aralia hispida	Bristly Sarsaparilla	S5	GREEN	X									X	X										
Aralia nudicaulis	Wild Sarsaparilla	S5	GREEN	X	X	X	X			X	X	X	X		X	X	X	X	X	X	X	X		X
Arceuthobium pusillum	Dwarf Mistletoe	S5	GREEN																		X			
Aronia melanocarpa	Black Chokeberry	S5	GREEN	X											X									
Aster acuminatus	Whorled Aster	S5	GREEN	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Aster lateriflorus	Farewell-Summer	S5	GREEN	X	X	X	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X
Aster macrophyllus	Large-Leaf Wood-Aster	S5	GREEN	X	X	X	X				X		X	X			X		X					X
Aster nemoralis	Bog Aster	S5	GREEN											X										
Aster novi-belgii	New Belgium American-Aster	S5	GREEN				X		X	X	X	X	X	X	X	X		X	X			X		X
Aster puniceus	Swamp Aster	S5	GREEN						X								X							

Scientific Name	Common Name	ACCDC Rank	NSDNR Rank	General	SS 1	SS 2	SS 3	SS 4	SS 5	SS 6	SS 7	SS 8	SS 9	SS 10	SS 11	SS 12	SS 13	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20
Aster radula	Rough-Leaved Aster	S5	GREEN	X	X				X						X		X							
Aster umbellatus	Parasol White-Top	S5	GREEN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Aster X blakei	a hybrid White Panicled American-Aster	HYB	GREEN						X															
Athyrium filix-femina	Lady-Fern	S5	GREEN	X			X				X	X		X			X							X
Betula alleghaniensis	Yellow Birch	S5	GREEN	X	X	X	X			X	X		X			X	X		X	X	X	X		X
Betula cordifolia	Heart-Leaved Paper Birch	S5	GREEN							X	X		X				X		X	X	X	X		X
Betula papyrifera	Paper Birch	S5	GREEN	X	X	X		X		X			X	X	X	X				X	X			
Betula populifolia	Gray Birch	S5	GREEN	X				X					X						X					
Bidens frondosa	Devil's Beggar-Ticks	S5	GREEN				X		X															
Brachyeletrum septentrionalis	Northern Short-husk	S5	GREEN										X											
Brachyelytrum erectum	Bearded Short-Husk	S4S5	GREEN		X												X							X
Bromus ciliatus	Fringed Brome	S4S5	GREEN						X	X							X	X		X				
Calamagrostis canadensis	Blue-Joint Reedgrass	S5	GREEN											X			X			X	X			X
Cardamine pensylvanica	Pennsylvania Bitter-cress	S5	GREEN														X						X	
carduus	Thistles	SE	EXOTIC									X											X	
Carex arctata	Black Sedge	S5	GREEN	X			X	X		X	X	X	X				X	X	X			X		X
Carex brunnescens	Brownish Sedge	S5	GREEN				X			X	X		X		X	X		X					X	X
Carex canescens	Hoary Sedge	S5	GREEN												X									
Carex communis	Fibrous-Root Sedge	S5	GREEN	X			X		X	X	X	X	X	X		X		X	X				X	
Carex crinita	Fringed Sedge	S4S5	GREEN	X																				
Carex debilis	White-Edge Sedge	S5	GREEN							X	X	X		X					X			X		X
Carex deflexa	Short-Stemmed Sedge	S4	GREEN									X	X											
Carex disperma	Softleaf Sedge	S5	GREEN				X									X	X							
Carex echinata	Little Prickly Sedge	S5	GREEN							X			X										X	X
Carex flava	Yellow Sedge	S5	GREEN							X	X						X		X				X	X
Carex folliculata	Long Sedge	S5	GREEN	X			X								X									
Carex gracillima	Graceful Sedge	S4S5	GREEN		X	X				X	X	X	X				X		X					X
Carex gynandra	A Sedge	S5	GREEN			X	X	X	X	X	X	X					X				X			X
Carex intumescens	Bladder Sedge	S5	GREEN		X	X	X	X	X	X	X	X	X	X			X		X			X	X	X
Carex leptalea	Bristly-Stalk Sedge	S5	GREEN						X															X
Carex leptonervia	Finely-Nerved Sedge	S5	GREEN		X		X			X	X	X					X	X	X			X		X
Carex lurida	Shallow Sedge	S5	GREEN	X						X	X	X					X		X			X	X	X
Carex nigra	Black Sedge	S5	GREEN																				X	
Carex novae-angliae	New England Sedge	S5	GREEN		X	X				X	X	X	X	X		X		X	X				X	X

Scientific Name	Common Name	ACCDC Rank	NSDNR Rank	General	SS 1	SS 2	SS 3	SS 4	SS 5	SS 6	SS 7	SS 8	SS 9	SS 10	SS 11	SS 12	SS 13	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20
Carex pallescens	Pale Sedge	S5	GREEN							X								X	X					
Carex pauciflora	Few Flowered Sedge	S5	GREEN												X									
Carex paupercula	Boreal Bog Sedge	S5	GREEN												X									
Carex retrorsa	Retrorse Sedge	S4	GREEN	X																				
Carex scabrata	Rough Sedge	S5	GREEN		X												X						X	
Carex scoparia	Pointed Broom Sedge	S5	GREEN								X	X	X				X					X	X	
Carex sp.	A Sedge	n/a	n/a							X	X	X								X	X	X	X	
Carex stipata	Stalk-Grain Sedge	S5	GREEN				X			X							X						X	
Carex swanii	Swan Sedge	S2?	YELLOW	X						X	X	X	X	X				X	X	X		X	X	X
Carex trisperma	Three-Seed Sedge	S5	GREEN			X	X			X											X			
Carex umbellata	Hidden Sedge	S4	GREEN															X						
Carex viridula	Little Green Sedge	S4	GREEN	X									X						X					
Carex vulpinoidea	Fox Sedge	S4?	GREEN	X																				
Centaurea nigra	Black Starthistle	SE	EXOTIC	X			X	X		X		X					X	X			X	X	X	
Cerastium vulgatum	Common Mouse-Ear Chickweed	SE	EXOTIC	X																				
Chrysanthemum leucanthemum	Oxeye Daisy	SE	EXOTIC	X								X						X	X			X	X	X
Chrysosplenium americanum	American Golden-Saxifrage	S5	GREEN														X							
Cicuta maculata	Spotted Water-Hemlock	S5	GREEN	X																				
Cinna latifolia	Slender Wood Reedgrass	S5	GREEN																					X
Circaea alpina	Small Enchanter's Nightshade	S5	GREEN		X					X						X	X			X	X			
Cirsium arvense	Creeping Thistle	SE	EXOTIC	X		X		X	X			X		X			X	X		X		X	X	
Cirsium muticum	Swamp Thistle	S5	GREEN																				X	
Cirsium vulgare	Bull Thistle	SE	EXOTIC	X								X											X	
Clematis virginiana	Virginia Virgin-Bower	S5	GREEN			X			X															
Clintonia borealis	Clinton's Lily	S5	GREEN												X	X								
Coptis trifolia	Goldthread	S5	GREEN	X	X	X	X			X	X	X	X	X	X	X	X		X	X	X	X		X
Cornus alternifolia	Alternate-Leaf Dogwood	S5	GREEN	X		X																		
Cornus canadensis	Dwarf Dogwood	S5	GREEN	X		X	X	X	X		X	X	X	X	X	X	X			X	X			
Cypripedium acaule	Pink Lady's-Slipper	S5	GREEN	X									X	X	X				X		X			
Cystopteris fragilis	Fragile Fern	S4	GREEN																	X				
Dalibarda repens	Dewdrop	S5	GREEN												X		X							
Danthonia compressa	Flattened Oatgrass	S4	GREEN				X			X				X			X	X		X		X	X	X
Danthonia spicata	Poverty Oat-Grass	S5	GREEN	X	X	X		X			X		X	X				X	X	X	X	X	X	X
Daphne mezereum	February Daphne	SE	EXOTIC									X											X	
Daucus carota	Wild Carrot	SE	EXOTIC	X					X									X	X					

Scientific Name	Common Name	ACCDC Rank	NSDNR Rank	General	SS 1	SS 2	SS 3	SS 4	SS 5	SS 6	SS 7	SS 8	SS 9	SS 10	SS 11	SS 12	SS 13	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	S5	GREEN	X		X	X			X	X	X	X	X	X	X		X	X	X	X	X		X
Deschampsia flexuosa	Crinkled Hairgrass	S5	GREEN	X	X			X		X	X	X		X		X				X	X	X	X	
Dichanthelium acuminatum	Panic Grass	S5	GREEN									X		X			X						X	X
Dichanthelium boreale	Northern Witchgrass	S5	GREEN			X		X		X		X	X	X		X						X		
Dichanthelium clandestinum	Deer-Tongue Witchgrass	S3	GREEN							X	X													
Dichanthelium lanuginosum	Panic Grass	S5	GREEN	X									X					X	X					
Dichanthelium sp.	A Grass	n/a	n/a	X						X	X										X	X		X
Diervilla lonicera	Northern Bush-Honeysuckle	S5	GREEN	X								X		X				X	X	X	X			
Drosera rotundifolia	Roundleaf Sundew	S5	GREEN	X											X				X					
Dryopteris campyloptera	Mountain Wood-Fern	S5	GREEN	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X
Dryopteris carthusiana	Spinulose Shield Fern	S5	GREEN							X	X	X	X	X			X			X	X			X
Dryopteris cristata	Crested Shield-Fern	S5	GREEN			X			X					X			X		X		X				
Dryopteris intermedia	Evergreen Woodfern	S5	GREEN	X	X	X	X			X	X	X		X		X	X		X		X	X		X
Dryopteris marginalis	Marginal Wood-Fern	S5	GREEN																	X				
Dryopteris x boottii	a Hybrid Wood-fern	HYB	n/a														X							
Dryopteris x triploidea	a Hybrid Wood-fern	HYB	n/a			X				X														
Eleocharis acicularis	Least Spike-Rush	S5	GREEN	X															X					
Eleocharis sp.	Spike Rush	n/a	n/a	X															X					
Eleocharis tenuis	Slender Spike-Rush		GREEN																				X	
Elymus pungens	Tick Quack Grass	SE	EXOTIC						X															
Elymus repens	Quackgrass	SE	EXOTIC	X																				
Empetrum nigrum	Black Crowberry	S5	GREEN	X											X									
Epifagus virginiana	Beechdrops	S4S5	GREEN																			X		
Epilobium angustifolium	Fireweed	S5	GREEN	X					X				X	X							X			
Epilobium ciliatum	Hairy Willow-Herb	S5	GREEN							X									X				X	
Epilobium leptophyllum	Linear-Leaved Willow-Herb	S5	GREEN					X			X												X	
Epilobium palustre	Marsh Willow-Herb	S5	GREEN							X														
Epipactis helleborine	Eastern Helleborine	SE	EXOTIC			X																		
Equisetum arvense	Field Horsetail	S5	GREEN														X						X	
Equisetum sylvaticum	Woodland Horsetail	S5	GREEN	X					X						X		X							
Erechtites hieraciifolia	Fireweed	S5	GREEN													X								
Erigeron strigosus	Daisy Fleabane	S5	GREEN	X																				
Eriophorum virginicum	Tawny Cotton-Grass	S5	GREEN	X											X									

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Eupatorium perfoliatum	Common Boneset	S5	GREEN				X			X														
Euphrasia nemorosa	Common Eyebright	S5SE	GREEN					X																
Euphrasia officinalis	Drug Eyebright	SE	EXOTIC	X					X			X		X										
Euthamia graminifolia	Flat-Top Fragrant-Golden-Rod	S5	GREEN	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Fagus grandifolia	American Beech	S5	GREEN			X																X		
Festuca filiformis	Hair Fescue	SE	EXOTIC																	X	X		X	
Festuca pratensis	Meadow Rye Grass	SE	EXOTIC	X														X	X					
Festuca rubra	Red Fescue	S5	GREEN									X								X		X	X	
Festuca sp.	Fescue	n/a	n/a											X										
Fragaria virginiana	Virginia Strawberry	S5	GREEN			X	X	X	X		X			X			X	X	X	X	X		X	X
Fraxinus americana	White Ash	S5	GREEN	X	X	X				X	X						X	X	X					X
Galeopsis tetrahit	Brittle-Stem Hempnettle	SE	EXOTIC	X				X	X			X						X				X	X	
Galium asprellum	Rough Bedstraw	S5	GREEN														X							
Galium palustre	Marsh Bedstraw	S5	GREEN														X						X	
Galium sp.	Bedstraw	n/a	n/a																		X			
Galium tinctorium	Stiff Marsh Bedstraw	S5	GREEN																	X				X
Galium trifidum	Small Bedstraw	S5	GREEN				X		X														X	
Galium triflorum	Sweet-Scent Bedstraw	S5	GREEN						X		X													
Gaylussacia baccata	Black Huckleberry	S5	GREEN												X									
Geum rivale	Purple Avens	S5	GREEN														X							
Glyceria canadensis	Canada Manna-Grass	S5	GREEN	X											X									
Glyceria grandis	American Mannagrass	S4S5	GREEN	X			X		X						X									
Glyceria laxa	Northern Mannagrass	S4?	GREEN				X			X							X							X
Glyceria sp.	A Grass	n/a	n/a							X					X						X			
Glyceria striata	Fowl Manna-Grass	S5	GREEN		X	X	X		X	X		X			X		X	X	X	X	X		X	X
Glyceria X laxa	Long Mannagrass	n/a	n/a														X							
Gnaphalium uliginosum	Low Cudweed	SE	EXOTIC	X																		X		
Gymnocarpium dryopteris	Northern Oak Fern	S5	GREEN	X	X	X	X		X	X	X						X			X	X			X
Hedeoma pulegioides	American Pennyroyal	S2S3	YELLOW	X																				
Hieracium aurantiacum	Orange Hawkweed	SE	EXOTIC					X	X					X				X					X	
Hieracium caespitosum	Meadow Hawkweed	SE	EXOTIC	X		X		X				X		X				X	X	X		X	X	
Hieracium murorum	Wall Hawkweed	SE	EXOTIC																				X	
Hieracium paniculatum	Panicled Hawkweed	S3	GREEN									X												
Hieracium scabrum	Rough Hawkweed	S5	GREEN									X	X	X								X		
Hieracium sp.	Hawkweed	n/a	n/a									X					X				X	X	X	

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Hieracium x floribundum	Smoothish Hawkweed	SE	EXOTIC							X		X												
Holcus lanatus	Common Velvet Grass	SE	EXOTIC	X			X		X			X		X			X	X					X	
Huperzia lucidula	Shining Fir-Clubmoss	S5	GREEN																X					
Hydrocotyle americana	American Water-Pennywort	S5	GREEN												X									
Hypericum canadense	Canadian St. John's-Wort	S5	GREEN	X			X			X	X				X				X			X		X
Hypericum perforatum	A St. John's-Wort	SE	EXOTIC	X				X	X					X				X	X				X	
Ilex verticillata	Black Holly	S5	GREEN	X			X	X	X				X	X	X		X	X		X	X	X		X
Impatiens capensis	Spotted Jewel-Weed	S5	GREEN				X			X							X			X			X	
Iris versicolor	Blueflag	S5	GREEN	X						X														
Juncus arcticus	Artic Rush	S5	GREEN												X									
Juncus articulatus	Jointed Rush	S5	GREEN	X			X						X		X				X					
Juncus brevicaudatus	Narrow-Panicled Rush	S5	GREEN	X			X		X		X				X								X	X
Juncus bufonius	Toad Rush	S5	GREEN															X						
Juncus canadensis	Canada Rush	S5	GREEN	X						X	X				X									X
Juncus effusus	Soft Rush	S5	GREEN				X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
Juncus sp.	A Rush	n/a	n/a															X						
Juncus tenuis	Slender Rush	S5	GREEN	X															X					X
Juniperus communis	Ground Juniper	S5	GREEN	X				X																
Juniperus horizontalis	Creeping Juniper	S5	GREEN											X										
Kalmia angustifolia	Sheep-Laurel	S5	GREEN	X					X				X		X									
Lactuca biennis	Tall Blue Lettuce	S5	GREEN															X						
Lactuca canadensis	Canada Lettuce	S5	GREEN																		X			
Lactuca sp.	A Lettuce	n/a	n/a	X																				
Larix laricina	American Larch	S5	GREEN												X									
Ledum groenlandicum	Common Labrador Tea	S5	GREEN	X											X									
Linnaea borealis	Twinflower	S5	GREEN		X	X	X	X		X	X	X	X			X	X				X	X		X
Lobelia inflata	Indian-Tobacco	S5	GREEN	X			X				X							X							
Lonicera caerulea	Mountain Fly-Honeysuckle	S4S4	GREEN	X	X				X			X													
Lonicera canadensis	American Fly-Honeysuckle	S5	GREEN	X	X	X	X			X							X				X	X	X	X
Ludwigia palustris	Marsh Seedbox	S5	GREEN	X																				
Luzula acuminata	Hairy Woodrush	S5	GREEN																			X		
Luzula multiflora	Common Woodrush	S5	GREEN	X		X	X	X		X		X	X	X				X	X	X			X	X
Lycopodium annotinum	Stiff Clubmoss	S5	GREEN								X										X			
Lycopodium clavatum	Running Pine	S5	GREEN	X							X	X	X	X		X								
Lycopodium dendroideum	Treelike Clubmoss	S4?	GREEN			X						X												

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Lycopodium hickeyi	Hickey's Clubmoss	S2?	UNDETERMINE																			X		
Lycopodium obscurum	Tree Clubmoss	S5	GREEN																			X		
Lycopus uniflorus	Northern Bugleweed	S5	GREEN		X					X	X		X	X	X		X	X			X			
Lysimachia terrestris	Swamp Loosestrife	S5	GREEN	X				X	X						X								X	
Lythrum salicaria	Purple Loosestrife	SE	EXOTIC	X																				
Maianthemum canadense	Wild Lily-of-The-Valley	S5	GREEN	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X		X
Matricaria matricarioides	Pineapple-Weed Chamomile	SE	EXOTIC	X																				
Medeola virginiana	Indian Cucumber-Root	S5	GREEN		X																			
Melampyrum lineare	American Cow-Wheat	S5	GREEN																		X			
Mentha arvensis	Corn Mint	S5	GREEN	X																			X	
Mentha x piperata	Peppermint	SE	EXOTIC															X						
Mitchella repens	Partridge-Berry	S5	GREEN		X				X						X		X							X
Monotropa uniflora	Indian-Pipe	S5	GREEN	X	X	X	X				X	X		X					X		X	X	X	
Myrica pensylvanica	Northern Bayberry	S5	GREEN	X				X	X			X	X	X	X						X	X		
Nemopanthus mucronata	Mountain Holly	S5	GREEN	X				X	X				X	X	X	X	X	X	X					
Oenothera biennis	Common Evening-Primrose	S5	GREEN	X										X										
Oenothera fruticosa	Narrow-Leaved Sundrops	S2S3SE?	UNDETERMINE	X														X						
Oenothera parviflora	Northern Evening-Primrose	S4?	GREEN											X										
Oenothera perennis	Small Sundrops	S5	GREEN	X			X		X		X	X						X						X
Onoclea sensibilis	Sensitive Fern	S5	GREEN	X		X		X			X			X			X				X		X	
Oryzopsis asperifolia	White-Grained Mountain-Ricegrass	S5	GREEN									X												
Osmunda cinnamomea	Cinnamon Fern	S5	GREEN	X	X	X	X	X	X	X	X		X	X	X		X			X	X		X	X
Osmunda claytoniana	Interrupted Fern	S5	GREEN	X	X		X	X	X	X	X		X	X	X		X				X			X
Osmunda regalis	Royal Fern	S5	GREEN											X										
Oxalis acetosella	White Wood-Sorrel	S5	GREEN	X	X	X	X				X					X	X		X	X	X	X		X
Oxalis stricta	Upright Yellow Wood-Sorrel	S5	GREEN															X					X	
Phalaris arundinacea	Reed Canary Grass	S5	GREEN	X																				
Phegopteris connectilis	Northern Beech Fern	S5	GREEN	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X		X
Phleum pratense	Meadow Timothy	SE	EXOTIC	X									X					X						X
Picea glauca	White Spruce	S5	GREEN	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Picea mariana	Black Spruce	S5	GREEN						X				X		X		X							
Picea rubens	Red Spruce	S5	GREEN	X	X	X	X			X			X		X	X	X		X		X			
Plantago lanceolata	English Plantain	SE	EXOTIC						X			X						X					X	

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Plantago major	Nipple-Seed Plantain	SE	EXOTIC	X														X	X				X	
Platanthera clavellata	Small Green Woodland Orchid	S5	GREEN												X									
Platanthera obtusata	Small Northern Bog-Orchid	S4S5	GREEN	X		X																		
Platanthera psycodes	Small Purple-Fringe Orchis	S4	GREEN	X							X						X						X	
Platanthera sp.	Orchis	n/a	n/a								X				X									
Poa compressa	Canada Bluegrass	SE	EXOTIC									X											X	
Poa palustris	Fowl Bluegrass	S5	GREEN															X						
Poa pratensis	Kentucky Bluegrass	S5	GREEN									X											X	
Poa saltuensis	Drooping Bluegrass	S4S5	GREEN		X						X													
Poa sp.	Bluegrass	n/a	n/a									X												
Pogonia ophioglossoides	Snakemouth Orchid	S5	GREEN												X									
Polygonum cilinode	Fringed Black Bindweed	S5	GREEN													X		X				X		
Polygonum persicaria	Lady's Thumb	SE	EXOTIC	X																				
Polygonum sagittatum	Arrow-Leaved Tearthumb	S5	GREEN	X					X									X						
Polypodium appalachianum	Appalachian Polypody	S3?	UNDETERMINE																	X				
Polypodium virginianum	Rock Polypody	S5	GREEN													X				X	X			
Polystichum acrostichoides	Christmas Fern	S5	GREEN	X	X	X		X			X											X		X
Populus grandidentata	Large-Tooth Aspen	S5	GREEN						X													X		
Populus tremuloides	Quaking Aspen	S5	GREEN	X				X	X				X									X		
Potentilla norvegica	Norwegian Cinquefoil	S5	GREEN	X			X									X							X	X
Potentilla recta	Sulphur Cinquefoil	SE	EXOTIC								X												X	
Potentilla simplex	Old-Field Cinquefoil	S5	GREEN	X		X	X	X	X	X	X	X	X	X	X		X	X	X			X	X	X
Potentilla sp.	Cinquefoil	n/a	n/a															X						
Prenanthes altissima	Tall Rattlesnake-root	S4S5	GREEN		X	X																		X
Prenanthes trifoliolata	Three-Leaved Rattlesnake-root	S5	GREEN	X	X						X						X					X		X
Prunella vulgaris	Self-Heal	S5	GREEN	X	X			X		X			X	X				X	X	X				X
Prunus pensylvanica	Fire Cherry	S5	GREEN	X						X		X	X	X										
Prunus serotina	Wild Black Cherry	S5	GREEN	X			X																	
Prunus virginiana	Choke Cherry	S5	GREEN	X	X			X	X			X	X	X		X		X		X	X	X	X	X
Pteridium aquilinum	Bracken Fern	S5	GREEN	X		X																		
Pyrola rotundifolia var. americana ameri	American Wintergreen	S5	GREEN																			X		
Pyrus malus	Common Apple	SE	EXOTIC						X															
Ranunculus acris	Tall Butter-Cup	SE	EXOTIC	X				X	X	X		X					X						X	

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Ranunculus repens	Creeping Butter-Cup	SE	EXOTIC	X			X			X		X		X			X	X		X	X		X	X
Rhamnus frangula	Glossy Buckthorn	SE	EXOTIC	X				X					X	X		X	X	X	X			X		
Rhinanthes crista-galli	Little Yellow-Rattle	S5	GREEN					X	X									X						
Rhododendron canadense	Rhodora	S5	GREEN	X											X									
Rhynchospora alba	White Beakrush	S5	GREEN	X											X									
Ribes glandulosum	Skunk Currant	S5	GREEN									X				X		X		X	X	X		
Ribes hirtellum	Smooth Gooseberry	S5	GREEN																	X				
Ribes lacustre	Bristly Black Currant	S5	GREEN	X										X						X	X			
Rosa canina	Dog Rose	SE	EXOTIC					X																
Rosa carolina	Carolina Rose	S4S5	GREEN					X																
Rosa multiflora	Rambler Rose	SE	EXOTIC	X																				
Rosa nitida	Shining Rose	S4	GREEN	X									X				X				X	X		
Rosa virginiana	Virginia Rose	S5	GREEN	X				X	X		X	X	X	X		X	X	X		X	X			
Rubus alleghaniensis	Allegheny Blackberry	S5	GREEN	X			X	X	X		X		X	X			X	X	X	X		X		X
Rubus canadensis	Smooth Blackberry	S5	GREEN		X		X	X	X	X			X	X			X	X	X	X	X	X		X
Rubus hispidus	Bristly Dewberry	S5	GREEN			X				X	X	X		X	X		X			X	X	X		
Rubus idaeus	Red Raspberry	S5	GREEN	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rubus pensilvanicus	Pennsylvania Blackberry	S3?	GREEN												X									
Rubus pubescens	Dwarf Red Raspberry	S5	GREEN		X	X	X	X	X		X	X			X		X	X		X	X			X
Rubus setosus	New England Blackberry	SR	UNDETERMINE	X																				
Rubus sp.	Dewberry	n/a	n/a	X			X	X	X	X			X			X		X				X		
Rumex acetosella	Alpine Dock	S5	GREEN						X			X	X	X				X				X	X	
Rumex crispus	Curly Dock	SE	EXOTIC																				X	
Salix discolor	Pussy Willow	S5	GREEN	X					X								X							
Salix humilis	Prairie Willow	S5	GREEN										X				X							
Sambucus canadensis	Common Elderberry	S5	NOT ASSESSED														X							
Sambucus racemosa	Red Elderberry	S5	GREEN	X			X		X	X		X	X	X		X		X	X	X		X	X	
Satureja vulgaris	Field Basil	S5	GREEN																				X	
Scirpus atrovirens	Woolgrass Bulrush	S4	GREEN	X					X	X				X				X	X			X		
Scirpus cyperinus	Cottongrass Bulrush	S5	GREEN	X			X	X	X	X	X	X	X	X			X		X				X	
Scutellaria galericulata	Hooded Skullcap	S5	GREEN																				X	
Senecio aureus	Golden Groundsel	S4	GREEN									X												
Senecio sylvaticus	Woodland Groundsel	SE	EXOTIC															X						
Senecio vulgaris	Common Groundsel	n/a	n/a																				X	

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Sisyrinchium montanum	Strict Blue-Eyed-Grass	S5	GREEN	X			X							X				X	X					
Smilacina trifolia	Three-Leaf Solomon's-Plume	S4S5	GREEN						X						X									
Solanum dulcamara	Climbing Nightshade	SE	EXOTIC															X				X	X	
Solidago canadensis	Canada Goldenrod	S5	GREEN					X						X										
Solidago flexicaulis	Broad-leaved Goldenrod	S5	GREEN	X	X																			
Solidago macrophylla	Large-Leaf Goldenrod	S4	GREEN			X	X																	
Solidago puberula	Downy Goldenrod	S5	GREEN	X						X			X			X				X	X	X		
Solidago rugosa	Rough-Leaf Goldenrod	S5	GREEN		X	X	X	X	X	X	X	X	X	X		X	XX	X	X	X	X	X	X	X
Solidago uliginosa	Bog Goldenrod	S5	GREEN	X					X						X									
Sonchus arvensis	Field Sowthistle	SE	EXOTIC						X															
Sorbus americana	American Mountain-Ash	S5	GREEN	X	X		X	X	X		X		X	X		X		X	X	X	X	X		X
Sorbus decora	Northern Mountain-Ash	S4	GREEN																	X				
Sorbus sp.	Mountain-Ash	n/a	n/a					X																
Sparganium	Burreed	n/a	n/a												X									
Sparganium emersum	Narrow-Leaf Burreed	S5	GREEN	X																				
Spiraea alba	Narrow-Leaved Meadowsweet	S5	GREEN												X									
Spiraea tomentosa	Hardhack Spiraea	S5	GREEN	X				X							X									
Spiranthes lacera	Ladies'-Tresses		GREEN											X										
Streptopus roseus	Rosy Twistedstalk	S5	GREEN								X													
Taraxacum officinale	Common Dandelion	SE	EXOTIC			X		X				X						X	X				X	X
Thalictrum pubescens	Tall Meadow-Rue	S5	GREEN	X	X				X	X							X	X		X				
Thelypteris noveboracensis	New York Fern	S5	GREEN	X	X	X		X	X	X	X		X	X	X		X		X	X	X	X		X
Thelypteris palustris	Marsh Fern	S5	GREEN						X												X			
Toxicodendron rydbergii	Northern Poison Oak	S5	GREEN						X															
Triadenum sp.	Marsh St. John's-wort	n/a	n/a												X									
Trientalis borealis	Northern Starflower	S5	GREEN	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X
Trifolium aureum	Yellow Clover	SE	EXOTIC	X																				
Trifolium pratense	Red Clover	SE	EXOTIC						X															
Trifolium repens	White Clover	SE	EXOTIC																X					
Triticum aestivum	Cultivated Wheat	SE	EXOTIC						X															
Tussilago farfara	Colt's Foot	SE	EXOTIC	X						X					X				X					X
Typha angustifolia	Small Bulrush		GREEN						X															
Typha latifolia	Broad-Leaf Cattail	S5	GREEN							X									X				X	X
Vaccijnium oxycoccos	Small Cranberry	S5	GREEN												X									

Scientific Name	Common Name	ACCDC Rank	NSDNR Rank	General	SS 1	SS 2	SS 3	SS 4	SS 5	SS 6	SS 7	SS 8	SS 9	SS 10	SS 11	SS 12	SS 13	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20
Vaccinium angustifolium	Late Lowbush Blueberry	S5	GREEN	X									X											
Vaccinium macrocarpon	Large Cranberry	S5	GREEN	X																				
Vaccinium myrtilloides	Velvetleaf Blueberry	S5	GREEN										X				X							
Vaccinium oxycoccos	Small Cranberry	S5	GREEN	X																				
Verbascum thapsus	Great Mullein	SE	EXOTIC	X								X						X					X	
Veronica officinalis	Gypsy-Weed	S5SE	EXOTIC	X	X	X	X	X		X	X	X	X	X			X	X	X	X		X	X	X
Veronica serpyllifolia	Thyme-Leaved Speedwell	S5	GREEN																				X	
Viburnum nudum	Possum-Haw Viburnum	S5	GREEN			X	X	X	X				X	X	X			X		X	X	X		
Viburnum opulus	Guelder-Rose Viburnum	S5	GREEN																				X	
Vicia cracca	Tufted Vetch	SE	EXOTIC	X																				
Viola blanda	Smooth White Violet	S5	GREEN		X	X	X	X																
Viola cucullata	Marsh Blue Violet	S5	GREEN		X		X		X	X	X	X	X	X		X	X	X				X		X
Viola lanceolata	Lance-Leaf Violet	S5	GREEN	X									X		X									
Viola macloskeyi	Smooth White Violet	S5	GREEN			X	X		X	X	X	X	X	X	X	X			X				X	X
Viola sagittata	Arrow-Leaved Violet	S3S4	GREEN	X									X									X		
Viola sororia	Northern Blue Violet	S5?	GREEN	X	X	X	X	X		X	X	X	X	X		X	X	X	X				X	X
Viola sp.	Violet	n/a	n/a								X			X									X	
Xyris difformis	Carolina Yellow-Eyed-Grass	S4	GREEN	X											X									

SS - Survey Site

APPENDIX D

WETLAND DATA

Table D1 Wetlands Found in the Project Area

Wetland Identification #	LSB	TB	CTS	MTS	DTS	TSS	LSS	FM	BM	SM	SWW	Approx. Wetland Size (ha)
19			X									0.16
20			X									0.15
27			X									29.16
56			X									1.10
77			X									0.07
79			X									0.56
12					X							1.10
57					X							1.11
15								X				0.04
24								X				0.41
74								X				0.18
23								X				0.18
65								X				0.78
73								X				0.29
76								X				0.21
55								X				0.11
31							X					0.07
41							X					0.21
47							X					0.33
69							X					0.21
71							X					0.12
1				X								0.13
5				X								16.59
11				X								1.75
33				X								1.05
39				X								0.26
42				X								0.20
50				X								0.18
51				X								0.14
52				X								0.25
53				X								0.05
60				X								0.75
63				X								0.95
78				X								1.48
2						X						1.38
13						X						1.94
14						X						0.28
16						X						2.50
17						X						2.73
18						X						0.44
25						X						0.73
28						X						0.42

Table D1 Wetlands Found in the Project Area

Wetland Identification #	LSB	TB	CTS	MTS	DTS	TSS	LSS	FM	BM	SM	SWW	Approx. Wetland Size (ha)
29						X						0.58
30						X						0.09
32						X						0.49
38						X						2.01
43						X						0.16
48						X						0.27
49						X						0.25
54						X						0.24
72						X						0.32
75						X						0.47
46		X										5.09
44	X	X	X									3.67
66			X					X				0.44
22								X			X	0.09
26								X			X	0.60
40							X				X	0.08
80	X	X	X	X								27.48
81			X			X						4.86
3			X			X						14.44
64						X		X				0.25
21						X					X	0.74
34						X					X	0.43
37						X		X	X	X	X	19.78
Total # of Occurences	2	3	11	14	2	24	6	13	1	1	6	82.00
Total Wetland Area (ha)												**153.61**

Key:
LSB = Low Shrub Bog
TB = Treed Bog
CTS = Coniferous Treed Swamp
MTS = Mixedwood Treed Swamp
DTS = Deciduous Treed Swamp
TSS = Tall Shrub Swamp
LSS = Low Shrub Swamp
FM = Fresh Marsh
SM = Salt Marsh
BM = Brackish Marsh
SWW = Shallow Water Wetland

Table D2 Wetland Area and Abundance in the Project Area by Wetland Type

Wetland Type	Wetland Area (ha)	Proportion of Wetland Cover (%)	Number of Wetlands
Coniferous Treed Swamp	31.21	20.3	6
Deciduous Treed Swamp	2.21	1.4	2
Fresh Marsh	2.20	1.4	8
Low Shrub Swamp	0.95	0.6	5
Mixedwood Treed Swamp	23.77	15.5	13
Tall Shrub Swamp	15.30	10	18
Treed Bog	5.09	3.3	1
Wetland Complex	72.88	47.4	12
Total	**153.61**	**99.9**	**65**

APPENDIX E

AVIAN FIELD PROGRAM INFORMATION

WIND TURBINE STUDY PRE-CONSTRUCTION (BASELINE) BIRD MONITORING PROTOCOL

1.0 INTRODUCTION

This bird survey protocol will be used as a guideline to gather information on pre-construction (baseline) information on birds that use and move through sites proposed for wind farm development. Specifically, this protocol applies to proposed Digby wind farm (refer to Appendix A for site location maps). Preliminary desktop studies have determined these sites to have High and Very High Level of Concern scores based on Environment Canda's Guidance Document for Environmental Assessment (Environment Canada 2007a). The proposed sampling program and level of effort is reflective of these scores which takes into account size of the site, the nature of the habitats at the site, and the numbers and species of birds expected.

The protocol was developed based on previous protocols developed in consultation with the Canadian Wildlife Service (CWS), as well as Environment Canada's Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (Environment Canada 2007b). This protocol is intended as a guideline only and adjustments may have to be made in response to weather conditions or changes in bird activities that can vary somewhat from one year to the next.

Field workers hired to perform these surveys will be skilled at identifying birds by song and call and by sight and will be familiar with the birds in the region where the survey is being undertaken. Results of these surveys will be included in the environmental assessment reports for the proposed wind farm developments. Data will be collected and presented in such a manner to allow comparison of baseline data with post-construction survey and monitoring results that will be required as follow-up.

2.0 BREEDING SEASON

During the breeding season, surveys will determine which species regularly use the area for nesting, for foraging during the breeding season, or for raising their young, and to obtain measures of abundance of bird species using the area. Such data will be used to predict the potential impact to breeding birds of developing turbines on a site and (when combined with post-assessment monitoring) to quantify the actual impact, if construction proceeds, in order to test the predictions.

The following describes specific sampling methods to be used and proposed sampling schedule.

2.1 Sampling Methods

Area searches, standardized area searches and point counts will be used as the effective means for developing a species list for the site. Point counts will follow Environment Canada guidelines, and will be used for the purpose of contributing to existing knowledge of the use of the site by birds during the breeding season, and to facilitate comparisons with the post-construction breeding bird community. For some bird species, such as marsh birds and some raptors, playback methods may also be used. Surveys require a field worker who is familiar with the methodology, and the songs and calls of all bird species likely to be encountered. Surveys will be undertaken twice during the early breeding season. Representative sampling will be undertaken in each major habitat type.

2.2 Schedule and Frequency

The following survey periods are proposed to obtain information on bird breeding behavior in the area.

- Two surveys in the early breeding season, from late May to early July.

3.0 SPRING AND FALL MIGRATION

For migrating birds, areas that contain habitats that may be important for migrants as stopover sites or wintering areas will be surveyed to determine whether they support large numbers of birds in these seasons. Some areas may also have high concentrations of birds flying through them, in which case there is a concern whether they may be flying at heights comparable to the blades of the wind turbines.

3.1 Sampling Methods

Surveys will be conducted during both spring and autumn migration. Passage migration counts and stopover counts will be conducted to determine how the site is used by migrant birds. Behavioral studies will also be conducted if significant concentrations of birds are present (such as migrating raptors or large flocks of waterbirds).

With specific respect to waterfowl, efforts will be made on site when these migrations are known to be occurring, based on past observations or on current information. Surveys will determine what flight paths, if any, become routine for staging waterfowl as they move about the study area. Number and height of migrating flocks in relation to proposed blade height will be recorded.

For migrants in transit such as raptors, surveys will be focused during weather conditions that promote migration. The heights of migrants, such as raptors, will be recorded.

Sampling will represent each major habitat type. If present, special habitats such as wetlands or shorelines for species that use these habitats in particular will be surveyed.

3.2 Schedule and Frequency

The following survey periods are proposed to obtain information on migrant and staging bird species in the area:

- For stopover migrants, the migration period will be separated into three components including a "core" period and shoulder periods on each side.
- For spring migration in the Maritimes, the core period is first three weeks of May and shoulder periods begin 15 April and end early June. For the fall migration the core period is the first three weeks of September, and shoulder periods begin mid-August and end late October.
- Within the core periods, surveys will be conducted twice a week (approximately once every three days), and for the shoulder periods, surveys will be conducted once a week.
- By having more frequent surveys within the core periods the possibility of missing a migrant "wave" is reduced.

4.0 OVERWINTERING

4.1 Sampling Methods

Counts during the winter (e.g., November to March) will be carried out using standardized area searches. Observations will note height of flights and specific areas of feeding, relative to proposed location of turbines.

As with migration stopover studies, if significant numbers of birds are present, searches will be complemented with behavioural studies to determine whether birds flying through areas will be within the future blade-swept area.

Sampling will represent each major habitat type.

4.2 Schedule and Frequency

The following survey periods are proposed to obtain information on use of the area by overwintering birds (e.g., songbirds, raptors, waterfowl):

- One survey every two to three weeks from November to April.

5.0 SUMMARY OF MONITORING EFFORT

A total of **126 to 140** hours will be spent monitoring bird use, during the pre-construction phase in 2008 as shown in Table 1.

TABLE 1 Summary of Monitoring Protocol

Season	Dates	Number of survey weeks	Monitoring Behaviour	Survey Methods	Frequency	Total Survey Hours
Winter	November 1-April 15	22 weeks	Overwintering	Standardized area searches Behavioural studies if required	One 4-hour survey every two to three weeks.	Approximately 30 to 44 hours
Spring	April 15-April 30 and last week of May	3 weeks	Spring Migration (shoulder period)	Passage migration counts Stopover count Behavioural studies if required	One 4-hour survey per week	12 hours
Spring	First three weeks of May	3 weeks	Spring Migration (core period)	Passage migration counts Stopover count Behavioural studies if required	One 4-hour survey twice a week (approximately every three days)	24 hours
Summer	June 1-August 15	10 weeks	Breeding	Area searches Standardized area searches Point counts Playback methods if required	Two 4-hour surveys over the breeding season	8 hours
Summer-Early Fall/ Late Fall	August 15-August 30, and last week of September to October 31.	2 weeks (Summer-Early Fall) and 5 weeks (Late Fall).	Fall Migration (shoulder period)	Passage migration counts Stopover count Behavioural studies if required	One 4-hour survey per week	28 hours
Fall	First three weeks of September	3 weeks	Fall Migration (core period)	Passage migration counts Stopover count Behavioural studies if required	One 4-hour survey twice a week (approximately every three days)	24 hours

6.0 REPORTING

Results of these surveys will be included in the environmental assessment reports for the proposed wind farm developments. Data will be collected and presented in such a manner to allow comparison of baseline data with post-construction survey and monitoring results that will be required as follow-up.

A seasonal species list will be developed. Observations for each species sighting will be recorded that will include the date (season), number of individuals, flight height, direction and location on the study area. Summaries will be presented for five bird groups: waterfowl, waterbirds, raptors, shorebirds and land birds.

7.0 CLOSURE

This document presents the proposed baseline survey protocol for monitoring birds at proposed wind farm development sites near Digby, Nova Scotia in order to gather data to support environmental assessment approvals. Specific methodologies will follow Environment Canada guidelines and will be conducted by a qualified birder.

8.0 REFERENCES

Environment Canada. 2007a. Wind Turbines and Birds: A Guidance Document for Environmental Assessment. Canadian Wildlife Service. April 2007.

Environment Canada. 2007b. Recommended Protocol for Monitoring Impacts of Wind Turbines on Birds. Canadian Wildlife Service. April 2007.

P:\envsci\102xxxx\1029448 Skypower NB EAs\Bird Monitoring Protocol-Sept 27-Beaver Mountain, NS.doc

Table E1 - Rare and Sensitive Bird Species Potentially Present in the Project Area (Previously Recorded within 100 km of the Project Area)

Scientific Name	Common Name	Prefered Habitat	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NS Endangered Species Act	*SARA* Status
Falco peregrinus anatum	Peregrine Falcon	Almost any habitat type that provides hunting opportunities. For nesting, prefer habitats with cliffs.	S1B	RED	Special Concern	Vulnerable	Threatened
Accipiter gentilis	Northern Goshawk	Mature coniferous and mixedwood forest generally remote from human habitation.	S3B	YELLOW	Not At Risk	-	-
Asio otus	Long-eared Owl	Various woodland habitats as well as open habitats.	S1S2	YELLOW	-	-	-
Histrionicus histrionicus	Harlequin Duck - Eastern population	Swift-moving streams in summer; and rocky, wave-lashed coasts and jetties in winter.	S1B,S1N	YELLOW	Special Concern	Endangered	Special Concern (Schedule 1)

Table E2 Summary of Bird Survey Site Visits

Monitoring Period	Survey Date	Primary Survey Method	Weather	Temperature (°C)*	Wind Speed and Direction**
Overwintering	November 14, 2007	Area Searches	-	9	13 km/h – S
Overwintering	December 14, 2007	Area Searches	-	-4	15 km/h - E
Overwintering	January 8, 2008	Area Searches	-	7	20 km/h – S
Overwintering	February 16, 2008	Area Searches	-	-8	34 km/h - WNW
Overwintering	March 9, 2008	Area Searches	-	4	34 km/h – SW
Overwintering	April 6, 2008	Area Searches	-	5	22 km/h – ENE
Spring Migration (shoulder period)	April 19, 2008	Area Searches	-	7	23 km/h – N
Spring Migration (shoulder period)	April 26, 2008	Area Searches	-	6	36 km/h – N
Spring Migration (core period)	May 4, 2008	Area Searches	Overcast, showers	10	15 km/h – S
Spring Migration (core period)	May 10, 2008	Area Searches	Showers	6	15 km/h – SE
Spring Migration (core period)	May 11, 2008	Area Searches	Overcast	9	28 km/h – NE
Spring Migration (core period)	May 15, 2008	Area Searches	Clear, sunny	10	15 km/h – NE
Spring Migration (core period)	May 19, 2008	Area Searches	Overcast, foggy	13	28 km/h – SW
Spring Migration (core period)	May 20, 2008	Area Searches	Clear, sunny	12	35 km/h – SW
Spring Migration (core period)	May 24, 2008	Area Searches	Partly cloudy	9	15 km/h – NW
Spring Migration (shoulder period)	May 27, 2008	Area Searches	Clear, sunny	13	15 km/h – SW
Breeding	June 1, 2008	Point Counts ***	Overcast, drizzle	12	14 km/h – SSW
Breeding	June 5, 2008	Point Counts	Clear, sunny	11	31 km/h – N
Breeding	June 7, 2008	Point Counts	Cloudy, foggy	12	12 km/h – S
Breeding	June 13, 2008	Point Counts	Sunny	14	19 km/h – WNW
Breeding	June 19, 2008	Point Counts	Clear, sunny	14	13 km/h – SE
Breeding	July 2, 2008	Point Counts	Overcast	15	23 km/h – SSE
Breeding	July 6, 2008	Point Counts	Clear, sunny	16	19 km/h – SSE
Breeding	July 29, 2008	Point Counts	Clear	16	16 km/h – SSE
Breeding	August 14, 2008	Point Counts	-	16	12 km/h - ENE
Fall Migration (shoulder period)	August 21, 2008	Area Searches	Sunny	15	15 km/h – NW
Fall Migration (core period)	September 5, 2008	Area Searches	Clear	18	15 km/h – SE
Fall Migration (core period)	September 8, 2008	Area Searches	Overcast, foggy	16	15 km/h – NW
Fall Migration (core period)	September 12, 2008	Area Searches	Cloudy	18	15 km/h – S
Fall Migration (core period)	September 15, 2008	Area Searches	Clear	20	40 km/h – S
Fall Migration (core period)	September 19, 2008	Area Searches	Sunny	13	8 km/h – NW
Fall Migration (shoulder period)	October 6, 2008	Area Searches	Overcast, misty	12	10 km/h – NW
Fall Migration (shoulder period)	October 14, 2008	Area Searches	Cloudy	15	<1 km/h – S
Fall Migration (shoulder period)	October 20, 2008	Area Searches	Cloudy	10	15 km/h – NW
Fall Migration (shoulder period)	October 27, 2008	Area Searches	Light rain	11	8 km/h – SE

*Average temperature during 4-hour survey
**Average wind speed and direction during 4-hour survey
***Refer to Figure E1 for Point Count survey locations; area searches were conducted throughout the Project Area.

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - JWSL, 2001 Air Photo Interpretation; NSTDB; NSDNR; Wetland Inventory Mapping, 2007, 1:10 000
Forestry - NSDNR; Forest Inventory Mapping, 2000-2001, 1:10,000, Clear cut areas modified by JWSL using 2005 Imagery, Google Earth Pro.

264500 266500 268500 270500
4944500 4942500 4940500

Bay of Fundy
Gooseberry Cove
Gullivers Cove
Theriaults Point
Gullivers Cove
Gullivers Cove Road
Haight Brook
Rossway
St. Marys Bay
217

PC1 PC2 PC3 PC4 PC5 PC6 PC7 PC8 PC9 PC10 PC11 PC12 PC13 PC14 PC15 PC16 PC17 PC18 PC19 PC20

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

N

SKYPOWER

Figure E-1

DIGBY WIND POWER PROJECT

Bird Survey Locations

Project Components
- Point Count Location
- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Study Area
- Proposed Site Development Area
- Watercourse
- Wetland
- Waterbody

Main Forested Land Cover
- Softwood - 75% softwood species
- Mixedwood - 74-26% softwood species
- Hardwood - < 25% softwood species

Other Forested Land Cover
- Natural Stand
- Treated
- Old Field
- Dead
- Tall Shrub Thicket
- Clear Cut

Non-Forested Land Use
- Cliff, Dunes, Coastal Rock
- Barren
- Agriculture
- Urban
- Beach
- Gravel Pit
- Road Corridor

0 300 600 900 1,200
Meters

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec

Table E3 Bird Species Observed During Breeding Point Counts, 2008

Highest Confirmed Breeding Status	Common Name	Latin Name	NSDNR Rank	ACCDC Rank	Number Observed
Possible	Sharp-shinned Hawk[1]	*Accipiter striatus*	Green	S4B	1
Possible	Red-winged Blackbird[1]	*Agelaius phoeniceus*	Green	S5B	4
Possible	Ruby-throated Hummingbird[1]	*Archilochus colubris*	Green	S5B	1
Observed	Great Blue Heron[1]	*Ardea herodias*	Green	S5B	1
Possible	Cedar Waxwing	*Bombycilla cedrorum*	Green	S5B	49
Confirmed	Ruffed Grouse	*Bonasa umbellus*	Green	S5	5
Possible	Red-tailed Hawk[1]	*Buteo jamaicensis*	Green	S5B	5
Observed	Red-shouldered Hawk[1,2]	*Buteo lineatus*	Accidental	SAN	1
Possible	Broad-winged Hawk[1]	*Buteo platypterus*	Green	S4B	2
Observed	Rough-legged Hawk[1]	*Buteo lagopus*	Green	S3N	1
Possible	American Goldfinch[1]	*Carduelis tristis*	Green	S5	17
Possible	Purple Finch	*Carpodacus purpureus*	Green	S5B	12
Observed	Turkey Vulture[1]	*Cathartes aura*	Accidental	SAB, SZN	10
Possible	Hermit Thrush	*Catharus guttatus*	Green	S5B	35
Possible	Northern Flicker	*Colaptes auratus*	Green	S5B	15
Possible	Eastern Wood Pewee	*Contopus virens*	Green	S4B	1
Possible	American Crow[1]	*Corvus brachyrhynchos*	Green	S5	52
Possible	Common Raven[1]	*Corvus corax*	Green	S5	17
Possible	Blue Jay[1]	*Cyanocitta cristata*	Green	S5	8
Confirmed	Magnolia Warbler	*Dendroica magnolia*	Green	S5B	21
Confirmed	Yellow Warbler	*Dendroica petechia*	Green	S5B	34
Possible	Pine Warbler	*Dendroica pinus*	Accidental	SAN	1
Confirmed	Black-throated Green Warbler	*Dendroica virens*	Green	S5B	140
Possible	Yellow-rumped Warbler	*Dendroica coronata*	Green	S5B	51
Possible	Pileated Woodpecker[1]	*Dryocopus pileatus*	Green	S5	2
Probable	Peregrine Falcon[1, 3]	Falco peregrinus anatum	Red	S1B	1
Possible	Merlin[1]	*Falco columbarius*	Green	S4B	1
Observed	American Coot	*Fulica americana*	Green	S2B	5
Confirmed	Common Yellowthroat[1]	*Geothlypis trichas*	Green	S5B	103
Confirmed	Dark-eyed Junco	*Junco hyemalis*	Green	S5	98
Observed	Herring Gull	*Larus argentatus*	Green	S4	67
Possible	White-winged Crossbill[1]	*Loxia leucoptera*	Undetermined	S5	21

Table E3 Bird Species Observed During Breeding Point Counts, 2008

Highest Confirmed Breeding Status	Common Name	Latin Name	NSDNR Rank	ACCDC Rank	Number Observed
Confirmed	Song Sparrow[1]	*Melospiza melodia*	Green	S5B	90
Confirmed	Black and White Warbler	*Mniotilta varia*	Green	S5B	20
Possible	Black-capped Chickadee	*Parus atricapillus*	Green	S5	1
Possible	Boreal Chickadee	*Parus hudsonicus*	Yellow	S4	3
Observed	Double-crested Cormorant	*Phalacrocorax auritus*	Green	S5B	69
Possible	Downy Woodpecker[1]	*Picoides pubescens*	Green	S5	2
Confirmed	Common Grackle	*Quiscalus quiscula*	Green	S5B	28
Possible	Golden-crowned Kinglet	*Regulus satrapa*	Green	S5B	7
Possible	Ruby-crowned Kinglet	*Regulus calendula*	Green	S5B	17
Possible	Eastern Phoebe[1]	*Sayornis phoebe*	Green	S2S3B	8
Probable	Ovenbird[1]	*Seiurus aurocapillus*	Green	S5B	5
Confirmed	American Redstart	*Setophaga ruticilla*	Green	S5B	19
Possible	Red-breasted Nuthatch	*Sitta canadensis*	Green	S3B	1
Possible	Chipping Sparrow	*Spizella passerina*	Green	S5B	1
Possible	American Tree Sparrow	*Spizella arborea*	Green	S5N	1
Possible	Tree Swallow[1]	*Tachycineta bicolor*	Green	S5B	8
Possible	Winter Wren	*Troglodytes troglodytes*	Green	S5B	12
Confirmed	American Robin	*Turdus migratorius*	Green	S5B	106
Possible	Orange-crowned Warbler	*Vermivora celata*	Accidental	SZN	1
Possible	Blue-headed Vireo	*Vireo solitarius*	Green	S5B	2
Possible	Canada Warbler[4]	*Wilsonia canadensis*	Yellow	S4B	1
Possible	Mourning Dove[1]	*Zenaida macroura*	Green	S5B	3
Confirmed	White-throated Sparrow	*Zonotrichia albicollis*	Green	S5B, SZN	132

[1]Species give s aerial flight display
[2]Red-shouldered Hawk is also listed as Threatened under Schedule 3 of SARA
[3]Peregrine Falcon is also listed as Threatened under Schedule 1 of SARA
[4]Canada Warbler is also listed as Threatened by COSEWIC

Table E4 Bird Species Observed During Overwintering Period, 2007 - 2008

Bird Group	Bird Code	Common Name	Latin Name	Total Observed	NSDNR Rank	ACCDC Rank
Waterfowl	LTDU	Long-tailed Duck	*Clangula hyemalis*	6	n/a	S4N
Waterfowl	BLSC	Black Scoter	*Melanitta nigra*	2	Green	S5M
Waterfowl	HARD	Harlequin Duck*	*Histrionicus histrionicus*	2	Yellow	S2N
Waterfowl	COEI	Common Eider	*Somateria mollissima*	52	Green	S5B, S5M, S4
Gamebird	RUGR	Ruffed Grouse	*Bonasa umbellus*	6	Green	S5
Waterbird	GBHE	Great Blue Heron	*Ardea herodias*	2	Green	S5B
Waterbird	BUFF	Bufflehead	*Bucephala albeola*	4	Green	S4N
Waterbird	HERG	Herring Gull	*Larus argentatus*	57	Green	S4
Waterbird	GBBG	Greater Black-backed Gull	*Larus marinus*	22	Green	S5B
Raptor	RTHA	Red-tailed Hawk	*Buteo jamaicensis*	3	Green	S5B
Raptor	RLHA	Rough-legged Hawk	*Buteo lagopus*	1	Green	S3N
Raptor	TUVU	Turkey Vulture	*Cathartes aura*	2	Accidental	SAB, SZN
Raptor	BAEA	Bald Eagle	*Haliaeetus leucocephalus*	1	Green	S5B,S4N
Landbird	RWBL	Red-winged Blackbird	*Agelaius phoeniceus*	4	Green	S5B
Landbird	CEDW	Cedar Waxwing	*Bombycilla cedrorum*	50	Green	S5B
Landbird	BOWX	Bohemian Waxwing	*Bombycilla garrulus*	16	Green	S5N
Landbird	CORE	Common Redpoll	*Carduelis flammea*	122	Green	S5N
Landbird	HORE	Hoary Redpoll	*Carduelis hornemanni*	1	Accidental	SAN
Landbird	AMCR	American Crow	*Corvus brachyrhynchos*	22	Green	S5
Landbird	CORA	Common Raven	*Corvus corax*	10	Green	S5
Landbird	BLJA	Blue Jay	*Cyanocitta cristata*	4	Green	S5
Landbird	DEJU	Dark-eyed Junco	*Junco hyemalis*	18	Green	S5
Landbird	NSHR	Northern Shrike	*Lanius excubitor*	1	Green	SZN
Landbird	WWCR	White-winged Crossbill	*Loxia leucoptera*	34	Undetermined	S5
Landbird	BCCH	Black-capped Chickadee	*Parus atricapillus*	58	Green	S5
Landbird	BOCH	Boreal Chickadee	*Parus hudsonicus*	10	Yellow	S4
Landbird	GCKI	Golden-crowned Kinglet	*Regulus satrapa*	2	Green	S5B
Landbird	RCKI	Ruby-crowned Kinglet	*Regulus calendula*	4	Green	S5B
Landbird	EUST	European Starling	*Sturnus vulgaris*	8	Exotic	SE
Landbird	AMRO	American Robin	*Turdus migratorius*	3	Green	S5B

*Harlequin Duck is also listed as a species of Special Concern under Schedule 1 of SARA and by COSEWIC

Table E5 Bird Species Observed During Spring Migration, 2008

Bird Group	Bird Code	Common Name	Latin Name	Number Observed	NSDNR Rank	ACCDC Rank
Waterfowl	ABDU	American Black Duck	*Anas rubripes*	13	Green	S5B
Gamebird	RUGR	Ruffed Grouse	*Bonasa umbellus*	2	Green	S5
Gamebird	RIPH	Ring-necked Pheasant	*Phasianus colchicus*	2	Exotic	SEB
Waterbird	GBHE	Great Blue Heron	*Ardea herodias*	1	Green	S5B
Waterbird	AMBI	American Bittern	*Botaurus lentiginosus*	1	Green	S4B
Waterbird	COLO	Common Loon	*Gavia immer*	24	Yellow	S4B, S4N
Waterbird	HERG	Herring Gull	*Larus argentatus*	27	Green	S4
Waterbird	DCCO	Double-crested Cormorant	*Phalacrocorax auritus*	6	Green	S5B
Raptor	RTHA	Red-tailed Hawk	*Buteo jamaicensis*	6	Green	S5B
Raptor	TUVU	Turkey Vulture	*Cathartes aura*	12	Accidental	SAB, SZN
Raptor	MERL	Merlin	*Falco columbarius*	1	Green	S4B
Landbird	RWBL	Red-winged Blackbird	*Agelaius phoeniceus*	11	Green	S5B
Landbird	RTHU	Ruby-throated Hummingbird	*Archilochus colubris*	2	Green	S5B
Landbird	CEDW	Cedar Waxwing	*Bombycilla cedrorum*	24	Green	S5B
Landbird	AMGO	American Goldfinch	*Carduelis tristis*	5	Green	S5
Landbird	PUFI	Purple Finch	*Carpodacus purpureus*	13	Green	S5B
Landbird	HETH	Hermit Thrush	*Catharus guttatus*	3	Green	S5B
Landbird	BEKI	Belted Kingfisher	*Ceryle alcyon*	1	Green	S5B
Landbird	NOFL	Northern Flicker	*Colaptes auratus*	7	Green	S5B
Landbird	AMCR	American Crow	*Corvus brachyrhynchos*	67	Green	S5
Landbird	CORA	Common Raven	*Corvus corax*	28	Green	S5
Landbird	BLJA	Blue Jay	*Cyanocitta cristata*	4	Green	S5
Landbird	BTBW	Black-throated Blue Warbler	*Dendroica caerulescens*	1	Green	S4B
Landbird	YRWA	Yellow-rumped Warbler	*Dendroica coronate*	101	Green	S5B
Landbird	MAWA	Magnolia Warbler	*Dendroica magnolia*	7	Green	S5B
Landbird	YWAR	Yellow Warbler	*Dendroica petechia*	52	Green	S5B
Landbird	CMWA	Cape May Warbler	*Dendroica tigrina*	1	Green	S4B
Landbird	BTNW	Black-throated Green Warbler	*Dendroica virens*	154	Green	S5B
Landbird	PIWO	Pileated Woodpecker	*Dryocopus pileatus*	2	Green	S5
Landbird	GRCA	Gray Catbird	*Dumetella carolinensis*	2	Green	S5B
Landbird	SOSP	Song Sparrow	*Melospiza melodia*	57	Green	S5B

Table E5 Bird Species Observed During Spring Migration, 2008

Bird Group	Bird Code	Common Name	Latin Name	Number Observed	NSDNR Rank	ACCDC Rank
Landbird	BAWW	Black and White Warbler	*Mniotilta varia*	12	Green	S5B
Landbird	COYE	Common Yellowthroat	*Geothlypis trichas*	15	Green	S5B
Landbird	DEJU	Dark-eyed Junco	*Junco hyemalis*	70	Green	S5
Landbird	NOPA	Northern Parula	*Parula americana*	4	Green	S5B
Landbird	BCCH	Black-capped Chickadee	*Parus atricapillus*	76	Green	S5
Landbird	BOCH	Boreal Chickadee	*Parus hudsonicus*	1	Yellow	S4
Landbird	SAVS	Savannah Sparrow	*Passerculus sandwichensis*	18	Green	S5B
Landbird	GRJA	Gray Jay	*Perisoreus Canadensis*	5	Yellow	S4
Landbird	COGR	Common Grackle	*Quiscalus quiscula*	31	Green	S5B
Landbird	RCKI	Ruby-crowned Kinglet	*Regulus calendula*	54	Green	S5B
Landbird	NOWA	Northern Waterthrush	*Seiurus noveboracensis*	1	Green	S5B
Landbird	AMRE	American Redstart	*Setophaga ruticilla*	5	Green	S5B
Landbird	CHSP	Chipping Sparrow	*Spizella passerine*	4	Green	S5B
Landbird	EUST	European Starling	*Sturnus vulgaris*	30	Exotic	SE
Landbird	TRES	Tree Swallow	*Tachycineta bicolor*	15	Green	S5B
Landbird	WIWR	Winter Wren	*Troglodytes troglodytes*	1	Green	S5B
Landbird	AMRO	American Robin	*Turdus migratorius*	52	Green	S5B
Landbird	REVI	Red-eyed Vireo	*Vireo olivaceus*	1	Green	S5B
Landbird	BHVI	Blue-headed Vireo	*Vireo solitarius*	2	Green	S5B
Landbird	MODO	Mourning Dove	*Zenaida macroura*	17	Green	S5B
Landbird	WTSP	White-throated Sparrow	*Zonotrichia albicollis*	173	Green	S5B, SZN
Landbird	WCSP	White-crowned Sparrow	*Zonotrichia leucophrys*	11	Green	SZN

Table E6 Bird Species Observed During Fall Migration, 2008

Bird Group	Bird Code	Common Name	Latin Name	Number Observed	NSDNR Rank	ACCDC Rank
Gamebird	SPGR	Spruce Grouse	*Falcipennis canadensis*	1	Green	S5
Gamebird	RIPH	Ring-necked Pheasant	*Phasianus colchicus*	3	Exotic	SEB
Waterbird	CAEG	Cattle Egret	*Bubulcus ibis*	1	Accidental	SAN
Waterbird	COLO	Common Loon	*Gavia immer*	4	Yellow	S4B, S4N
Waterbird	HERG	Herring Gull	*Larus argentatus*	80	Green	S4
Waterbird	GBBG	Greater Black-backed Gull	*Larus marinus*	16	Green	S5B
Waterbird	NOGA	Northern Gannet	*Morus bassanus*	1	Green	S5M
Waterbird	DCCO	Double-crested Cormorant	*Phalacrocorax auritus*	36	Green	S5B
Waterbird	COEI	Common Eider	*Somateria mollissima*	14	Green	S5B, S5M, S4
Raptor	SSHA	Sharp-shinned Hawk	*Accipiter striatus*	4	Green	S4B
Raptor	RTHA	Red-tailed Hawk	*Buteo jamaicensis*	6	Green	S5B
Raptor	BWHA	Broad-winged Hawk	*Buteo platypterus*	5	Green	S4B
Raptor	TUVU	Turkey Vulture	*Cathartes aura*	5	Accidental	SAB, SZN
Raptor	MERL	Merlin	*Falco columbarius*	1	Green	S4B
Raptor	BAEA	Bald Eagle	*Haliaeetus leucocephalus*	6	Green	S5B, S4N
Landbird	RWBL	Red-winged Blackbird	*Agelaius phoeniceus*	8	Green	S5B
Landbird	RTHU	Ruby-throated Hummingbird	*Archilochus colubris*	2	Green	S5B
Landbird	CEDW	Cedar Waxwing	*Bombycilla cedrorum*	44	Green	S5B
Landbird	BOWX	Bohemian Waxwing	*Bombycilla garrulous*	1	Green	S5N
Landbird	PISI	Pine Siskin	*Carduelis pinus*	20	Green	S5
Landbird	AMGO	American Goldfinch	*Carduelis tristis*	23	Green	S5
Landbird	PUFI	Purple Finch	*Carpodacus purpureus*	146	Green	S5B
Landbird	HETH	Hermit Thrush	*Catharus guttatus*	1	Green	S5B
Landbird	NOFL	Northern Flicker	*Colaptes auratus*	6	Green	S5B
Landbird	AMCR	American Crow	*Corvus brachyrhynchos*	48	Green	S5
Landbird	CORA	Common Raven	*Corvus corax*	4	Green	S5
Landbird	BLJA	Blue Jay	*Cyanocitta cristata*	65	Green	S5
Landbird	YRWA	Yellow-rumped Warbler	*Dendroica coronate*	22	Green	S5B
Landbird	YTWA	Yellow-throated Warbler	*Dendroica dominica*	12	Accidental	SAN
Landbird	MAWA	Magnolia Warbler	*Dendroica magnolia*	3	Green	S5B

Table E6 Bird Species Observed During Fall Migration, 2008

Bird Group	Bird Code	Common Name	Latin Name	Number Observed	NSDNR Rank	ACCDC Rank
Landbird	PAWA	Palm Warbler	*Dendroica palmarum*	3	Green	S5B
Landbird	PIWA	Pine Warbler	*Dendroica pinus*	1	Accidental	SAN
Landbird	BTNW	Black-throated Green Warbler	*Dendroica virens*	24	Green	S5B
Landbird	PIWO	Pileated Woodpecker	*Dryocopus pileatus*	2	Green	S5
Landbird	COYE	Common Yellowthroat	*Geothlypis trichas*	3	Green	S5B
Landbird	DEJU	Dark-eyed Junco	*Junco hyemalis*	94	Green	S5
Landbird	WWCR	White-winged Crossbill	*Loxia leucoptera*	103	Undetermined	S5
Landbird	RBWO	Red-bellied Woodpecker	*Melanerpes carolinus*	1	Accidental	SAN
Landbird	SOSP	Song Sparrow	*Melospiza melodia*	61	Green	S5B
Landbird	BCCH	Black-capped Chickadee	*Parus atricapillus*	35	Green	S5
Landbird	SAVS	Savannah Sparrow	*Passerculus sandwichensis*	16	Green	S5B
Landbird	GRJA	Gray Jay	*Perisoreus Canadensis*	2	Yellow	S4
Landbird	DOWO	Downy Woodpecker	*Picoides pubescens*	2	Green	S5
Landbird	COGR	Common Grackle	*Quiscalus quiscula*	23	Green	S5B
Landbird	RCKI	Ruby-crowned Kinglet	*Regulus calendula*	10	Green	S5B
Landbird	GCKI	Golden-crowned Kinglet	*Regulus satrapa*	6	Green	S5B
Landbird	AMRE	American Redstart	*Setophaga ruticilla*	1	Green	S5B
Landbird	RBNU	Red-breasted Nuthatch	*Sitta canadensis*	5	Green	S3B
Landbird	ATSP	American Tree Sparrow	*Spizella arborea*	1	Green	S5N
Landbird	EUST	European Starling	*Sturnus vulgaris*	42	Exotic	SE
Landbird	TRES	Tree Swallow	*Tachycineta bicolor*	6	Green	S5B
Landbird	AMRO	American Robin	*Turdus migratorius*	117	Green	S5B
Landbird	REVI	Red-eyed Vireo	*Vireo olivaceus*	1	Green	S5B
Landbird	MODO	Mourning Dove	*Zenaida macroura*	28	Green	S5B
Landbird	WTSP	White-throated Sparrow	*Zonotrichia albicollis*	24	Green	S5B, SZN

ANALYSIS OF BIRD DATA, GULLIVERS COVE WINDPOWER SITE

STATISTICAL ANALYSES

The raw data consist of counts of birds made during roughly 4-h observation periods on 10 days in spring and 10 days in fall, 2008. These are minimal data sets for producing any statistically robust results, but can be treated to modest data exploration.

To maximize power of the analysis, it was best to combine the passerines (excluding crows) and near passerines (i.e., doves, woodpeckers, hummingbirds) as a single count, plausibly representing waves of transient or stopover migrants in the area. Because migration counts are unlikely to show linear changes through the season (i.e., more likely to show a peak or peaks), dates were grouped into 10-day categories in spring and 15-day categories in fall. Wind direction and speed are the most likely factors affecting the intensity of migration and stopover in the region. These were logged on-site (as nearest cardinal and point categories: N, NW, W, etc.) and are also available for Yarmouth, Halifax and Saint John at <http://www.climate.weatheroffice.ec.gc.ca/>. Yarmouth and Saint John in spring can plausibly be used to account respectively for migration from the south and drift from the west, and Halifax and Saint John in fall to account respectively for migration from the northeast and drift from the west. The wind variables from the weather stations were taken as mean values of direction and speed during the 6 h period around the previous midnight, possibly capturing prior conditions for overnight migration. They were also converted to compass categories. The somewhat variable estimates (3.8-4.5 h) of survey times were incomplete, so could not be used as an explanatory variable.

The combination of categorical and ordinal data can be used in General Linear Models (GLMs). While more powerful techniques are available (e.g. Bayesian techniques to take advantage of expectations in migration, etc.), General Additive Models for fitting nonlinear functions to seasonal and compass data, etc., these approaches are unlikely to reveal any patterns in small data sets that are not suggested by simple GLMs.

Spring Migration

There were no significant variables in GLMs using wind data from on-site, Yarmouth and Saint John. The best results (highest R^2) used the on-site wind data:

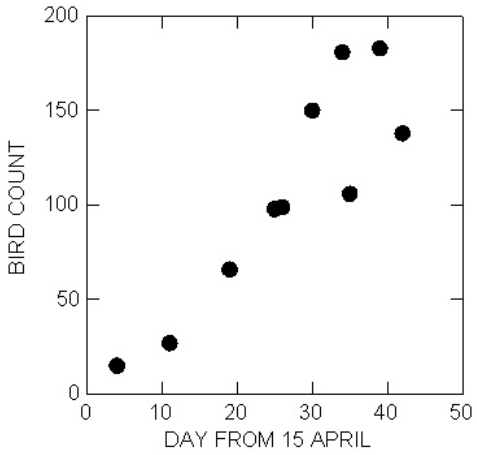
Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Wind speed	1376.000	1	1376.000.	0.255	0.427
Wind Dir. (category)	17895.402	4	4473.851.	0.220	0.253
10-day interval (category)	1075.667	2	537.834.	0.000	0.723
Error	2809.000	2	1404.500		

The model is ill-behaved, with outliers and low tolerances. Also apparent is a correlation between season and wind direction, with N, and NE winds prevailing early in the season, and SW and NW winds later.

Day from 15 Apr. [	4	11	19	25	26	30	34	35	39	42]
Wind Direction	[N	N	S	SE	NE	NE	SW	SW	NW	NW]

With stepwise elimination of wind speed, both (categorical) wind direction (at P = 0.071) and 10-day interval (at p = 0.045) may separately affect the spring bird counts, but are impossible to disentangle in such a small data set.

With effects of wind eliminated, the highly significant increase (P <0.001) of numbers counted during the season is manifest (p < 0.001).

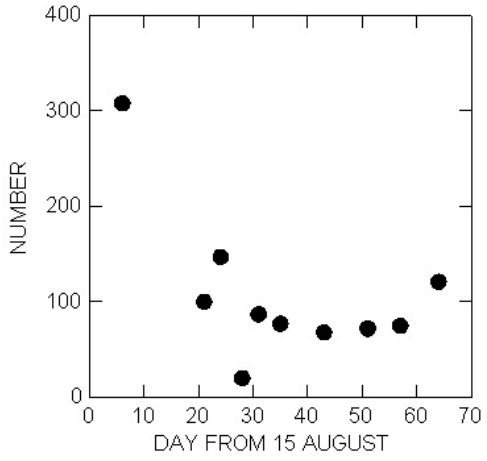


Fall Migration

Again, the best GLM again used on-site wind data, but revealed no significant effects of season (here in categorical 15-day intervals), or wind directions and speeds, and the model is badly behaved, with outliers and predicted counts ranging below zero.

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Wind Speed	1200.462	1	1200.462	0.170	0.751
Wind Direction	1260.822	3	420.274	0.060	0.974
15-day Interval	38126.556	4	9531.639	1.353	0.562
Error	7045.538	1	7045.538		

Again, in a stepwise GLM, only season (expressed as 15-day intervals) is by itself significant (at P = 0.037). This is evidently driven by a large count at the beginning of the season, followed by greatly reduced, but irregular ones thereafter.



DISCUSSION AND CONCLUSIONS

Further statistical analysis of the limited available data does not seem worthwhile. In both spring and fall, the strongest influence on overall numbers seems to be seasonal, with possibly some influence of winds in spring. But, in neither instance does the seasonal pattern appear to reflect an expected migration peak of overall numbers in, say, mid-to-late May in spring and late September and early October in fall. Thus scrutiny of the species involved is probably more revealing than statistical analysis of the combined counts.

In spring, the initial passerines present on the site were largely early migrants or year-round residents. Thereafter there were buildups of several short- and long-distance migrants, for example:

	4 May	10-11 May (av.)	15 May	19-20 May (av.)	24 May	27 May
Am Robin	8	4	0	6	8	14
B.-c. Chickadee	6	12	4	11	0	0
Sparrows, junco	22	38	64	48	33	34
Warblers	6	17.5	58	69.5	76	45

This pattern suggests that by May, American Robin and sparrows were fully settled in the area, that in late May chickadees had either moved out or were (typically) quietly incubating in available nest holes, and that most warblers largely arrived and settled, as expected, by mid-May. There is no evidence of a migratory peak of passage in any of the species or groups.

In fall, the large initial total count (308 on 21 August) was driven by high counts of several sparrows (Junco, White-throated, Song), and by a very large count of Purple Finch. The sparrows do not normally migrate in numbers at this season, and were more probably resident and regional adults and young in this environmentally degraded area, with much edge habitat and presumably shrubby cover. The Purple Finch is certainly not

as much migratory as nomadic – certainly at this season. Thereafter counts varied between 20 and 147 birds. Most sparrows had disappeared, but there were periodic large counts of European Starling, Cedar Waxwing, Purple Finch (smaller than those of 21 August) and White-winged Crossbills, which are all more nomadic than migratory. There was an initial peak count of 43 wood warblers, mostly Black-throated Green, and too early for major migratory movements. Thereafter there were very few long-distance nighttime migrants like vireos (total 1 Red-eyed), wood warblers (17), and *Catharus* thrushes (1 Hermit Thrush). Not until October were there good counts of short-distance day-migrants, such as Blue Jay (32), American Robin (92), and Dark-eyed Junco (43).

The general conclusion from these data and observations is that the area is not a major "corridor" or stopover site for waves of migrants arriving or leaving the province. The counts generally show no evidence of major peaks of arrival or departure of the sort observed every spring and autumn on Brier I., where on some days many hundreds of sparrows, warblers, and other species can be observed near North Point light station. Neither were major raptor flights – hundreds of Broad-winged Hawks in on Brier Island in fall, for example - in evidence over the site. It may be that the degraded upland habitat, while suitable for nesting species like seed-eating sparrows and attractive to cone-feeding species (good counts of Purple Finches. White-crossbills, Purple Finches) is not very suitable for insect-fueled night-migrants like flycatchers, vireos, warblers, *Catharus* thrushes. It is noteworthy that the large numbers of migrants spring and fall have been noted (pers. obs.) in the lowland areas at the head of St. Marys Bay immediately to the northeast of the site. Those richer habitats may tend to deflect local migration from the highland areas.

Thus the area's importance may be of greater importance as breeding habitat for species that can use its degraded habitats. Perhaps any development of the area should pay more heed to "footprint" effects on remaining "natural" habitat than to possible threats of tower collisions by large numbers of passage migrants.

Ian McLaren
22 February 2009

APPENDIX F

NOISE IMPACT STUDY

Sound Impact Assessment Digby Wind Power Project

SKYPOWER CORP.

Project No. 1030972.

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EXECUTIVE SUMMARY

Project developer SkyPower Corp. (SkyPower) is proposing to construct and operate a wind energy facility located in Digby County in Gulliver's Cove, Nova Scotia (the Digby Wind Power Project; the Project). The Toronto-based renewable energy developer SkyPower has partnered with Nova Scotia-based community economic development organization Scotian WindFields Inc. To evaluate the potential sound impacts resulting from this Project, Jacques Whitford Stantec Limited was asked to conduct a sound impact assessment.

The key issues dealt with in the sound impact assessment were sound produced by Project operations. A set of receptors were selected (receptors 1-17), which were considered potentially sensitive to Project-related sound. Jacques Whitford Stantec Limited recorded background sound measurements for receptors 4, 10, and 15.

The Ontario Ministry of Environment (MOE) guideline NPC-232 *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)* (MOE, 2004) was consulted in terms of general assessment guidelines for industrial sound impacting land use that has qualities of rural areas (Class 3), such as the area considered in the current study. In addition, the MOE's guidance document *Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators* (MOE, 2004) was used to determine wind turbine sound criteria according to wind speed.

Sound modelling was conducted using CadnaA version 3.7, which includes the calculation methodology of the International Organization for Standardization (ISO) *Standard 9613 – Attenuation of Sound during Propagation Outdoors* (ISO 9613) (ISO,1993). Local meteorology and terrain was considered in modelling. Sound power level data provided by the manufacturer were used to model operational sound at the selected receptors. Predicted sound levels at receptors increased with increasing wind speed due the fact that the sound power level of the wind turbine generators also increased with increasing wind speed.

In general, the sound levels at the receptor locations are predicted to be mostly dominated by existing background sound levels and not by the sound produced from operations of the proposed Digby Wind Power Project. Therefore, it was concluded that that the Project is not expected to have a significant sound impact on nearby receptors.

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SOUND IMPACT ASSESSMENT

1 INTRODUCTION

Project developer SkyPower Corp. (SkyPower) is proposing to construct and operate a 30-megawatt (MW) wind power facility located in Digby County in Gulliver's Cove, Nova Scotia (the Digby Wind Power Project; the Project). The Toronto-based renewable energy developer SkyPower has partnered with Nova Scotia-based community economic development organization Scotian WindFields Inc. The wind power facility will consist of twenty 1.5 MW wind turbine generators with a 34.5 kV collection system connected to a new substation, on land located in Gulliver's Cove, Digby County, Nova Scotia. The proposed Project is referred to as the Digby Wind Power Project ("the Project").

The sound impact assessment included sound level data representative of the existing ambient sound environment in the study area and modeling results, showing the predicted sound levels at receptors resulting from Project operation.

2 ASSESSMENT FOCUS

Sound modelling was undertaken to predict the impact of the Project on the sound environment in the study area to support the preparation of the Sound Impact Assessment (SIA) for the Project. Table 2.1 lists the key issues taken into consideration during the modelling exercise.

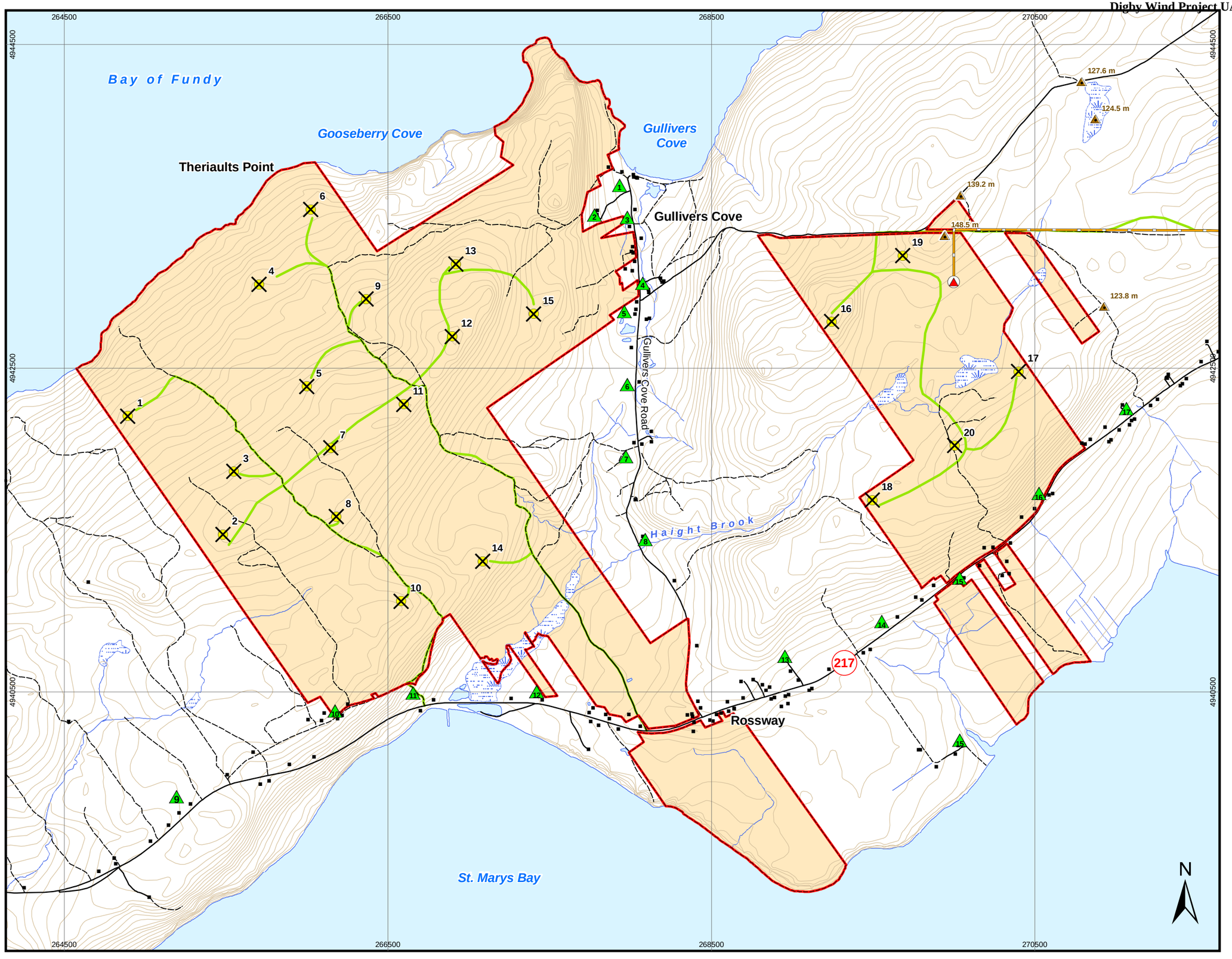
Table 2.1 Summary of Sound Issues Associated with Construction and Operation of the Digby Wind Power Project

Project Phase	Key Issue	Relevance to Project
Construction	Effects of construction sound on local residents	Construction sound included site leveling, grading, pile driving, excavation, concrete pouring and steel erection. The level of sound will vary depending on the types of construction activities occurring at any given time. Because materials will have to be transported to the site during construction and operations, there may be an increase in trucks and/or traffic overall in the area. The level of sound will vary depending on the speed and type of vehicle.
Operations	Effects of operations sound on local residents	Operations sound includes sound emitted by equipment associated with the wind turbine, which can vary according to wind speed. Other sound sources related to Project operations could include increased road traffic during maintenance periods.

2.1 Study Area

The proposed Project is to be located in the Municipality of Digby, in the community of Gulliver's Cove, Nova Scotia. The wind energy facility will be constructed on undeveloped woodlands generally bounded to the north by the Bay of Fundy; to the east and west by undeveloped land and sparsely populated residential areas; and to the south by the Evangeline Trail (Route 217), sparsely populated residential areas and St. Mary's Bay. Gulliver's Cove Road divides the property. The Study Area identified for the Project is considered that area within which direct Project interactions with the natural environment could occur. Within this area, there are a number of potentially sensitive receptors (residences), which were considered in this sound impact assessment. The locations of each receptor are presented in Figure 2.1

Background sound measurements were collected for receptors 4, 10, and 15, which were used to assess the existing sound levels in the Study Area. The calculated 1-hour L_{eq} values for each background noise monitoring site are presented in Appendix B.



SKYPOWER

Figure 2.1

DIGBY WIND POWER PROJECT

Noise Model Receptor Locations

- Noise Model Receptor Location

Project Components

- Proposed 69 kV Substation
- Proposed Turbine Location
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Spot Elevation
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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2.2 Sound Design and Mitigation

The Digby Wind Power Project will be designed to reduce sound from the installed turbines and the transmission of sound to potentially sensitive receptors.

Best practices will be followed at all times, including low sound equipment where applicable and local sound control. Specific mitigation that will be applied at the site during the construction and operations phases is described in the following sections.

2.3 Construction

Construction sound will occur during site leveling and grading, pile driving (if required), excavation, concrete pouring and steel and component erection. Nova Scotia does not have any provincial regulations or guidelines to regulate sound emitted during construction. Alberta's Energy Utilities Board (EUB) *Directive 038: Noise Control Directive* states that reasonable measures must be undertaken to reduce the effect of construction sound from new facilities (or modifications to new facilities) on nearby residences (EUB,1999). Based on this, the following mitigation measures will be applied:

- Nearby residents will be advised of significant sound generating activities and these will be scheduled to create the least disruption to receptors.
- All internal combustion engines will be fitted with appropriate muffler systems.

The EUB allows for construction to occur 24 hours/day; however it recommends attempting to limit construction activities during the hours of 07:00 and 22:00 to reduce the potential impacts of construction sound on receptors. While an attempt should be made to adhere to this recommendation, construction activities may occur outside of this period, as required by the Project schedule. In particular, efforts should be made to limit the operation of noisier activities associated with construction (i.e., impact pile driving, if required) to daytime hours.

2.4 Operations

Wind turbine generators produce sound through a number of different mechanisms which can be categorized into mechanical and aerodynamic sound sources. The major mechanical components including the gearbox, generator and yaw motors each produce their own characteristic sounds, including sound with tonal components. Other mechanical systems such as fans and hydraulic motors can also contribute to the overall sound emissions. Mechanical sound is radiated at the surfaces of the turbine, and by openings in the nacelle casing. Mechanical issues involving yaw motor supports or power train design can result in anomalous sounds such as periodic booming or tonal sounds.

The interaction of air and the turbine blades produces aerodynamic sound through a variety of processes as air passes over and past the blades. The sound produced by air interacting with the turbine blades tends to be broadband sound, but is amplitude modulated as the blades pass the tower, resulting in a characteristic 'swoosh'. Generally, wind turbines radiate more sound as the wind speed increases.

To reduce sound impacts resulting from Project operations the following mitigative measure are recommended:

- attending to routine maintenance of the wind turbines and associated equipment, as recommended by the manufacturer.

3 PROJECT RESIDUAL EFFECTS

3.1 Analyses

3.1.1 Determining Environmental Sound Criteria

Nova Scotia does not have specific sound guidelines for assessing the acoustic impact of wind turbines on residential properties. Consequently, the sound guidelines of the Ontario Ministry of Environment (MOE) have been used for the basis of this assessment.

Specifically, MOE guideline NPC-232 *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)* (MOE, 1995) provides general assessment guidelines for industrial sound impacting land use that has qualities of rural areas (Class 3). Characteristics that may indicate the presence of a Class 3 area include:

- a small community with less than 1000 population;
- agricultural area; and
- a rural recreational area such as a cottage or a resort area; or a wilderness area.

The MOE refers to one-hour energy equivalent average sound levels (Leq), in units of A-weighted decibels (dBA), which are unites weighted to reflect the spectral sensitivity of human hearing. NPC-232 indicates that the applicable sound level limit for a stationary sound source is the existing background sound level. The sound level limit must be representative of the minimum background sound level that occurs or is likely to occur during the operation of a stationary source. Data from background sound monitoring conducted during times when the background sound level is at its lowest can be used to determine the lowest one hour L_{eq}, which will represent the background sound level. However, where background sound levels are low, exclusionary minimum criteria apply, with an exclusionary limit of 45 dBA specified for quiet nighttime periods, and 50 dBA specified for quiet daytime periods.

Wind turbines are unique in that they generate more sound as wind speeds increase, and because increasing wind speeds cause elevated background sound levels, MOE have set out supplementary guidance for the assessment of wind turbine generator sound in the *Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators* (MOE, 2004). The guidance document gives criteria for the combined impacts of all wind turbine generators in an area as a function of wind speed (Table 3.1).

Table 3.1 MOE Criteria for Wind Turbines

Wind Speed (m/s)	4	5	6	7	8	9	10	11
Wind Turbine Sound Criteria, NPC-232 (dBA)	40	40	40	43	45	49	51	53

The lowest sound level limit at a point of reception in a Class 3 area, under conditions of average wind speed below 6 m/s, expressed in terms of the hourly L_{eq}, is 40 dBA or the minimum hourly background sound level established in accordance with requirements in Publications NPC-232, whichever is higher.

The sound level limit at a point of reception in a Class 3 area, under conditions of average wind speed above 6 m/s, expressed in terms of the hourly L_{eq}, is determined by the wind turbine sound criteria (Table 3.1) or the minimum hourly background sound level established in accordance with requirements in Publications NPC-232, whichever is higher.

Background (or baseline) sound monitoring was conducted for receptors 4, 10, and 15 by Jacques Whitford Stantec Limited on June 2nd and 3rd, 2008 and the minimum hourly background L_{eq} values were determined for these three receptors (Table 3.2).

Table 3.2 Background Sound Levels for Selected Receptors

Receptor No.	Lowest One Hour Leq (dBA)
4	46
10	27
15	26

Due to the proximity of receptor no. 4 to wetlands the background data was elevated by the chorus of a Northern Spring Peeper (*Pseudacris crucifer*) and song birds. The baseline sound for that location would be more typical of that measured at receptor no.'s 10 and 15.

No background measurements were taken for the remaining receptors; however receptor 4 is located closest to receptors 1-8, therefore the minimum hourly background L_{eq} at receptor 4 was used for receptors 1-8. Receptor 10 is located closest to receptors 9-12, therefore the minimum hourly background L_{eq} at receptor 10 was used for receptors 9-12, and receptor 15 is located closest to receptors 13-17, therefore the minimum hourly background L_{eq} at receptor 15 was used for receptors 13-17. The lowest one hour L_{eq} values replace the wind turbine sound criteria given in Table 4.1 for receptors 1-8, since they indicate higher sound levels. For receptors 9-17 the MOE criteria for wind turbines (Table 3.1) applies.

Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators (MOE, 2004) details the method of sound impact assessment to undertake whereby the manufacturers sound power level data is entered into the sound model, which predicts sound at a receptor over a full range of wind speeds. It also specifies using the calculation methodology of the International Organization for Standardization (ISO) *Standard 9613 – Attenuation of Sound during Propagation Outdoors* (ISO 9613) (ISO, 1993). ISO 9613 yields a receptor sound level under a downwind propagation situation, which is favorable to the propagation of sound from a source to a receptor. ISO 9613 does not describe a method for predicting sound levels under a specific meteorological condition, nor does it claim to predict a sound level impact under a worst-case atmospheric condition.

A number of jurisdictions, including the Province of Ontario and the United States Environmental Protection Agency (US EPA), have established specific regulatory limits for sound pressure levels from industrial or construction activities. In the province of Nova Scotia the Nova Scotia Department of Environment and Labour (NSDEL) *Guidelines for Noise Measurement and Assessment* (NSDOE, 1989) set sound pressure levels for the day, evening and nighttime. The criteria in these guidelines are:

- Leq 65 dBA between 0700 h and 1900 h
- Leq 60 dBA between 1900 h and 2300 h
- Leq 55 dBA between 2300 h and 0700 h

These guidelines are intended to "facilitate the evaluation of noise pollution in the environment". The guidelines were intended to apply to the environments where the members of the public "live, work and play".

There is not a specific noise bylaw in place for Digby County.

3.1.2 Modelling Methods

3.1.2.1 General Overview

Sound modeling was completed to predict the effects of the Project on the sound environment in the local study area. The sound modelling was undertaken in accordance with the requirements of *Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators* (MOE, 2004*)* and ISO 9613.

3.1.2.2 Model Description

Sound modelling was conducted using CadnaA (Computer Aided Noise Abatement) version 3.7, a computer program capable of predicting sound levels at specified receiver positions originating from a variety of sound sources. Applicable national or international standards can also be included in its analysis, such as those prescribed by ISO 9613.

CadnaA can also account for such factors as:

- distance attenuation (i.e., geometrical dispersion of sound with distance);
- atmospheric attenuation (i.e., the rate of sound absorption by atmospheric gases in the air between sound sources and receptors);
- ground attenuation (i.e., effect of sound absorption by the ground as sound passes over various terrain and vegetation types between source and receptor);
- screening effects of surrounding terrain; and
- meteorological conditions and effects.

The influences of meteorology and terrain and vegetation on sound attenuation in the local study area were considered to be of particular importance and are described in the following topics.

3.1.2.3 Meteorology

Meteorological factors, such as temperature, humidity, wind speed and direction influence sound propagation. The effects of wind on outdoor sound propagation during different weather conditions could cause large variations in project-related sound levels measured at a receptor. If the receptor is upwind of the facility, the wind could cause greater than normal outdoor sound attenuation and lower sound levels at the residence than would occur with no wind. However, if the residence is downwind of the facility, the opposite effect could occur, resulting in higher sound levels than normal at the residence. Crosswinds have less effect on outdoor sound propagation and would render sound levels that are similar to those in calm conditions. The ISO 9613 sound model simulates downwind propagation under a mildly developed temperature inversion (both of which enhance sound propagation) and provide a case representation of potential effects during conditions that favor transmission of sound to the receptor.

The following meteorological elements were assumed for the sound assessment:

- temperature = 10°C;
- relative humidity = 70 percent; and
- wind conditions = variable.

The relative humidity was assumed to be 70 percent because this condition enhances sound propagation. Based on the likelihood of receiving complaints in the summer, an average temperature value typical of summer conditions in the area was used in the sound model. These meteorological parameters can be

considered typical of night-time conditions in the spring and summer (when outdoor activities are more likely) and representative of the sound effects during these seasons.

3.1.2.4 Terrain and Vegetation

Factors such as terrain conditions, types of vegetation and ground cover can all affect the absorption that takes place when sound waves travel over land. For example, if the ground is moist or covered in fresh snow or vegetation, it will be absorptive and aid in sound attenuation. In contrast, if the ground is hard-packed or frozen, it will be reflective and will not aid in sound attenuation.

With the exception of the town of Digby and the presence of Highway 101, the study area is mostly forested, but does support other habitats for vascular plants including wetlands, abandoned agricultural land, disturbed habitats and sea cliffs. The turbines will be in operation throughout the year; therefore, a variety of ground conditions will occur that affect sound attenuation potential. Typically, ground conditions in summer promote sound attenuation, whereas winter ground conditions often do not. At the same time, residents are more likely to be outdoors or have their house windows open, which can make them more sensitive to potential sound effects. The topography of the area was included during modelling; therefore any terrain shielding effects that may attenuate sound were taken into account.

3.1.2.5 Model Prediction Confidence

The sound propagation algorithm used in the sound model is from ISO 9613 standard. The published accuracy for ISO 9613 is ± 3 dBA over source-receiver distances between 100 m and 1000 m. A similar degree of accuracy would be expected over the distances considered in this assessment.

In terms of meteorological conditions, ISO 9613 produces results that are representative of meteorological conditions favouring sound propagation (i.e., downwind and inversion conditions). Because these conditions do not occur everyday, model predictions are conservative and actual sound levels at the receptors might be less than predicted the majority of the time.

In general, the predictive capacity of the model is considered to be high, leading to a high level of confidence in the results of the model.

3.2 Construction Sound

Typical construction activities that would create sound are presented in Table 3.3. The actual equipment used on site might differ from those listed below.

Table 3.3 Typical Sound Emission Levels of Construction Equipment

Construction Equipment	Typical Sound Level at 15 m (dBA)
Earth Moving	
Loader	**85**
Bulldozer	**85**
Backhoe	**80**
Scraper	**89**
Grader	**85**
Materials Handling	
Crane (mobile)	**83**
Concrete mixer	**85**
Concrete pump	**82**

Table 3.3 Typical Sound Emission Levels of Construction Equipment

Construction Equipment	Typical Sound Level at 15 m (dBA)
Concrete vibrator	**76**
Stationary Equipment	
Air compressor	**81**
Generator	**81**
Impact Equipment	
Jack hammer	**88**
Pile driver (impact)	**101**

SOURCE: US Department of Transportation (2006)

Since noisier construction activities will likely occur between the hours of 07:00 and 22:00, construction activity is expected to have little to no effect on night-time sound levels. The level of sound will vary according to the type of construction activity and the number of pieces of equipment in operation at any given time.

To reduce the sound pressure levels at the nearest residents to below the threshold of significance, a combination of mitigative measures will be employed, including but not limited to:

- limiting the amount of construction equipment operating simultaneously; and
- ensuring all equipment have quality mufflers and are well maintained.

3.3 Operations Sound

Operational sound associated with the Project was modelled, excluding other existing sound sources. Modelling the sound generated from operations of the 20 wind turbine generators was conducted by first obtaining the manufacturer sound power level data as a function of wind speed (Table 3.4).

Table 3.4 Manufacturer Sound Power Level Data

Wind Speed at 10 m	Sound Power Level (db) at Hub Height of 80 m
3	<96
4	<96
5	99.1
6	103
7	<104

Source: GE Energy, 2005

The information provided in Table 3.4 was included in sound modelling. In addition, the coordinates and tower height of the wind turbine generators were also incorporated. These details are given in Table 3.5.

Table 3.5 Wind Turbine Generator Locations

Wind Turbine No.	Coordinates		Turbine Hub Height (m)
	Easting (UTM)	Northing (UTM)	
1	264893	4942205	80
2	265481	4941472	80

Table 3.5 Wind Turbine Generator Locations

Wind Turbine No.	Coordinates		Turbine Hub Height (m)
	Easting (UTM)	Northing (UTM)	
3	265549	4941862	80
4	265705	4943019	80
5	266000	4942386	80
6	266023	4943481	80
7	266148	4942007	80
8	266182	4941582	80
9	266366	4942926	80
10	266582	4941059	80
11	266599	4942276	80
12	266898	4942695	80
13	266922	4943143	80
14	267087	4941307	80
15	267402	4942835	80
16	269244	4942786	80
17	270399	4942480	80
18	269496	4941685	80
19	269684	4943195	80
20	270005	4942021	80

Sound modelling was conducted for five different scenarios, which varied according to the wind speeds presented in Table 3.5. The predicted sound levels at receptors resulting from these scenarios are shown in Tables 3.6 - 3.9. Other sound sources contributing to baseline sound levels were not included when predicting sound levels.

Table 3.6 Modeled Project Operational Sound Levels at a Wind Speed of 3 and 4 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
1	267932	4943629	3 & 4	28	46
2	267779	4943446	3 & 4	30	46
3	267982	4943431	3 & 4	30	46
4	268076	4943024	3 & 4	31	46
5	267962	4942851	3 & 4	32	46
6	267982	4942399	3 & 4	31	46
7	267972	4941953	3 & 4	30	46
8	268091	4941442	3 & 4	28	46
9	265194	4939852	3 & 4	22	40
10	266175	4940383	3 & 4	30	40
11	266656	4940492	3 & 4	31	40
12	267420	4940502	3 & 4	29	40
13	268956	4940720	3 & 4	24	40
14	269554	4940933	3 & 4	28	40
15	270035	4941201	3 & 4	30	40

Table 3.6 Modeled Project Operational Sound Levels at a Wind Speed of 3 and 4 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
16	270526	4941726	3 & 4	26	40
17	271066	4942250	3 & 4	24	40

Table 3.7 Modeled Project Operational Sound Levels at a Wind Speed of 5 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
1	267932	4943629	5	31	46
2	267779	4943446	5	33	46
3	267982	4943431	5	33	46
4	268076	4943024	5	34	46
5	267962	4942851	5	35	46
6	267982	4942399	5	34	46
7	267972	4941953	5	33	46
8	268091	4941442	5	31	46
9	265194	4939852	5	25	40
10	266175	4940383	5	33	40
11	266656	4940492	5	34	40
12	267420	4940502	5	32	40
13	268956	4940720	5	27	40
14	269554	4940933	5	31	40
15	270035	4941201	5	33	40
16	270526	4941726	5	29	40
17	271066	4942250	5	27	40

Table 3.8 Modeled Project Operational Sound Levels at a Wind Speed of 6 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
1	267932	4943629	6	35	46
2	267779	4943446	6	37	46
3	267982	4943431	6	37	46
4	268076	4943024	6	38	46
5	267962	4942851	6	39	46
6	267982	4942399	6	38	46
7	267972	4941953	6	37	46
8	268091	4941442	6	35	46
9	265194	4939852	6	29	40

Table 3.8 Modeled Project Operational Sound Levels at a Wind Speed of 6 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
10	266175	4940383	6	37	40
11	266656	4940492	6	38	40
12	267420	4940502	6	36	40
13	268956	4940720	6	31	40
14	269554	4940933	6	35	40
15	270035	4941201	6	37	40
16	270526	4941726	6	33	40
17	271066	4942250	6	31	40

Table 3.9 Modeled Project Operational Sound Levels at a Wind Speed of 7 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
1	267932	4943629	7	36	46
2	267779	4943446	7	38	46
3	267982	4943431	7	38	46
4	268076	4943024	7	39	46
5	267962	4942851	7	40	46
6	267982	4942399	7	39	46
7	267972	4941953	7	38	46
8	268091	4941442	7	36	46
9	265194	4939852	7	30	43
10	266175	4940383	7	38	43
11	266656	4940492	7	39	43
12	267420	4940502	7	37	43
13	268956	4940720	7	32	43
14	269554	4940933	7	36	43
15	270035	4941201	7	38	43
16	270526	4941726	7	34	43
17	271066	4942250	7	32	43

All predicted sound levels, for each wind speed scenario, are in compliance with the corresponding Wind Turbine Sound Criterion, NP-205. As the predicted operational sound levels indicate, the sound levels at receptors increased with increasing wind speed. This increase in predicted sound level resulted from a rise in the wind turbine sound power level, which is directly related to wind speed, as provided by the manufacturer (refer to Table 3.4).

Some jurisdictions outside of North America are adopting more stringent guidelines such as *"Wind Farms: Environmental Noise Guidelines*" (EPA, 2007) from the state of South Australia. These guidelines stipulate a maximum of 35 dBA or 5 dBA above background (refer to Appendix B for Project background data). This

project meets the second criterion, and this provides further support for the conclusions that sound should not be of concern. It does not preclude the possibility that sound be alleged to be a problem when other factors, such as aesthetics, are not accepted by local residents.

In summary, it is useful to combine the predicted operational sound levels with background sound data to obtain a more accurate representation of the potential sound levels at the selected receptor locations (Table 3.10).

Table 3.10 Combined Predicted Operational and Background Sound Levels at Receptors

Receptor No.	Predicted Operational and Background Sound Level (dBA)			
	3 & 4 m/s	5 m/s	6 m/s	7 m/s
1	57	57	57	57
2	57	57	57	57
3	57	57	57	57
4	57	57	57	57
5	57	57	57	57
6	57	57	57	57
7	57	57	57	57
8	57	57	57	57
9	42	42	42	42
10	42	42	42	42
11	42	42	42	42
12	42	42	42	42
13	42	42	42	42
14	45	45	45	45
15	45	45	45	45
16	45	45	45	45
17	45	45	45	45

4 CONCLUSIONS

The results presented in Table 3.10 show that sound levels at the receptor locations will be primarily dominated by existing background sound levels and not by the sound produced from operations of the Digby Wind Power Project. Therefore, it is not expected that the Project will have a significant impact, with respect to sound, on nearby receptors.

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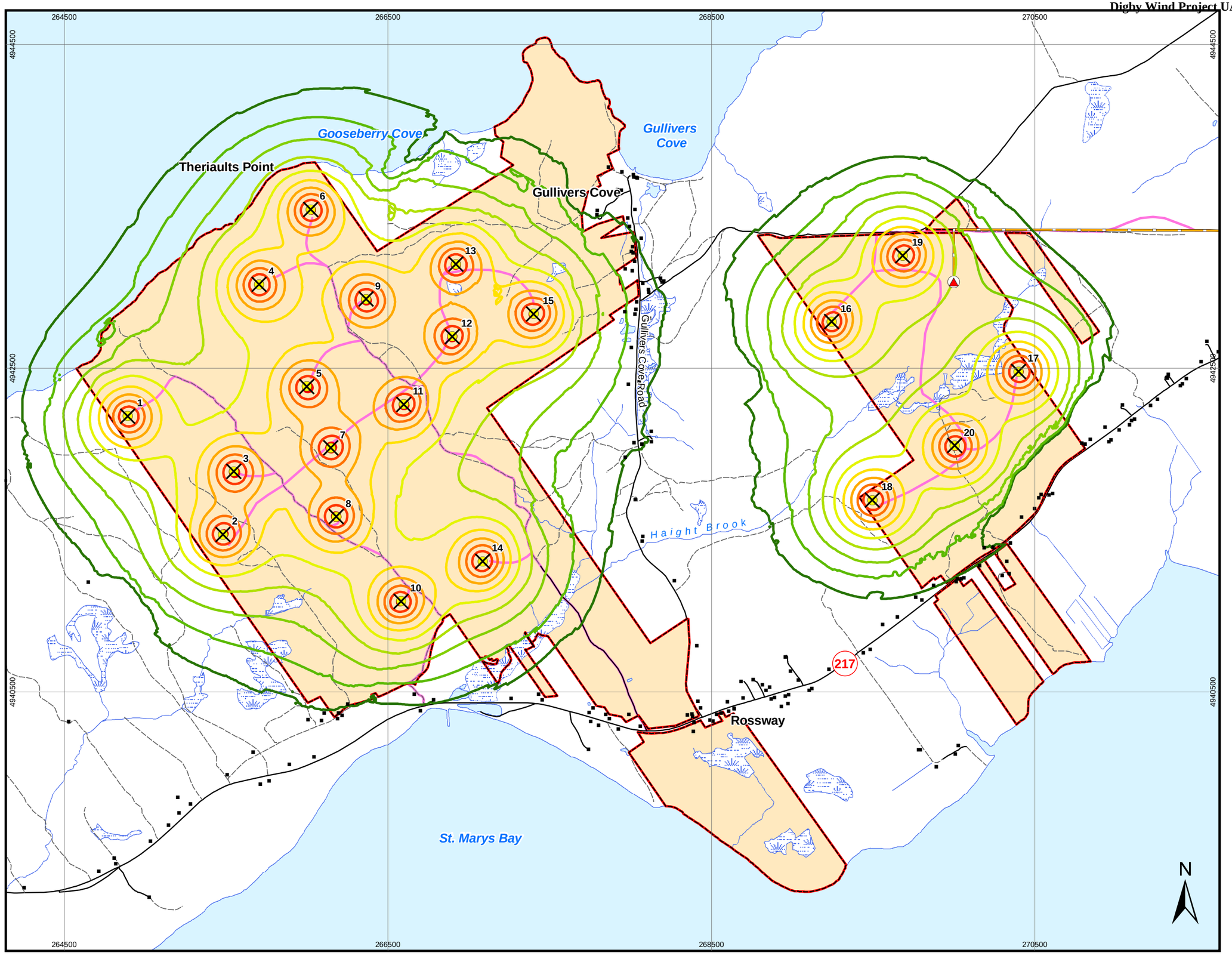
6 APPENDICES

Appendix A- Operation Sound Contour Maps

Appendix B- Background Noise

APPENDIX A

Operation Sound Contour Maps



SKYPOWER

Figure A1

DIGBY WIND POWER PROJECT

Noise Contours at a Wind Speed of 3 & 4 Metres/Second

Noise Contours

- 30 db
- 32 db
- 34 db
- 36 db
- 38 db
- 40 db
- 42 db
- 44 db
- 46 db
- 48 db

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

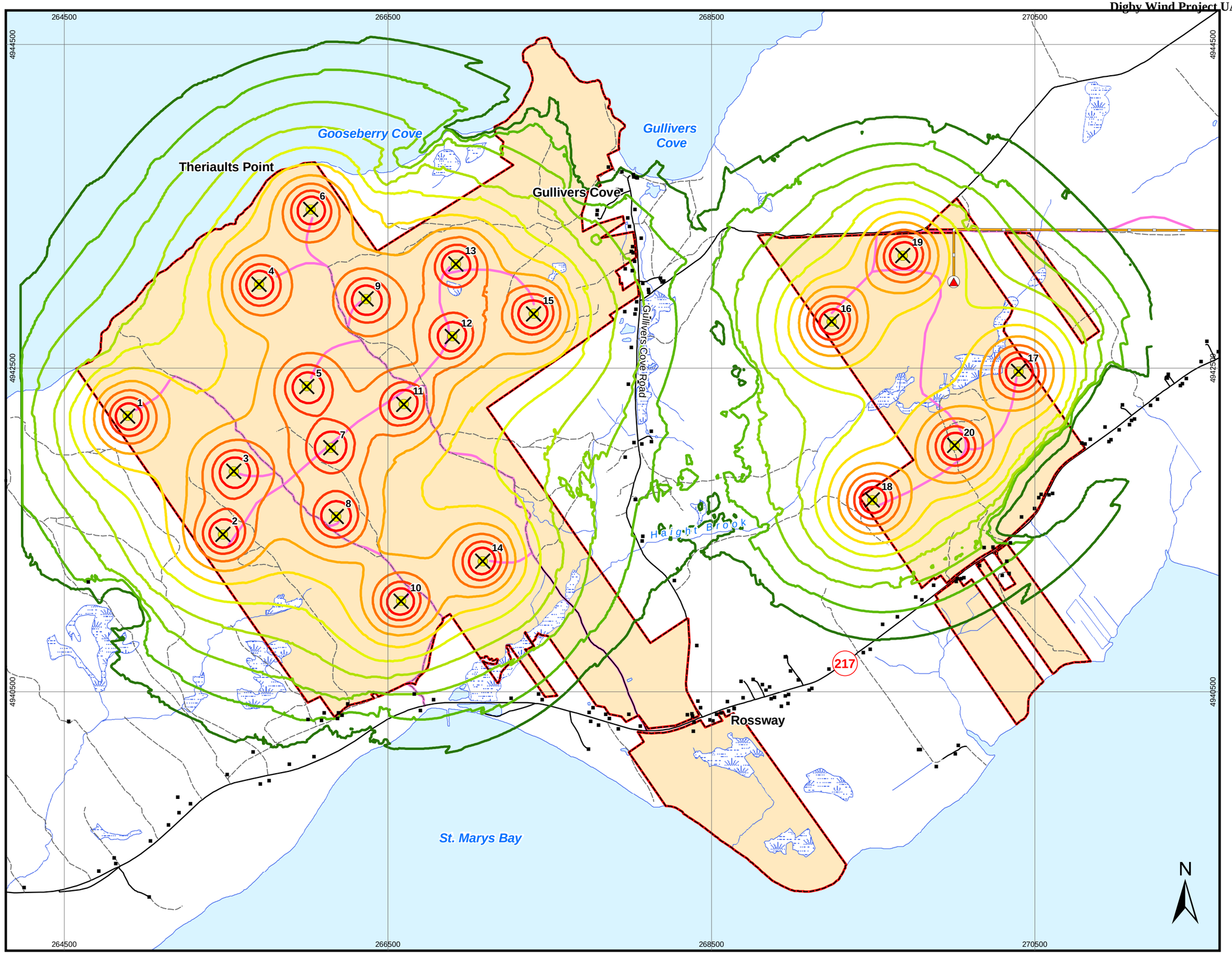
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Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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SKYPOWER

Figure A2

DIGBY WIND POWER PROJECT

Noise Contours at a Wind Speed of 5 Metres/Second

Noise Contours

- 30 db
- 32 db
- 34 db
- 36 db
- 38 db
- 40 db
- 42 db
- 44 db
- 46 db
- 48 db

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

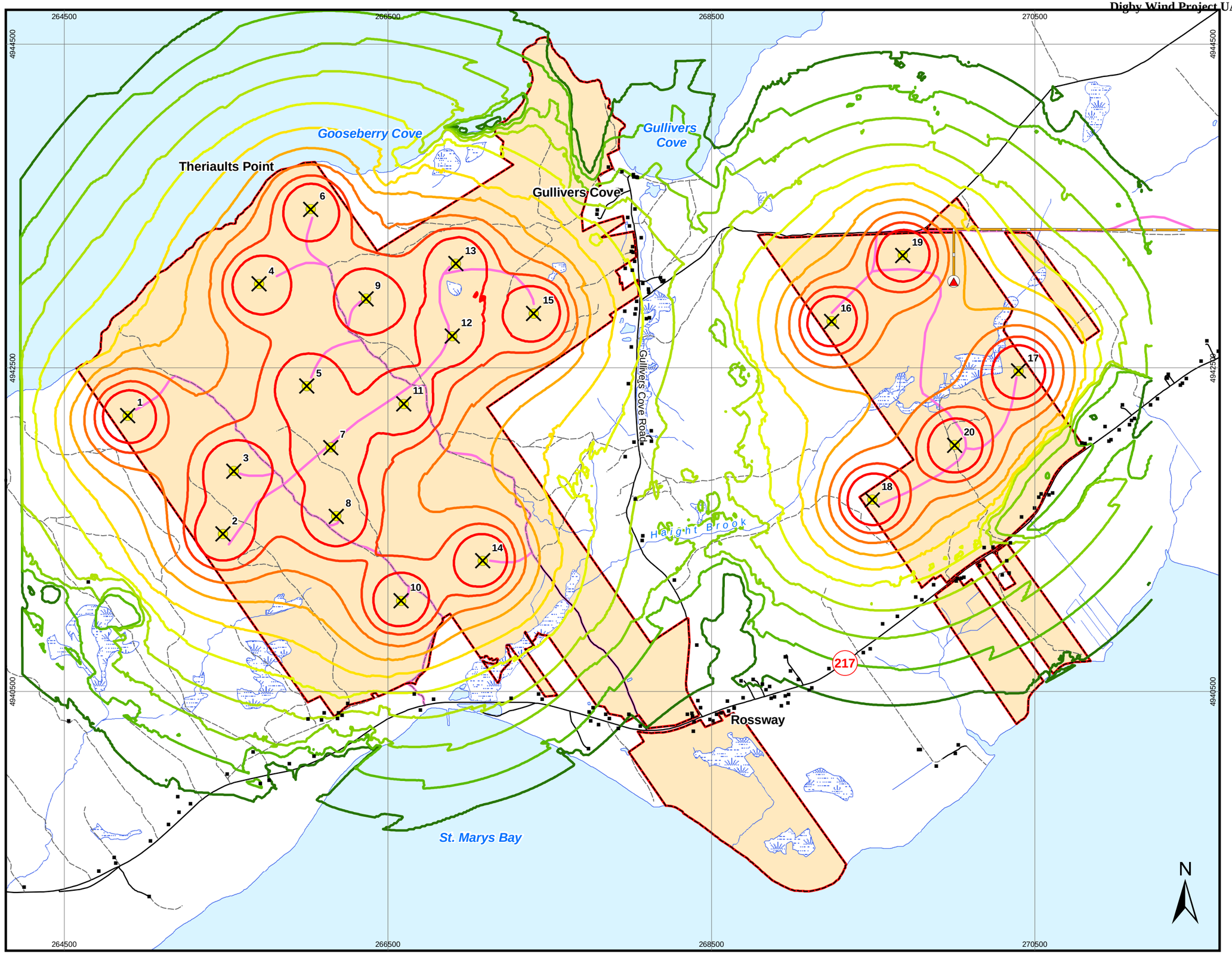
0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec



SKYPOWER

Figure A3

DIGBY WIND POWER PROJECT

Noise Contours at a Wind Speed of 6 Metres/Second

Noise Contours

- 30 db
- 32 db
- 34 db
- 36 db
- 38 db
- 40 db
- 42 db
- 44 db
- 46 db
- 48 db

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

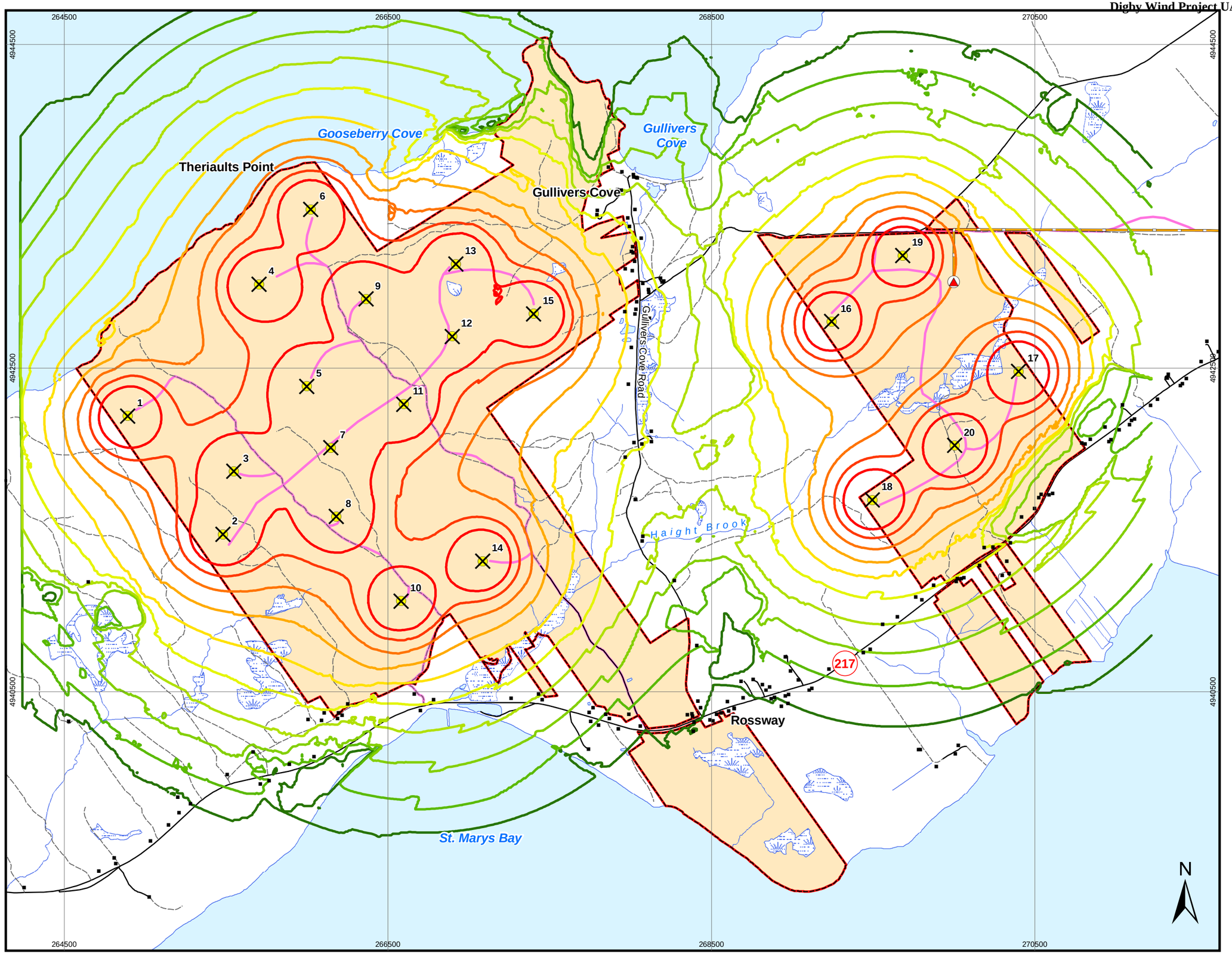
0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec



SKYPOWER

Figure A4

DIGBY WIND POWER PROJECT

Noise Contours at a Wind Speed of 7 Metres/Second

Noise Contours

- 30 db
- 32 db
- 34 db
- 36 db
- 38 db
- 40 db
- 42 db
- 44 db
- 46 db
- 48 db

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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APPENDIX B

Background Data

Table B1 Measured 1-Hour Background Sound Pressure Levels

Time	Site 1	Site 2	Site 3	NSDOE Guideline
15:00	-	-	-	65
16:00	57	38	-	65
17:00	48	38	48	65
18:00	47	37	45	65
19:00	56	36	44	60
20:00	54	44	46	60
21:00	65	41	41	60
22:00	65	34	38	60
23:00	62	30	34	55
0:00	58	27	36	55
1:00	56	28	29	55
2:00	53	36	33	55
3:00	55	41	26	55
4:00	57	45	36	55
5:00	49	40	45	55
6:00	49	40	40	55
7:00	49	47	47	65
8:00	49	37	46	65
9:00	53	37	45	65
10:00	50	40	45	65
11:00	49	38	46	65
12:00	48	40	46	65
13:00	46	44	46	65
14:00	47	50	47	65
15:00	49	48	50	65
16:00	50	-	48	65
Average	57	42	45	-

APPENDIX F

NOISE IMPACT STUDY

Sound Impact Assessment Digby Wind Power Project

SKYPOWER CORP.

Project No. 1030972.

Stantec

EXECUTIVE SUMMARY

Project developer SkyPower Corp. (SkyPower) is proposing to construct and operate a wind energy facility located in Digby County in Gulliver's Cove, Nova Scotia (the Digby Wind Power Project; the Project). The Toronto-based renewable energy developer SkyPower has partnered with Nova Scotia-based community economic development organization Scotian WindFields Inc. To evaluate the potential sound impacts resulting from this Project, Jacques Whitford Stantec Limited was asked to conduct a sound impact assessment.

The key issues dealt with in the sound impact assessment were sound produced by Project operations. A set of receptors were selected (receptors 1-17), which were considered potentially sensitive to Project-related sound. Jacques Whitford Stantec Limited recorded background sound measurements for receptors 4, 10, and 15.

The Ontario Ministry of Environment (MOE) guideline NPC-232 *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)* (MOE, 2004) was consulted in terms of general assessment guidelines for industrial sound impacting land use that has qualities of rural areas (Class 3), such as the area considered in the current study. In addition, the MOE's guidance document *Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators* (MOE, 2004) was used to determine wind turbine sound criteria according to wind speed.

Sound modelling was conducted using CadnaA version 3.7, which includes the calculation methodology of the International Organization for Standardization (ISO) *Standard 9613 – Attenuation of Sound during Propagation Outdoors* (ISO 9613) (ISO,1993). Local meteorology and terrain was considered in modelling. Sound power level data provided by the manufacturer were used to model operational sound at the selected receptors. Predicted sound levels at receptors increased with increasing wind speed due the fact that the sound power level of the wind turbine generators also increased with increasing wind speed.

In general, the sound levels at the receptor locations are predicted to be mostly dominated by existing background sound levels and not by the sound produced from operations of the proposed Digby Wind Power Project. Therefore, it was concluded that that the Project is not expected to have a significant sound impact on nearby receptors.

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SOUND IMPACT ASSESSMENT

1 INTRODUCTION

Project developer SkyPower Corp. (SkyPower) is proposing to construct and operate a 30-megawatt (MW) wind power facility located in Digby County in Gulliver's Cove, Nova Scotia (the Digby Wind Power Project; the Project). The Toronto-based renewable energy developer SkyPower has partnered with Nova Scotia-based community economic development organization Scotian WindFields Inc. The wind power facility will consist of twenty 1.5 MW wind turbine generators with a 34.5 kV collection system connected to a new substation, on land located in Gulliver's Cove, Digby County, Nova Scotia. The proposed Project is referred to as the Digby Wind Power Project ("the Project").

The sound impact assessment included sound level data representative of the existing ambient sound environment in the study area and modeling results, showing the predicted sound levels at receptors resulting from Project operation.

2 ASSESSMENT FOCUS

Sound modelling was undertaken to predict the impact of the Project on the sound environment in the study area to support the preparation of the Sound Impact Assessment (SIA) for the Project. Table 2.1 lists the key issues taken into consideration during the modelling exercise.

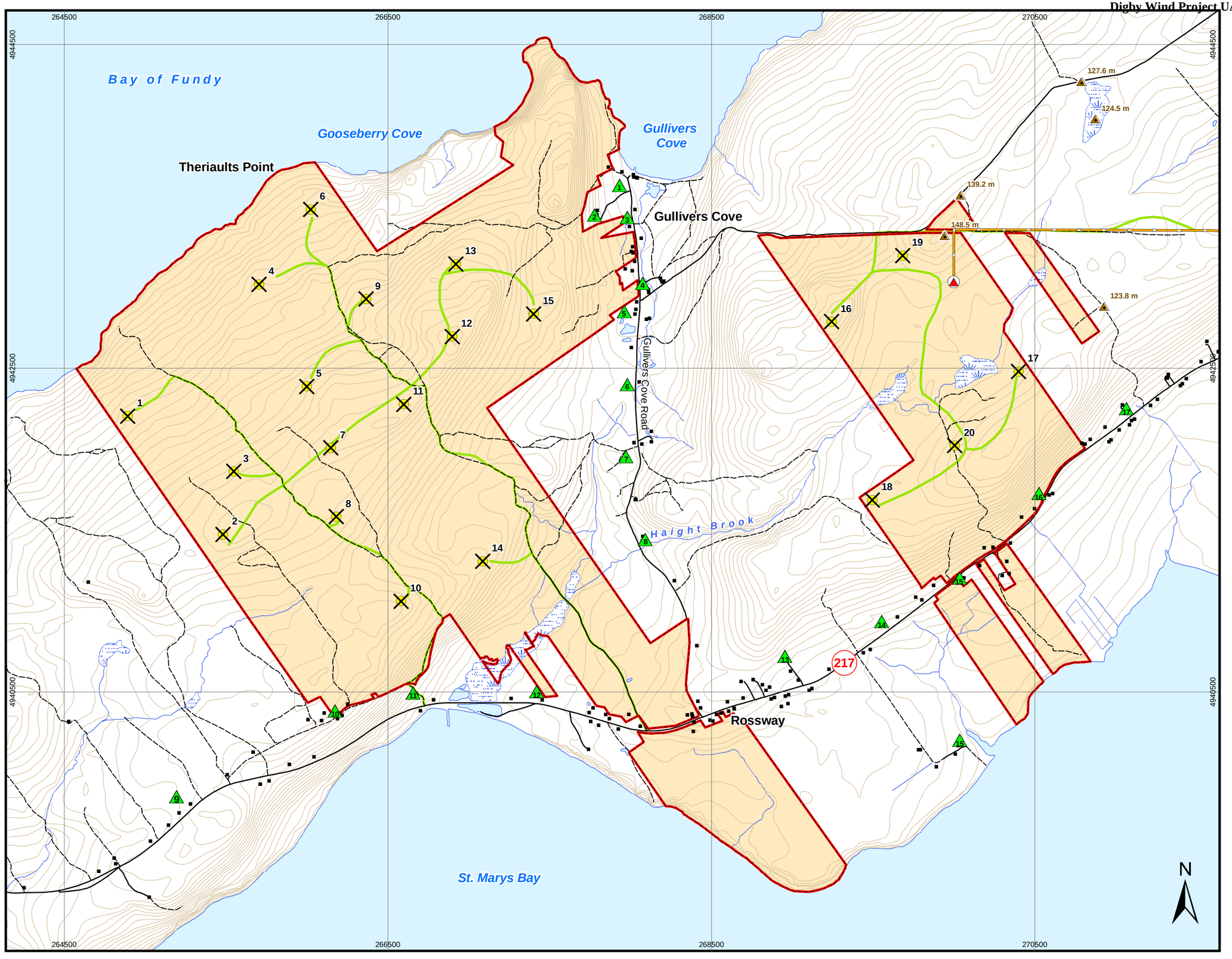
Table 2.1 Summary of Sound Issues Associated with Construction and Operation of the Digby Wind Power Project

Project Phase	Key Issue	Relevance to Project
Construction	Effects of construction sound on local residents	Construction sound included site leveling, grading, pile driving, excavation, concrete pouring and steel erection. The level of sound will vary depending on the types of construction activities occurring at any given time. Because materials will have to be transported to the site during construction and operations, there may be an increase in trucks and/or traffic overall in the area. The level of sound will vary depending on the speed and type of vehicle.
Operations	Effects of operations sound on local residents	Operations sound includes sound emitted by equipment associated with the wind turbine, which can vary according to wind speed. Other sound sources related to Project operations could include increased road traffic during maintenance periods.

2.1 Study Area

The proposed Project is to be located in the Municipality of Digby, in the community of Gulliver's Cove, Nova Scotia. The wind energy facility will be constructed on undeveloped woodlands generally bounded to the north by the Bay of Fundy; to the east and west by undeveloped land and sparsely populated residential areas; and to the south by the Evangeline Trail (Route 217), sparsely populated residential areas and St. Mary's Bay. Gulliver's Cove Road divides the property. The Study Area identified for the Project is considered that area within which direct Project interactions with the natural environment could occur. Within this area, there are a number of potentially sensitive receptors (residences), which were considered in this sound impact assessment. The locations of each receptor are presented in Figure 2.1

Background sound measurements were collected for receptors 4, 10, and 15, which were used to assess the existing sound levels in the Study Area. The calculated 1-hour L_{eq} values for each background noise monitoring site are presented in Appendix B.



SKYPOWER

Figure 2.1

DIGBY WIND POWER PROJECT

Noise Model Receptor Locations

- Noise Model Receptor Location

Project Components

- Proposed 69 kV Substation
- Proposed Turbine Location
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Spot Elevation
- Road
- Unpaved Road
- Railroad
- Contour (5m)
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

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2.2 Sound Design and Mitigation

The Digby Wind Power Project will be designed to reduce sound from the installed turbines and the transmission of sound to potentially sensitive receptors.

Best practices will be followed at all times, including low sound equipment where applicable and local sound control. Specific mitigation that will be applied at the site during the construction and operations phases is described in the following sections.

2.3 Construction

Construction sound will occur during site leveling and grading, pile driving (if required), excavation, concrete pouring and steel and component erection. Nova Scotia does not have any provincial regulations or guidelines to regulate sound emitted during construction. Alberta's Energy Utilities Board (EUB) *Directive 038: Noise Control Directive* states that reasonable measures must be undertaken to reduce the effect of construction sound from new facilities (or modifications to new facilities) on nearby residences (EUB,1999). Based on this, the following mitigation measures will be applied:

- Nearby residents will be advised of significant sound generating activities and these will be scheduled to create the least disruption to receptors.
- All internal combustion engines will be fitted with appropriate muffler systems.

The EUB allows for construction to occur 24 hours/day; however it recommends attempting to limit construction activities during the hours of 07:00 and 22:00 to reduce the potential impacts of construction sound on receptors. While an attempt should be made to adhere to this recommendation, construction activities may occur outside of this period, as required by the Project schedule. In particular, efforts should be made to limit the operation of noisier activities associated with construction (i.e., impact pile driving, if required) to daytime hours.

2.4 Operations

Wind turbine generators produce sound through a number of different mechanisms which can be categorized into mechanical and aerodynamic sound sources. The major mechanical components including the gearbox, generator and yaw motors each produce their own characteristic sounds, including sound with tonal components. Other mechanical systems such as fans and hydraulic motors can also contribute to the overall sound emissions. Mechanical sound is radiated at the surfaces of the turbine, and by openings in the nacelle casing. Mechanical issues involving yaw motor supports or power train design can result in anomalous sounds such as periodic booming or tonal sounds.

The interaction of air and the turbine blades produces aerodynamic sound through a variety of processes as air passes over and past the blades. The sound produced by air interacting with the turbine blades tends to be broadband sound, but is amplitude modulated as the blades pass the tower, resulting in a characteristic 'swoosh'. Generally, wind turbines radiate more sound as the wind speed increases.

To reduce sound impacts resulting from Project operations the following mitigative measure are recommended:

- attending to routine maintenance of the wind turbines and associated equipment, as recommended by the manufacturer.

3 PROJECT RESIDUAL EFFECTS

3.1 Analyses

3.1.1 Determining Environmental Sound Criteria

Nova Scotia does not have specific sound guidelines for assessing the acoustic impact of wind turbines on residential properties. Consequently, the sound guidelines of the Ontario Ministry of Environment (MOE) have been used for the basis of this assessment.

Specifically, MOE guideline NPC-232 *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)* (MOE, 1995) provides general assessment guidelines for industrial sound impacting land use that has qualities of rural areas (Class 3). Characteristics that may indicate the presence of a Class 3 area include:

- a small community with less than 1000 population;
- agricultural area; and
- a rural recreational area such as a cottage or a resort area; or a wilderness area.

The MOE refers to one-hour energy equivalent average sound levels (Leq), in units of A-weighted decibels (dBA), which are unites weighted to reflect the spectral sensitivity of human hearing. NPC-232 indicates that the applicable sound level limit for a stationary sound source is the existing background sound level. The sound level limit must be representative of the minimum background sound level that occurs or is likely to occur during the operation of a stationary source. Data from background sound monitoring conducted during times when the background sound level is at its lowest can be used to determine the lowest one hour L_{eq}, which will represent the background sound level. However, where background sound levels are low, exclusionary minimum criteria apply, with an exclusionary limit of 45 dBA specified for quiet nighttime periods, and 50 dBA specified for quiet daytime periods.

Wind turbines are unique in that they generate more sound as wind speeds increase, and because increasing wind speeds cause elevated background sound levels, MOE have set out supplementary guidance for the assessment of wind turbine generator sound in the *Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators* (MOE, 2004). The guidance document gives criteria for the combined impacts of all wind turbine generators in an area as a function of wind speed (Table 3.1).

Table 3.1 MOE Criteria for Wind Turbines

Wind Speed (m/s)	4	5	6	7	8	9	10	11
Wind Turbine Sound Criteria, NPC-232 (dBA)	40	40	40	43	45	49	51	53

The lowest sound level limit at a point of reception in a Class 3 area, under conditions of average wind speed below 6 m/s, expressed in terms of the hourly L_{eq}, is 40 dBA or the minimum hourly background sound level established in accordance with requirements in Publications NPC-232, whichever is higher.

The sound level limit at a point of reception in a Class 3 area, under conditions of average wind speed above 6 m/s, expressed in terms of the hourly L_{eq}, is determined by the wind turbine sound criteria (Table 3.1) or the minimum hourly background sound level established in accordance with requirements in Publications NPC-232, whichever is higher.

Background (or baseline) sound monitoring was conducted for receptors 4, 10, and 15 by Jacques Whitford Stantec Limited on June 2nd and 3rd, 2008 and the minimum hourly background L_{eq} values were determined for these three receptors (Table 3.2).

Table 3.2 Background Sound Levels for Selected Receptors

Receptor No.	Lowest One Hour Leq (dBA)
4	46
10	27
15	26

Due to the proximity of receptor no. 4 to wetlands the background data was elevated by the chorus of a Northern Spring Peeper (*Pseudacris crucifer*) and song birds. The baseline sound for that location would be more typical of that measured at receptor no.'s 10 and 15.

No background measurements were taken for the remaining receptors; however receptor 4 is located closest to receptors 1-8, therefore the minimum hourly background L_{eq} at receptor 4 was used for receptors 1-8. Receptor 10 is located closest to receptors 9-12, therefore the minimum hourly background L_{eq} at receptor 10 was used for receptors 9-12, and receptor 15 is located closest to receptors 13-17, therefore the minimum hourly background L_{eq} at receptor 15 was used for receptors 13-17. The lowest one hour L_{eq} values replace the wind turbine sound criteria given in Table 4.1 for receptors 1-8, since they indicate higher sound levels. For receptors 9-17 the MOE criteria for wind turbines (Table 3.1) applies.

Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators (MOE, 2004) details the method of sound impact assessment to undertake whereby the manufacturers sound power level data is entered into the sound model, which predicts sound at a receptor over a full range of wind speeds. It also specifies using the calculation methodology of the International Organization for Standardization (ISO) *Standard 9613 – Attenuation of Sound during Propagation Outdoors* (ISO 9613) (ISO, 1993). ISO 9613 yields a receptor sound level under a downwind propagation situation, which is favorable to the propagation of sound from a source to a receptor. ISO 9613 does not describe a method for predicting sound levels under a specific meteorological condition, nor does it claim to predict a sound level impact under a worst-case atmospheric condition.

A number of jurisdictions, including the Province of Ontario and the United States Environmental Protection Agency (US EPA), have established specific regulatory limits for sound pressure levels from industrial or construction activities. In the province of Nova Scotia the Nova Scotia Department of Environment and Labour (NSDEL) *Guidelines for Noise Measurement and Assessment* (NSDOE, 1989) set sound pressure levels for the day, evening and nighttime. The criteria in these guidelines are:

- Leq 65 dBA between 0700 h and 1900 h
- Leq 60 dBA between 1900 h and 2300 h
- Leq 55 dBA between 2300 h and 0700 h

These guidelines are intended to "facilitate the evaluation of noise pollution in the environment". The guidelines were intended to apply to the environments where the members of the public "live, work and play".

There is not a specific noise bylaw in place for Digby County.

3.1.2 Modelling Methods

3.1.2.1 General Overview

Sound modeling was completed to predict the effects of the Project on the sound environment in the local study area. The sound modelling was undertaken in accordance with the requirements of *Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators* (MOE, 2004*)* and ISO 9613.

3.1.2.2 Model Description

Sound modelling was conducted using CadnaA (Computer Aided Noise Abatement) version 3.7, a computer program capable of predicting sound levels at specified receiver positions originating from a variety of sound sources. Applicable national or international standards can also be included in its analysis, such as those prescribed by ISO 9613.

CadnaA can also account for such factors as:

- distance attenuation (i.e., geometrical dispersion of sound with distance);
- atmospheric attenuation (i.e., the rate of sound absorption by atmospheric gases in the air between sound sources and receptors);
- ground attenuation (i.e., effect of sound absorption by the ground as sound passes over various terrain and vegetation types between source and receptor);
- screening effects of surrounding terrain; and
- meteorological conditions and effects.

The influences of meteorology and terrain and vegetation on sound attenuation in the local study area were considered to be of particular importance and are described in the following topics.

3.1.2.3 Meteorology

Meteorological factors, such as temperature, humidity, wind speed and direction influence sound propagation. The effects of wind on outdoor sound propagation during different weather conditions could cause large variations in project-related sound levels measured at a receptor. If the receptor is upwind of the facility, the wind could cause greater than normal outdoor sound attenuation and lower sound levels at the residence than would occur with no wind. However, if the residence is downwind of the facility, the opposite effect could occur, resulting in higher sound levels than normal at the residence. Crosswinds have less effect on outdoor sound propagation and would render sound levels that are similar to those in calm conditions. The ISO 9613 sound model simulates downwind propagation under a mildly developed temperature inversion (both of which enhance sound propagation) and provide a case representation of potential effects during conditions that favor transmission of sound to the receptor.

The following meteorological elements were assumed for the sound assessment:

- temperature = 10°C;
- relative humidity = 70 percent; and
- wind conditions = variable.

The relative humidity was assumed to be 70 percent because this condition enhances sound propagation. Based on the likelihood of receiving complaints in the summer, an average temperature value typical of summer conditions in the area was used in the sound model. These meteorological parameters can be

considered typical of night-time conditions in the spring and summer (when outdoor activities are more likely) and representative of the sound effects during these seasons.

3.1.2.4 Terrain and Vegetation

Factors such as terrain conditions, types of vegetation and ground cover can all affect the absorption that takes place when sound waves travel over land. For example, if the ground is moist or covered in fresh snow or vegetation, it will be absorptive and aid in sound attenuation. In contrast, if the ground is hard-packed or frozen, it will be reflective and will not aid in sound attenuation.

With the exception of the town of Digby and the presence of Highway 101, the study area is mostly forested, but does support other habitats for vascular plants including wetlands, abandoned agricultural land, disturbed habitats and sea cliffs. The turbines will be in operation throughout the year; therefore, a variety of ground conditions will occur that affect sound attenuation potential. Typically, ground conditions in summer promote sound attenuation, whereas winter ground conditions often do not. At the same time, residents are more likely to be outdoors or have their house windows open, which can make them more sensitive to potential sound effects. The topography of the area was included during modelling; therefore any terrain shielding effects that may attenuate sound were taken into account.

3.1.2.5 Model Prediction Confidence

The sound propagation algorithm used in the sound model is from ISO 9613 standard. The published accuracy for ISO 9613 is ± 3 dBA over source-receiver distances between 100 m and 1000 m. A similar degree of accuracy would be expected over the distances considered in this assessment.

In terms of meteorological conditions, ISO 9613 produces results that are representative of meteorological conditions favouring sound propagation (i.e., downwind and inversion conditions). Because these conditions do not occur everyday, model predictions are conservative and actual sound levels at the receptors might be less than predicted the majority of the time.

In general, the predictive capacity of the model is considered to be high, leading to a high level of confidence in the results of the model.

3.2 Construction Sound

Typical construction activities that would create sound are presented in Table 3.3. The actual equipment used on site might differ from those listed below.

Table 3.3 Typical Sound Emission Levels of Construction Equipment

Construction Equipment	Typical Sound Level at 15 m (dBA)
Earth Moving	
Loader	**85**
Bulldozer	**85**
Backhoe	**80**
Scraper	**89**
Grader	**85**
Materials Handling	
Crane (mobile)	**83**
Concrete mixer	**85**
Concrete pump	**82**

Table 3.3 Typical Sound Emission Levels of Construction Equipment

Construction Equipment	Typical Sound Level at 15 m (dBA)
Concrete vibrator	**76**
Stationary Equipment	
Air compressor	**81**
Generator	**81**
Impact Equipment	
Jack hammer	**88**
Pile driver (impact)	**101**

SOURCE: US Department of Transportation (2006)

Since noisier construction activities will likely occur between the hours of 07:00 and 22:00, construction activity is expected to have little to no effect on night-time sound levels. The level of sound will vary according to the type of construction activity and the number of pieces of equipment in operation at any given time.

To reduce the sound pressure levels at the nearest residents to below the threshold of significance, a combination of mitigative measures will be employed, including but not limited to:

- limiting the amount of construction equipment operating simultaneously; and
- ensuring all equipment have quality mufflers and are well maintained.

3.3 Operations Sound

Operational sound associated with the Project was modelled, excluding other existing sound sources. Modelling the sound generated from operations of the 20 wind turbine generators was conducted by first obtaining the manufacturer sound power level data as a function of wind speed (Table 3.4).

Table 3.4 Manufacturer Sound Power Level Data

Wind Speed at 10 m	Sound Power Level (db) at Hub Height of 80 m
3	<96
4	<96
5	99.1
6	103
7	<104

Source: GE Energy, 2005

The information provided in Table 3.4 was included in sound modelling. In addition, the coordinates and tower height of the wind turbine generators were also incorporated. These details are given in Table 3.5.

Table 3.5 Wind Turbine Generator Locations

Wind Turbine No.	Coordinates		Turbine Hub Height (m)
	Easting (UTM)	Northing (UTM)	
1	264893	4942205	80
2	265481	4941472	80

Table 3.5 Wind Turbine Generator Locations

Wind Turbine No.	Coordinates		Turbine Hub Height (m)
	Easting (UTM)	Northing (UTM)	
3	265549	4941862	80
4	265705	4943019	80
5	266000	4942386	80
6	266023	4943481	80
7	266148	4942007	80
8	266182	4941582	80
9	266366	4942926	80
10	266582	4941059	80
11	266599	4942276	80
12	266898	4942695	80
13	266922	4943143	80
14	267087	4941307	80
15	267402	4942835	80
16	269244	4942786	80
17	270399	4942480	80
18	269496	4941685	80
19	269684	4943195	80
20	270005	4942021	80

Sound modelling was conducted for five different scenarios, which varied according to the wind speeds presented in Table 3.5. The predicted sound levels at receptors resulting from these scenarios are shown in Tables 3.6 - 3.9. Other sound sources contributing to baseline sound levels were not included when predicting sound levels.

Table 3.6 Modeled Project Operational Sound Levels at a Wind Speed of 3 and 4 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
1	267932	4943629	3 & 4	28	46
2	267779	4943446	3 & 4	30	46
3	267982	4943431	3 & 4	30	46
4	268076	4943024	3 & 4	31	46
5	267962	4942851	3 & 4	32	46
6	267982	4942399	3 & 4	31	46
7	267972	4941953	3 & 4	30	46
8	268091	4941442	3 & 4	28	46
9	265194	4939852	3 & 4	22	40
10	266175	4940383	3 & 4	30	40
11	266656	4940492	3 & 4	31	40
12	267420	4940502	3 & 4	29	40
13	268956	4940720	3 & 4	24	40
14	269554	4940933	3 & 4	28	40
15	270035	4941201	3 & 4	30	40

Table 3.6 Modeled Project Operational Sound Levels at a Wind Speed of 3 and 4 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
16	270526	4941726	3 & 4	26	40
17	271066	4942250	3 & 4	24	40

Table 3.7 Modeled Project Operational Sound Levels at a Wind Speed of 5 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
1	267932	4943629	5	31	46
2	267779	4943446	5	33	46
3	267982	4943431	5	33	46
4	268076	4943024	5	34	46
5	267962	4942851	5	35	46
6	267982	4942399	5	34	46
7	267972	4941953	5	33	46
8	268091	4941442	5	31	46
9	265194	4939852	5	25	40
10	266175	4940383	5	33	40
11	266656	4940492	5	34	40
12	267420	4940502	5	32	40
13	268956	4940720	5	27	40
14	269554	4940933	5	31	40
15	270035	4941201	5	33	40
16	270526	4941726	5	29	40
17	271066	4942250	5	27	40

Table 3.8 Modeled Project Operational Sound Levels at a Wind Speed of 6 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
1	267932	4943629	6	35	46
2	267779	4943446	6	37	46
3	267982	4943431	6	37	46
4	268076	4943024	6	38	46
5	267962	4942851	6	39	46
6	267982	4942399	6	38	46
7	267972	4941953	6	37	46
8	268091	4941442	6	35	46
9	265194	4939852	6	29	40

Table 3.8 Modeled Project Operational Sound Levels at a Wind Speed of 6 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
10	266175	4940383	6	37	40
11	266656	4940492	6	38	40
12	267420	4940502	6	36	40
13	268956	4940720	6	31	40
14	269554	4940933	6	35	40
15	270035	4941201	6	37	40
16	270526	4941726	6	33	40
17	271066	4942250	6	31	40

Table 3.9 Modeled Project Operational Sound Levels at a Wind Speed of 7 m/s

Receptor No.	Receptor Location		Wind Speed (m/s)	Predicted Operational Sound Level (dBA)	Wind Turbine Sound Criterion (dBA)
	Northing (UTM)	Easting (UTM)			
1	267932	4943629	7	36	46
2	267779	4943446	7	38	46
3	267982	4943431	7	38	46
4	268076	4943024	7	39	46
5	267962	4942851	7	40	46
6	267982	4942399	7	39	46
7	267972	4941953	7	38	46
8	268091	4941442	7	36	46
9	265194	4939852	7	30	43
10	266175	4940383	7	38	43
11	266656	4940492	7	39	43
12	267420	4940502	7	37	43
13	268956	4940720	7	32	43
14	269554	4940933	7	36	43
15	270035	4941201	7	38	43
16	270526	4941726	7	34	43
17	271066	4942250	7	32	43

All predicted sound levels, for each wind speed scenario, are in compliance with the corresponding Wind Turbine Sound Criterion, NP-205. As the predicted operational sound levels indicate, the sound levels at receptors increased with increasing wind speed. This increase in predicted sound level resulted from a rise in the wind turbine sound power level, which is directly related to wind speed, as provided by the manufacturer (refer to Table 3.4).

Some jurisdictions outside of North America are adopting more stringent guidelines such as *"Wind Farms: Environmental Noise Guidelines*" (EPA, 2007) from the state of South Australia. These guidelines stipulate a maximum of 35 dBA or 5 dBA above background (refer to Appendix B for Project background data). This

project meets the second criterion, and this provides further support for the conclusions that sound should not be of concern. It does not preclude the possibility that sound be alleged to be a problem when other factors, such as aesthetics, are not accepted by local residents.

In summary, it is useful to combine the predicted operational sound levels with background sound data to obtain a more accurate representation of the potential sound levels at the selected receptor locations (Table 3.10).

Table 3.10 Combined Predicted Operational and Background Sound Levels at Receptors

Receptor No.	Predicted Operational and Background Sound Level (dBA)			
	3 & 4 m/s	5 m/s	6 m/s	7 m/s
1	57	57	57	57
2	57	57	57	57
3	57	57	57	57
4	57	57	57	57
5	57	57	57	57
6	57	57	57	57
7	57	57	57	57
8	57	57	57	57
9	42	42	42	42
10	42	42	42	42
11	42	42	42	42
12	42	42	42	42
13	42	42	42	42
14	45	45	45	45
15	45	45	45	45
16	45	45	45	45
17	45	45	45	45

4 CONCLUSIONS

The results presented in Table 3.10 show that sound levels at the receptor locations will be primarily dominated by existing background sound levels and not by the sound produced from operations of the Digby Wind Power Project. Therefore, it is not expected that the Project will have a significant impact, with respect to sound, on nearby receptors.

5 REFERENCES

Alberta Energy and Utilities Board (EUB). 2007. *Directive 038: Noise Control.* Calgary, Alberta.

Environment Protection Authority of South Australia (EPA). 2007. *Wind Farms Environmental Noise Guidelines (interim).*

GE Energy. 2005. *Technical Documentation Wind Turbine Generator System GE 1.5sl/sle 50 & 60 Hz*.

International Standard (ISO). 1993. *Acoustics – Attenuation of Sound During Propagation Outdoors*.

Ministry of Environment (MOE). 1995. *Sound Level Limits for Stationary Sources in Class 3 Areas (Rural).*

Nova Scotia Department of Environment (NSDOE). 1989. *Guidelines for Noise Measurement and Assessment.*

Ontario Ministry of the Environment (MOE). 1995. *Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban)*. Publication NPC-205.

Ontario Ministry of the Environment (MOE). 2004. *Interpretation for Applying MOE Technical Publications to Wind Turbines.*

U.S. Department of Transportation, Federal Highway Administration. 2006. *Effective Noise Control during Nighttime Construction*.

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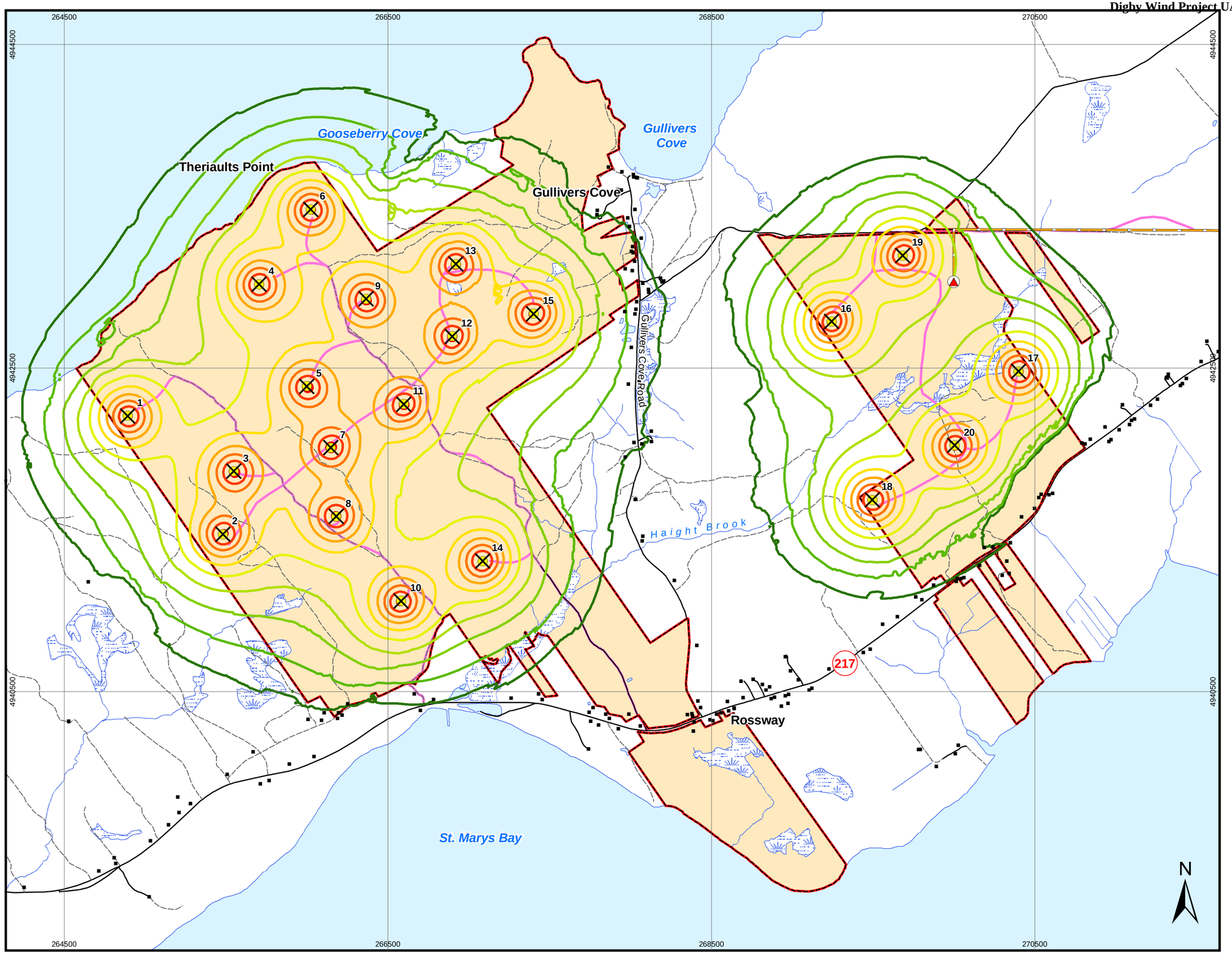
6 APPENDICES

Appendix A- Operation Sound Contour Maps

Appendix B- Background Noise

APPENDIX A

Operation Sound Contour Maps



SKYPOWER

Figure A1

DIGBY WIND POWER PROJECT

Noise Contours at a Wind Speed of 3 & 4 Metres/Second

Noise Contours

- 30 db
- 32 db
- 34 db
- 36 db
- 38 db
- 40 db
- 42 db
- 44 db
- 46 db
- 48 db

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

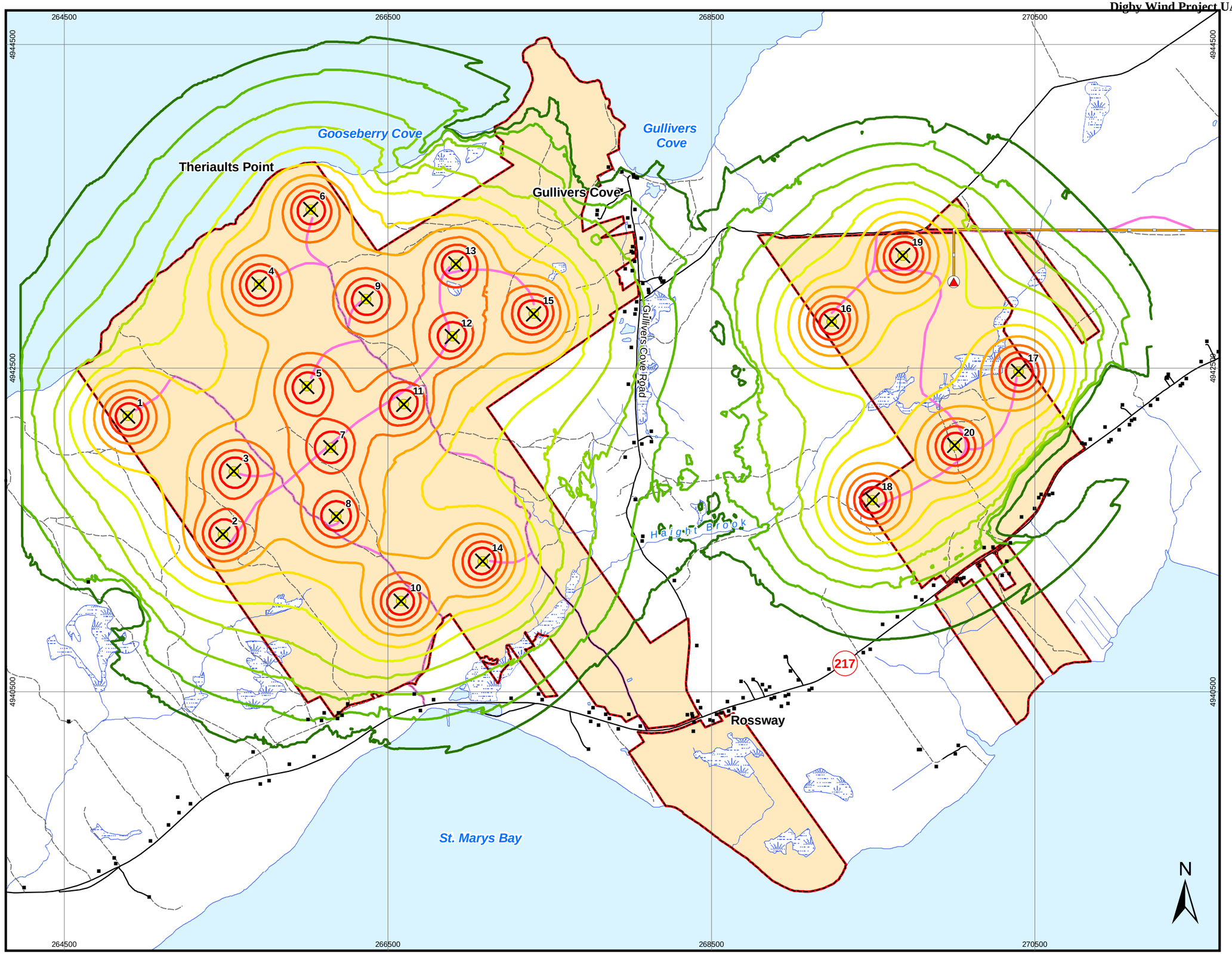
0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec



SKYPOWER

Figure A2

DIGBY WIND POWER PROJECT

Noise Contours at a Wind Speed of 5 Metres/Second

Noise Contours

- 30 db
- 32 db
- 34 db
- 36 db
- 38 db
- 40 db
- 42 db
- 44 db
- 46 db
- 48 db

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

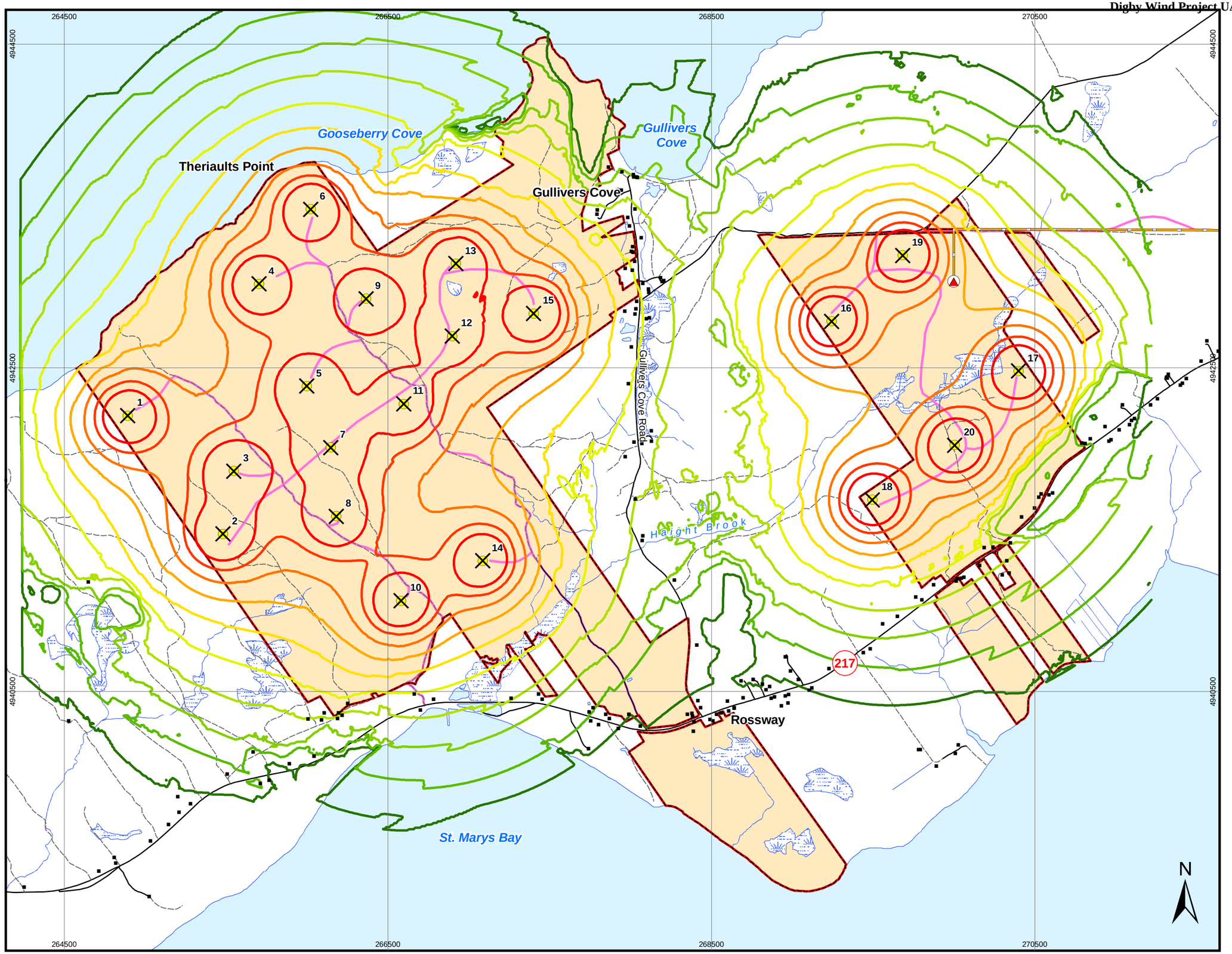
0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec



SKYPOWER

Figure A3

DIGBY WIND POWER PROJECT

Noise Contours at a Wind Speed of 6 Metres/Second

Noise Contours

- 30 db
- 32 db
- 34 db
- 36 db
- 38 db
- 40 db
- 42 db
- 44 db
- 46 db
- 48 db

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

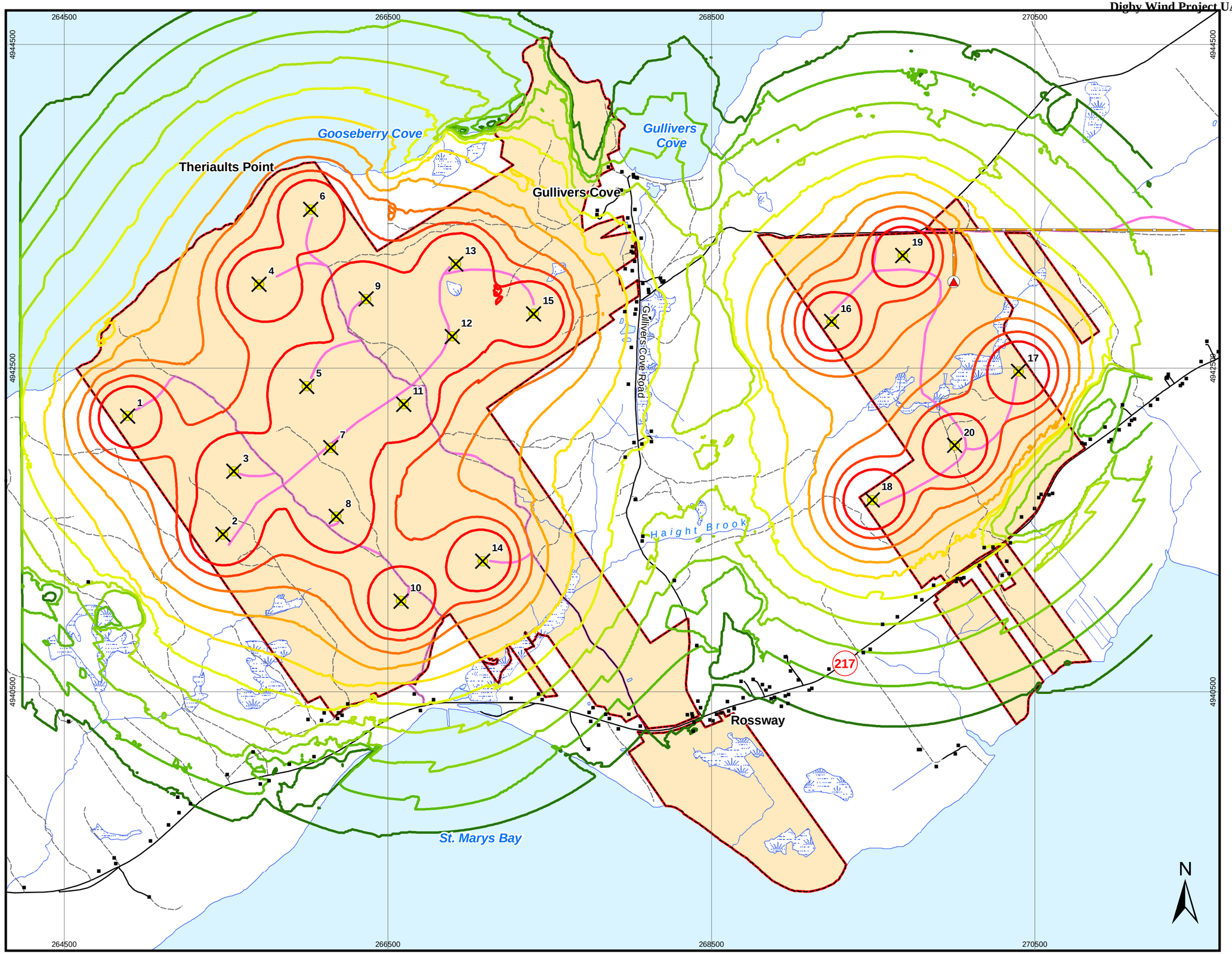
0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec



SKYPOWER

Figure A4

DIGBY WIND POWER PROJECT

Noise Contours at a Wind Speed of 7 Metres/Second

Noise Contours

- 30 db
- 32 db
- 34 db
- 36 db
- 38 db
- 40 db
- 42 db
- 44 db
- 46 db
- 48 db

Project Components

- Proposed Turbine Location
- Proposed 69 kV Substation
- Proposed Turbine Access Road
- Proposed Transmission Route Nov. 28-08
- Proposed Site Development Area

Map Features

- Building
- Road
- Unpaved Road
- Railroad
- Watercourse
- Wetland
- Waterbody

0 300 600 900 1,200

Meters

Data Sources:
Planimetric Data - NSGC; Nova Scotia Topographic Database (NSTDB), 1997, 1:10 000 (GeoNOVA)
Project Components - Skypower, Nov. 2008
Wetlands - NSTDB & NSDNR; Wetland Inventory Mapping, 2007, 1:10 000

Map Parameters
Projection: UTM/NAD83/Z20
Scale 1:22,000
Date: April 2009
Project No.: 1030972.01

Stantec

APPENDIX B

Background Data

Table B1 Measured 1-Hour Background Sound Pressure Levels

Time	Site 1	Site 2	Site 3	NSDOE Guideline
15:00	-	-	-	65
16:00	57	38	-	65
17:00	48	38	48	65
18:00	47	37	45	65
19:00	56	36	44	60
20:00	54	44	46	60
21:00	65	41	41	60
22:00	65	34	38	60
23:00	62	30	34	55
0:00	58	27	36	55
1:00	56	28	29	55
2:00	53	36	33	55
3:00	55	41	26	55
4:00	57	45	36	55
5:00	49	40	45	55
6:00	49	40	40	55
7:00	49	47	47	65
8:00	49	37	46	65
9:00	53	37	45	65
10:00	50	40	45	65
11:00	49	38	46	65
12:00	48	40	46	65
13:00	46	44	46	65
14:00	47	50	47	65
15:00	49	48	50	65
16:00	50	-	48	65
Average	57	42	45	-

APPENDIX G

CVs OF STUDY TEAM MEMBERS

Heather Giddens BSc, MES

Project Manager

Ms. Giddens is a Project Manager and Team Leader of Jacques Whitford's Environmental Permitting and Planning Group in Dartmouth, NS. Since joining Jacques Whitford in 1998, Ms. Giddens has managed or been involved in various environmental management projects including environmental impact assessment reports, regulatory permitting, environmental protection plans, environmental management systems, baseline studies, and waste management studies for several private and public sector clients including onshore and offshore projects.

EDUCATION

Master of Environmental Studies, Dalhousie University, Halifax, Nova Scotia, 1998
Thesis: Conflict in the Countryside: Agricultural Land Use Disputes in Kings County, Nova Scotia

Bachelor of Science (B.Sc.), Honours, Biology
Acadia University, Wolfville, Nova Scotia, 1996
Thesis: An Interdisciplinary Approach to Community-Led Decision Making: The Key to Local Sustainability

Jacques Whitford Leadership Program, Queens School of Business, 2007-ongoing
Project Management Essentials, 2005, 2006
Leaders and Managers Program, 2001-2003
Cumulative Effects Assessment Training, 2001
Orientation to the Canadian Environmental Assessment Act and Regulations, 2000
Project Management Breakthroughs, 2000
Priority Manager and Priority Planning Program, 1999

PROJECT EXPERIENCE

Environmental Assessment and Regulatory Approvals

Deep Panuke Offshore Gas Development Project- Regulatory Approvals and Environmental Support for Onshore Pipeline Construction, Halifax, NS, 2008-2009 (Project Manager)

North Dartmouth Trunk Sewer EA and Regulatory Approvals, Dartmouth, NS, 2008 (Project Manager)

Lake Banook Canoe Course Improvements Projects EA and Regulatory Approvals, Dartmouth, NS, 2008 (Project Manager)

Highway 102 Environmental Approvals, Halifax, NS, 2008-2009 (Project Manager)

Highway 101 Twinning Environmental Assessment Report, Halifax, NS, 2007-2009 (Project Manager)

Environmental Issues and Regulatory Roadmap for Tidal Power Project, United States. 2008 (Project Manager)

MARLANT Environmental Assessment Guidance Document for Routine Projects, Halifax, NS, 2008 (Project Manager)

Highway 104 New Glasgow to Sutherlands River Twinning Project CEAA Screening, Antigonish, NS 2004-2005 (Environmental Analyst)

Highway 104 Antigonish Federal/Provincial Environmental Assessment, Antigonish, NS 2002-2005(Environmental Analyst/Project Coordinator)

Highway 101 Digby to Weymouth North Environmental Assessment, Digby, NS, 2001-2002 (Environmental Analyst/Project Coordinator)

Beaver Bank Bypass Environmental Assessment Registration, Sackville, NS, 2000-2001 (Environmental Analyst/Project Coordinator)

New Minas Interchange/ Connector and North Collector Environmental Assessment Registration, New Minas, NS, 1999-2000 (Environmental Analyst/Project Coordinator)

Deep Panuke Offshore Gas Development Project Environmental Assessment Report, Halifax, NS, 2006-2007 (Project Coordinator and Biophysical Team Lead)

EnCana Corporation Deep Panuke Offshore Gas Development Project, Halifax, NS, 2001-2002 (Environmental Analyst/Project Coordinator)

Sovereign Resources Quarry Modification Project Environmental Assessment Registration, Bedford, NS, 2004-2005 (Environmental Analyst)

Halifax Harbour Solutions Project, CEAA Environmental Screening, Halifax, NS, 2000-2002 (Environmental Analyst/Project Coordinator)

Heather Giddens BSc, MES
Project Manager

Sheet Harbour Gypsum Loading Terminal CEAA Environmental Screening, NS, Sheet Harbour, NS, 2001-2002 (Environmental Analyst)

Environmental Assessment of Offshore Exploration Drilling on Cortland and Empire Licenses, Halifax, NS, 2002-2003 (Project Manager/Environmental Analyst)

Environmental Assessment of Offshore Exploration Drilling on EL 2381/EL 2382, Halifax, NS, 2002-2003 (Project Manager/Environmental Analyst)

Environmental Assessment of Offshore Exploration Drilling on EL 2378/EL 2379, Halifax, NS, 2002-2003 (Project Manager/Environmental Analyst)

Offshore Seismic Exploration Screening Assessment, Halifax, NS, 2003, (Project Manager/Environmental Analyst)

Environmental Assessment of Deepwater Exploration Drilling on Torbrook, Weymouth, Barrington, Caledonia, Plympton and Highland, Halifax, NS, 2003 (Project Manager/Environmental Analyst)

Environmental Screening for Offshore Exploration Drilling on Mahone Block, Halifax, NS, 2001 (Project Manager/Environmental Analyst)

Environmental Screening for Offshore Exploration Drilling in Annapolis Block, Halifax, NS, 2001 (Environmental Analyst)

Halifax Lateral Pipeline Project Comprehensive Study Report, Halifax, NS, 1999 (Environmental Analyst)

Various Environmental Screenings for Department of National Defence, Halifax, NS, 2000-2005 (Project Manager/Environmental Analyst)

CEAA Screening for Sable Island Helicopter Refueling Facility, Halifax, NS, 2001 (Environmental Analyst)
Sackville River Bridge CEAA Environmental Screening, Sackville, NS, 2000
(Environmental Analyst)

Aulds Cove Quarry Expansion Environmental Assessment Registration, Aulds Cove, NS, 2000 (Environmental Analyst)

Environmental Management Planning

Natural Resource Management Plans for Select MARLANT Properties in NS, Halifax, NS, 2008 (Project Manager)

Natural Resource Management Plans for MARLANT Properties in Newfoundland, Halifax, NS, 2007 (Project Manager)

Deep Panuke Onshore Construction Environmental Protection Plan. Goldboro, NS, 2008 (Project Manager)

Bear Head LNG Environmental Protection Plan, Bear Head, NS, 2004-2005 (Environmental Analyst)

Sable Offshore Energy Inc Offshore/Onshore Environmental Protection Plans and Waste Management Plan, Goldboro, NS, 2001 (Environmental Analyst)

Halifax Lateral and Point Tupper Lateral Pipeline Projects, Environmental Protection Plans, Halifax, NS, 1999-2000 (Environmental Analyst)

Chevron Canada Resources Offshore Waste Management Plan, Halifax, NS, 2002 (Environmental Analyst)

Marathon Canada Limited Offshore Waste Management Plan, Halifax, NS, 2001 (Environmental Analyst)

Environmental Management System for J.D. Kline Water Supply Plant, Halifax, NS, 2000-2001 (Environmental Analyst)

Rapporteur for 5-Year Review of the Canadian Environmental Assessment Act , Halifax, NS, 2000

** denotes projects completed with other firms*

Robert Federico MPA

Practice Lead Environmental Impact Assessment and Regulatory Approvals

Robert Federico is a Principal and senior project manager who has been with Jacques Whitford for over 17 years managing numerous environmental studies including impact assessments, waste management studies, environmental management systems, public and stakeholder consultants and policy studies. He is currently leads the environmental impact assessment and permitting practice for Jacques Whitford in Nova Scotia. He has been responsible for or participated in major environmental assessments and regulatory reviews (federal and provincial) for such projects as: Lower Churchill Hydroelectric Project; the Sydport Marine Terminal; Eider Rock Refinery; the Bear Head LNG Project and associated pipeline project; Grassy Point LNG; Sydney Tar Ponds Clean-up; Deep Panuke Project; the Fundy Tidal Power Strategic Environmental Assessment; the Blue Atlantic Project; Hudson Energy Project; Rockingham Container Terminal; the Halifax Harbour Solutions Project; development of numerous highways in Nova Scotia; Halifax Lateral Pipeline Project; the Point Tupper Lateral Project; numerous quarries including the Sovereign Quarry; and the Sheet Harbour gypsum loading facility.

Mr. Federico has made numerous presentations and published papers on environmental impact assessment and environmental management.

EDUCATION

M.P.A. Graduate Program in Public Policy and Administration , Columbia University, School of International and Public Affairs, New York, New York, 1986

B.A. Philosophy, State University of New York, College at Purchase, Purchase, New York, 1978

AWARDS

Jacques Whitford Award for Technical Excellence, 2002

Jacques Whitford Award for Project Management, 2004

PROJECT EXPERIENCE

Background Report for the Fundy Tidal Energy Strategic Environmental Assessment, Offshore Energy Environmental Research Association (OEER) and Province of New Brunswick. 2007-2008, Bay of Fundy, NB (Project Manager)
This report is a background study on ocean renewable energy which is intended to facilitate a Strategic Environmental Assessment (SEA) of potential tidal energy development projects in the Bay of Fundy.

Lower Churchill Hydroelectric Project, Newfoundland and Labrador Hydro, 2007-2008 (Co-EIS Lead)
Federal-Provincial assessment (CEAA Panel review) currently underway.

Environmental Assessment for Sydport Container Terminal and Channel Dredging, Sydney Marine Group, 2007-present, Sydney, NS (Project Manager)
Federal/provincial assessment conducted according to the CEAA and Nova Scotia Environment Act. This project, in Sydney Harbour, Nova Scotia, also included provision of regulatory advice and coordination and preparation of environmental applications.

Environmental Impact Assessment and Permitting, Bear Head Liquefied Natural Gas (LNG) Terminal, Access Northeast Energy Inc., 2003-present, Goldboro, NS (Project Manager)
Federal/provincial assessment conducted according to the CEAA and Nova Scotia Environment Act. Also included input on site selection and development of a regulatory roadmap, as well as development and implementation of a public consultation program, development of environmental management plans and permitting.

Environmental Assessment Bear Head Pipeline, Maritimes Northeast Pipeline, 2005-2007, Goldboro, NS (Project Manager)
Federal/provincial assessment of natural gas pipeline from Bear Head LNG facility to main transmission pipeline at Goldboro.

*Environmental Impact Assessment for Sydney Tar Ponds Clean-up, 2005-2006, Sydney, NS (Co-lead)
Prepared assessment reports for CEAA Panel Review as well as preparation for Panel hearings.

Environmental Impact Statement, Deep Panuke Offshore Gas Development, PanCanadian/EnCana, 2001-2002;2006-2007 (Task Leader and Senior Advisor)
Included the preparation of an Environmental Impact Statement and a Comprehensive Study Report.

Robert Federico MPA

Practice Lead Environmental Impact Assessment and Regulatory Approvals

Environmental Assessment for In-Situ Leach Mining Project at Silver Mine, Cape Breton, 2005-2006 (Project Manager)

Environmental Assessment and Permitting Sovereign Resources Quarry Modification, 2005-present (Project Manager)

Comprehensive Study Environmental Assessment for the Halifax Lateral Pipeline Project, Maritimes & Northeast Pipeline Management Limited, 1998-1999, Halifax, NS (Project Coordinator)
Included the preparation of an Environmental Report, a Comprehensive Study Report, and a Supplementary Information Report, and a Field Studies Report.

Environmental Assessment for the Point Tupper Lateral Pipeline Project, Maritimes & Northeast Pipeline Management Limited, 1999, Mulgrave, NS (Project Coordinator)
Included the preparation of an Environmental Report and a Supplementary Information Report.
Project details in italics (grey). Details in italics, in grey. Details in italics, in grey. Details in italics, in grey. Details in italics, in grey.
Environmental Impact Statement, Blue Atlantic Transmission System Project, El Paso, (Task Leader)
Involves the construction and operation of a subsea natural gas pipeline and onshore processing facilities and will likely require a federal/provincial assessment conducted according to the CEAA and Nova Scotia Environment Act. Applications under the National Energy Board Act will also be required.

Environmental Impact Statement, Hudson Energy Project, GenPower, 2001-2002 (Task Leader)
Involves the construction and operation of a natural gas power generation facility and high voltage direct current subsea cable for energy export and will likely require a federal/provincial assessment conducted according to the CEAA and Nova Scotia Environment Act. Applications under the National Energy Board Act will also be required.

Industrial Facility EIAs, Trinidad Tobago, 2006 (Peer Review)
Conducted two peer reviews of EIAs for Government of Trinidad and Tobago for: proposed aluminium complex in the Union Industrial Site, LaBrea; and the proposed steel complex at Point Lisas.

Environmental Screening, Jetty NJ/NK Reconstruct, DND, 2000 (Project Manager)
Environmental assessment under CEAA for the demolition and reconstruction of a major military wharf in Halifax Harbour.

Environmental Assessment for Marine Bulk Loading Terminal, Tusket Mining Inc., Sheet Harbour, NS, (Project Manager)
Federal/provincial assessment of the development of a gypsum loading facility.

Environmental Assessment for Return of Boat Harbour to a Tidal Estuary, Pictou County, NS, 2003-ongoing (Project Manager)
CEAA screening level assessment for the decommissioning of a portion of a wastewater treatment facility associated with the Kimberly-Clark pulp and paper mill. Also includes the development and implementation of a public consultation program.

Environmental Assessment for Halifax Harbour Solutions Project, Halifax, NS 1998-2002 (Project Manager)
CEAA screening level assessment for the development of a regional wastewater treatment system including: three sewage treatment plants; collector sewers; marine outfalls; and a sludge composting facility.

Environmental Screening Report for the Development of the Rockingham Container Terminal, Halifax, NS, 2000-2002 (Project Manager)
Prepared pursuant to the CEAA and related guidelines.

Environmental Assessment, Highway 104, New Glasgow to Sutherlands River, North, NS, 2003-2005 (Project Manager)
CEAA assessment of a highway twinning project with potential bypass option. A community impact study including a full-day community workshop and several newsletters has been undertaken to assist with route options evaluation.

Class II Environmental Assessment, Highway 104 (Project Manager)
Federal/provincial assessment of the development of 15 km of new highway.

Class II Environmental Assessment, Highway 101 (Project Manager)
Federal/provincial assessment of the development of 26 km of new highway.

Robert Federico MPA
Practice Lead Environmental Impact Assessment and Regulatory Approvals

Environmental Registration for the New Minas Interchange/Connector and North Collector Highway, New Minas NS (Project Manager)
Provincial assessment of a new highway development.

Environmental Assessment Report for the Beaverbank By-pass Highway, Beaverbank, NS (Project Manager)

Highway 103 Barrington By-pass, Environmental Assessment Report, Barrington, NS (Project Coordinator)
Coordinated socioeconomic studies and report preparation for impact assessment of 8.2 km of new highway.

Radial Heredia Highway, San Jose, Costa Rica (Environmental Assessment Trainer)
Provided environmental assessment training to a local consulting team conducting the environmental impact assessment of a new highway near San Jose, Costa Rica.

PUBLICATIONS/PRESENTATIONS

R. Federico. "Environmental Approvals for Large Projects in Atlantic Canada: A Consultant's Perspective." Presented at Environmental Law in Atlantic Canada, Halifax, May 16, 2006.

R. Federico, S. Murphy. "Environmental Approvals for Bear Head LNG Terminal and Other Projects: A Consultant's Perspective." Presented to the national conference of provincial environmental assessment administrators, Halifax, August 17, 2006.

R. Federico. "No Surprises" – A Practical Approach to Successful EIAs. Presented at IAIA '05 Conference, Boston, June 2005.

R. Federico. Deep Panuke: Facing Environmental Challenges Posed by Offshore Oil and Gad Projects. Published in Thirty Years of Solutions, 2002.

Hurley, G., D. Fanning, R. Federico. Waste Management for Sable Offshore Energy Inc. Presented at the Canadian Waste Management Conference, Halifax, September 2000.

Fanning, D., R. Federico, T.E. Hickey and C. Moore. 1995, Highway 101 Landfill Environmental Audit and Health Risk Assessment, Sackville, Nova Scotia. Presented at the 17th Canadian Waste Management Conference, Quebec City, September, 1995.

Federico, R. and S. Fudge. 1995. Conducting Waste Minimization Audits. Presented at the Regional Workshop on Chemical Control and Waste Minimization in CARICOM states. January, 1995.

Haley, D., and R. Federico. Halifax Harbour Source Control Implementation Strategy. Presented at the Canadian Pollution Prevention Roundtable, Halifax, May, 1997.

Charles, M., and R. Federico. Environmental Management Guidebooks for Small and Medium Size Organizations. Presented at the Canadian Pollution Prevention Roundtable, Halifax, May, 1997.

John Walker PhD

Principal and Senior Project Manager
Eastern Regional Practice Director, Air Quality
National Practice Director, Noise

Dr. Walker is a Principal of the firm Senior Project Manager in the JWEL Dartmouth office, and has 26 years experience in the environmental consulting industry. He has been involved in environment, industrial hygiene and other industrial studies for such diverse clients as Michelin (Canada), Uniroyal, Nova Scotia Power, INCO, El Paso Corporation, Shell Brunei, Harvard School of Public Health, Environment Canada, Nova Scotia Department of Environment, Transportation and Public Works, and General Motors. Dr. Walker has assisted many of these organizations to adapt and benefit from changes in the policy and regulatory environments. His international work has included World Bank and private sector clients in China, Kazakstan, Iran, Syria, Brunei, Brazil, Chile, and Argentina. He earned his doctorate in air pollution meteorology and environmental physics from the University of Guelph in 1980.

EDUCATION

Ph.D., Air Pollution Meteorology, University of Guelph, Ontario, 1980

M.Sc., Geography (Climatology), Queen's University, Kingston, Ontario, 1976

B.Sc.,Geography (Hons)., Queen's University, Kingston, Ontario, 1975

PROFESSIONAL ASSOCIATIONS

Air and Waste Management Association – Immediate Past Chair, Atlantic Section

PROJECT EXPERIENCE

QUALITY/METEROLOGY

NPRI and Greenhouse Gas Studies (Project Manager)
Managed the update of the NPRI reporting and greenhouse gas inventory for Neenah Paper, Pictou, NS.

Air Quality Strategy (Project Manager & Technical Director)
Study to develop an air quality strategy for the Halifax Regional Municipality.

Michelin (Canada) Project Manager
A series of projects for Michelin, including training programs in air quality regulations and compliance for environmental staff of all Michelin (Canada) facilities; source testing at Waterville facility; dispersion modelling and permitting assistance at Waterville, Granton, and Bridgewater plants.

Maritime Steel (Manger of source testing, dispersion modelling and consultation for the repermitting of the facility in New Glasgow)

Province of Nova Scotia (Project Manager)
Designed (in conjunction with Environment Canada and the Nova Scotia Department of Environment) and managed the implementation of the air quality monitoring program for the Sydney Tar Ponds Clean-Up

World Bank (Consultant)
Retained by the World Bank in 2002 as an expert consultant to design an approximately $10 million (capital cost), air quality monitoring program for major cities in Iran, including Tehran, Masshad, Arak, and Isfohan.

ElPaso Corporation (Project Manager)
Set up air quality programs including modelling and monitoring for the Blue Atlantic Transmission System and the Sable Offshore Energy Program.

Brunei Shell Refinery (Project Manager)
Designed the air quality monitoring program, meteorological monitoring station, and odour management system for the Sungai Bera Remediation Joint Venture at the Shell Petroleum Refinery, Brunei.

Cavendish Farms (Project Manager)
Project Manager of air quality monitoring program for the Cavendish Farms processing plant in New Anaan, Prince Edward Island.

Voisey's Bay Nickel (INCO) (Project Manager)
Designed two meteorological and air quality stations for installation in northern Labrador during the Voisey's Bay Environmental Assessment.

John Walker PhD
Principal and Senior Project Manager
Eastern Regional Practice Director, Air Quality
National Practice Director, Noise

Air Quality Studies - Industrial

Air quality assessment of numerous gypsum, gravel, and other quarries and bulk shipping operations.

Manager of air quality assessments for many industrial plants, including the Trigen-PEI waste to energy plant in Charlottetown, PEI, an energy-to-waste plant in North Bay, and enrgy-to-waste plant in Kitchener, three Michelin plants in Granton, Waterville, and Bridgewater..

Project manager in an investigation and measurement program to determine odour emissions from the Acadian Seaplants facility in Nova Scotia.

Performed air quality modelling for the Voisey's Bay smelter/refinery complex at Argentia

Performed air quality assessment of the Voisey's Bay mine and mill project in Labrador

Testified as an expert witness for General Motors during a trial relating to changes under the Environmental Protection Act

Project Manager, cooling tower impact study, IBM T.J. Watson Research Center, Yorktown Heights, New York

Project Manager, air quality and noise monitoring programs for Cavendish Farms, New Annan, Prince Edward Island

Air Quality Assessment

Project Manager, wind tunnel air quality study of University of Maryland at Baltimore - Health Sciences Facility, Biomedical Research Division and the Penn Street Pharmokinetics Building

Project Manager, dispersion modelling (EPA ISC) and wind tunnel modelling for the National Institutes of Health, Bethesda Maryland.

Project Manager, Harvard University School of Public Health - Francois Xavier Bagnold Building and Building No. 2, study of the dispersion from fume hoods and laboratory exhausts.

Project Manager, wind tunnel study of exhaust reconfiguration at the Roswell Park Cancer Cell Center, Buffalo, New York

Project Manager, wind tunnel study to investigate the aerodynamic drag of a US Navy Icebreaker, and testing to ensure that main engine exhausts were not reingested by the air intakes.

Project Manager for a numerical study of ventilation design for the proposed US Navy Surface Warfare Center, Ship Materials Testing Facility, Bethesda, Maryland.

Camp Hill Medical Centre – Problem Investigation

Project Manager – L'Anse aux Meadows, Newfoundland – study of recurring air quality buildings in national park buildings.

Noise Studies

ConocoPhillips Surmont Project (Project Manager and Principal Scientist)
An assessment of noise impacts for the ConocoPhillips Noise Impact Assessment, Fort McMurray, Alberta.

Sydney Tar Ponds Agency (Principal scientist)
Noise and air quality for the environmental assessment of the Sydney Tar Ponds Clean-Up.

Bilicon Nova Scotia (Project Manager)
Noise and air quality impact assessment for the Whites Point Quarry, Nova Scotia.

Petro Canada Sturgeon Upgrader (Principal Scientist and Task Manager)
An assessment of noise impacts for the PetroCanada Sturgeon Upgrader Project, Fort Saskatchewan, Alberta.

Turbine Generator Project (Project Manager)
A study of baseline noise during operation and shutdown modes of the Maritime Electric Company Limited plant in Charlottetown, Prince Edward Island, and Principal Scientist for acceptance testing and verification.

Nova Scotia Transportation and Public Works (Project Manager)
An assessment of noise and noise barrier design for Highway 104 at Salt Springs Provincial Park, NS

Halifax-Dartmouth Bridge Commission (Project Manager)

John Walker PhD
Principal and Senior Project Manager
Eastern Regional Practice Director, Air Quality
National Practice Director, Noise

An assessment of potential construction noise impacts of the Third-Lane Project for the Macdonald Bridge, Halifax-Dartmouth, NS

Jacques Whitford Environment (Project Manager)
Noise Impact Study for the Fixed Link Crossing at Borden, Prince Edward Island

Environmental Impact Studies

Air quality and noise issues related to:

- Voisey's Bay mine/mill project in Labrador and the smelter/refinery project in Argentia
- Potential impacts of nuclear powered vessels berthing in Canadian ports
- Assessment of environmental impacts of offshore training activities by DND

Project Manager, study of the air quality issues with respect to the Prince Edward Home wood-fired system, Charlottetown, Prince Edward Island

Conducted air quality and noise background measurement programs and impact assessment for the Halifax Harbour Sewage Treatment Plants.

Project Manager, Air Quality and Noise studies, Environmental Baseline Study, CFB Trenton

Environmental Studies – International

Member of the Project Appraisal Mission of the World Bank to the Syrian Arab Republic to develop a project to test alternate vehicle technologies in Syria as a Global Environment Facility project.

Developed and presented a series of workshops on Urban Air Quality Management and Vehicle Emission Reduction in the cities of Xiamen, Haikou, and Chongqing, P.R. China as part of an Environment Canada project.

Technical Director of the project for the People's Municipality of Shanghai to investigate the air quality and noise impacts of the Inner Ring Road

Assisted World Bank in the direction of the environmental assessment of urban transport projects in three cities, Shenyang, Fushun, and Anshan in Liaoning province of P.R. China

Participated in World Bank project identification mission to the Republic of Kazakstan, CIS, to develop strategies to improve urban air quality. This involved meeting with the Ministry of Environment and agencies in Almaty to review air quality monitoring activities and data.

Provided technical assistance and review to the World Bank and Xinjiang Environmental Technology Assessment Center for the Urumqi Urban Transport Improvement Program.

Retained by the World Bank to assist the Municipality of Shijiazhuang, China, in the conduct of urban airshed modelling and other components of the Environmental Assessment of urban transport projects.

Contracted to compile a handbook for the World Bank on the conduct of environmental assessments with a focus on the noise and air quality aspects.

Electric Power Sector Studies

Project Manager, dispersion modelling study to assess the impacts of flue gas desulphurization on the ground level impacts of the Lingan Thermal Generating Station, Cape Breton, Nova Scotia.

Project Manager, dispersion modelling for the peaking power turbines at Burnside, Victoria Junction, and Tusket, Nova Scotia.

Managed an air quality and noise assessment, including dispersion modelling, for a gas turbine power station in Halifax Regional Municipality.

Developed and presented training programs in air pollution meteorology to staff on Electricity Generating Authority of Thailand

Modelled air quality impacts for the Bruce Nuclear Energy Centre

Air quality modelling for the cogeneration project at Abitibi-Price, Stephenville, NF.

Developed a series operational air quality computer model for the Nova Scotia Power Corporation

Provided expert review and testimony at hearings for the proposed Burnside energy from waste incinerator in Dartmouth NS

John Walker PhD
Principal and Senior Project Manager
Eastern Regional Practice Director, Air Quality
National Practice Director, Noise

Coordinated environmental assessment for a proposed energy from waste plant in North Bay, Ontario, including assessment of existing landfill conditions

Preliminary air quality analysis for a proposed energy from waste facility at Ship Point, Nova Scotia

Long-range transport air pollution model development and testing for Nova Scotia Power.

Assessment of feasibility of Flue Gas Desulphurization options using dispersion models for Lingan Thermal Generating Station, Nova Scotia.

Conducted preliminary environmental assessment for an energy from waste plant in Kitchener, Ontario

Probable Maximum Precipitation Study for Manitoba Hydro in support of the dam safety program for the Lower Nelson River

Long-Range Transport model development and studies for Ontario Hydro, including preparation of evidence for National Energy Board hearings.

Water quality model development for the Dock Street Power Station, Philadelphia.

Oil & Gas Sector Studies

Designed and coordinated a technological assessment and permitting program for low temperature thermal desorption of petroleum hydrocarbon soil contaminants

Coordinated the environmental assessment and testified at the Ontario Energy Board Hearings for the 50 km Georgian Bay Reinforcement Pipeline

Assessed life cycle effects of sour gas treatment and disposal options for offshore energy projects of Pan Canadian (now EnCana).

Climate Change, Meteorology, Climatology and Extreme Event Studies

Performed Probable Maximum Precipitation study for the Lower Nelson River drainage basin, Manitoba

Performed climatological analysis relating the anomalous sequences of a 10 year period to the projected impact of climatic change as predicted by the CSU, GISS and GFDL models

Developed and tested wind forecast techniques for the Beaufort Sea and Canadian Arctic Waters

Developed wind forecast methods based on ship buoy and ship observations on the Great Lakes and compared the two development bases as input to wave models

Waste Management

Performed landfill gas characterization/quantification (US EPA Scholl Canyon Model) and odour dispersion modelling (US EPA ISC2) from the Highway 101 Landfill, Sackville Nova Scotia

Supervised the development of an emergency response model for Project Swiftsure, the project to incinerate Canada's chemical weapons

Expert advisor to counsel for the Regional Municipality of Niagara for the OWMC Waste Disposal Site Environmental Assessment

Project Manager for air quality and noise impacts of the proposed Waste Diversion Facility, City of Kingston

Advised in the development of landfill gas monitoring protocol for the Eastview Landfill Guelph, Ontarioore oil project.

PUBLICATIONS

Role of Agrometeorology in Predicting Crop Injury by Air Pollution, Presented at the O.A.C. Agriculture Conference, University of Guelph, Guelph, Ontario, 1977 (Co-author)

A Note on Temperature and Humidity Profile Measurement Over Forests Using Diodes, J. App. Meteor - 16, 106-109, 1977 (Co-author)

Ozone Uptake and its Relationship to Damage in Corn, Final Report to A.E.S. for D.S.S. Contract KM601-7-19045, 1979 p. 52 (Co-author)

Ozone Uptake by Corn, Ph.D. Thesis, University of Guelph, Ontario, 1980

Ozone Uptake by Corn, Presented at the 75th Annual Meeting of the Air Pollution Control Association, New Orleans, 1982, June.

John Walker PhD
Principal and Senior Project Manager
Eastern Regional Practice Director, Air Quality
National Practice Director, Noise

Experiments in the Development of Marine Weather Forecasting Techniques off the East Coast, Presented at the 18th Annual Congress of the Canadian Meteorological and Oceanographic Society, 1 Halifax, 1984, June (Co-author).

Urban Air Quality and Vehicle Emissions. Presented at the First Sino-Canadian Workshop on Climate Change, Beijing, April 1999.

Software Design for the Development of Marine Weather Forecast Techniques, Presented at the 18th Annual Congress of the Canadian Meteorological and Oceanographic Society, Halifax, 1984, June (Co-author).

PAH in the Air of Sydney, Nova Scotia. Presented at the Conference of Chemical Institute of Canada, Atlantic Chapter, 1993.

Pollution Prevention in Action: Green Industry Analysis of a Guelph Industry. 40th Ontario Conference on the Environment, June 1993, (Co-author).

Urban Air Quality, Greenhouse Gases, and Motor Vehicle Emissions. Proceedings Sino-Canadian Workshop on Climate Change, Beijing, April 12-13, 1999.

Motor Vehicle Control Strategies for Urban Air Quality Management. Presented at the International Conference on Urban Pollution Control Technology, Hong Kong, 13-15 October, 1999.

Competition and Compromise – Environmental Factors in Waste Management. Presented at the 22nd Canadian Waste Management Conference, Halifax, 25-27 September, 2000.

Air Quality Monitoring Programs at the Onshore Facilities of Sable Offshore Energy Inc. Presented at the Offshore Technology Association of Nova Scotia, October 6, 2000.

Comparison of AERMOD, ISC3 and CALPUFF in the Environmental Assessment of a Sour Gas Plant (coauthor). Presented at the Guideline on Air Quality Mondels Conference (US EPA/AWMA) Mystic Connecticut, October 2003.

On-Road Vehicle Emissions in Santiago de Chile, Sao Paulo and Buenos Aires, Presented at the 5th Conference on Urban Air Quality, March 2005, Valencia, Spain.

Gillian Asche MASc

Air and Noise Quality Scientist

Gillian Asche, M.A.Sc., B.Sc., is a scientist in the Environmental Planning and Permitting group with the Jacques Whitford Dartmouth office. With her background in Environmental Biology and Environmental Engineering, her academic training includes environmental site assessment, groundwater dispersion modeling, risk assessment, and site remediation. Since joining Jacques Whitford team in the summer of 2007, Ms. Asche has been involved in numerous projects including air dispersion modeling, sound pressure level modelling, source emissions testing, ambient air and sound quality monitoring, source emissions inventory and environmental assessments. As well Ms. Asche has successfully completed training related to GHG Verification Using ISO 14064, orientation to the Canadian Environmental Assessment Act, and sound pressure level modelling using Cadna.

EDUCATION

Master of Applied Science, Environmental Engineering, Memorial University, St. John's, Newfoundland, 2005

Bachelor of Science, (Environmental Biology), Sir Wilfred Grenfell College, Memorial University, Corner Brook, Newfoundland, 2004

REGISTRATIONS

Basic Seminar, Cadna A, DataKustik, 2008
Advanced Seminar, Cadna A, Datakustik, 2008
Orientation to CEAA 101, Canadian Environmental Assessment Agency, 2008
Greenhouse Gas Verification using ISO 14064, Canadian Standards Association, 2008
WHMIS Training, Jacques Whitford, 2007

Year Award Name, Project Name

PROJECT EXPERIENCE

Air Quality

Maritime Steel Industrial Approval Assistance, New Glasgow, NS (Air Quality Scientist)
Preparation of a Pollution Prevention Plan and a Solid Waste Management Plan, Maritime Steel and Foundries Limited (2008)

Environmental Assessment Sydport, Sydney, NS (Air & Noise Quality Scientist)
Atmospheric Environment Value Ecosystem Component for the Environmental Assessment, Marine Terminal, Sydney, NS

Air Quality Services, Industrial Approval Assistance, New Glasgow, NS (Air Quality Scientist)
Air Dispersion Modelling Study, Air Emissions Inventory, Source Emissions Testing and Compilation of the 2007 National Pollutant Release Inventory, Neenah Paper (2008)

Dispersion Modelling, Bridgewater, NS (Air Quality Scientist)
Air Dispersion Modelling Study, Michelin Bridgewater (2008)

Air Quality Monitoring, Bedford, NS (Air Quality Scientist)
Ambient Air Monitoring Program, Sovereign Resources (2007-2008).

Boiler 7 Source Emissions Testing, Corner Brook, NL (Air Quality Scientist)
Source Emissions Testing, Corner Brook Pulp and Paper Ltd. (2007).

Air Quality Services, Goldboro, NS (Air Quality Scientist)
Air Emissions Inventory, Air Dispersion Modelling and Environmental Assessment of the air quality impacts of the proposed Petrochemical Plant in Goldboro, NS (2007)

Environmental Assessment Highway 101, Windsor, NS (Air & Noise Quality Scientist)
Air quality component of the Environmental Assessment of the Highway 101 Twinning (Phase Four) (2007).

Source Emissions Testing and Air Dispersion Modelling, Waterville, NS (Air Quality Scientist)
Source Emissions Testing and Air Dispersion Modelling, Michelin Waterville (2007)

Acoustic Environment Studies

Noise Modelling, Lameque, NB (Air & Noise Quality Scientist)
Sound Pressure Level Modelling Wind Turbine Farm, Lameque, NB

Acoustic Technical Study, Saint John, NB (Air & Noise Quality Scientist)

Gillian Asche MASc
Air and Noise Quality Scientist

Sound Pressure Level Modelling, (Cadna A) Project Eider Rock, Irving Oil (2008)

Ambient Noise Monitoring, Bedford, NS (Air & Noise Quality Scientist)
Baseline Ambient Noise Quality Monitoring Program, Sovereign Resources, (2007-2008)

Acoustic Environment Services, Goldboro, NS (Air & Noise Quality Scientist)
Baseline Ambient Noise Quality Monitoring and development of Noise Monitoring Plan, Keltic Petrochemicals (2007)

Noise Assessment, Dartmouth, NS (Air & Noise Quality Scientist)
Neighbourhood Study of Sound Pressure Levels, Tufts Cove, Nova Scotia Power Inc (2007)

Michael Crowell MSc

Principal

Michael Crowell, M.Sc. is a terrestrial ecologist with over 22 years experience with Jacques Whitford. He is a highly experienced botanist and plant ecologist having conducted numerous botanical surveys and plant community studies in a wide range of habitat types throughout Atlantic Canada. Mr. Crowell is also an experienced wildlife ecologist. He has conducted breeding bird surveys, aerial raptor and waterfowl surveys, aerial large mammal surveys, small mammal trapping, general mammal surveys, reptile surveys and amphibian surveys for a wide variety of projects throughout Atlantic Canada. His terrestrial ecological skills are used mainly in environmental assessments to assess the effects of various anthropogenic activities on rare or endangered species and sensitive habitats. As part of this process Mr. Crowell develops mitigative measures to eliminate or reduce the adverse effects of these activities. Mr. Crowell has been responsible for designing and implementing a variety of environmental monitoring programs for rare or endangered species as well as terrestrial and wetland habitats. He is also experienced in conducting wetland evaluations and wetland functional analyses. Mr. Crowell is also experienced in air photo interpretation and plant community mapping from air photos as well as the description of plant communities. He has used these skills to prepare ecological land classifications for various areas in Atlantic Canada

EDUCATION

Master of Science, Dalhousie University, Halifax, Nova Scotia, 1988

Bachelor of Science (Honours), Terrestrial Ecology, Joint Degree awarded by Mount St. Vincent University and Dalhousie University, Halifax, Nova Scotia, 1981

PROJECT EXPERIENCE

Highway 104 Follow-up Studies, New Glasgow, NS. 2008-ongoing (Senior Wetland Ecologist)
Developed and implemented a program to salvage and relocate Blunt-leaf Pondweed (Potamogeton obtusifolius) in a wetland infilled as a result of highway twinning.

Vegetation Control Program for CFB Gagetown, NB, 2007 (Senior Terrestrial Ecologist)
Conducted plant community mapping and habitat descriptions for manouvering and target areas at CFB Gagetown.

Department of National Defence Wetland Functional Analyses, NS, 2004-2005 (Senior Wetland Ecologist)
Conducted wetland functional analyses for wetlands found on six DND properties in Nova Scotia

Department of National Defence Wetland Biophysical Inventories, NS, 2004-2005 (Senior Wetland Ecologist)
Conducted rare plant, bird, mammal, reptile and amphibian surveys for 37 wetlands on six DND properties in Nova Scotia.

Nova Scotia Department of Natural Resources Protected Beaches Biophysical Inventories, NS, 2005-2006 (Senior Terrestrial Ecologist)
Compiled vascular plant inventories and plant community descriptions for dune and wetland habitats at 11 provincially protected beaches in Nova Scotia.

New Brunswick Department of Transportation TransCanada Highway Twinning, Woodstock, NB, 2003 (Terrestrial Ecologist)
Conducted breeding bird, vascular plant inventories and aerial deer and moose surveys for the rerouting of the Trans-Canada Highway between Woodstock and Grand Falls, NB.

Project Eider Rock Environmental Assessment, St. John, NB, 2007 (Terrestrial Ecologist)
Conducted rare plant and wetland vegetation inventories for the environmental assessment for an oil refinery.

Bear Head LNG Project, Bear Head, NS, 2005-2006 (Senior Terrestrial Ecologist)
Conducted rare plant and breeding bird surveys as part of the environmental assessments for the Bear Head LNG plant and associated natural gas pipeline, Port Hawkesbury, NS

Halifax Stanfield International Airport Rare Plant Monitoring Program, Enfield, NS, 2004-ongoing (Senior Terrestrial Ecologist)
Conducted monitoring of a population of Southern Twayblade orchid (Listera australis).

Strait Crossing Inc. Terrestrial Monitoring Program, Cape Jourimain, NB and Borden, PE, 1993-1997 (Senior Terrestrial Ecologist)
Designed and implemented rare plant, waterfowl, seabird, and terrestrial bird monitoring for the Confederation Bridge project.

** denotes projects completed with other firms*

Michael Crowell MSc
Principal

Loblaws Wetland Compensation Program, Yarmouth, NS, 2006-ongoing (Senior Wetland Ecologist)
Designed and implemented a plant community monitoring program to monitor the recovery of a wetland following cessation of ATV trampling disturbance.

Highway 101 Phase 4 Twinning Environmental Assessment in Antigonish, NS
Client: Nova Scotia Transportation and Infrastructure Renewal
Client Reference Contact: Elizabeth Pugh, Environmental Engineer
TEL: (902) 424-6418
EMAIL: pughel@gov.ns.ca
Contract Duration: Summer 2008
Role: Senior Terrestrial Ecologist
Project scope for Highway 101 Phase 4 Twinning Environmental Assessment included conducting rare plant surveys, breeding bird survey, shorebird surveys and wetland functional analyses plus preparation of text for the EA which was done in 2007. It also included the design and implementation of a shorebird monitoring study conducted in 2008.

Permitting of Hydro-electric Reservoirs in Nova Scotia
Client: Nova Scotia Power Inc.
Client Reference Contact: Dan Thompson, Environmental Specialist, Environmental Operations Approvals
TEL: (902) 428-7589
EMAIL: dan.thompson@nspower.ca
Contract Duration: Summers 2006, 2007, 2008
Role: Senior Terrestrial Ecologist
Project scope for Permitting of Hydro-electric Reservoirs in Nova Scotia included conducting rare plant surveys and wetland biophysical surveys for 18 NSPI reservoirs. Surveys were conducted in 2006, 2007 and 2008.

Nathan Ayer MES
Environmental Analyst

Nathan is a member of the company-wide sustainability initiative out of the Dartmouth office. Nathan has strong research and analytical skills developed through project work experience in the private, public, and non-profit sectors. Nathan brings to Jacques Whitford Stantec particular expertise in the application of Life Cycle Assessment (LCA). He has conducted a number of comprehensive LCAs, published peer-reviewed articles on LCA in respected industry journals, and given presentations and lectures on LCA at conferences and to a wide range of interested groups and organizations. In addition to these areas of expertise, Nathan has expertise in Carbon Footprinting and Environmental Impact Assessments.

EDUCATION

Masters of Environmental Studies, Dalhousie University, Halifax, Nova Scotia, 2007

Bachelor of Arts, Mount Allison University, Sackville, New Brunswick, 2003

PROFESSIONAL ASSOCIATIONS

Co-Editor, Journal of Cleaner Production, Special Issue on the Sustainability of Seafood Production and Consumption, published in 2009.

Member, Food Climate Research Network, U.K., 2006-present.

Best Methodological Contribution, InLCA/LCM 2006, Washington, D.C.

PROJECT EXPERIENCE

Recent Project Experience

Renewable Energy Asset Map, 2008, Cape Breton, NS (Research Analyst)
As a research analyst on this project for a regional planning commission, provided research and analysis on the biophysical and economic potential for renewable resource development in the Cape Breton region. This included a literature and data review on the existing resource base in the region, consultation with renewable energy experts, development of a workshop for expert consultation, and working with GIS experts to develop renewable energy resource maps.

Sustainable Product Assessment Framework, 2008 – 2009, Ottawa, ON (Lead Technical Researcher)
As lead technical researcher, conducting screening level life cycle assessments of several key office supply products in order to determine the key life cycle environmental impacts of concern. Information from this assessment will be used to develop a sustainable product assessment framework and will be incorporated into a supply chain management software program for an industry leading office supplies company.

Digby Wind Farm Environmental Assessment, 2008 – 2009, Digby, NS (Research Analyst)
Researching and analyzing data on migrating, overwintering, and breeding bird activity in the area of the proposed wind turbines. Preparing summary tables and summary chapter for the EA document to describe the potential impacts of the proposed turbines on birds using the area for various life cycle activities.

SMART Report – Lignin and Cellulose Production, 2008 – 2009, Nova Scotia (Research Analyst)
Using a life cycle assessment framework to assess the environment benefits of adopting a new technology for lignin and cellulose production in the pulp and paper industry. Results of the study will be used to inform a federal funding program for sustainable technology development.

Sydport Channel Dredging and Marine Terminal Environmental Assessment, 2008 – 2009, Sydney, NS (Research Analyst)
Coordinating, researching, and writing the chapters for each of the five marine valued ecosystem components (VECs), including commercial fisheries, marine fish and water quality, vessel navigation, benthic communities and sediment quality, and marine mammals and marine-related birds. Writing and providing research support as needed on other sections of the EA.

Schefferville Iron Ore Mine Environmental Impact Statement, 2008 – 2009, Shefferville, NL (Research Analyst)
Coordinating various chapters of this EIS, developing the Project Description, ensuring the EIS is compliant with the government guidelines, writing and providing research support as needed.

Nathan Ayer MES
Environmental Analyst

Highway 101 Shorebird Monitoring, 2008 – 2009, Windsor, NS (Research Analyst)
Conducted surveys of shorebirds in a marsh adjacent to the site of a proposed highway twinning project. Collected field data and summarized data in a GIS unit. Data collection is complete, and is now being summarized and analyzed to determine usage patterns of the marsh by shorebirds and to predict the environmental effects of the highway twinning project on these birds and their marsh habitat.

LCA Framework – Strathcona County Environmental Sustainability Framework, 2008, Strathcona County, AB (Research Analyst)
Provided life cycle assessment expertise to the development of a municipal decision-making framework. This included the development of a background report on life cycle assessment and life cycle management and providing recommendations for the application of these tools in a municipal setting.

Analysis of Collaborative Software as a Tool for Environmental Sustainability, 2008, U.S. (Research Analyst)
As lead technical researcher for this project, helped to develop a framework for the client to use to provide its customers with a quantification of the travel-related greenhouse gas emissions that are avoided by using online collaboration software. This project work included a review of existing methodologies, development of a novel, robust framework that could be applied to all of the client's customers, and collaboration with the client to test the framework on real-world data.

Project Eider Rock Environmental Assessment, 2008, Saint John, NB (Research Analyst)
Conducted research, analysis, and report preparation for various components of the environmental assessment of a new oil refinery, including the assessment of existing marine vessel traffic, the environmental effects of oil refineries on residential property values, and the environmental effects of the refinery on Aboriginal land and resource use.

Nunavut Oil and Gas Strategic Environmental Assessment, 2008, Nunavut (Research Analyst)
Developed an approach and criteria for selecting study areas for a strategic environmental assessment to be used for management of future oil and gas exploration and development in the Nunavut territory.

Low-Carbon Diet for Bon Appétit Management Company, 2007-2008, Dartmouth, NS (Research Analyst)
Provided consultation to a U.S. food distribution company on the life cycle greenhouse gas emissions associated with the production and distribution of their core menu items. Conducted a comprehensive literature review of life cycle assessment studies of global food production systems in order to estimate the GHG emissions for each life cycle stage of various food products and to determine areas where improvements could be made in their supply chain. Analyzed data, constructed reports, and provided methodological advice and recommendations on next-steps for the company.

Life Cycle Assessment (LCA) of Salmon Fisheries and Aquaculture, 2005 -2007, Halifax, NS (Master's Research)
Collaborated with colleagues at Dalhousie University in Canada, Ecotrust Knowledge Systems in the U.S., and the Swedish Institute for Food and Biotechnology (SIK) to deliver phase 1 of this international study comparing the life cycle impacts of salmon fishing and aquaculture systems in the North-East Pacific. Analyzed and compared the potential environmental impacts of four (4) Canadian salmon aquaculture systems using life cycle assessment, and helped develop the life cycle framework and life cycle inventory for a number of salmon fishing systems. Scoped and conducted a full LCA for each aquaculture system, and researched various methodological aspects of LCA and the ISO standards for LCA. Conducted literature reviews, primary research, constructed research reports and peer-reviewed journal articles, and presented results in a number of academic, government, and public forums. Details in italics, in grey. Details in italics, in grey.

PUBLICATIONS

Ayer, N., Tyedmers, P. Assessing Alternative Aquaculture Technologies: Life Cycle Assessment of Salmonid Culture Systems in Canada. Journal of Cleaner Production 17(3): 362-373. 2009.

Ayer, N., Cote, R. P., Tyedmers, P.H., Willison, J.H.M. Sustainability of seafood production and consumption: an introduction to the special issue. Journal of Cleaner Production 17(3): 321-324. 2009.

Ayer, N., Tyedmers, P., Pelletier, N., Sonesson, U., Scholz, A. Co-Product Allocation in Life Cycle

Nathan Ayer MES
Environmental Analyst

Assessments of Seafood Production Systems: Review of Problems and Strategies. Int J of LCA: 12(7), 480-487. 2007.

Pelletier, N., Ayer, N., Tyedmers, P., Kruse, S.A., Flysjo, A., Robillard, G., Ziegler, F., Scholz, A.J., Sonesson, U. Impact Categories for Life Cycle Assessment Research of Seafood Production Systems: Review and Prospectus. Int J of LCA: 12(6), 414-421. 2007.

Tyedmers, P., Pelletier, N., Ayer, N. Biophysical Sustainability and Approaches to Marine Aquaculture Development Policy in the United States. A Report to the Marine Aquaculture Task Force. School for Resource and Environmental Studies, Dalhousie University. 2007.

Ayer, N. Less Bad: Raising fish on land is not the eco-panacea some would have us believe. Alternatives, 32(3), p31. 2006.

PAPERS PRESENTED

Canadian Society for Ecological Economics (CANSEE) 7th Biennial Conference, July 27, 2007, Halifax, NS. Presented the paper “Assessing Alternative Aquaculture Technologies: Life Cycle Assessment of Salmonid Culture Systems in Canada”.

Nova Scotia Department of Environment and Labour, February 15, 2007, Halifax, NS.
Presented the paper “Assessing Alternative Aquaculture Technologies: Life Cycle Assessment of Salmonid Culture Systems in Canada” as well as lecturing on general Life Cycle Assessment methodology.

University of New Brunswick, January 17, 2007, Fredericton, NB. Presented the paper “Assessing Alternative Aquaculture Technologies: Life Cycle Assessment of Salmonid Culture Systems in Canada” as well as lecturing on general Life Cycle Assessment methodology.

Environment Canada, January 9, 2007, Dartmouth, NS. Presented the paper “Assessing Alternative Aquaculture Technologies: Life Cycle Assessment of Salmonid Culture Systems in Canada” as well as lecturing on general Life Cycle Assessment methodology.

InLCA/LCM 2006, October 4-6, 2006, Washington, D.C.. Presented the paper “Co-Product Allocation in Life Cycle Assessments of Seafood Production Systems: A Review of Allocation Problems and Applied Strategies”.

*Selected as Best Methodological Contribution at the conference.

Mary Jane Keefe BSc

Environmental Scientist

Mary Jane Keefe, a project scientist and a Project Manager-in-Training with the Environmental Permitting and Planning team in Dartmouth Nova Scotia, has five years experience working in the environmental field. Before joining Jacques Whitford, Ms. Keefe worked in Richmond, Virginia at a Site Design Engineering Firm conducting wetland delineations, Phase I and Phase II Environmental Site Assessments, stormwater management plans and stream assessments. Since joining Jacques Whitford, Ms. Keefe has played a key role on many large scale Environmental Assessments both at the federal and provincial level. Most recently Ms. Keefe worked on the Sydport Harbour Access Channel Deepening and the Proposed Sydport Container Terminal EA. In addition, she has coordinated, authored and reviewed sections of Natural Resource Management Plans and Training Area Management Plan prepared for three sites in Newfoundland and three sites Nova Scotia. Ms. Keefe has also completed smaller scale EAs and Environmental Protection Plans for private and public clients. Ms. Keefe is committed to working with the Jacques Whitford team to deliver professional results for the services requested.

EDUCATION

Bachelor of Science, Environmental Science, Mount Allison University, Sackville, NB, 2002

Workplace Hazardous Materials Information System (WHMIS), 2007

PROJECT EXPERIENCE

Preliminary Wetland Delineations completed in Chesterfield County, Virginia for various private and public clients.

Virginia Storm water Management Plans for private and public clients throughout Virginia.

Storm water Quality Testing During Construction Activities, Ashburn Golf Club, Halifax, Nova Scotia (November 2007)

Phase I Environmental Site Assessment of MediaView Blue Cross Office Building, Dartmouth, Nova Scotia (October 2007)

Phase I Environmental Site Assessment of 20 Titus Street, Halifax, Nova Scotia (October 2007).

Phase I Environmental Site Assessment of 1 Let bridge Road, Happy Valley-Goose Bay, Newfoundland and Labrador (November 2007).

Phase I and II Environmental Site Assessment of Moirés Chocolate Plant, Dartmouth, Nova Scotia (October/November 2007).

Phase II Environmental Site Assessment Eason's Transport, Kernville, Nova Scotia (October/November 2007).

Phase II Environmental Site Assessment CREIT Management 99 Wyse Road, Dartmouth, Nova Scotia (November 2007).

Phase I/II Environmental Site Assessments completed throughout Virginia and North Carolina for various private and public clients.

Natural Resources Management Plans (NRMPS), Cambria Rifle Range, Emerald Vale Training Area and Parkers Pond Training Area (January 2008)

EA Guidance Document for Routine Projects on Selected MARLANT properties (January 2008).

Integrated Pest Management Plan, CFB Halifax. (March 2008)

Range Training Area Management Plans (RTAMPS), Cambria Rifle Range, Emerald Vale Training Area and Parkers Pond Training Area (March 2008).

Halifax International Airport Voluntary CEAA Screening (October 2008).

Sydport Harbour Access Channel Deepening and the Proposed Sydport Container Terminal Environmental Assessment (in Draft December 2008).

Digby Wind Energy Project Environmental Assessment (in progress January 2009).

Beaver Mountain Wind Energy Project Environmental Assessment (in progress 2009).

** denotes projects completed with other firms*

Julianne Sullivan MSc, CEPIT
Environmental Scientist

Julianne Sullivan, an aquatic ecologist and project scientist, has several years experience working in various areas of the aquatics field including freshwater and marine ecosystems. Her areas of expertise include aquatic ecology, ichthyology, habitat studies, and watershed monitoring/inventories. She has worked for provincial and federal levels of government, in academics, with private industry and community groups, and as an educator. In her various roles as project lead, teacher, and scientist, she has focused on strong communication and attention to detail. Ms. Sullivan has been involved in public and stakeholder consultation (including interviews) for a variety of aquatic-environment projects including those related to aquatic species-at-risk studies as well as pipeline and highway construction aquatic habitat impact assessments. Her work has involved desk-top studies, lab and field based fish identification, and field investigations, including assessments on a wide range of aquatic habitat environments. She is technically proficient and focuses on accurate, efficient data collection, presentation and interpretation. Ms. Sullivan is committed to working with the Jacques Whitford team to deliver professional results for the services requested.

EDUCATION

Master of Science, Aquatic Ecology, University of Toronto, Toronto, Ontario, 2003

Bachelor of Science (Honours), Biology, Mount Allison University, Sackville, New Brunswick, 2000

Technical:
Certified Environmental Practitioner in Training (CEPIT).

Backpack Electrofishing Certificate Course, University of New Brunswick, 2007 (including First Aid-CPR)

Toastmasters, 2007 - present

Identification of Ontario Fishes, Royal Ontario Museum, 2002

PROJECT EXPERIENCE

Conducted field survey data collection, including water quality and fish sampling for multiple Halifax Regional Municipality (HRM) monitoring programmes (including multi-year studies) in lakes throughout the HRM.

Conducted ocean-based water quality sampling for repeat monitoring of the Halifax Harbour.

Assessed and identified a historical collection of preserved fish, data and records as part of a collaboration between the Department of Fisheries and Oceans (DFO) and the Royal Ontario Museum (ROM) for a Species-At-Risk project.

Reviewed, researched and wrote biological component of socio-economic impact assessment reports for the proposed listing of various species under SARA.

Teaching assistant, laboratory demonstrator, science instructor: effectively communicated a broad range of scientific ideas in a stimulating environment.

Lead on-site crews for fish removals associated with pipeline and road construction (including electrofishing, site monitoring, and netting).

Provided technical and permitting environmental support for large municipal project to update a trunk sewer; project includes coordination of multiple provincial and federal approvals and attention to the interests of several public and not-for-profit groups.

Researched, developed, implemented and tested novel habitat quantification method for littoral zone fish and habitat assessment.

Assessed stream environments throughout Nova Scotia to establish baseline conditions, make watercourse determinations, and collect data for monitoring programmes (including water, fish, invertebrate and habitat sampling); often related to impacts from development.

Completed watercourse crossing assessments and a desktop review of the fish community for the Highway 101 Phase 4 Environmental Assessment Aquatic VEC (Valued Environment Component).

Modeled phosphorus loading potential of a lake (planned for flooding) as part of the Keltic Petrochemical Facility Project (Provincial Environmental Assessment approval conditions).

Facilitated Environmental Effects Monitoring (EEM) field data collection for multiple pulp and paper sites and mining sites, including fish population and health surveys, benthic, sediment and water sampling (marine and freshwater).

Lucie Kendell

GIS Specialist

Lucie Kendell has been a GIS Specialist with Jacques Whitford Limited in Dartmouth NS since June of 2005. Her responsibilities include GIS Analysis, Cartography, Database Construction, and Data Management. Prior to Jacques Whitford, Lucie worked as an offshore navigator and has specific experience in ice scour mapping, interpretation, and database development for northern environments. She has over six years of industry experience and has been working with GIS software for eight years.

EDUCATION

Advanced Diploma in Marine Geomatics (Honours), Centre of Geographic Sciences, Lawrencetown, NS 2002

Bachelor of Arts, Major Geography; Minor Canadian Studies, (Graduated on the Dean's List), Mount Allison University, Sackville, New Brunswick, 2001

AWARDS

Lucie has been awarded appreciation awards for her outstanding support at the Techsploration Alumnae Young Women's Conference (NSCC, Dartmouth, NS 2003 & 2005), and at the Skills Energy Youth Quest (COGS, Lawrencetown, NS 2003).

In 2001, Lucie was awarded the CN Scholarship for Women for excellence in pursuing a non-traditional career path at Nova Scotia Community College.

In 2001, Lucie was awarded the Greco Scholarship Award for outstanding school and workplace proficiency, Sackville, NB.

In 2001, Lucie was awarded the David Blackwood Prize for her outstanding ability to combine scholarly excellence with a strong commitment to the support of student activities, Mt. Allison University, Sackville, NB.

In 2001, Lucie was awarded the Geography Departmental Award for her contribution and achievement during her years of study at Mt. Allison University, Sackville, NB.

PROJECT EXPERIENCE

GIS Data Management/Environmental Analysis

Viewshed Analysis and 3D Rendering, 2008, Sydney, NS (3D Modeling, Cartography, Reporting)
Compilation of proposed port infrastructure for viewshed analysis of surrounding area. Design of 3D rendering and photo montages for land use analysis.

Geodatabase Hazard Assessment, 2008, Canadian Beaufort Sea/Greenland's Disko Bay/Orphan Basin (Data Compilation, Geodatabase Design/Construction, Cartography, Reporting)
Compilation of geologic, geophysical, and environmental datasets for three offshore lease blocks; Beaufort Sea, Orphan Basin, and Disko Bay; Geodatabase development for application in site hazard assessment.

Geodatabase for MARLANT GIS Data, 2006, Newfoundland/Nova Scotia (Geodatabase Construction, Metadata, Reporting)
Compilation of geographic datasets for nearly fifty DND/DCC Sites located across the Maritime Provinces into three Geodatabases (topography, environmental thematic mapping, and aerial photography) with associated metadata and an explanative user guide.

Salt Management Plan – Vulnerable Area Mapping, 2005, Halifax, NS (Model Testing, Reporting, Presentation)
Instructions to guide users through a GIS model developed by Jacques Whitford to identify and rank areas potentially vulnerable to road salt, in accordance with Environment Canada's Code of Practice for the Environmental Management of Road Salts (2004).

*Offshore Unexploded Ordinance Assessment, 2005, Newfoundland/Nova Scotia (Data Acquisition, GIS Cartography, Reporting)
Offshore investigation of reported unexploded ordinance sites and GIS database compilation of all resultant data sets.

*Beaufort Sea Repetitive Ice Scour Mapping Programs, 2004/2003/2001, Canadian Beaufort Sea (Data Acquisition, Interpretation, GIS Cartography, Statistics, Reporting)

Lucie Kendell
GIS Specialist

Analysis of new offshore ice scouring along repetitive survey lines, regional geologic assessment, sediment transport at artificial island sites.

Corridor/Constraint Mapping

Pipeline Route Land Classification Mapping, 2006/07, St. John's, NL (Data Acquisition and Analysis, GIS Cartography)
Ecological land classification mapping using satellite imagery for proposed transmission line route (Labrador).

Gas Pipeline Routing and Constraint Mapping, 2005/06, Ontario & Quebec (Data Acquisition and Analysis, GIS Cartography
Environmental constraint mapping for proposed and/or existing pipeline routes.

*Gros Cacouna LNG Terminal Project, 2004, Quebec, (2D Depth to Bedrock Profiles, Cartography, Reporting)
Bathymetry and geophysical investigation of proposed LNG terminal location.

*Sakhalin Pipeline Ice Scour Project, 2003, Sea of Okhotsk, Russia (Data Acquisition, Interpretation, GIS Cartography, Statistics, Reporting)
Offshore geophysical investigation and GIS mapping of ice scour events within proposed pipeline corridors.

*Boat Harbour Project, 2002, Dartmouth, NS (Data Acquisition, Cartography)
Bathymetry mapping of proposed pipeline corridor.

*Deep Lake Water Cooling Project, 2002, Lake Ontario, ON (Data Acquisition, Cartography, Reporting)
Offshore hazard investigation of proposed pipeline corridor.

SOFTWARE SKILLS

GIS, Drafting, Data Processing – ESRI ArcGIS ArcMap 9.x, ESRI ArcView 3.x, AutoCAD 2007/Map, CARIS 4.4a, Surfer v8, CARIS HIPS v5.3, CODA Playback

Graphics – CorelDRAW v10

Database, Statistics – MS Visual Fox Pro, Grapher v4

Navigation – HyPack Max v2.12a, CODA

EQUIPMENT EXPERIENCE

Navigation – GPS (CSI DGPS Max, CSI DGPS Pro, Assorted Trimble Products)

Marine Surveying – Sidescan Sonar Towfish and Recorder (Klein 100/500kHz, Klein 595, Coda DA100/DA50); Echosounder (Odom Echotrac, Knudsen, Elac); Sonardyne USBL; SG Brown Gyrocompass; TSS Motion Sensor; Topcon Total Station/Level, Marine Magnetics Magnetometer

Sampling – AML Sound Velocimeter; Coastal Ocean CTD; Coastal Ocean Turbidity Meter; VanVeen and Shipek Sediment Grab Samplers; Kammerer and Niskin Water Samplers

ADDITIONAL TRAINING

ArcPAD Workshop – ESRI Canada, 2008

AutoCAD 2007 Essentials Course – CAD/CAM Systems, 2006

Safety Oriented First Aid – St. John's Ambulance, 2006

Learning to Use the Geodatabase – ESRI Canada, 2005

Pleasure Craft Operator Card – FNCC, 2003

PADI Open Water Diver Certification – Torpedo Rays Scuba, 2003

Marine Emergency Duties (MED) A1 – NS Nautical Institute, 2002

Trimble GPS Certification – COGS, 2001

WHMIS & OHS – COGS, 2001; WHMIS Refresher, 2005

** denotes projects completed with other firms*

Chris Shupe

Geomatics/Remote Sensing Analyst

Chris Shupe, Geomatics/Remote Sensing Analyst with Jacques Whitford Limited in Dartmouth, NS, is responsible for preparation, interpretation and analysis of satellite and air photo data to support various disciplines in preparing environmental assessments. He performs land cover identification and land use and disturbance classification to identify the impact of disturbances on the landscape. Before coming to Dartmouth, Chris held the role of senior analyst within Calgary's Geomatics department. As such, he has played a key role in the project planning, spatial analysis and mapping on key projects including Imperial Oil's Mackenzie Gas pipeline, Cold Lake and Kearl Lake SAGD projects and Altalink's Heartland 500kV transmission line project. With over 6 years of experience working in Alberta's Oil and Gas sector and with his strong background and education in both cartography and remote sensing, Chris has also played a significant role in the development and implementation of the company's cartographic/graphic and quality control standards.

EDUCATION

Adv Diploma, Remote Sensing, Centre of Geographic Sciences (COGS)
Lawrencetown, Nova Scotia 2003

Cartography, Digital Mapping, Centre of Geographic Sciences (COGS)
Lawrencetown, Nova Scotia, 2001

Technical Photography, Algonquin College of Science and Technology
Ottawa, Ontario 1995

PROJECT EXPERIENCE

***GIS Analyst/Data Management (Environmental, Energy, Traditional Knowledge)* (e.g. Sector, Service Type, etc.)**

Mackenzie Gas Project Biophysical Baseline and Environmental Impact Assessment. Imperial Oil Resources Ventures Limited, Northwest Territories, Port Colborne Natural Environment and Human Health Risk Assessments, 2001-2005

Noel Major (Sweet and Sour) Gas Project Terrain and EIA Studies. BP Canada, Dawson Creek, British Columbia, 2006-2007

Kearl Oil Sands Project Environmental Impact Assessment. Imperial Oil Resources Ventures Limited, Fort McMurray, Alberta, 2004-2007

Scotford Upgrader Baseline Study and Environmental Impact Assessment. Shell Canada Limited, Fort Saskatchewan, Alberta, 2005-2007

Proposed Heartland 500Kv Transmission Project. Altalink/EPCOR, Edmonton, Alberta, 2007

Heartland Upgrader Baseline Study and Environmental Impact Assessment. Value Creation, BA Energy Inc., Fort Saskatchewan, Alberta, 2004

Shell Caroline Wildlife Survey and Environmental Management Plan. Shell Canada Limited, Caroline, Alberta, 2004

Bay of Fundy Strategic Environmental Impact Assessment, Offshore Energy Environmental Research Association, Nova Scotia, Canada - 2007

Highway 101 Twinning, Nova Scotia Department of Transportation and Infrastructure Renewal, Windsor, Nova Scotia - 2007

Lower Churchill HVDC ELC Classification. Newfoundland Hydro, Newfoundland and Labrador, 2007 - 2008

** denotes projects completed with other firms*

Dr. Ian A. McLaren, M.Sc., Ph.D.

Dr. Ian A. McLaren, M.Sc., Ph.D., is a Professor Emeritus in the Department of Biology at Dalhousie University, where he has a broad interests in natural history, has done extensive research and writing on birds, and recently assisted with statistical analyses of potential impacts of wind turbines on birds. He has an extensive history of scientific involvement on potential impacts of the oil and gas industry and other developments in the Atlantic region including as scientific advisor to federal and/or provincial panels reviewing environmental assessments of the Confederation Bridge, and the Venture, Hibernia and Cohasset/Panuke projects. He was an expert witness for the Sable Offshore Energy Project before the Joint Federal/Provincial Panel and member of the Sable Environmental Effects Monitoring Advisory Group. Dr. McLaren has provided statistical analysis on bird surveys for various wind farms in Nova Scotia, including a proposed wind farm in Digby (Cullodon) and another in Antigonish (Glen Dhu). Dr. McLaren is a past President of the Canadian Nature Federation, Nova Scotia Nature Trust and past Chair of the Sable Island Preservation Trust.

Carl Haycock

Mr. Haycock is a long time resident of Westport, Nova Scotia. A fisherman by trade and naturalist by interest, Mr. Haycock is well known as an experienced whale watching and birding guide in the Digby Area. Mr. Haycock was the founder of Brier Island Ocean Studies and established the first whale-watching enterprise there. Mr. Haycock is a member of the Nova Scotia Bird Society and is well respected within the birding community.

NORTH

Q TURBINE No. 19
N 4943280.000
E 266341.000
ELEV 71.025

Q TURBINE No. 17
N 4943299.000
E 267049.000
ELEV 100.875

Q TURBINE No. 12
N 4943048.000
E 266738.000
ELEV 110.880

NO DEVELOPMENT OR ACCESS THROUGH

OLD MOUNTAIN ROAD

EXISTING TOWER

Q TURBINE No. 5
N 4942881.000
E 265820.000
ELEV 68.775

Q TURBINE No. 8
N 4942846.036
E 266496.526
ELEV 102.695

Q TURBINE No. 7
N 4942911.000
E 267037.000
ELEV 133.879

NO DEVELOPMENT OR ACCESS THROUGH UNLESS OWNER AGREES

Q TURBINE No. 1
N 4942653.000
E 266894.000
ELEV 139.675

Q TURBINE No. 20
N 4942485.000
E 265521.000
ELEV 80.635

Q TURBINE No. 11
N 4942443.000
E 265938.000
ELEV 101.215

Q TURBINE No. 10
N 4942314.000
E 266681.000
ELEV 133.625

Q TURBINE No. 15
N 4942260.000
E 265241.000
ELEV 72.975

Q TURBINE No. 6
N 4942081.000
E 266255.000
ELEV 136.935

EXISTING MET TOWER

TRANSMISSION LINE

Q TURBINE No. 4
N 4942194.000
E 266468.000
ELEV 137.385

NO DEVELOPMENT

Q TURBINE No. 3
N 4942108.000
E 265550.000
ELEV 98.875

Q TURBINE No. 16
N 4941945.000
E 265094.000
ELEV. 93.175

Q TURBINE No. 14
N 4941953.000
E 266043.000
ELEV 133.575

Q TURBINE No. 9
N 4941807.000
E 265841.000
ELEV 127.792

Q TURBINE No. 18
N 4941681.000
E 265214.000
ELEV 114.495

Q TURBINE No. 2
N 4941643.000
E 265641.000
ELEV 134.577

Q SUBSTATION
N 4941678.107
E 266124.179
ELEV 119.000

Q TURBINE No. 13
N 4941501.000
E 265415.000
ELEV 128.539

EXISTING MET TOWER

GULLIVER'S COVE RD

HAIGHT BROOK

ROBICHEAU ROAD

HIGHWAY 217

ROSSWAY

No.	Description	Date	By
E	REV'D LOCATION TURBINE 8	MAR 17/10	RO'C
D	ADDED 25M WETLAND BUFFER	MAR 01/10	RO'C
C	ADDED SUBSTATION COORD'S	FEB 16/10	RO'C
B	GENERAL REVISION	FEB 10/10	RO'C
A	ISSUED FOR EA SUBMISSION	JAN 29/10	RO'C

Revision or Issue

3240384
NOVA SCOTIA
LIMITED

DIGBY WIND
POWER PROJECT

SITE PLAN

CBCL LIMITED
Consulting Engineers
ISO 9001 CERTIFIED

Scale
1:6000

Date JAN 2010	Drawn BG
Designed JH	Checked RO'C
Approved	
Contract No. 090630.04	Revision E
Drawing No. EA1	

DRAWING: L:\090630.04\14 Civil\090630 EA1.dwg LAYOUT: EA1 DATE: 17 Mar, 2010-10:43am

Environmental Protection Plan R1

Digby Wind Power Project

March 5, 2010

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Acronyms

CWS	Canada Wildlife Service
EPP	Environmental Protection Plan
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Department of the Environment
Nova Scotia Power Inc.	
WHMIS	Workplace Hazardous Materials Information System

Chapter 1 Introduction

1.1 Scope and Purpose

The scope and purpose of this document is to describe the protective measures and plans to be implemented by Nova Scotia Power Inc. and its contractors to ensure the safe and responsible environmental protection of human and ecological receptors during the construction phase of this project. The environmental risks and activities will vary during construction; with adherence to this Environmental Protection Plan (EPP), however, potential adverse environmental impacts will be mitigated.

When appropriate, the Environmental Protection Plan will be amended to address the operation and decommissioning phases of the project. Currently, these phases are still under development.

1.2 Responsibility

The Digby Wind Power Project's Approval is subject to conditions which will need to be met during the construction phase. In turn, these requirements are reflected in the Environmental Protection Plan (EPP). It is the responsibility of Nova Scotia Power Inc. and their Contractor(s) to ensure that these environmental commitments are carried out. Nova Scotia Power Inc. is responsible to advise the Contractor(s) on protection measures and ensure that environmental responsibilities are adhered to. The contractor(s) have the responsibility to install, maintain and monitor control measures in place until the completion of the contract.

In addition to the Environmental Assessment Approval conditions, Nova Scotia Power Inc. has an Environmental Policy that states, amongst other commitments, to *consider pollution prevention its first option, in preference to control or clean-up where economical, feasible, practical and achievable*. Nova Scotia Power Inc. requires all employees and contractors to carry out the environmental responsibility of their jobs.

Chapter 2 Construction Phase

A variety of activities will be occurring simultaneously during the construction of the Digby Wind Power Project; diligent practice of environmental best practices employed by Nova Scotia Power Inc. will prevent adverse environmental impacts on the surrounding habitat. Of primary importance is the implementation of the necessary erosion and sedimentation control techniques in all areas where there is exposed soil and a potential for erosion. This EPP, will be kept on site at all times, and all individuals conducting work on this project will be trained regarding the environmental requirements. This document was developed to ensure conditions are monitored and controlled to protect those employed on site, the public and the environment.

The general site works consist of the construction of access roads, preparation of lay-down areas and preparation of the wind turbine sites. The work generally includes, but is not limited to:

- The installation of sediment control measures,
- Tree clearing and grubbing,
- The disposal of debris,
- Excavation and filling for roads and pads,
- The installation of culverts,
- Ditching and the storage of borrow materials,
- The storage of turbines and associated equipment,
- Erection of the turbines and associated equipment, and
- Site preparation for operational phase.

After that point in time the Project is considered “Operational” and will be treated as such. An addendum to the EPP, regarding operational environmental protection measures, will be submitted to NSE prior to the Operations Phase of the project to address site impact prevention.

The Site Plan is attached as Appendix A to this document and shows the locations of the turbines, pads and access roads.

2.1 Limits of Construction

- All work will begin after this Environmental Protection Plan has been approved by Nova Scotia Environment;
- All contractor operations will be limited to those areas outlined in construction drawings and detailed by the Project Manager (or designate);
- The Project Manager will be on site during the clearing and construction phases of the project and will be responsible for contractors. Additionally, the responsibility of community complaint response will also be assigned to this person.
    - Project Manager (On Site) - Glen Smith; 902-221-1916

- Clearing will begin only after the limits of clearing operations have been established and agreed upon by the Project Manager (or designate);
- No clearing or construction shall begin until the wetland areas including buffers are delineated to the satisfaction of the Project Manager (or designate); and
- Do not disturb, cut down or damage trees or vegetation outside the limits of the established clearing area, with the exception of those that are marked unsafe.

2.2 On-Site Administration Facilitates

- An area will be designated for construction trailers, vehicles and equipment;
- Washroom and toilet facilitates will be provided for on-site personnel;
- The maintenance and removal of waste water and refuse/debris will be provided under contract to a Contractor specializing in this work (appropriate containers will be provided); and
- There will be an area designated for a lay down area which will be used to temporarily store such items as reels of cable and other materials needed for the Project.

2.3 Site Management.

Buffer zones are required to ensure that potentially environmentally sensitive habitat is protected from impacts of the Project. To further protect habitat during the execution of the project activities, Nova Scotia Power Inc. will ensure that steps are taken to manage erosion and sedimentation.

- Buffer zones of 30 m will be maintained between the Project site and potentially environmentally sensitive habitat, i.e., any project related disturbed area, and wetlands, water courses, vegetation, etc.;
- If the 30m buffer cannot be adhered to then mitigation plans will be developed and implemented to ensure that a consistent low risk to impact habitat is maintained; or
- If a low risk to impact habitat cannot be maintained then the Project works will be modified or moved, failing this option;
- Nova Scotia Power Inc. will contact NSE and negotiate permission to alter a wetland, cross a water course, etc. per existing regulations.

2.4 Clearing, Grubbing and Disposal of Vegetation

The primary concern during clearing is to prevent ground disturbance that may result in the sedimentation of water courses and wetlands. To this end:

- Clearing, grubbing, and dispose of vegetation and other debris will be conducted per contract specifications;
- Clearing specifications may vary between Project areas based on land owner demands, but, in general, clearing involves the cutting of trees, piling of merchantable timber and the chipping of all non-salvageable material such as brush, slashings, limbs, fallen branches and other surface brush;
- There is to be no trees felled in a watercourse or wetland.

- Site inspect with the Project Manager (or designate) and the Contractor(s) to verify any items to remain;
- Before the beginning of clearing operations, contractors must review with the Project Manager (or designate) the limits, which are also indicated on the site drawings;
- No clearing shall begin until wetlands and associated buffers have been appropriately delineated;
- Prevent damage to the wetlands, trees, surface watercourses, natural features and the root systems and/or branches of trees located outside the designated areas, with the exception of those trees that are marked unsafe;
- Area(s) must be cleared as directed by Project Manager (or designate), e.g., the height of stumps left from clearing operations to be not more than 300 mm above ground surface;
- Grub out stumps, roots, embedded logs, humus, organic and other objectionable material to not less than 200 mm below ground surface;
- Grub out visible rock fragments and boulders greater than 300 mm in greatest dimension, but less than 0.25 m^3;
- Cleared vegetation and grubbing piles may result in disposal offsite at a proper land fill site as approved by the Owner;
- Leave ground surface in a condition suitable for immediate grading operations subject to the approval of the Project Manager (or designate); and
- Existing drainage ditches or natural watercourses will not be obstructed, unless appropriate permits are approved.

2.5 Disposal Off-Site

- Dispose of all concrete waste and packaging materials at an off-site facility as approved by the Project Manager (or designate).
- Surplus material such as overburden, vegetation debris and approved embankment material, etc., not required for placement in fills, and material unsuitable for grading or landscaping, will depend on land owner agreements, but may result in offsite disposal.
- Recyclable materials and materials banned from landfills, i.e., paper, cardboard, drink containers, wood, scrap steel, paint, etc. will be collected separately for recycling;
- There will be no burning of wastes on site;
- Domestic waste, including food waste, shall be gathered daily and stored in closed steel containers for removal and disposal at an approved waste disposal site (container type and disposal frequency will be such as to support vector management);
- Non-recyclable non-hazardous construction wastes shall be removed from site on an as required basis for disposal at an approved waste disposal site; and
- Hazardous materials will follow NS Provincial disposal requirements.

2.6 Erosion and Sedimentation Control

The following section outlines the guiding principles and provides some specifics on the requirements of a site specific Erosion and Sediment Control Plan (ESCP). The ESCP may be refined by the selected earthworks contractor with input from Nova Scotia Power Inc. and the guiding principles adopted from the NSE Erosion and Sediment Control Handbook for Construction Sites. Changes to this plan may require approval by NSE.

The earthworks contractor will be selected based on various criteria, one of which is environmental performance. Nova Scotia Power Inc. will ensure the contractor complies with Nova Scotia Power Inc. best management practices for the prevention and control of erosion and sedimentation. Nova Scotia Power Inc. will have an on-site Construction Supervisor who will provide appropriate oversight of all earthworks to assure that environmental, health and safety standards are met.

All erosion and sediment control (ESC) measures will be in place prior to site disturbance, maintained during project activities and left in place until the disturbed area is stabilized. The main objectives of the ESCP are to minimize the amount of exposed soil and the time of exposure as well as to mitigate impacts on water sources by keeping sediment on-site. The main receptors of concern are wetlands and watercourses.

2.6.1 Guiding Principles

The following ESC principles are minimum requirements taken from Nova Scotia Power Inc. best management practices:

i) Steep slopes, erodible soils, watercourses, wet areas and other areas of high erosion potential are to be avoided, where possible and practical;

ii) The amount and exposure time of fine soils will be minimized where possible by minimizing grubbing, timing of construction to avoid wet periods, and staging construction schedules. Examples include:

- Both temporary and permanent control measures for erosion and sedimentation will be implemented in an appropriate timeframe;
- Grades will be minimized during construction. Unprotected slopes should be stabilized by gravel or geotextile fabric (or other appropriate materials); and
- Hydroseeding, gravelling, or equivalent mitigation of unprotected cut and fill slopes, spoil areas and topsoil stockpiles will take place as soon as possible;

iii) Use responsible travel practices on access roads, thereby reducing habitat damage and soil loss;

iv) Ensure culverts are kept in good working shape and use erosion protection at storm drain outlets;

v) Control run-off and prevent sediment from leaving the site as follows:

- The placement of the erosion protection material will be carried out by starting at the upstream end of the watercourse and progressing down stream.
- The material used for erosion protection material will be clean, durable, non-ore bearing, non-toxic and obtained from a non-watercourse source.

- Prior to placement of erosion protection materials, banks will be graded to a uniform slope not exceeding 2:1.
- Erosion materials shall be placed immediately flowing preparation of the bank.
- Stabilize and protect loose or eroding materials with mechanical techniques, such as grading exposed faces, installing brush matting or rip-rap or applying filter fabrics; and
- Intercept silt-laden water from access roads or excavation dewatering, and at the base of lower slopes use slash or straw, or construct sediment traps, or take-off/drainage diversion ditches to channel drainage to sedimentation ponds or filtering systems. For nearstream work, silt curtains or booms may be required;

vi) Maintain and monitor erosion control measures regularly* until a stable condition is achieved by:

- All erosion protection works must be installed and maintained in isolation of the streamflow and must not encroach upon the channel beyond the thickness of the largest material required (based on velocity of the watercourse).
- Ensuring that sediment control structures are in working order at all times; and
- Inspecting sediment control structures for integrity after any significant rainfall occurs and correct any damaged devices immediately.

*Note: Under normal conditions, the control measures should be checked on a predetermined basis, e.g., twice daily, to make certain that nothing has come loose or that no debris is caught that may affect the efficiency of the control measures.

If compliance issues arise or items of concern are identified during construction, the Nova Scotia Environment (NSE) Regional Office will be contacted as soon as possible after discovery. Nova Scotia Power Inc. will provide a root cause analysis for quantifying the extent of the problem and provide a corrective action plan with the intended actions to eliminate or manage its potential consequences to the environment or human health. Where necessary, construction will be halted until a plan of action is agreed to with NSE.

2.6.2 Sediment Barriers Including Silt Fencing

Sediment barriers are used as a temporary perimeter control to intercept sediment-laden runoff as it leaves the construction area. The barrier will slow flow and allow sediment to settle out before it enters a ditch or watercourse. Fine grained sediment is trapped, while storm runoff may pass through at a slower rate. The most commonly used barrier is the silt fence barrier.

- Silt fencing is to be installed correctly as specified by the manufacturer and as directed by the Project Manager (or designate). It will be the joint responsibility of the Contractor and the Site Inspector to ensure that it is erected correctly and functioning properly;
- Silt fencing is to be installed in areas where erosion or sediment travel is anticipated with special consideration given to steep gradients and sensitive receptors such as wetlands and watercourses;
- Silt fencing will be installed prior to any grubbing work and construction;

- Fencing that has fallen or has been damaged will be repaired immediately;
- Accumulated sediment will be cleaned out at regular intervals (to be predetermined during site preparation meetings), and after heavy rain falls; and
- The collected sediment will be held in a covered stockpile, or sent off-site as approved by the Project Manager (or designate).

2.6.3 Location of Stockpile/Excavated Material

- Work will be conducted per the standard grading practices as outlined in the NSE Erosion and Sedimentation Control Handbook for Construction;
- Any topsoil and overburden to be stored on site will be secured with either hay or plastic covering;
- Soils are not to be stored near wetlands nor watercourses (<30 m); and
- Site drainage shall be managed to prevent surface water from eroding stock materials.

2.6.4 Surface Run-Off Measures

- During construction, surface run-off will be directed to sediment control facilities installed and maintained to the requirements of the NSE; and
- Turbine pad slopes in sensitive areas will be covered with straw or equivalent to stabilize and minimize silt laden run-off.

2.6.5 Revegetation

Maintaining vegetation and re-establishing disturbed areas as soon as practical is important. Vegetation intercepts and reduces runoff velocity, filters out sediment, increases infiltration to the soil and holds the soil in place. A revegetation program will therefore be undertaken in those areas disturbed by construction. Revegetation will help restore disturbed areas to a state consistent with the original environment. Areas disturbed during construction will be hydo- seeded or equivalent mitigation employed. The intent of this program is to apply, establish and maintain seed in all areas disturbed by construction. Hydro-seeding will be implemented primarily for bank stabilization and in support of erosion/sediment control methods. Hydro-seeding consists of applying a mixture of seed, fertilizer, mulch, binder and water on areas cleared of vegetation to accommodate construction and to produce a uniform cover of grasses.

- Hydroseed shall be applied, established and maintained in all areas disturbed by construction activities as directed by the Project Manager (or designate);
- All seed mixes proposed for use, shall be approved via their seed analysis, 10 days prior to their application;
- The hydro- seeding schedule is to coincide with preparation of the soil surface; and
- Materials and methods of application to be used for hydro- seeding are outlined in the Specification.

Subsequent to the completion of the wind turbines, the lay-down areas in the vicinity of each of the wind turbine sites will be cleared of any debris. After construction, a small

parking area will be provided at each site; all the remaining areas will be re-vegetated (with the exception of access roads).

2.7 Watercourses

Currently, it is anticipated that 2 (two) water courses will be crossed during the upgrading of Bennett Lane. At this time there have not been any other watercourses identified, however, this will be verified by additional desktop assessments and ground surveys. The following principles will be followed for all watercourse crossings on the property:

- Watercourses and wetlands crossings will be avoided, as practicable.
- Watercourses and wetland crossings will not result in permanent diversion restriction or blockage of natural drainage.
- Crossings will be restricted to a single location and occur at right angles to the watercourse or wetland. Crossings should be located in areas which exhibit a stable soil type and where grades approaching the crossings will not be too steep.
- Temporary spans will be located at a narrow point on the watercourse or wetland.
- The approaches to watercourse crossings will be stabilized with brush mats, where necessary.
- Fording will not be permitted, unless the watercourse is dry, and streambed rutting and bank deterioration cannot occur.
- Stream banks prone to erosion may require additional stabilization. Material used to stabilize/repair stream banks will be clean, non-erodible and will not come from the stream bank or bed.

In every case, where required, an NSE Watercourse Alteration Approval (Water Approval) will be obtained and the NSE Watercourse Alteration Specifications will, at a minimum, be followed.

2.8 Wetlands

Nova Scotia Power Inc. will take a hierarchical approach to wetland conservation with the primary objective of avoidance of wetland habitat. It is known based on assessment work completed to date as part of the EA process that wetlands do exist in the vicinity of some turbines and access roads. Construction will proceed with the primary objective of conserving wetland habitat and a 30m natural buffer surrounding the wetland, to the extent possible. In locations where preservation of a 30m buffer is unattainable, other engineering controls described in Section 2.6 above will be employed to prevent wetland habitat alteration. Based on the knowledge of existing wetlands from the work completed to date, initial tree clearing activities will occur in those areas of the original 14 turbines, whose locations were approved in August 2009. The newly moved turbines locations, per EA addendum submitted February 2010, will be evaluated for wetlands as soon as snow cover allow ecologist access to the site. Once wetland delineation is

completed, clearing in these locations can occur with attention to any mitigation measures required.

Nova Scotia Power Inc. is confident all wetlands can be avoided however, if unforeseen and unavoidable wetland habitat is encountered, NSE will be quickly informed and an application to alter a wetland, if required, will be submitted.

2.9 Blasting (Road Construction)

- Should blasting be necessary for rock excavation, it will be conducted in accordance with Part II of the Construction Safety Regulations of the Nova Scotia Labour and Workforce Development.
- Blasting will be permitted only after securing the approval of the Project Manager (or designate) and only after appropriate permits have been obtained and per the Specification;
- Conduct Blasting operations using only certified personnel;
- Cover rock with effective mats;
- Provide warning to all persons in the vicinity of the work before blasting;
- Repair damage caused by blasting at no additional cost to the contract;
- Regulatory requirements (or otherwise) arising from hauling, storing, handling and use of explosives and for the effects arising from blasting, including vibrations, concussion, flying material, structural damage to adjacent properties will be addressed; and
- Provide seismic monitoring as recommended by the Contractor's insurers.

2.10 Storage and Handling of Hazardous Materials

All necessary steps shall be taken to prevent and minimize the spillage, misplacement or loss of fuels and other hazardous materials. More specifically:

- Hazardous materials will be minimally used during the construction of the wind turbines;
- Hazardous materials may include corrosion and fouling inhibitors, paints, industrial cleaners, lubricating oils and fuels;
- All materials stored on site shall be stored, handled and labeled according to Workplace Hazardous Materials Information System (WHMIS) regulations, as well as any other applicable federal or provincial regulation;
- Vehicles and heavy equipment utilized during project construction will be inspected and maintenance tasks completed, as well as carry appropriately stocked spill response kits to ensure adequate response to a release;
- Any equipment maintenance, e.g., oil changes lubrication, etc., that are necessary will be conducted in a contained area within the laydown area;
- The fuelling and maintenance of mobile vehicles and large equipment will not be permitted within 50 m of wetlands or watercourses;
- Used oil filters, grease cartridges containers and other products associated with equipment maintenance shall be collected and disposed of in accordance with regulatory guidelines; and

- Spills of any such materials will be contained as quickly as possible and reported to the regulatory authorities (Environmental Emergency phone number: 1 (800) 565-1633 or 1 (902) 426-6030). Prompt clean up of contaminated materials will be executed.

2.11 Dust Control

The Contractor shall implement dust control measures as required by the Project Manager (or designate).

- Water or environmentally friendly alternatives such as Ammonium Lignan Sulfonate. shall be used for dust control; and
- Mud and dust shall be removed from paved roads and at access points to the site

2.12 Environmental Training

Environmental training and orientation will be mandatory for Nova Scotia Power Inc. and Contractor staff prior to construction. Training will be coordinated by Nova Scotia Power Inc. Environmental Department, it will include (but not limited to) an overview of the environmental requirements of the Project, the applicable section of the Approval, the Project's mitigation plans (this EPP), environmental legislation, standard practices and procedures, and any area sensitivities (i.e. wetlands, archaeology, etc.). Sessions will be held periodically during the course of the Project, as required.

2.13 Environmental Monitoring

Environmental monitoring programs will be implemented to monitor changes to those ecosystem components deemed to be most at risk during the construction of the turbines. Nova Scotia Power Inc.'s Environmental Team will supervise and/or coordinate all monitoring programs to:

- Ensure that due diligence is being exercised while carrying out project activities;
- Verify the accuracy of environmental assessment predictions;
- Evaluate the effectiveness of proposed mitigation measures to reduce and/or eliminate environmental impacts; and
- Identify the requirements, if necessary, for enhanced mitigation.

An area of concern is surface water drainage, its discharging in to habitat and its potential for environmental impacts. Nova Scotia Power Inc. will ensure the following criteria are implemented and adhered to during the construction phase of the Project.

- Clear Flow (Normal Background Conditions):
    - Maximum increase of 25mg/L from background levels for any short term exposure (< 24 hours)
    - Maximum average increase of 5mg/L from background levels for longer term exposure (24 hours < 30 days)
- High Flow (Spring Freshet and Storm Events);
    - Maximum increase of 25mg/L from background levels at any time when background levels are 25mg/L < 250mg/L

- Shall not increase more than 10% over background levels when background is >250mg/L

Specific forms and record keeping methods will be employed for monitoring and will be kept on file, as appropriate.

Municipality and Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 80.000 FEE 147.00
RECEIPT No _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
№ 7600

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. 00060089
Field Card No. 51945000 (30132088)

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME ALAN A. FOGG
ADDRESS Robichaud Rd. Waterford
POSTAL CODE PHONE

Applicant
NAME 3240384 Nova Scotia LTD
ADDRESS Emera
POSTAL CODE PHONE

Builder
NAME
ADDRESS Same
POSTAL CODE PHONE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW 775 sq Ft
☐ ACCESSORY BUILDING	☐ ADDITION
☑ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☐ OTHER	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Steel building on Engineered Slab
Plans on File

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

Ken Comeau — Feb 15, 2010
OWNER OR AUTHORIZED AGENT — DATE

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Ken Comeau
Construction Supervisor

BUILDING PERMIT ISSUED

Feb 15. 2010 — Alfred Comeau
DATE — INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE — INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 450,000 FEE 652.50
RECEIPT No. _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
№ 7379

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30132088
Field Card No. _____

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME Alan A. Fogg
ADDRESS Robichaud Rd. Waterford
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above
POSTAL CODE PHONE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Plans on File
3 units

All Work to NRC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☑ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
Alfred Lovett — INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE _____ INSPECTOR _____

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 150,000 FEE 262.50
RECEIPT No. _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
№ 7384

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30132732
Field Card No. _____

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME PC FuTures LTD
ADDRESS Gulliver's Cove Rd.
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above
POSTAL CODE PHONE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Engineered Plans on File
1 UNIT
ALL Work to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE: Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
Alfred Power — INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE _____ INSPECTOR _____

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 600,000 FEE 1,050.00
RECEIPT No. _____

DOCUMENTS SUPPLIED
COPY OF DEED ☐ SITE PLAN ☐
BLDG. PLANS ☐ SURVEY PLAN ☐
SPECIFICATIONS ☐ CONTOUR PLAN ☐

BLDG. PER. APPLIC.
№ 7383

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30132815
Field Card No. 04737601 51988000

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME James & Beverly Bennett
ADDRESS 9907 Highway 217 Rossway
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine 4 unit	

IF COMMERCIAL COMPLETE THIS SECTION Jan 2F09

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Engineered Plans on File
4 UNITS PH 608 Revised Plan
All work to NBC-05

FOUNDATION
FOOTINGS: ☐ CONCRETE / SIZE; ☐ OTHER; DESCRIBE OTHER
WALLS: ☐ CONCRETE, THICKNESS, HEIGHT; ☐ BLOCK, SIZE, BELOW GRADE

FRAMING
BEAMS: ☐ WOOD, SIZE; ☐ STEEL, SIZE
COLUMN: ☐ WOOD; ☐ STEEL; SPACING
JOISTS: 1st FLOOR SIZE SPACING SPAN; 2nd FLOOR SIZE SPACING SPAN
STUDS: EXTERIOR SPACING; INTERIOR SPACING
ROOF SYSTEM: ☐ RAFTER SIZE, ☐ LENGTH; ☐ TRUSS BUILDER / DESIGNER
SHEATHING: FLOOR, ROOF, WALLS

FINISH
EXTERIOR WALL | INTERIOR
AIR BARRIER | VAPOUR BARRIER
INSULATION

BUILDING SERVICES
ELECTRICIAN | PLUMBER
HEATING, TYPE | CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL | APPROVED DATE
WATER SUPPLY ☐ DUG ☑ DRILLED ☐ MUNICIPAL | INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

x _____ x Feb 19, 2009
OWNER OR AUTHORIZED AGENT DATE

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 Alfred Doucet
DATE INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 300,000 FEE 525.00
RECEIPT No. _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
№ 7377

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. / PID: 30167761
Field Card No. 09268936 51939000

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME Linda & Larry Lewis
ADDRESS 185 Robichaud Rd Waterford
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above
POSTAL CODE PHONE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine 3 unit	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Engineered Plans on File
3 UNITS ON
ALL Work to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

* _____ * Feb 19, 2009
OWNER OR AUTHORIZED AGENT DATE

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 Alfred Jones
DATE INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 150,000 FEE 262.50
RECEIPT No. _____

DOCUMENTS SUPPLIED
COPY OF DEED ☐ SITE PLAN ☐
BLDG. PLANS ☐ SURVEY PLAN ☐
SPECIFICATIONS ☐ CONTOUR PLAN ☐

BLDG. PER. APPLIC.
№ 7384

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30132732
Field Card No. 00581895 52026000

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME PC FuTures LTD
ADDRESS Gulliver's Cove Rd.
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine Two Units	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Engineered Plans on File
2 UNIT PD. See Revised Plan.
ALL Work to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
Alfred Power — INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE — INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby
P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 150,000 FEE 262.50
RECEIPT No. _____

DOCUMENTS SUPPLIED
COPY OF DEED ☐ SITE PLAN ☐
BLDG. PLANS ☐ SURVEY PLAN ☐
SPECIFICATIONS ☐ CONTOUR PLAN ☐

BLDG. PER. APPLIC.
№ 7381

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30133011
Field Card No. D5088976 51968000

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME Chester Fogg & Marie Fogg
ADDRESS Highway 217 Rossway
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above
POSTAL CODE PHONE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine 2 units	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Plans on File
2 units as See Revised Plan
All work to NBC-05

FOUNDATION
FOOTINGS: ☐ CONCRETE / SIZE ☐ OTHER — DESCRIBE OTHER
ALLS: ☐ CONCRETE ☐ BLOCK — THICKNESS — SIZE — HEIGHT — BELOW GRADE

FRAMING
EAMS: ☐ WOOD ☐ STEEL — SIZE — COLUMN ☐ WOOD ☐ STEEL — SPACING
JOISTS: 1st FLOOR — SIZE — SPACING — SPAN; 2nd FLOOR — SIZE — SPACING — SPAN
STUDS: EXTERIOR — SPACING; INTERIOR — SPACING
ROOF SYSTEM: ☐ RAFTER SIZE ☐ LENGTH; ☐ TRUSS BUILDER / DESIGNER
SHEATHING: FLOOR — ROOF — WALLS

FINISH
EXTERIOR WALL — INTERIOR
AIR BARRIER — VAPOUR BARRIER
INSULATION

BUILDING SERVICES
ELECTRICIAN — PLUMBER
HEATING TYPE — CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL — APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL — INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE: Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
Alfred Powell — INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE — INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 450,000 FEE 652.50
RECEIPT No. _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
№ 7379

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30132088
Field Card No. 00060089 51945000

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME ALAN A. Fogg
ADDRESS Robichaud Rd. Waterford
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above
POSTAL CODE PHONE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine Units	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS Jan 28-09
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Plans on File
3 units on See Rousseau Rd
All work to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
Alfred Lovett — INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE _____ INSPECTOR _____

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 150,000 FEE 262.50
RECEIPT No. _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
№ 7381

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30133011
Field Card No. #

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME Chester Fogg & Mage Fogg
ADDRESS Highway 217 Rossway
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above
POSTAL CODE PHONE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Plans on File
1 UNIT
ALL WORK to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

x _____ OWNER OR AUTHORIZED AGENT
x Feb 19, 2009 DATE

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 DATE
Alfred Lovell INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 150,000 FEE 262.50
RECEIPT No. _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
No 7382

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30133029
Field Card No. _____

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME Chester + Marie Fogg
ADDRESS Highway 215 Rossway
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Plans on File
1 Unit

ALL Work To NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE — INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 300,000 FEE 525.00
RECEIPT No. _____

DOCUMENTS SUPPLIED
COPY OF DEED ☐ SITE PLAN ☐
BLDG. PLANS ☐ SURVEY PLAN ☐
SPECIFICATIONS ☐ CONTOUR PLAN ☐

BLDG. PER. APPLIC.
№ 7377

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30167761
Field Card No. _____

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME Linda & Larry Lewis
ADDRESS 185 Robichaud Rd Waterford
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above
POSTAL CODE PHONE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Engineered Plans on File
2 UNITS

ALL Work to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
ALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

EAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE: Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby
P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 150,000 FEE 262.50
RECEIPT No. _____

DOCUMENTS SUPPLIED
COPY OF DEED ☐ SITE PLAN ☐
BLDG. PLANS ☐ SURVEY PLAN ☐
SPECIFICATIONS ☐ CONTOUR PLAN ☐

BLDG. PER. APPLIC.
No 7378

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30167829
Field Card No. _____

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME Alan A. Fogg
ADDRESS Robichaud Rd. Waterford
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above
POSTAL CODE

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Engineered Plans on File
1 UNIT
All Work to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

× _____ × Feb 19, 2009
OWNER OR AUTHORIZED AGENT DATE

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

_____
Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 _____
DATE INSPECTOR

OCCUPANCY PERMIT ISSUED

_____ _____
DATE INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 150,000 FEE 262.50
RECEIPT No. _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
Nº 7386

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30168538
Field Card No. _____

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME Linda Lewis
ADDRESS 607 Gullivers Cove Rd
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind turbine	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Plans on File
1 UNIT

ALL Work to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE: Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
Alfred Lovett — INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE _____ INSPECTOR _____

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

Municipality And Town of Digby

P.O. Box 429, Digby, N.S. B0V 1A0 Phone: 245-6776

DATE REC'D _____ BY _____
EST. VALUE 150,000 FEE 262.50
RECEIPT No. _____

DOCUMENTS SUPPLIED

COPY OF DEED	☐	SITE PLAN	☐
BLDG. PLANS	☐	SURVEY PLAN	☐
SPECIFICATIONS	☐	CONTOUR PLAN	☐

BLDG. PER. APPLIC.
№ 7385

APPLICATION FOR

☑ BUILDING PERMIT ☐ DEMOLITION ☐ OCCUPANCY PERMIT

Property No. PID: 30168587
Field Card No. _____

PLEASE PRINT CLEARLY AND PRESS FIRMLY, YOU ARE MAKING COPIES

Owner
NAME PC Futures LTD
ADDRESS Gullver's Cove Rd
POSTAL CODE PHONE

Applicant
Scotian Windfields Partners Corp.
250 Yonge Street. Toronto

Builder
Same as above

USE	TYPE OF CONSTRUCTION
☐ SINGLE FAMILY DWELLING	☑ NEW
☐ ACCESSORY BUILDING	☐ ADDITION
☐ COMMERCIAL BUILDING	☐ REPAIR / ALTER
☐ FARM BUILDING	☐ RELOCATE
☐ GARAGE SERVING DWELLING	☐ DEMOLISH
☐ STORAGE SHED	
☑ OTHER Wind Turbine	

IF COMMERCIAL COMPLETE THIS SECTION

☐ RESIDENTIAL	NO. OF UNITS
☐ RETAIL	NO. OF UNITS
☐ PERSONAL SERVICES	NO. OF UNITS
☐ INDUSTRIAL	

PLEASE DESCRIBE USE
Plans on File
1 UNIT

ALL Work to NBC-05

FOUNDATION

FOOTINGS	☐ CONCRETE / SIZE		DESCRIBE OTHER
	☐ OTHER		
WALLS	☐ CONCRETE	THICKNESS	HEIGHT
	☐ BLOCK	SIZE	BELOW GRADE

FRAMING

BEAMS	☐ WOOD	SIZE	COLUMN	☐ WOOD	SPACING
	☐ STEEL	SIZE		☐ STEEL	
JOISTS	1st FLOOR	SIZE	SPACING		SPAN
	2nd FLOOR	SIZE	SPACING		SPAN
STUDS	EXTERIOR	SPACING			
	INTERIOR	SPACING			
ROOF SYSTEM	☐ RAFTER SIZE	☐ LENGTH			
	☐ TRUSS BUILDER / DESIGNER				
SHEATHING	FLOOR	ROOF	WALLS		

FINISH

EXTERIOR WALL	INTERIOR
AIR BARRIER	VAPOUR BARRIER
INSULATION	

BUILDING SERVICES

ELECTRICIAN	PLUMBER
HEATING, TYPE	CONTRACTOR
SEPTIC SYSTEM ☐ ON SITE ☐ MUNICIPAL	APPROVED DATE
WATER SUPPLY ☐ DUG ☐ DRILLED ☐ MUNICIPAL	INSTALLER

COMPLETE LOCATION INFORMATION ON BACK COVER

OWNER OR AUTHORIZED AGENT — DATE: Feb 19, 2009

Inspector - check block if information is sufficient

MANDATORY INSPECTIONS

I hereby acknowledge the mandatory inspections as listed below and as construction supervisor for this project agree to arrange for inspection at specified intervals. I acknowledge the penalties, as outlined in the Building Code Act and the Regulations pursuant to the Act, for failure to comply.

1) Footings prior to forming up of walls
2) Foundation prior to backfill
3) Framing after completion
4) Vapour barrier prior to finish
5) Occupancy prior to using building

Construction Supervisor

BUILDING PERMIT ISSUED

Feb 16, 2009 — DATE
INSPECTOR

OCCUPANCY PERMIT ISSUED

DATE — INSPECTOR

WHITE - APPLICATION YELLOW - PERMIT PINK - ASSESSOR'S BUFF - WORKSHEET

THOMAS, JOSEPH

From: Hubert Vroom [hvroom@municipality.digby.ns.ca]
Sent: Thursday, January 28, 2010 10:14 AM
To: THOMAS, JOSEPH
Subject: RE: Digby Wind Power Project - Renewed Building Permits

Your permits have been kept active, we do not reissue new permits simply add a note to the file. It is our practice to , when requested, keep them active for a six month period, that is why I asked for a start up date. The municipality is in favour of this project and we will do all we can. We are telling the public that the permit have been issued and are active.
Thank You
Hubert

From: THOMAS, JOSEPH [mailto:Joe.Thomas@emera.com]
Sent: January-27-10 12:29 PM
To: Hubert Vroom
Subject: FW: Digby Wind Power Project - Renewed Building Permits

Mr Vroom,

I know that you are very busy, so I'll be brief.

1. Please respond via e-mail and confirm that the building permits in question have been renewed for a further year until February 2011.
2. Would it also be possible to get copies of the renewed permits ? If scanning and sending pdfs, please send to me. If faxing please fax to 902-428-6112 attn Suzanne Dillabough for Dan Muldoon.

Thanks in advance for your cooperation and assistance.

Joseph X Thomas, P. Eng
Technical Consultant
Office: 404-1773

From: THOMAS, JOSEPH
Sent: Tuesday, January 26, 2010 8:20 AM
To: 'Hubert Vroom'
Subject: RE: Digby Wind Power Project - Building Permits

Mr Vroom,

Thank you for talking to me this morning and the attached e-mail.

Is it also accurate to state that all the building permits have been renewed and are now valid until mid February 2011 ?

Joseph X Thomas, P. Eng
Technical Consultant
902-428-6256

From: Hubert Vroom [mailto:hvroom@municipality.digby.ns.ca]
Sent: Tuesday, January 26, 2010 8:15 AM
To: THOMAS, JOSEPH

Subject: RE: Digby Wind Power Project - Building Permits

Good Morning;

Please be advised that the name of the owner has been changes to "3240384 Nova Scotia Limited " and the contact person is now listed as Dan P. Muldoon, General Manager, Engineering and Construction, Emera Inc. With the address listed as 1894 Barrington St.,Barrington Tower,Halifax, Nova Scotia.

Thank you,
Yours in building safety
Hubert

From: THOMAS, JOSEPH [mailto:Joe.Thomas@emera.com]
Sent: January-18-10 11:07 AM
To: Hubert Vroom
Subject: Digby Wind Power Project - Building Permits

Mr Vroom,

Thank you for talking with me this morning.

As discussed, Emera has taken over Skypower's assets and would like to renew the attached building permits which are due to expire mid February, 2010.
Work is expected to start on this project mid March, 2010. As the work progresses, if there are any changes required, we will be in touch with your department.

Please contact me if you have any questions. Attached below is the contact information for the individual in overall charge of this project.

Please let me know as soon as you can whether you have all the information that you require to process this request.

Regards

Joseph X Thomas, P. Eng
Emera Technical Consultant

Phone 902-404-1773
Cell 902-460-8230

A wholly owned subsidiary of Emera Inc., 3240384 Nova Scotia Limited, purchased all of Skypower's assets and rights in the Digby Wind Farm on December 23, 2009. Emera is now proceeding with its interests in the project through 3240384 Nova Scotia Limited.

The person within Emera responsible for the Digby Wind Farm is as follows:

Dan P. Muldoon
General Manager, Engineering and Construction
Emera Inc.
1894 Barrington St.
Barrington Tower
Halifax, Nova Scotia

Phone 902-428-6314
Cell 902-233-1976
e-mail dan.muldoon@emera.com

From: Stephane Desdunes [mailto:StephaneD@interwind.ca]
Sent: Tuesday, January 12, 2010 12:41 PM
To: MULDOON, DAN
Cc: Marc McClean; David Bacon
Subject: FW: Digby Wind Power Project - Building Permits

Hi Dan,

Just wanted to forward this email from Hubert Vroom about the building permits which will expire around February 16th 2010. To renew the permits, they require a start up date for the project. His email address is hvroom@municipality.digby.ns.ca and he can be reached at 902-245-6776.

Stephane Desdunes
Eastern Region, Project Director
Interwind Corp. (formerly SkyPower Corp.)
Phone: (416) 979-4625 x.2407
Fax: (416) 981-8686
Cell: (647) 502-9541

From: Hubert Vroom [mailto:hvroom@municipality.digby.ns.ca]
Sent: Monday, January 04, 2010 8:03 AM
To: Scott Oldewening
Subject: RE: Digby Wind Power Project - Building Permits

Hello Scott;
Thank you for your letter and request to renew your permits with a name change. Can you provide a start up date for the prioject?
Thanks
Hubert

From: Scott Oldewening [mailto:ScottO@skypower.com]
Sent: December-21-09 2:51 PM
To: Hubert Vroom
Subject: RE: Digby Wind Power Project - Building Permits

Hi Hubert,

I just wanted to follow up with you on this request (I just left you a voice message at the Building Department as well). Do you have any questions for us?
I'm sorry to pester you about this, but there is some urgency on this for us – and we are hoping that this won't have to wait until after Christmas!
Thanks for your attention on this.

Scott Oldewening
Manager of Permitting & Planning and In-House Counsel
Interwind Corp. (formerly SkyPower Corp.)
Phone: (416) 979-4625 x.2828
Fax: (416) 981-8686
Cell: (647) 449-6100
scotto@skypower.com

From: Marc McClean
Sent: Wednesday, December 16, 2009 1:46 PM
To: hvroom@municipality.digby.ns.ca
Cc: Scott Oldewening; Cory Basil
Subject: Digby Wind Power Project - Building Permits

Hi Hubert,

I understand you have been dealing with Scott Oldewening, our Permits Manager, concerning the building permits for the Digby Wind Power Project, including discussing requirements to transfer the permits to another entity because Intewind Corp. (SkyPower Corp. recently changed it name to Interwind Corp.) is in the process of selling its project assets. Scott is away today ill, so I am emailing you in his absence.

Attached find a letter seeking renewal of the project's building permits for an additional year and a request to transfer the 'applicant' information for the permits from Interwind Corp. (Skypower Corp. recently changed its name to Interwind Corp.) to the purchaser of the project assets, 3240384 Nova Scotia Limited, conditional on the closing of the transaction, as detailed in the letter.

If you have any questions, please do not hesitate to contact me or Scott.

Regards, Marc

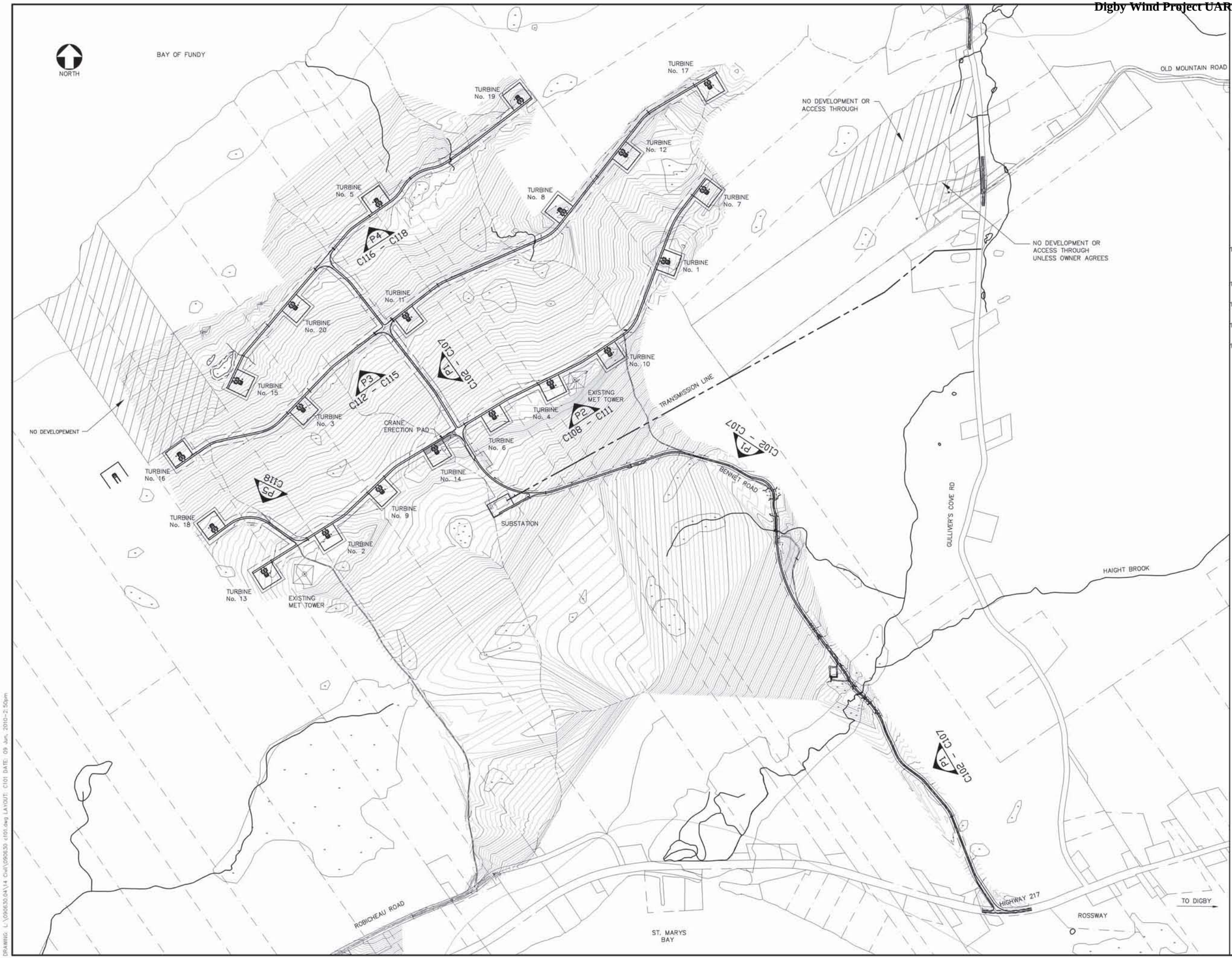
Marc McClean
General Counsel
Interwind Corp.
250 Yonge Street, Suite 1602
Toronto, ON M5B 2L7
Direct: 416.363.4136
Fax: 416.981.8686
marcm@skypower.com

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containing high risk attachments like ZIP, EXE or others that could contain viruses.
If you have a business need to send such an email, please contact the recipient for instru

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If you have a business need to send such an email, please contact the recipient for instru



GENERAL NOTES

1. TOPOGRAPHIC SURVEY CONDUCTED BY TERRAIN GROUP INC.
2. ALL ELEVATIONS ARE IN METRES TO CANADIAN GEODETIC DATUM.
3. FOR GEOTECHNICAL INFORMATION SEE REPORT BY STRUM ENVIRONMENTAL (PROJECT No. 09-3280) DATED MAY 2009.
4. PLACE EROSION AND SEDIMENT CONTROL DEVICES BEFORE COMMENCEMENT OF WORK.
5. CONTRACTOR RESPONSIBLE TO ENSURE THAT ALL CULVERTS WILL HANDLE HS20 LOADING CONDITIONS.
6. CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF ALL GRUBBINGS INCLUDING TOPSOIL AND STUMPS. CONTRACTOR TO NEGOTIATE LOCATIONS FOR DISPOSAL WITH LANDOWNERS.
7. ALL ROADS TO BE CONSTRUCTED TO HS20 LOADING REQUIREMENTS. ALL CRANE ROADS AND PADS TO HAVE A MINIMUM SOIL BEARING CAPACITY OF 6 KSF
8. CONTRACTOR TO OBTAIN ALL NECESSARY PERMITS REQ'D TO PERFORM WORK AND TO COMPLY WITH ALL PERMIT REQUIREMENTS AND CONDITIONS.
9. THE CONTRACTOR CONFIRM ALL EXISTING DIMENSIONS, ELEVATIONS AND LOCATIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER.
10. THE CONTRACTOR SHALL CHECK AND VERIFY ALL PROPOSED DIMENSIONS BEFORE PROCEEDING WITH CONSTRUCTION. ANY ADJUSTMENTS WILL BE MADE BY THE ENGINEER AS NECESSARY.
11. CONTRACTOR IS RESPONSIBLE FOR SETTING GRADES AND LAYOUT CONTROL.
12. CONTRACTOR TO COMPLY WITH ALL APPLICABLE ENVIRONMENTAL REGULATIONS.
13. AT COMPLETION OF WORK REINSTATE ALL DISTURBED SURFACES TO THE SATISFACTION OF THE ENGINEER.
14. A DIGITAL DRAWING OF THE SITE WILL BE PROVIDED TO THE CONTRACTOR FOR LAYOUT AFTER THE PROJECT IS AWARDED.

LIMIT OF CLEARING:

TRANSMISSION ROW = 20.000m (66')

TRUCK ACCESS ROW = 20.000m (66')

CRANE ACCESS ROW = 38.100m (125')

TURBINE SITES = 99.3mx63.5m

SUBSTATION = 81.5mx38.8m

No.	Description	Date	By
3	RELOCATED POWER POLES	MAY 25/10	RO'C
2	ISSUED FOR CONSTRUCTION	MAY 3/10	RO'C
1	RE-ISSUED FOR TENDER	APR 13/10	RO'C
0	ISSUED FOR TENDER	FEB 23/10	RO'C
A	ISSUED FOR 90% REVIEW	FEB 19/10	RO'C

Revision or Issue

Emera Utility Services

DIGBY WIND FARM PROJECT

CIVIL
SITE PLAN

CBCL LIMITED
Consulting Engineers
ISO 9001 CERTIFIED

Scale
1: 6000

REGISTERED PROFESSIONAL ENGINEER
FEB 23/10
J. F. HENMAN
2735
PROVINCE OF NOVA SCOTIA

Date	Drawn
FEB 2010	BG
Designed: JH	Checked: RO'C
Approved: RO'C	
Contract No: 090630.04A	Revision: 3
Drawing No: C101	

DRAWING: L:\090630.04\14 Civil\090630 c101.dwg LAYOUT: C101 DATE: 09 Jun, 2010-2:52pm

REDACTED

Request IR-13:

Reference CONFIDENTIAL Appendix 11, Garrad Hassan Report

(a) Reference page 14 of 99, Section 5.1

(i) Please provide backup used by NSPI to produce the power curve

(ii) The last sentence on page 55 of 99 states that the power curve must be adjusted for differences between site air density and the air density to which the power curve is referenced. Was the air density assumed by the wind turbine manufacturer to derive its power curve the same as that at the Digby site and if not, please provide details on how the required adjustment was performed and by whom?

(iii) Please explain the term "peak power coefficient", how it is computed, and its significance.

(b) Reference page 14 of 99, Section 5.2

(i) Please confirm, or explain why not, the NSPI supplied layout for the wind farm is the latest layout. If not the latest layout, will the new layout have any impact on the estimated wind farm energy production?

(ii) The second paragraph and the fourth paragraph recommend an approach to the turbine manufacturer, has this been done? If so, what was the result? If not, why not?

Request IR-13: (cont'd)

(iii) In the third paragraph, GH expresses concerns about additional losses due to wind management. Has the energy output been reduced due to additional losses due to wind sector management?

(c) Reference page 61 of 99, Wake Effect, last paragraph

(i) Does this mean that GH has used a conservative approach to compute the net energy output, i.e. it could be greater? If not, please explain why not.

(ii) What, in GH's estimation, is the impact on the 0.932 factor in the table on page 60 of 99, i.e. if the conservative approach was not used how would this factor change?

(d) Reference page 62 of 99, Turbine Availability

(i) Out of the data base of 25 wind farms, how many of them are located in similar climates to the Digby wind farm?

(ii) If only the wind farms in a similar climate were used, what would the turbine availability factor be?

(iii) In NSPI's opinion, based on the operating experience of existing Nova Scotia wind farms, is the GH assumed factor reasonable? If not, what Would NSPI recommend as a more reasonable number?

Request IR-13: (cont'd)

(e) Reference page 63 of 99, Grid Availability

(i) Is the assumed factor based on GH's experience or is it based on grid availability at the interconnection point to the NSPI grid?

(ii) If the grid availability is based on GH's experience, please supply the NSPI grid availability at the Digby project interconnection point to the NSPI grid.

(iii) The last sentence of the 2c paragraph is exactly the same as that of paragraph 2a. Is this an error?

(f) Reference page 60 of 99, Net Energy Output

(i) Where is the Net Energy Output measured, i.e. at the Point of Change of Ownership, the Point of Interconnection or elsewhere? Note: these points are as defined in Appendix 12, page 111 of 179.

(ii) If the Net Energy Output is not computed at the Point of Interconnection, please explain why not and provide the Net Energy Output at the Point of Interconnection.

(g) Reference page 66 of 99, sections 5b and 5c

(i) Is the percentage degradation due to icing based on GH's data base for wind farms or on icing degradation for climatic conditions similar to that expected for the Digby wind farm?

Request IR-13: (cont'd)

(ii) In NSPl's opinion, based on the operating experience of existing Nova Scotia wind farms, is the GH assumed factor reasonable? If not, what would NSPI recommend as a more reasonable number?

Response IR-13:

(a) (i) Please refer to Confidential Attachments 1-2.

(ii) The density at which the sales power curve is calculated is [redacted] kg/m3, while the average site air density is [redacted] kg/m3. While these are close, adjustments were still made on an individual turbine basis (using a standard air density vs. elevation lapse rate). This was done within the WindFarmer software used by Garrad Hassan (GH) for the energy calculations, using the standard International Electrotechnical Commission (IEC) method.

(iii) The peak power coefficient (Cp) is a metric to describe how efficiently a wind turbine is extracting kinetic energy from the wind for a given rotor diameter, air density and wind speed. It is used to determine if a power curve is 'reasonable' or not. In the case of the GE 1.5sle, the peak Cp of [redacted] is well within expectations for modern turbines.

(b) (i) The layout in the report is the final layout that is being constructed.

Response IR-13: (cont'd)

(ii) NSPI did approach the turbine manufacturer. On February 3, 2010 NSPI signed a change order (Change Order #9) to have GE re-run the Mechanical Loads Analysis for the new layout of turbines – the turbines are closer together in the final layout than in the previous layout. Please refer to Confidential Attachment 3.

(iii) No.

(c) (i-ii) GH used their latest available techniques to give their best possible assessment of the wake losses. Although GH refers to it as the 'large' wind farm wake model, it is still valid for small and medium wind farms. However, the required adjustment is typically much smaller. In the case of Digby, it was [redacted] percent. GH confirms this is not a conservative estimate.

(d) (i) There are actually many more wind farms in the GH turbine availability database. Twenty five wind farms were initially used to determine the sensitivity between time-based availability and energy-based availability. It is not the number of wind farms used to determine the average availability. In other words, this was the database that initially demonstrated that the relationship was 1:1, or, that a 1 percent reduction in time-based availability resulted in a 1 percent energy loss, on average.

Response IR-13: (cont'd)

The database used to determine the starting availability assumption is much larger, and includes many wind farms in similar climate to Digby. It is difficult to define an exact number, unless there is an exact definition for the 'climate' of each. Also, this specific availability line item is independent of climate. The loss factors that are dependent on climate are dealt with separately as environmental loss factors.

(i) The climate-specific adjustments are accounted for in the 'environmental' losses. For example, while turbine shutdown due to cold weather or icing would ultimately affect availability, these are accounted for as separate loss line items on a site-specific basis. Therefore, the turbine availability, loss 2a, is independent of climate.

(iii) Yes.

(e) (i) This is based on GH experience on operational wind farms in Canada.

(ii) The supply to the 77V - Conway Substation is 69kV line L-5533. For the five year period January 1st 2005 to December 31st 2009, two outages to this line occurred. The total outage time (hours) for this five year period is 5 hours and 11 minutes (5.1833 hours)

(iii) Yes, this is an error. The last sentence of 2c should read 'associated with the downtime of the grid'.

Response IR-13: (cont'd)

(f) (i-ii) Net Energy Output is assumed to be measured at the point of sale of the output (that is, at the meter), which is also assumed to be the same as the point of interconnect. An electrical efficiency of 97 percent is a standard assumption used for all electrical losses, and that a site-specific detailed assessment has not been undertaken by GH.

(g) (i) The losses due to icing are based on the observed climatic conditions at the Digby wind farm, from the on-site meteorological data.

(ii) NSPI believes this assumption is reasonable.

REDACTED

Request IR-14:

Reference Appendix 12, General Interconnection Agreement

(a) Page 70 of 179, Section 11.5, Provision of Security. Please provide details on the security provided from the date of the initial RFP response up to the present time and how this may change with NSPI assuming ownership. Include in your response the name of the interconnection customer who provided the security and how the provider of the security changed when the project was sold to another entity.

(b) There is no date on page 8 of 179 of Appendix 12. However, the signature page 110 of 179 shows February 4, 2010. Why is this not filled in on page 8?

(c) Page 117 of 179, section 3, refers to a system impact study dated 2008-12-17. Please provide a copy of this study. If not part of the system impact study, please provide a copy of the project developer's interconnection request and the date of such request.

(d) Page 117 of 179, please provide a single line diagram of the NSPI system showing how the substations affected by this project, e.g. Conway, Gulch, Paradise, Tremont, Tusket, etc, are interconnected.

(e) Page 117 of 179, please explain why a metering upgrade is required on L-5531 and L-5533 at Gulch.

Request IR-14: (cont'd)

(f) Page 117 of 179, under Revenue Metering, it states that: "Metered quantities to be compensated to the point of delivery at the 77V Conway Substation." Where is the point of delivery defined? Is it the same as the Point of Interconnection? If not, please explain.

(g) Page 126 of 179, please explain what is included in the annual licence cost of $1088 and provide backup for the estimate.

(h) Page 126 of 179, last paragraph, please provide an update on the status of the "legally binding easement". If this document is part of the present filing, please provide the location of the filing. If not provided, please file this document.

(i) Page 127 of 179, table 1. There appears to be parts of the table that are either redacted or obscured so it is impossible to see any value there. Based on the column totals, all these values appear to be zero, please confirm.

(j) Page 127 of 179, Table 1. Please explain why the "interest capitalized" for this estimate is zero.

(k) Page 130 of 179, Section 2.1. This states that Appendix D contains the One line containing the System changes required at various substation. Please indicate clearly on the one line diagrams what changes are required compared to the present configuration.

Request IR-14: (cont'd)

(l) Page 131 of 179, the second paragraph mentions that a more detailed estimate of the transmission line can be prepared once the final route is established. Has the final route been established, and if so, is the final detailed estimate available? If so, please provide with appropriate backup.

(m) Page 151 of 179

(i) This single line diagram for the Conway substation shows the interconnection of the 69 KV line from the Digby Wind farm to the 69 KV bus. This line termination contains only one 69 KV circuit breaker. Please confirm or explain why it cannot confirm.

(ii) In at least two earlier applications to the Board, a wind farm interconnection required a three breaker ring bus at the interconnection point to the NSPI system. Please explain why a three breaker ring bus is not required for this project.

(n) The GIA attached is with the NSPI affiliate. Was there a GIA with SKYPOWER? If yes, please provide a copy.

(o) Appendix A, page 113 of 179, describes other network upgrades.

(i) What is the cost of these network upgrades?

(ii) Is this cost included in this project cost?

Request IR-14: (cont'd)

(iii) The Board has received separate applications for approval of work order numbers CI#38819, CI#33525 and CI#11004, for Caanan Road/Tremont Area. Are any of these network upgrades part of the above work orders? If yes, please identify these with cost estimates.

Response IR-14:

(a) Security was provided by 324 NSL (the Interconnection Customer) on January 15, 2010 in an amount of [redacted] plus HST for design and procurement activities, per Appendix B of the GIA. On March 15, 2010, 324 NSL provided security in the amount of [redacted] plus HST for construction activities, per Appendix B of the GIA. This represented the total amount of security required under Section 11.5 and as specified in Appendix B of the GIA. Subsequent to the transfer of project ownership from 324 NSL to NSPI, the GIA was assigned to NSPI and the security held from 324 NSL was released back to that company. A project number was established within NSPI to allow project costs to be allocated, pending the Capital Work Order review and approval process.

(b) The date of February 4, 2010 as entered on the signature page should have been entered on page 8 of the GIA when executed.

(c) Please refer to UARB IR-1 Attachment 21.

Please refer to Attachment 1 for a copy of the IR#141 Interconnection Request, received 20 April 2007.

Response IR-14: (cont'd)

(d) Two drawings showing the interconnections of the substations affected by the Digby Wind Project are provided in Confidential Attachment 2.

(e) The metering rating on L-5533 and L-5531 is currently limited to 18MVA (150 amps) by the existing current transformer ratings. With the Digby Wind project in service, the load flows will exceed 18MVA on both these lines, necessitating the need to upgrade the metering.

(f) The term "point of delivery" is not defined in the GIA. The Delivery Point is a defined term in the PPA. The point of delivery for the Digby project is the same as the Point of Interconnection; that is, the 69 kV bus at 77V Conway Substation. Please refer to UARB IR-9(b).

(g) The annual license cost of $1,088 found on Page 126 of 179 of the GIA is an estimate of the radio licensing fees to be paid to Industry Canada by NSPI for radio frequencies used for the Digby Wind telecommunications. This estimate was calculated in accordance with procedures in Industry Canada's "Spectrum Management and Telecommunications Policy – Radio Communication Information Circular - Guide for Calculating Radio License Fees" RIC-42, Issue 8, May 2003. Please refer to Attachment 3.

(h) Please refer to UARB IR-5(f).

(i) The shaded boxes are zeros.

Response IR-14: (cont'd)

(j) The estimate provided on page 127 was completed as part of the Facility Study for the previous independent project owner. Work for external project owners is fully paid for in advance of the project commencing so that no interest (allowance for funds used during construction) is required.

In NSPI's filing for the interconnection costs, interest has been estimated and is included in CI's 39627 and 39628 under the 094 account.

(k) The drawings in Appendix D have been provided with the system changes shown in red in Confidential Attachment 4.

(l) The final route for the transmission line has been established. The final detailed cost estimate is as submitted in CI 39627, Digby Wind Project Transmission Line.

(m) (i) Confirmed.

(ii) A three breaker ring is not required at this location as the Digby Wind Farm interconnection transmission line terminates directly on the 69kV bus at the Conway substation. Previous projects tapped midway onto existing transmission lines requiring the three breaker ring to terminate the two new line terminals created plus the interconnection to the generation project.

(n) A GIA was not executed with Skypower.

(o) (i) The network upgrades have been estimated at $[redacted].

REDACTED

Response IR-14: (cont'd)

(ii) The network upgrade costs have been filed as CI 39628.

(iii) No.

Nova Scotia Power Inc.

Generator Interconnection Request Appendix 1 to GIP

NOVA SCOTIA POWER An Emera Company

The undersigned Interconnection Customer submits this request to interconnect its Generating Facility with the Transmission Provider's Transmission System pursuant to a Tariff. A valid Interconnection Request must include an applicable deposit amount as Specified in the Generator Interconnection Procedures (GIP Sec. 3.1, 3.3.1)

Applicant Information

Applicant			
Company Name:	6739954 Canada Corp.	Street Address:	250 Yonge St.
Contact Name:	Charmaine Thompson	Unit/Suite:	16th floor
Phone:	(416) 979-4625	City:	Toronto
Fax:	(416) 981-8686	Province:	Ontario
E-Mail:	charmaine.t@skypower.com	Country:	CANADA
		Postal / Zip Code:	M5B 2L7

Project Information

Project			
Name:	Scotian WindField Digby	Project Location:	Digby (map attached) N45° 35' 29", W65° 53' 59"
Owner/Developer:	6739954 Canada Corp.	Point of Interconnection Requested:	77kV Conway Sub on 69kV
Engineering Consultant:	TBD	Proposed In-Service Date:	by 09/11/01 yy/mm/dd

This Interconnection Request is for (check one):

- [X] A proposed new Generating Facility
- [ ] An increase in the generating capacity or a Material Modification of an existing Generating Facility.

The type of interconnection service requested (check one): (GIP 3.2)

- [ ] Energy Resource Interconnection Service
- [X] Network Resource Interconnection Service

Maximum megawatt electrical output of the proposed new Generating Facility:

30 MW summer at 30 degrees C 30 MW winter at -10 degrees C

OR

MW increase in the generating capacity of an existing Generating Facility

Evidence of Site Control as specified in the GIP (check one) (GIP 3.3.1)

- [X] Is attached to this Interconnection Request
- [ ] Will be provided at a later date in accordance with this GIP

This Interconnection Request is Submitted by:

I hereby certify that, to the best of my knowledge, all the information provided in this Interconnection Request And Equipment Information Form is true and correct.

6739954 Canada Corp — VP Project Management

Name of Interconnection Customer (Type or Print) — Title:

Signature — Date: 4/19/01

Contact Information- Send completed form in hardcopy to:

Nova Scotia Power Inc.,
5 Long Lake Drive, Halifax, NS
B3S 1N8
Attention: Interconnection Engineer

NS Power - Generator Interconnection Coordinator Use

Received By: — Date and Time Received:

Signature

Nova Scotia Power Inc.
Generator Interconnection Request
Attachment A to Appendix 1 - Interconnection Request

NOVA SCOTIA POWER
An Emera Company

GENERATING FACILITY DATA

UNIT RATINGS

kVA		Degrees C		Voltage	
Power Factor				Connection (e.g. wye)	
Short Circuit Ratio				Frequency (hz)	
Stator Amps at Rated kVA				Field Volts	
Max MW		Degrees C		Speed (RPM)	

COMBINED TURBINE-GENERATOR-EXCITER INERTIA DATA

Inertia Constant H		kW-sec/kVA	Moment-of-Inertia WR^2		lb.-ft.^{2}

REACTANCE DATA (PER UNIT-RATED KVA)

	DIRECT AXIS		QUADRATURE AXIS	
Synchronous – saturated	X_{dv}		X_{qv}	
Synchronous – unsaturated	X_{di}		X_{qi}	
Transient – saturated	X'_{dv}		X'_{qv}	
Transient – unsaturated	X'_{di}		X'_{qi}	
Subtransient – saturated	X''_{dv}		X''_{qv}	
Subtransient – unsaturated	X''_{di}		X''_{qi}	
Negative Sequence – saturated	$X2_v$			
Negative Sequence – unsaturated	$X2_i$			
Zero Sequence – saturated	$X0_v$			
Zero Sequence – unsaturated	$X0_i$			
Leakage Reactance	Xl_m			

FIELD TIME CONSTANT DATA (SEC)

Open Circuit	T'_{do}		T'_{qo}	
Three-Phase Short Circuit Transient	T'_{d3}		T'_{q}	
Line to Line Short Circuit Transient	T'_{d2}			
Line to Neutral Short Circuit Transient	T'_{d1}			
Short Circuit Subtransient	T''_{d}		T''_{q}	
Open Circuit Subtransient	T''_{do}		T''_{q}	

ARMATURE TIME CONSTANT (SEC)

Three Phase Short Circuit	T_{a3}	
Line to Line Short Circuit	T_{a2}	
Line to Neutral Short Circuit	T_{a1}	

NOTE: If information requested above is not applicable, indicate by marking "N/A."

MW CAPABILITY AND PLANT CONFIGURATION - GENERATING FACILITY DATA

ARMATURE WINDING RESISTANCE DATA (PER UNIT)

Positive	R1	
Negative	R2	
Zero	R0	

Rotor Short Time Thermal Capacity	I_2^2t				
Field Current at Rated kVA, Armature Voltage and PF				AMPS	
Field Current at Rated kVA and Armature Voltage, 0 PF				AMPS	
Three Phase Armature Winding Capacitance				MICROFARAD	
Field Winding Resistance		OHMS			C
Armature Winding Resistance (Per Phase)		OHMS			C

CURVES

Provide Saturation, Vee, Reactive Capability, Capacity Temperature Correction curves.
Designate normal and emergency Hydrogen Pressure operating range for multiple curves

GENERATOR STEP-UP TRANSFORMER DATA

RATINGS

Capacity kVA	Self-cooled	kVA	Max. nameplate	kVA
Voltage ratio	Generator Side	kV	System Side	kV
Winding Connections	Low Voltage	☐ WYE	or	☐ DELTA
	High Voltage	☐ WYE	or	☐ DELTA
	Tertiary Voltage	☐ WYE	or	☐ DELTA
Fixed Taps Available				

IMPEDANCE

Positive **Z1**	(on self-cooled rating)	%	X/R
Zero **Z0**	(on self-cooled rating)	%	X/R

EXCITATION SYSTEM DATA

Identify appropriate IEEE model block diagram of excitation system and power system stabilizer (PSS) for computer representation in power system stability simulations and the corresponding excitation system and PSS constants for use in the model.

GOVERNOR SYSTEM DATA

Identify appropriate IEEE model block diagram of governor system for computer representation in power system stability simulations and the corresponding governor system constants for use in the model.

WIND GENERATORS

Number of generators to be interconnected pursuant to this Interconnection Request: 13

Elevation: ____ Single Phase ☐ Three Phase ☒

Inverter: Manufacturer: SIEMENS Model Number ____

Model name: SWT-2.3-93 Version: ____

List of adjustable set points for the protective equipment or software:

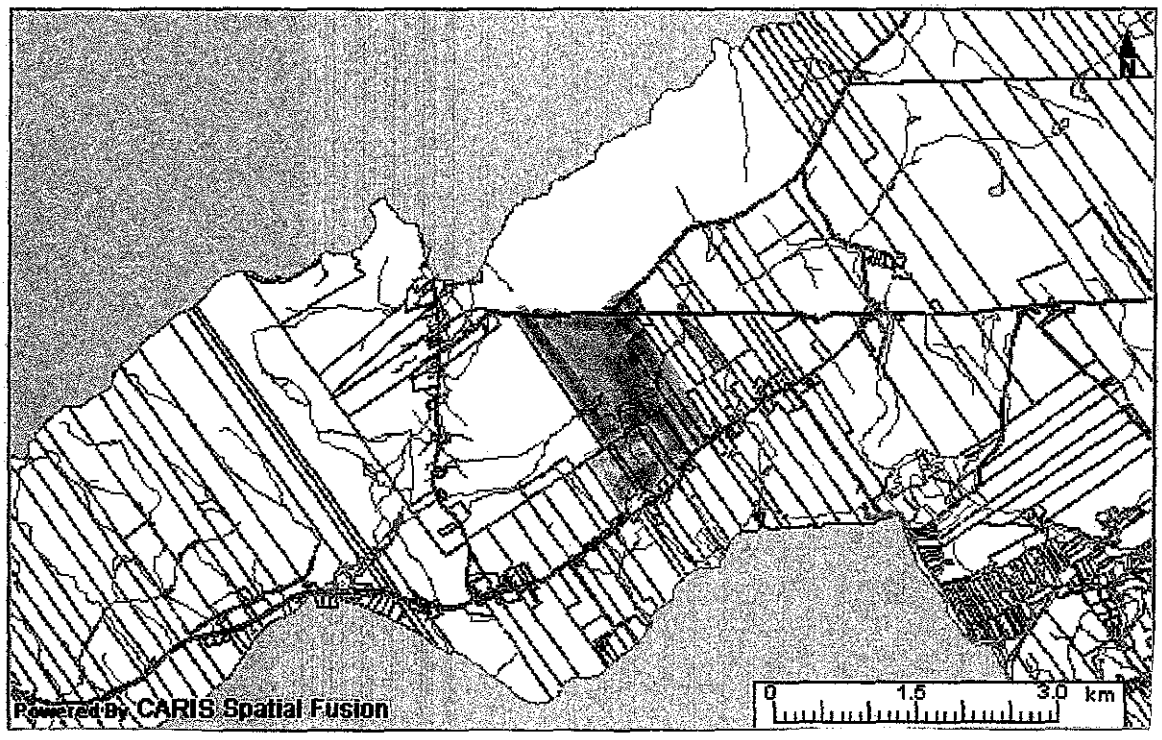
Note: A completed PTI - PSS/E data sheet for the WEC must be supplied with the Interconnection Request. If other data sheets are more appropriate to the proposed device then they shall be provided and discussed at Scoping Meeting.

INDUCTION GENERATORS

Field Volts:	
Field Amperes:	
Motoring Power (kW):	
Neutral Grounding Resistor (If Applicable) :	
I_2^2t or K (Heating Time Constant):	
Rotor Resistance:	
Stator Resistance:	
Stator Reactance:	
Rotor Reactance:	
Magnetizing Reactance:	
Short Circuit Reactance:	
Exciting Current:	
Temperature Rise:	
Frame Size:	
Design Letter:	
Reactive Power Required In Vars (No Load) :	
Reactive Power Required In Vars (Full Load) :	
Total Rotating Inertia, H:	

Rossway Community, located in Digby County

We currently have two parcels of land totally 529 acres under Option to Lease agreements as depicted on the map below. We are including copies of the Option to Lease Agreements with property maps of each parcel and land along with ownership information from the Nova Scotia Government Property on Line System.



SIEMENS

SWT-2.3-93, 60 Hz Application Electrical Specifications

Generator

Type	Asynchronous
Nominal power	2300kW
Speed range	600 - 1800 rpm
Nominal voltage	750V @ 1550 rpm
Nominal current	2070 A
Frequency	16,5 - 60 Hz
Protection	IP 54
Generator designation	AMA 500L4A
Generator manufacturer	ABB

Generator protection

Insulation class	F
Winding temperatures	2 x 3 PT100 sensors
Bearing temperatures	1 PT100 at each bearing
Bearing insulation	Insulation at both bearings
Grounding brush	On drive end

Generator Cooling

Cooling system	Air to air
Ventilation	Shaft mounted fan
Ventilation type	Centrifugal
External flow direction	From D-end to N-end
Control parameter	Winding temperature

Frequency converter

Operation	4Q Full scale converter
Switching	PWM
Switching frequency	1250/2500 Hz
Cooling	Liquid

Power factor at 690 V and nominal grid conditions

Power factor correction	Frequency converter control
Power factor range	0,9 cap. to 0,9 ind.

Main circuit protection

Circuit breaker	ABB E-max
Surge arrester	100 kA varistors

Earthing requirements

Earth resistance	Acc. to IEC1024.1
Depth electrodes	Min. 2 x 5 m 50 mm^2 Cu
Ring electrode	Min. 1 x ø12 m 50 mm^2 Cu
Foundation reinforcement	Must be connected to earth electrodes.

Peak power levels

10 min average	100 % of nominal
30 sec-average	110 % of nominal

Grid requirements

Nominal grid frequency	60 Hz
Minimum voltage	90 % of nominal
Maximum voltage	110 % of nominal
Minimum frequency	94 % of nominal
Maximum frequency	104 % of nominal
Maximum current asym.	5%
Max 1 s. short circuit level at controller's grid terminals	40 kA
Min. 1 s short circuit level at controller's grid terminals	5 kA
Grid error numbers	Max. 300 per year
Transformer impedance requirement	6-20 %. To be specified by Siemens Wind Power

Power consumption from grid (approximately)

At stand-by	5.0 kW
At stand-by, yawing	9.6 kW
Before cut-out (60 s)	18 kW
After cut-out (600 s)	18 kW

UL Recognition

The LV controller system of the wind turbine is UL recognized and not UL listing.

Optional, not included in standard scope of supply:

Typical transformer data

Rating	2600 kVA
Voltage	0.69 / 11 kV or 0.69 / 33 kV
Cooling	Oil/Surface convection
Loss (P_0/P_n)	3 / 22 kW
Protection	Circuit breaker
Insulation	Designed for frequency converter operation

Siemens Wind Power A/S reserves the right to change the specifications without previous notice
All data are subject to tolerances in accordance with IEC.

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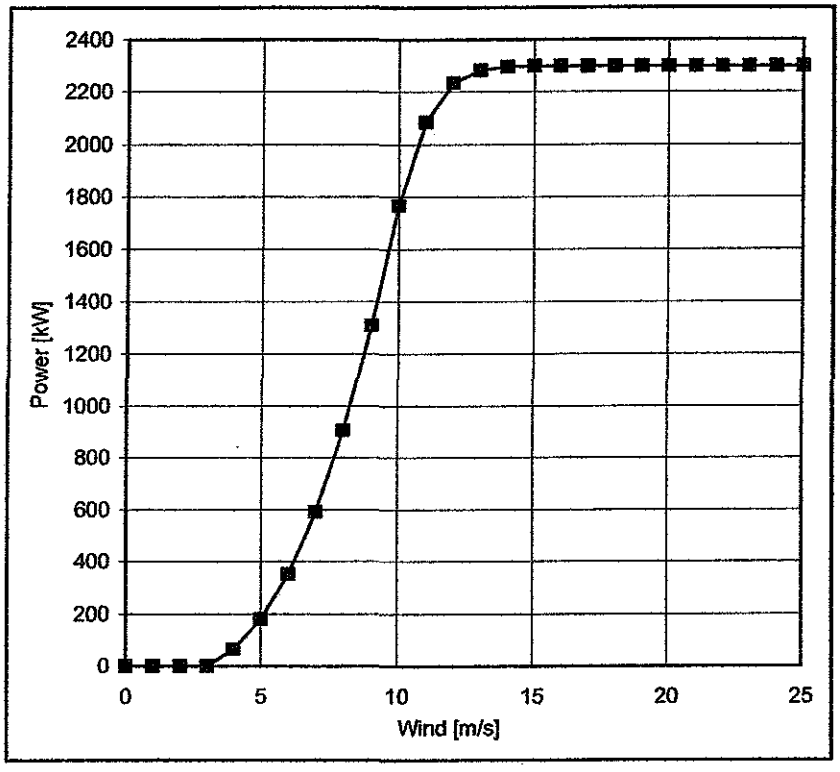
SIEMENS

Sales Power Curve, SWT-2.3-93
Document PG-R-03-10-0000-0096-01
HST / 26.06.2006

SWT-2.3-93
Sales Power Curve

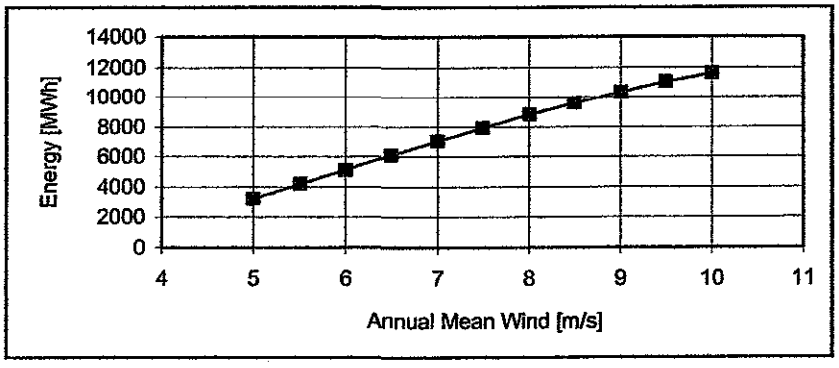
The calculated power curve data are valid for standard air density conditions of 15 deg.C Air temperature, 1013 mBar air pressure and 1.225 kg/m3 air density, clean rotor blades, and horizontal, undisturbed air flow with 10% turbulence intensity.

Wind [m/s]	Power [kW]
0.0	0
1.0	0
2.0	0
3.0	0
4.0	65
5.0	180
6.0	352
7.0	590
8.0	906
9.0	1308
10.0	1767
11.0	2085
12.0	2234
13.0	2283
14.0	2296
15.0	2299
16.0	2300
17.0	2300
18.0	2300
19.0	2300
20.0	2300
21.0	2300
22.0	2300
23.0	2300
24.0	2300
25.0	2300



The annual energy production data for different annual mean wind speeds in hub height are calculated from the above power curve assuming a Rayleigh wind speed distribution, 100 percent availability, and no reductions d to array losses, grid losses, or other external factors affecting the production.

Wind [m/s]	Energy [MWh]
5.0	3237
5.5	4177
6.0	5133
6.5	6088
7.0	7036
7.5	7925
8.0	8791
8.5	9579
9.0	10323
9.5	11000
10.0	11615



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SWT-2.3-93
Technical Description

General
The following is a brief technical description of the main components of the SWT-2.3-93 Wind Turbine Generator.

Rotor
The SWT-2.3-93 rotor is a three-bladed cantilevered construction, mounted upwind of the tower. The power output is controlled by pitch regulation. The rotor speed is variable and is designed to maximize the aerodynamic efficiency.

Blades
The B45 blades are made of fiberglass-reinforced epoxy in Siemens' proprietary IntegralBlade® manufacturing process. In this process the blades are cast in one piece to eliminate weaker areas at glue joints. The blades are mounted on pitch bearings and can be feathered 80 degrees for shutdown purposes. Each blade has its own independent pitching mechanism capable of feathering the blade under any operating condition. The blade pitch arrangement allows for optimization of the power output throughout the operating range, and the blades are feathered during standstill to minimize wind loads.

Rotor Hub
The rotor hub is cast in nodular cast iron and is fitted to the main shaft with a flange connection. The hub is sufficiently large to provide a comfortable working environment for two service technicians during maintenance of blade roots and pitch bearings from inside the structure.

Main shaft and bearing
The main shaft is forged in alloy steel and is hollow to facilitate the transfer of power and signals to the blade pitching system. The main shaft is supported by a self-aligning double spherical roller bearing, which is shrunk onto the main shaft. The bearing is grease lubricated and the bearing seals are labyrinth seals.

Gearbox
The gearbox is a custom-built three-stage planetary-helical design. The first high torque stage is of a helical planetary design. The two high-speed stages are of a normal helical design and provide the offset of the high-speed shaft that is needed to allow passage of power and control signals to the pitch systems.

The gearbox is shaft-mounted and the main shaft torque is transferred to the gearbox by a shrink disk connection. The gearbox is supported on the nacelle with flexible rubber bushings.

The gearbox is fitted with an oil conditioning system. All bearings are lubricated with oil fed directly from a large in-line filter and is cleaned by an off-line filter unit.

The gearbox is fitted with sensors for monitoring temperature, oil pressure and vibration levels.

Generator
The generator is a fully enclosed asynchronous generator. The generator has a squirrel-cage rotor without slip-rings. The generator rotor construction and stator winding is designed for high efficiency at partial loads. The generator is protected with thermal switches and analogue temperature measurement sensors.

The generator is fitted with a separate thermostat-controlled ventilation arrangement. Air is recirculated internally in the generator and heat is transferred through an air-to-air heat exchanger that separates the internal environment in the generator from the ambient air.

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Mechanical brake
The mechanical brake is fitted to the gearbox high-speed shaft and has two hydraulic calipers.

Yaw system
The yaw bearing is an externally geared ring with a friction bearing. Eight electric planetary gear motors drive the yawing.

Tower
The SWT-2.3-93 Wind Turbine Generator is mounted on a tapered tubular steel tower. The tower has internal ascent and direct access to the yaw system and nacelle. It is equipped with platforms and internal electric lighting.

Controller
The Wind Turbine Generator controller is a microprocessor-based industrial controller. The controller is complete with switchgear and protection devices. It is self-diagnosing and has a key board and display for easy readout of status and for adjustment of settings.

The NetConverter® power conversion system allows generator operation at variable speed, frequency and voltage while supplying power at constant frequency and voltage to the MV transformer. The power conversion system is a modular arrangement for easy maintenance and is water-cooled.

SCADA
The SWT-2.3-93 Wind Turbine Generator is equipped with the Siemens WebWPS SCADA System. This system offers remote control and a variety of status views and useful reports from a standard internet web browser. The status views present information, including electrical and mechanical data, operation and fault status, meteorological data and grid station data.

Primary-level users can be granted access to key server features.

Turbine Condition Monitoring
In addition to the Siemens WebWPS SCADA System, the SWT-2.3-93 Wind Turbine Generator is equipped with the unique Siemens TCM condition monitoring system. This system monitors the vibration level of the main components and compares the actual vibration spectra with a set of established reference spectra. Result review, detailed analysis and reprogramming can all be carried out using a standard web browser.

Operation Systems
The Wind Turbine Generator operates automatically. It is self-starting when the wind speed reaches an average of about 3 to 5 m/s (about 10 mph). The output increases approximately linearly with the wind speed until the wind speed reaches 13 to 14 m/s (about 30 mph). At this point, the power is regulated at rated power.

If the average wind speed exceeds the maximum operational limit of 25 m/s (56 mph), the Wind Turbine Generator is shut down by feathering the blades. When the average wind speed drops back below the restart average wind speed, the systems reset automatically.

Siemens Wind Power A/S reserves the right to change the above specifications without previous notice.

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SWT-2.3-93
Technical Specifications

Rotor

Type	3-bladed, horizontal axis
Position	Upwind
Diameter	93 m
Swept area	6800 m²
Synchronous rotor speed	6-16 rpm
Power regulation	Pitch regulation with variable speed
Rotor tilt	6 degrees

Blade

Type	Self-supporting
Blade length	45 m
Tip chord	0.8 m
Root chord	3.5 m
Aerodynamic profile	NACA 63.xxx, FFAxxx
Material	GRE
Surface gloss	Semi-mat, < 30 / ISO2813
Surface colour	Light grey, RAL 7035

Aerodynamic brake

Type	Full span pitching
Activation	Hydraulic [active], fail-safe

Load supporting parts

Hub	Nodular cast iron
Main bearing	Spherical roller bearing
Main shaft	Alloy steel
Nacelle bed plate	Steel

Transmission system

Coupling hub - shaft	Flange
Coupling shaft – gearbox	Shrink disc
Gearbox type	3-stage planetary/helical
Gearbox ratio	1 : 91
Gearbox lubrication	Splash / forced lubrication
Oil volume	Approx. 400 l
Gearbox oil filtering	Inline and offline
Gearbox cooling	Separate oil cooler
Gearbox designation	PEAB 4456
Gearbox manufacturer	Winergy
Coupling gear - generator	Double flexible coupling

Mechanical brake

Type	Fail-safe disc brake
Position	High speed shaft
Number of callipers	2

Canopy

Type	Totally enclosed
Material	Steel

Generator

Type	Asynchronous
Nominal power	2300 kW
Protection	IP 54
Cooling	Integrated heat exchanger
Insulation class	F
Generator designation	AMA 500L4 BAYH
Generator manufacturer	ABB

Grid terminals (LV)

Nominal power	2300 kW
Voltage	690 V
Frequency	50 Hz or 60 Hz

Yaw system

Type	Active
Yaw bearing	Externally geared slewring
Yaw drive	Eight electric gear motors with frequency converter
Yaw brake	Passive friction brake

Controller

Type	Microprocessor
SCADA system	WPS via modem
Controller designation	KK WTC 3.0
Controller manufacturer	KK Electronic A/S

Tower

Type	Cylindrical and/or tapered tubular
Hub height	80 m or site specific
Corrosion protection	Painted
Surface gloss	Silk mat, 30-40 / ISO2813
Colour	Light grey, RAL 7035

Operational data

Cut-in wind speed	4 m/s
Nominal power at	13-14 m/s
Cut-out wind speed	25 m/s
Maximum 2 s gust	55 m/s (standard version) 60 m/s (special version)

Weights (approximately)

Rotor	60,000 kg
Nacelle	82,000 kg
Tower for 80 m hub height	162,000 kg

Siemens Wind Power A/S reserves the right to change the above specifications without previous notice.

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SWT-2.3-93
Design Climatic Conditions

The design climatic conditions are the boundary conditions at which the turbine can be applied without supplementary design review. Applications of the wind turbine in more severe conditions may be possible, depending upon the overall circumstances. A project site-specific review requires the completion by the Client of the "Project Climatic Conditions" form.

Subject	ID	Issue	Unit	Value
1. Wind, operation	1.1	Wind definitions	-	IEC 61400-1
	1.2	IEC class	-	IIA
	1.3	Air density, ρ	kg/m^3	1.225
	1.4	Mean wind speed, v_{ave}	m/s	8.5
	1.5	Weibull scale parameter, A	m/s	9.6
	1.6	Weibull shape parameter, k	-	2
	1.7	Wind shear exponent, α	-	0.20
	1.8	Mean turbulence intensity at 15 m/s, I_{15}	-	0.16
	1.9	Standard deviation of turbulence intensity, $\sigma(I_{15})$	-	0.02
	1.10	Standard deviation of wind direction	Deg	7.5
	1.11	Maximum flow inclination,	Deg	8
	1.12	Minimum turbine spacing, in rows	D	3
	1.13	Minimum turbine spacing, between rows	D	5
2. Wind, extreme	2.1	Wind definitions		IEC 61400-1
	2.2	Air density, ρ	kg/m^3	1.225
	2.3	Maximum hub height 10 min.wind, $v10_{max}$	m/s	42.5
	2.4	Maximum 2 s gust in hub height, $v_{hub,2s}$	m/s	59.5
	2.5	Maximum hub height power law index, α	-	0.20
3. Temperature	3.1	Temperature definitions	-	IEC 61400-1
	3.2	Minimum temperature, stand-still, $T_{min,s}$	Deg.C	-20
	3.3	Minimum temperature, operation, $T_{min,o}$	Deg.C	-10
	3.4	Maximum temperature, operation, $T_{max,o}$	Deg.C	35
	3.5	Maximum temperature, stand-still, $T_{max,s}$	Deg.C	45
4. Corrosion	4.1	Corrosion definitions	-	ISO 12944
	4.2	External corrosion class	-	C3
	4.3	Internal corrosion class	-	C2
	4.4	Internal climate control	-	Yes
5. Lightning	5.1	Lightning definitions	-	IEC 1024
	5.2	Annual number of strikes at tip height	-	0.1
6. Dust	6.1	Dust definitions	-	-
	6.2	Dust conditions, ground level	-	Normal DK
	6.3	Dust conditions, hub height	-	Normal DK
7. Hail	7.1	Maximum hail diameter	mm	20
	7.2	Maximum hail falling speed	m/s	20
8. Ice	8.1	Ice definitions	-	IEC 61400-1
	8.2	Ice conditions		Normal DK
9. Trees	9.1	If the height of trees within 500m of any turbine location height exceeds 1/3 of H – D/2 where H is the hub height and D is the rotor diameter then restrictions may apply. Please contact Siemens for information on the maximum allowable tree height with respect to the site and the turbine type.		

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RIC-42
Issue 8
May 2003

Spectrum Management and Telecommunications Policy

Radiocommunication Information Circular

Guide for Calculating Radio Licence Fees

Canada

Aussi disponible en français - CIR-42

Radiocommunication Information Circulars are issued for the guidance of those engaged in radiocommunications in Canada. The information contained in these circulars is subject to change without notice. It is therefore suggested that interested persons consult the nearest district office of Industry Canada for additional details. While every reasonable effort has been made to ensure accuracy, no warranty is expressed or implied. As well, these circulars have no status in law.

Comments and suggestions may be directed to the following address:

Industry Canada
Radiocommunications and
Broadcasting Regulatory Branch
300 Slater Street
Ottawa, Ontario
K1A 0C8

Attention: DOSP

via e-mail: spectrum_pubs@ic.gc.ca

All spectrum publications are now available on the Internet at:

http://strategis.gc.ca/spectrum

Preface

The purpose of this Radiocommunication Information Circular (RIC) is to provide the general public with information on how to calculate their radio licence fees for radiocommunication systems operating in the following services:

- Public Information Service,
- Developmental Service,
- Fixed Service,
- Land Mobile Service, and
- Radiodetermination service.

The *Radiocommunication Regulations* exempt **mobile stations** in the aeronautical and maritime service, as well as fixed and **mobile stations** in the amateur service, from the requirement of obtaining a radio licence. A radio apparatus is exempted provided that it complies with certain exemption criteria.

More details on exemption criteria for ship and aircraft stations can be found on our internet Web site at: http://strategis.ic.gc.ca/epic/internet/insmt-gst.nsf/vwGeneratedInterE/h_sf01775e.html.

For the amateur service, details can be found on our internet Web site at: http://strategis.ic.gc.ca/epic/internet/insmt-gst.nsf/vwGeneratedInterE/sf02088e.html.

For information on the calculation of licence fees for radiocommunication systems operating in Fixed Radio Frequency Bands (such as microwave systems, including Space stations), please contact one of our district offices. A list of Industry Canada's district offices can be found in Radiocommunication Information Circular 66 (RIC-66).

Radiocommunication Information Circular 19 (RIC-19) provides Radiocommunication Service Provider licensees, and potential licensees, with information on System Licensing and how it applies to radio licences issued to service providers and their subscribers, with particular attention to the concept of High, Medium, and Low Congestion zones. System Licensing applies to both mobile dispatch systems (two-way radiocommunications) and to paging systems (one-way radiocommunications).

Introduction

Under the *Radiocommunication Act*, the Minister of Industry is responsible for the orderly establishment of radio stations as well as the orderly development and efficient operation of radiocommunication in Canada, while respecting the policy objectives set out in the *Telecommunications Act*.

The radio authorization process is one of several features of the spectrum management program, established under the authority of the Minister, to accomplish these objectives. Radio licensing provides for the operation of radio systems, according to government policies and technical requirements. Licensing also helps to prevent harmful interference between stations.

References

Radiocommunication Act

Radiocommunication Regulations

Telecommunications Act

Department of Industry Act

Under the *Radiocommunication Act* the Governor in Council may set fees for radio authorizations[1] and for services provided by Industry Canada which are related to spectrum management.

Fees for radio licences are set out in the *Radiocommunication Regulations*. The applicable fee is determined by the type of station licensed and the type of service used. In certain cases, the amount of radio frequency spectrum required or number of frequencies assigned and the location of operations are also taken into account.

This circular may be used to assist in calculating radio licence fees as prescribed in the *Radiocommunication Regulations*, Part VIII, entitled “Fees”.

For Narrowband Multipoint Communication Systems (MCS) refer to Internal Procedure Circular 2-1-14 (IPC-2-1-14). A MCS consists of either a fixed or mobile master radio station communicating on a one- or two-way basis with associated remote stations. The master station controls, activates or interrogates two or more remote sites and receives communications from these remote sites or both. A MCS can be operated by a radiocommunication user or a radiocommunication service provider.

1

"***radio authorization***" means a licence, certificate or authorization issued by the Minister under paragraph 5(1)*(a)* of the Radiocommunication Act **.**

For Fixed Wireless Access systems operating below 1 GHz refer to Internal Procedure Circular 2-1-23 (IPC-2-1-23) [To be published]. Fixed Wireless Access systems, also known as Wireless Local Loop Systems, are defined as a system that connects subscribers to the public switched telephone network (PSTN) using radio signals as a substitute for copper for all or part of the connection between the subscriber and the switch. Fixed wireless access generally refers to the use of radio to provide access to a public telecommunications network for telephone and/or data services serving residential and business communities.

Licensing Principles

A transmitter and its associated receiver are generally located at the same site, however, if they are located at different sites they shall be considered as separate stations for licence fee purposes and licensed accordingly.

Different radio sites are defined as locations that are more than 100 metres apart. In cases where the applicant has two installations on or in the same building, separated by more than 100 metres, Industry Canada will determine, on a case-by-case basis, whether one or two radio licences should be issued.

Duplicate facilities, when established at the same site for circuit protection purposes and which have the same frequency complement, shall **not** be subject to duplicate licences or fees. Facilities that are not duplicate for circuit protection but are considered to be on the same site will be charged the sum of the fees applicable to the complement of radio apparatus located at that site.

Definitions

The radio licence fee payable for new stations include both the issuance fee and the monthly fee and are calculated from the month the licence is issued to March 31.

1. **Radio licence fee**, is the fee payable for the issuance, continuance in force, renewal or reinstatement of a radio licence and is composed of the following, as applicable:

Definitions

1. Radio Licence fee

   (a) Issuance fee
   (b) Monthly fee
   (c) Renewal fee
   (d) Reinstatement fee
   (e) Short-term fee

2. Telephone Channel Equivalencies

(a) the **issuance fee** is payable for the initial issuance of a radio licence as set out in column II of the applicable item of Parts I to VII of Schedule III of the *Radiocommunication Regulations*.

(b) the **monthly fee**, is payable for the continuance in force of a radio licence until the radio licence has expired as set out in column III of the applicable item of Parts I to VII of Schedule III of the *Radiocommunication Regulations*.

(c) the **renewal fee** is the annual fee payable for the renewal of a radio licence, before the licence expires on March 31 of each year, and is set out in column IV of the applicable item of Parts I to VII of Schedule III of the *Radiocommunication Regulations*.

Licence Renewal Fee is the annual fee that you must pay to renew your licence. You will be mailed a renewal invoice prior to the licence expiry date of March 31.

(d) the **reinstatement fee** is payable for the reinstatement of a radio licence after the licence has expired on March 31 of any year as is set out in:

(i) column V of the applicable item of Parts I to VII of Schedule III of the *Radiocommunication Regulations*, where the fee is paid during the period beginning on April 1 and ending on April 30 of the following year; and

(ii) column VI of the applicable item of Parts I to VII of Schedule III of the *Radiocommunication Regulations*, where the fee is paid during the period beginning on May 1 and ending on March 31 of the following year.

(e) the **short-term fee**, is payable for the issuance and continuance in force of a radio licence for a term of not more than 30 days and is the sum of the issuance fee set out in column II and the monthly fee set out in column III of the applicable item of Parts I to VII of Schedule III of the *Radiocommunication Regulations*.

Short-Term Licence Fee is the fee you must pay if you require a licence that is valid for only 30 days. Short-term licences are available for all classes of radio licences.

These schedules can be found in **Appendix A** of this document.

2. **Telephone Channel Equivalencies:** For the purpose of calculating the radio licence fees payable for a radio licence authorizing operation on certain frequencies for radio apparatus installed in a fixed station or space station referred to in section 61 or 65 or 73 of the *Radiocommunication Regulations*, section 58.*(c)* applies:

58.*(c)* one digitally modulated channel is equivalent to the number of telephone channels calculated by dividing the modulation bit rate by 64 kilobits per second.

General Information

The following information applies to most types of radio licences:

1. All radio apparatus must be licensed under the *Radiocommunication Act* unless it is only capable of receiving broadcasting or is exempted under the applicable standard of the *Radiocommunication Regulations*.

2. There is a separate fee for each transmit and receive frequency. The total licence fee is the sum of all of the individual fees for the station. This does not apply to mobile stations.

3. Radio station licensees are to inform the Department of any changes they make to their radio station's operating parameters, such as a change of location, frequency, power level, antenna height or pattern. They may also have to submit a revised application for further review by Industry Canada.

4. There is no charge for a licence amendment if the location and type of service remain the same. If you request an amendment that results in a higher fee, the amendment fee is the difference between your original fee and the new fee.

5. The date the Department authorizes the licence, not the date the radio station application was submitted, determines the monthly fee. The fee payable for a new licence is the sum of the issuance fee and the total monthly fee.

6. Licence fees must be paid in full before the radio licence can be issued. Once issued, the licence is valid until its expiry date which, for all but short term licences, is March 31. No portion of the licence fee is refundable.

Radiocommunication Services and Stations

Part 1, section 3 of the *Radiocommunication Regulations* outlines the radiocommunication services and stations for which radio licences can be issued.

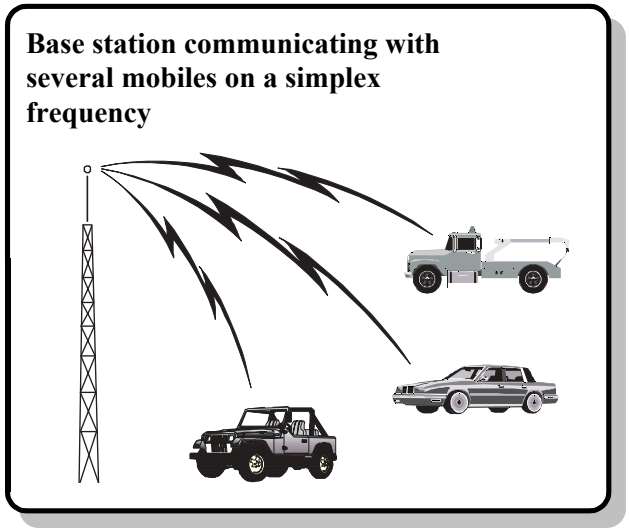
	Services	Fee Schedules	Type of Stations
(i)	Aeronautical service	Schedule III, Part I, Item 2	Mobile stations
		Schedule III, Part III, Item 1	Fixed stations
(ii)	Amateur radio service	*item repealed SOR/2000-78*	
(iii)	Public information service	Schedule III, Part I, Item 3	Mobile stations
		Schedule III, Part III, Item 2	Fixed stations
(iv)	Developmental service	Schedule III, Part I, Item 4	Mobile stations
		Schedule III, Part III, Item 1	Fixed stations
(v)	Fixed service	Schedule III, Part II	Fixed stations
		Schedule III, Part III, Item 1	Fixed stations
		Schedule III, Part III, Item 2	Fixed stations
(vi)	Intersatellite service	Schedule III, Part VI	Fixed stations
		Schedule III, Part VII, Item 1	Fixed stations
(vii)	Land mobile service	Schedule III, Part IV, Item 1*(a)*, 1*(b)*	Fixed stations
		Schedule III, Part V	Fixed stations
		Schedule III, Part I, item 5	Mobile stations
(viii)	Maritime service	Schedule III, Part I, Item 2	Mobile stations
		Schedule III, Part III, Item 1	Fixed stations
(ix)	Radiodetermination service	Schedule III, Part I, Item 4	Mobile stations
		Schedule III, Part III, Item 1	Fixed stations

Example 1:

Fixed Base Station Communicating with Mobiles located in a Metropolitan Area

This example describes how to calculate your radio licence fee if the radio system you intend to use is made up of one base station communicating with 6 mobile stations. In this example, the stations are in the Land Mobile Service and **not** part of a radiocommunication service provider system. You intend to install your base station in downtown Saskatoon, Saskatchewan in April.

(System Configuration)



Base Station

1. From **Schedule IV**, Saskatoon is a metropolitan area.

2. From **Schedule III, Part IV, Item 1*(a)***, under "Metropolitan Area", the radio licence fee for a fixed station communicating with a mobile station in a metropolitan area is the sum of the issuance fee (**Column II**), $35 plus the monthly fee (**Column III**) $9.70 times 12 months (April 1 to March 31); for each assigned transmit or received frequency.

3. Since the fee is based on the number of transmit and receive frequencies, and there is one transmit frequency and one receive frequency required, the total fee for the base station is $302.80: ($35 + (12 months x $9.70)) x 2 (frequencies) = $302.80

4. For a short term licence **(one month duration)**, the licence fee would be the issuance fee (**Column II**) plus the monthly fee (**Column III**): ($35 + $9.70) x 2 (frequencies) = $89.40

5. The renewal fee **(Column IV)** for the following year will be: 2 (frequencies) x $116 = $232.

Frequency (MHz)			Channel [2]		Licence Fee Calculation		
Transmit (TX)	Receive (RX)	Communicating with	TX	RX	Issuance	Renewal	Monthly / Short-term
160.000	160.000	mobile stations	1	1	$35 + $35	$116 + $116	$9.70 +$9.70

[2] Channel means the number of transmit and/or receive frequencies assigned.

Mobile Stations

1. From **Schedule III, Part I, Item 5**, under the "Mobile station in the Land Mobile service", the radio licence fee for each mobile is the sum of the issuance fee (**Column II**) $12 plus the monthly fee (**Column III**) which is $3.40 times 12 months (April 1 to March 31), for a total of $52.80 per mobile stations.

2. Multiply the licence fee per unit by the number of mobile stations involved (6) to give you the total licence fee for the mobile stations.

   6 mobiles x $52.80 = $316.80

3. For a short-term licence **(one month duration)** the licence fee would be the issuance fee plus the monthly fee:

   $12 + $3.40 = $15.40 for a single mobile station

4. The renewal fee **(Column IV)** for the following year will be: 6 mobiles x $41 = $246.

Frequency (MHz)			Channel		Licence Fee Calculation		
Transmit (TX)	Receive (RX)	Communicating with	TX	RX	Issuance	Renewal	Monthly / Short-term
160.000	160.000	base stations	1	1	$12	$ 41	$ 3.40

Total System Fee Calculation:

Base Station	$ 302.80
Mobile Stations	$ 316.80

Total Fee: **$ 619.60** (Initial radio licence)

The total renewal fee (**Column IV**) for the following year will be:

Base Station	$ 232
Mobile Stations	$ 246

Total Fee: **$ 478** (Renewal)

For a station located in a non-metropolitan area, refer to **Schedule III, Part IV, Item 1*(b)*** under "Other Area". The same calculations applies.

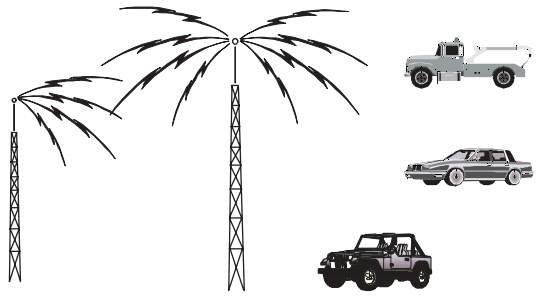
Example 2:

Base Station Communicating with Mobile Stations via a Repeater

This example describes how to calculate your radio licence fee if the radio system that you intend to use is made up of a base station communicating with 8 mobile stations via a repeater. In this example, the stations are in the Land Mobile Service and **not** part of a radiocommunication service provider system. You intend to install your base station in June in an area that is **not** considered metropolitan under **Schedule IV**.

(System Configuration)

Base station communicating with 8 mobile stations via a repeater



Base Station

1. From **Schedule III, Part II, Item 1**, the fee for a fixed station communicating with another fixed station is the sum of the issuance fee or $10 plus the monthly fee of $2.80 times 10 months, which covers the period from June to March the following year.

2. Since the fee is based on the number of assigned transmit and receive frequencies, and there is one transmit and one receive required, the total fee for the base station is:

($10 x 2) + (($2.80 x 2) x 10 months) = $76.00

Frequency (MHz)			Channel		Licence Fee Calculation		
Transmit (TX)	Receive (RX)	Communicating with	TX	RX	Issuance	Renewal	Monthly / Short-term
160.000	161.000	mobile stations via repeater	1	1	$10 + $10	$34 + $34	$2.80+ $2.80

3. For a short-term licence **(one month duration)** the licence fee would be the issuance fee plus the monthly fee: ($10 + $2.80) x 2 = $25.60

4. The renewal fee for the following year will be $68.00

Repeater Station

The repeater is made up of the following two components *a* and *b* below:

a. a fixed station communicating with another fixed station;

1. From **Schedule III, Part II, Item 1**, the fee for a fixed station communicating with another fixed station is the sum of the issuance fee (**Column II**) or $10 plus the monthly fee (**Column III**) of $2.80 times 10 months, which covers the period from June to March the following year.

2. Since the fee is based on the number of assigned transmit and receive frequencies, and there is one transmit and one receive required, the total fee for the base station is:

   ($10 x 2) + (($2.80 x 2) x 10 months) = $76.00

b. a fixed station communicating with a mobile station.

1. From **Schedule III, Part IV, Item 1*(b)***, under "Other Area", the fee for a fixed station communicating with mobile stations, is the sum of the issuance fee (**Column II**) or $16 plus the monthly fee (**Column III**) of $4.40 times 10 months, which covers the period from June to March the following year.

2. Since the fee is based on the number of assigned transmit and receive frequencies, and there is one transmit and one receive required, the total fee for the base station is:

   ($16 x 2) + (($4.40 x 2) x 10 months) = $120.00

   Total licence fee for the repeater station is: $76.00 + $120.00 = $196.00

Mobile Station

1. From **Schedule III, Part I, Item 5**, under the "Mobile station in the Land Mobile service", the licence fee for each mobile is the issuance fee **(Column II)**, $12 plus the monthly fee **(Column III)** which is $3.40 times 10 months, for a total of $46 per mobile station..

2. Multiply the fee by the number of mobile stations involved (8) to get the fee for the mobiles

   8 mobiles x ($12 + ($3.40 x 10) = $368.

3. For a short-term licence **(one month duration)** the licence fee would be the issuance fee plus the monthly fee:

   $12 + $3.40 = $15.40

4. The renewal for the following year will be: 8 mobiles x $41 = $328.

Frequency (MHz)			Channel		Licence Fee Calculation		
Transmit (TX)	Receive (RX)	Communicating with	TX	RX	Issuance	Renewal	Monthly / Short-term
160.000	161.000	base station via repeater	1	1	$12	$41	$ 3.40

Total System Licence Fee Calculation:

1.	Base Station	$ 76
2.	Repeater Station	
	Fixed to fixed (transmit & receive)	$ 76
	Fixed to mobile (transmit & receive)	$ 120
3.	Mobile Stations: 8	$ 368
	Total Fee:	**$ 640**

Note: When there are no base stations communicating via the repeater i.e. mobiles only, the "fixed station communicating with another fixed station" component does not apply.

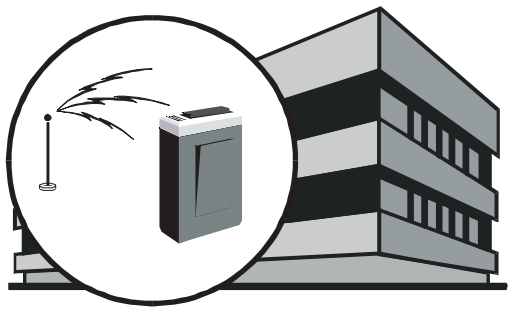
Example 3:

In-Plant Paging System

This example describes how to calculate your licence fees if you intend to install an in-plant paging system for your business. Your business is located in downtown Saint John, New Brunswick and you would like an authorization starting in April.

(System Configuration)

In-Plant Paging System



Base Station

1. From **Schedule IV**, Saint John is a metropolitan area.

2. From **Schedule III, Part IV, Item 1*(a)***, the licence fee for a fixed station communicating with a mobile station in a metropolitan area is the sum of the issuance fee **(Column II)**, $35 plus the monthly fee **(Column III)** which is $9.70 times 12 months (April 1 to March 31) for each assigned transmit or receive frequency.

3. Since there is no receive frequency, the total

fee for the paging transmitter is:

$35 + ($9.70 x 12 months) = $151.40

4. For a short-term licence **(one month duration)** the licence fee would be the issuance fee plus the monthly fee:

($35 + $9.70) = $44.70

5. The renewal fee **(Column IV)** for the following year will be: $116.

Frequency (MHz)			Channel		Licence Fee Calculation		
Transmit (TX)	**Receive (RX)**	**Communicating with**	**TX**	**RX**	**Issuance**	**Renewal**	**Monthly / Short-term**
149.000	-	paging receivers	1	-	$35	$116	$9.70

Total System Fee Calculation:

1. Base Station **$151.40**
2. Paging Receivers exempt*

Total Fee: $151.40

***Note:** Paging Receivers, under the *Radiocommunication Regulations,* are exempt from licensing, so there is no licence fee.

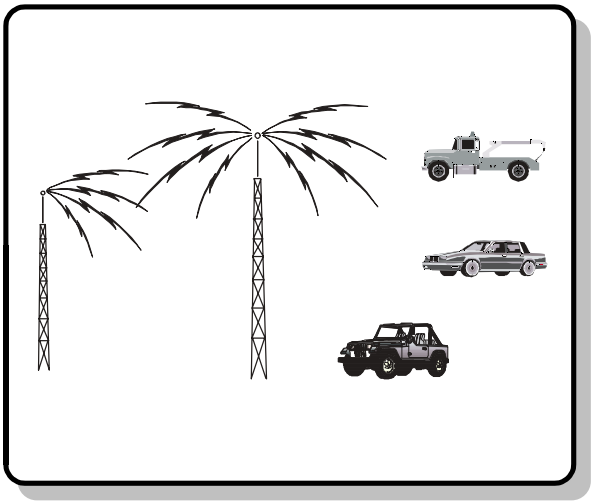
The radio licence fee applicable to radiocommunication service providers providing paging services is outlined in Schedule III, Part V, item 3.

Example 4:

Repeater System for a Radiocommunication Service Provider

This example describes how to calculate your radio licence fee for a repeater system if you are a radiocommunication service provider in the Land Mobile Service. You intend to put the system in operation in April. The station is located downtown Ottawa, Ontario.

(System Configuration)



Repeater Station

1. From **Schedule VI**, Ottawa is considered as a medium congested zone.

2. From **Schedule III, Part V, Item 2*(b)***, under Dispatch, the licence fee for a fixed station in the Land Mobile Service installed in a medium congested zone is the sum of the issuance fee **(Column II)**, $158 plus the monthly fee for one year **(Column III)** $43.80 for each assigned transmit or received frequency.

Total Fee Calculation:

($158 x 2) + (($43.80 x 2) x 12) = $1367.20

3. The renewal fee for the following year will be $1052.00 as there are no issuance fees:

$526.00 x 2 = $1052.00

4. For a short-term licence **(one month duration)** the licence fee would be the issuance fee plus the monthly fee:

($158 x 2) + ($43.80 x 2) = $403.60

Total Fee: $403.60

Frequency (MHz)			Channel		Licence Fee Calculation		
Transmit (TX)	Receive (RX)	Communicating with	TX	RX	Issuance	Renewal	Monthly / Short-term
460.0375	465.0375	subscribers	1	1	$158+$158	$526+$526	$43.80+$43.80

In the case where a radiocommunication service provider would be using radio links between stations, **Schedule III, Part II** would apply since the function of the links is **not for dispatch purposes** but for Point-to-Point communications between fixed stations.

Appendix A

Schedule III

Part I

"(*Sections 55, 56 and 60*)

Fee Schedule Applicable for a Mobile Station in any Service other than the Amateur Radio Service" SOR/2000-78

Item	Column I Type of Station, for all Authorized Transmit and Receive Frequencies	Column II Issuance Fee	Column III Monthly Fee	Column IV Renewal Fee	Column V Reinstatement Fee (April)	Column VI Reinstatement Fee (May)
1.	"Item repealed." SOR/2000-78					
2.	Mobile station in the aeronautical or maritime services	$11.00	$3.00	$36.00	$38.00	$41.00
3.	Mobile station in the public information service	11.00	3.00	36.00	38.00	41.00
4.	Mobile station in the developmental or radiodetermination service	12.00	3.40	41.00	43.00	46.00
5.	Mobile station in the land mobile service	12.00	3.40	41.00	43.00	46.00
6.	Mobile station communicating with a space station	12.00	3.40	41.00	43.00	46.00
7.	Other mobile station	12.00	3.40	41.00	43.00	46.00

Schedule III *(continued)*

Part II

(Sections 55, 56, 58, 61 and 65)

Fee Schedule Applicable to Radiocommunication Users for Fixed Stations that Communicate with other Fixed Stations or Space Stations

Item	Column I Number of Telephone Channels per Radio Frequency Assigned to each Transmitter or Receiver	Column II Issuance Fee	Column III Monthly Fee	Column IV Renewal Fee	Column V Reinstatement Fee (April)	Column VI Reinstatement Fee (May)
1.	From 1 to 24	$10.00	$ 2.80	$ 34.00	$ 36.00	$ 39.00
2.	From 25 to 60	13.00	3.50	42.00	44.00	48.00
3.	From 61 to 120	15.00	4.20	50.00	53.00	57.00
4.	From 121 to 300	27.00	7.60	91.00	96.00	103.00
5.	From 301 to 600	45.00	12.60	151.00	159.00	171.00
6.	From 601 to 960	64.00	17.80	213.00	224.00	241.00
7.	From 961 to 1,200	83.00	23.10	277.00	291.00	314.00
8.	1,201 or more	$83.00, plus $19.00 per 300 telephone channels or portion thereof in excess of 1,200	$23.10, plus $5.30 per 300 telephone channels or portion thereof in excess of 1,200	$277.00, plus $63.00 per 300 telephone channels or portion thereof in excess of 1,200	$291.00, plus $66.00 per 300 telephone channels or portion thereof in excess of 1,200	$314.00, plus $71.00 per 300 telephone channels or portion thereof in excess of 1,200

Schedule III *(continued)*

Part III

(*Sections 55, 56, 62 and 72*)

Fee Schedule Applicable to Radiocommunication Users for Fixed Stations Operating in Certain Services

Item	Column I Type of Station, for all Authorized Transmit and Receive Frequencies	Column II Issuance Fee	Column III Monthly Fee	Column IV Renewal Fee	Column V Reinstatement Fee (April)	Column VI Reinstatement Fee (May)
1.	Fixed station referred to in subsection 62(1) or section 72 of these Regulations	$12.00	$3.40	$41.00	$43.00	$46.00
2.	Fixed station in the public information service	11.00	3.00	36.00	38.00	41.00

Schedule III *(continued)*

Part IV

(*Sections 55, 56, 63 and 64*)

Fee Schedule Applicable to Radiocommunication Users for Fixed Stations in the Land Mobile Service

Item	Column I For each Assigned Transmit or Receive Frequency	Column II Issuance Fee	Column III Monthly Fee	Column IV Renewal Fee	Column V Reinstatement Fee (April)	Column VI Reinstatement Fee (May)
1.	(*a*) Metropolitan Area	$35.00	$9.70	$116.00	$122.00	$131.00
	(*b*) Other Area	16.00	4.40	53.00	56.00	60.00

Schedule III *(continued)*

Part V

(*Sections 55, 56 and 66 to 71*)

Fee Schedule Applicable to Radiocommunication Service Providers for Fixed Stations in the Land Mobile Service

Item	Column I Type of Operation, and Area, Congestion Zone or Coverage Area	Column II Issuance Fee	Column III Monthly Fee	Column IV Renewal Fee	Column V Reinstatement Fee (April)	Column VI Reinstatement Fee (May)
1.	For each assigned transmit or receive frequency					
	(*a*) Metropolitan Area	$ 35.00	$ 9.70	$ 116.00	$ 122.00	$ 131.00
	(*b*) Other Area	16.00	4.40	53.00	56.00	60.00
2.	Dispatch					
	For each assigned transmit or receive frequency					
	(*a*) High Congestion Zone	315.00	87.60	1,051.00	1,104.00	1,191.00
	(*b*) Medium Congestion Zone	158.00	43.80	526.00	552.00	596.00
	(c) Low Congestion Zone	79.00	21.80	262.00	275.00	297.00
3.	Paging					
	For each assigned transmit or receive frequency					
	(*a*) High Congestion Zone	110.00	30.70	368.00	386.00	417.00
	(*b*) Medium Congestion Zone	95.00	26.30	316.00	332.00	358.00
	(c) Low Congestion Zone	79.00	21.80	262.00	275.00	297.00
4.	Cellular Mobile Radio Frequencies					
	For each assigned transmit or receive frequency	142.00	39.40	473.00	497.00	536.00

Item	Column I Type of Operation, and Area, Congestion Zone or Coverage Area	Column II Issuance Fee	Column III Monthly Fee	Column IV Renewal Fee	Column V Reinstatement Fee (April)	Column VI Reinstatement Fee (May)
5.	Broadband Personal Communications Services Radio Frequencies For each 10 MHz assigned block of transmit or receive frequencies					
	(*a*) Coverage Area radius is $\geq$ 1 km	2,700.00	750.00	9,000.00	9,450.00	10,200.00
	(*b*) Coverage Area radius is < 1 km	27.00	7.50	90.00	95.00	102.00
6.	Narrowband Personal Communications Services Radio Frequencies For each 12.5 kHz assigned block of transmit or receive frequencies	158.00	43.80	525.00	551.00	595.00

Schedule III *(continued)*

Part VI

(*Sections 55, 56, 58 and 73*)

Fee Schedule Applicable for Space Stations that Communicate with Fixed Stations or Space Stations

Item	Column I Number of Telephone Channels per Radio Frequency Assigned to each Transmitter or Receiver	Column II Issuance Fee	Column III Monthly Fee	Column IV Renewal Fee	Column V Reinstatement Fee (April)	Column VI Reinstatement Fee (May)
1.	From 1 to 24	$ 353.00	$ 98.10	$1,177.00	$ 1,236.00	$ 1,334.00
2.	From 25 to 60	441.00	122.60	1,471.00	1,545.00	1,667.00
3.	From 61 to 120	530.00	147.10	1,765.00	1,853.00	2,000.00
4.	From 121 to 300	946.00	262.70	3,152.00	3,310.00	3,572.00
5.	From 301 to 600	1,608.00	446.60	5,359.00	5,627.00	6,074.00
6.	From 601 to 960	2,269.00	630.30	7,564.00	7,942.00	8,573.00
7.	From 961 to 1200	2,931.00	814.30	9,771.00	10,260.00	11,074.00
8.	1201 or more	$2,931.00, plus $662.00 per 300 telephone channels or portion thereof in excess of 1,200	$814.30, plus $183.90 per 300 telephone channels or portion thereof in excess of 1,200	$9,771.00, plus $2,207.00 per 300 telephone channels or portion thereof in excess of 1,200	$10,260.00, plus $2,317.00 per 300 telephone channels or portion thereof in excess of 1,200	$11,074.00, plus $2,501.00 per 300 telephone channels or portion thereof in excess of 1,200

Schedule III *(concluded)*

Part VII

(*Sections 55, 56 and 74*)

Fee Schedule Applicable to Radiocommunication Service Providers for Space Stations that Communicate with Mobile Stations

Item	Column I For Each Assigned Transmit or Receive Frequency	Column II Issuance Fee	Column III Monthly Fee	Column IV Renewal Fee	Column V Reinstatement Fee (April)	Column VI Reinstatement Fee (May)
1.	Space Station	$142.00	$39.40	$473.00	$497.00	$536.00

Schedule IV

(*Sections 55, 63, 66 and 79*)

Metropolitan Areas

Item	Column I Metropolitan Area	Column II North Latitude	Column III North Latitude	Column IV West Longitude	Column V West Longitude
1.	Calgary, Alta.	50° 51'	51° 13'	113° 50'	114° 18'
2.	Chicoutimi-Jonquière, Que.	48° 22'	48° 27'	70° 55'	71° 13'
3.	Edmonton, Alta.	53° 19'	53° 45'	113° 10'	113° 45'
4.	Halifax, N.S.	44° 35'	44° 43'	63° 29'	63° 40'
5.	Hamilton, Ont.	43° 09'	43° 24'	79° 43'	80° 00'
6.	Kitchener, Ont.	43° 20'	43° 32'	80° 16'	80° 36'
7.	London, Ont.	42° 54'	43° 03'	81° 08'	81° 21'
8.	Montréal, Que.	45° 21'	45° 45'	73° 18'	74° 00'
9.	Oshawa, Ont.	43° 50'	43° 57'	78° 45'	78° 55'
10.	Ottawa-Hull, Ont., Que.	45° 17'	45° 30'	75° 30'	75° 55'
11.	Québec, Que.	46° 41'	46° 52'	71° 06'	71° 25'
12.	Regina, Sask.	50° 22'	50° 33'	104° 29'	104° 43'
13.	Saint John, N.B.	45° 13'	45° 18'	66° 00'	66° 10'
14.	Saskatoon, Sask.	52° 04'	52° 15'	106° 23'	106° 47'
15.	St. Catharines-Niagara, Ont.	43° 03'	43° 17'	79° 02'	79° 20'
16.	St. John's, Nfld.	47° 30'	47° 38'	52° 32'	52° 48'
17.	Sudbury, Ont.	46° 25'	46° 34'	80° 46'	81° 02'
18.	Thunder Bay, Ont.	48° 18'	48° 29'	89° 09'	89° 20'
19.	Toronto, Ont.	43° 24'	43° 55'	78° 55'	79° 43'
20.	Vancouver, B.C.	49° 00'	49° 23'	122° 31'	123° 17'
21.	Victoria, B.C.	48° 24'	48° 45'	123° 15'	123° 32'
22.	Windsor, Ont.	42° 13'	42° 21'	82° 50'	83° 07'
23	Winnipeg, Man.	49° 42'	50° 00'	96° 57'	97° 30'

Schedule V

(*Sections 55, 67, 68 and 78*)

High Congestion Zones

	Column I	Column II		Column III		Column IV		Column V		Column VI		Column VII		Column VIII		Column IX		Column X	
		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates	
Item	Regional Area	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.
1.	Calgary, Alta.	51° 06'	114° 13'	51° 06'	113° 58'	50° 57'	113° 58'	50° 57'	114° 13'	-	-	-	-	-	-	-	-	-	-
2.	Edmonton, Alta.	53° 36'	113° 37'	53° 36'	113° 23'	53° 28'	113° 23'	53° 28'	113° 37'	-	-	-	-	-	-	-	-	-	-
3.	Montréal, Que.	45° 24'	74° 00'	45° 41'	73° 44'	45° 42'	73° 27'	45° 31'	73° 24'	45° 24'	73° 27'	-	-	-	-	-	-	-	-
4.	Toronto, Ont.	44° 08'	79° 40'	44° 00'	78° 45'	43° 02'	78° 45'	43° 02'	79° 30'	43° 10'	80° 00'	43° 40'	80° 00'	-	-	-	-	-	-
5.	Vancouver, B.C.	49° 23'	123° 25'	49° 23'	122° 08'	49° 00'	122° 08'	49° 00'	123° 20'	49° 19'	123° 25'	-	-	-	-	-	-	-	-
6.	Victoria, B.C.	49° 20'	124° 30'	49° 20'	124° 00'	48° 50'	123° 00'	48° 18'	123° 15'	48° 18'	123° 45'	48° 35'	123° 45'	-	-	-	-	-	-

Digby Wind Project UARB IR-14 Attachment 3 Page 24 of 25

Schedule VI

(*Sections 55, 67, 68 and 78*)

Medium Congestion Zone

	Column I	Column II		Column III		Column IV		Column V		Column VI		Column VII		Column VIII		Column IX		Column X		Column XI	
		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates		Geographical Coordinates	
Item	Regional Area	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.	North Lat.	West Long.
1	Calgary, Alta.	51° 13'	114° 18'	51° 13'	113° 50'	50° 51'	113° 50'	50° 51'	114° 18'	-	-	-	-	-	-	-	-	-	-	-	-
2	Chicoutimi, Que.	48° 23'	71° 18'	48° 28'	71° 18'	48° 38'	70° 48'	48° 33'	70° 48'	48° 23'	71° 00'	-	-	-	-	-	-	-	-	-	-
3	Chilliwack, B.C.	49° 23'	122° 08'	49° 23'	121° 30'	49° 00'	121° 30'	49° 00'	122° 08'	-	-	-	-	-	-	-	-	-	-	-	-
4	Edmonton, Alta.	53° 45'	113° 45'	53° 45'	113° 10'	53° 19'	113° 10'	53° 19'	113° 45'	-	-	-	-	-	-	-	-	-	-	-	-
5	Halifax, N.S.	44° 48'	63° 46'	44° 48'	63° 25'	44° 33'	63° 25'	44° 33'	63° 46'	-	-	-	-	-	-	-	-	-	-	-	-
6	London, Ont.	43° 08'	81° 26'	43° 08'	81° 03'	42° 54'	81° 03'	42° 54'	81° 26'	-	-	-	-	-	-	-	-	-	-	-	-
7	Montréal, Que	45° 36'	74° 31'	46° 03'	73° 28'	46° 03'	73° 04'	45° 32'	72° 52'	45° 21'	72° 10'	45° 30'	71° 45'	45° 20'	71° 45'	45° 12'	72° 10'	45° 12'	74° 07'	-	-
8	Ottawa, Ont.	45° 35'	76° 00'	45° 35'	75° 25'	45° 12'	75° 25'	45° 12'	76° 00'	-	-	-	-	-	-	-	-	-	-	-	-
9	Québec, Que	46° 49'	71° 32'	46° 40'	71° 22'	46° 40'	71° 13'	46° 49'	71° 06'	46° 55'	71° 10'	46° 55'	71° 20'	-	-	-	-	-	-	-	-
10	Regina, Sask.	50° 33'	104° 43'	50° 33'	104° 29'	50° 22'	104° 29'	50° 22'	104° 43'	-	-	-	-	-	-	-	-	-	-	-	-
11	Saint John, N.B.	45° 18'	66° 12'	45° 24'	66° 00'	45° 10'	66° 00'	45° 10'	66° 12'	-	-	-	-	-	-	-	-	-	-	-	-
12	Saskatoon, Sask.	52° 12'	106° 45'	52° 12'	106° 23'	52° 05'	106° 23'	52° 05'	106° 45'	-	-	-	-	-	-	-	-	-	-	-	-
13	St. John's, Nfld.	47° 38'	52° 50'	47° 38'	52° 36'	47° 29'	52° 36'	47° 29'	52° 50'	-	-	-	-	-	-	-	-	-	-	-	-
14	Sudbury, Ont.	46° 36'	81° 07'	46° 36'	80° 46'	46° 25'	80° 46'	46° 25'	81° 07'	-	-	-	-	-	-	-	-	-	-	-	-
15	Thunder Bay, Ont.	48° 29'	89° 20'	48° 29'	89° 09'	48° 18'	89° 09'	48° 18'	89° 20'	-	-	-	-	-	-	-	-	-	-	-	-
16	Toronto, Ont.	44° 16'	79° 20'	44° 07'	78° 30'	42° 53'	78° 30'	42° 53'	80° 00'	43° 20'	80° 45'	43° 40'	80° 45'	43° 40'	80° 22'	44° 02'	80° 00'	44° 40'	80° 00'	44° 40'	79° 20'
17	Trois-Rivières, Que.	46° 32'	72° 42'	46° 32'	72° 35'	46° 23'	72° 27'	46° 18'	72° 35'	-	-	-	-	-	-	-	-	-	-	-	-
18	Vancouver, B.C.	49° 50'	124° 50'	50° 00'	124° 30'	49° 23'	123° 10'	49° 23'	123° 25'	49° 19'	123° 25'	49° 00'	123° 20'	49° 20'	124° 00'	-	-	-	-	-	-
19	Victoria, B.C.	49° 50'	125° 20'	49° 50'	124° 50'	49° 20'	124° 00'	49° 20'	124° 30'	48° 35'	123° 45'	48° 18'	123° 45'	49° 20'	125° 20'	-	-	-	-	-	-
20	Windsor, Ont.	42° 21'	83° 07'	42° 21'	82° 45'	42° 05'	82° 45'	42° 05'	83° 07'	-	-	-	-	-	-	-	-	-	-	-	-
21	Winnipeg, Man.	50° 02'	97° 22'	50° 02'	96° 51'	49° 44'	96° 51'	49° 44'	97° 22'	-	-	-	-	-	-	-	-	-	-	-	-

Digby Wind Project UARB IR-14 Attachment 3 Page 25 of 25

REDACTED

Request IR-15:

Reference Appendix 13, Assignment and Assumption of Contracts Agreement

(a) Reference page 1 of 7, the second "whereas" recital. Should the term Assignee" used in this whereas be "Assignor". If not, why not?

(b) Please provide a copy of the Purchase Order with Magna Electric Corporation listed as item 5 on Schedule A, Page 6 of 6.

Response IR-15:

(a) The term "Assignee" used in the second "whereas" recital should be "Assignor".

(b) Please refer to Confidential Attachment 1.

REDACTED

Request IR-16:

Reference CONFIDENTIAL Appendix 16, Discounted Cash Flow EAM Analysis

(a) Please provide an electronic copy of the spreadsheet with all formulae intact.

(b) Reference page 1 of 4

(i) The total capital cost is shown as approximately $77.6 million. However the total of the four work order applications is $82.8 million (Executive summary, page 3 of 26, line 12). Please explain the difference between the two values.

(ii) Please explain why the calculations in Appendix 16 are not based on a total capital cost of $82.8 million.

(iii) Please provide the justification for the amount of the capital cost assumed to qualify for class 43.2 tax depreciation.

(iv) Is the amount classified as class 43.2 an NSPI assumption or has this been approved by Revenue Canada? If a NSPI assumption, what assurances can NSPI provide that Revenue Canada will accept this classification?

(v) Reference Sustaining capital, please provide details on what this covers and the basis for the estimate including the specific years used for this expenditure.

Request IR-16: (cont'd)

(vi) Reference ecoENERGY Rebate, please provide justification for the price of [redacted]

(vii) Please provide details on the calculation of the annual OM&G costs.

(c) Reference page 2 of 4

(i) Please provide details on the calculation of cash taxes.

(ii) Please provide details on the calculation of EVA taxes.

(iii) Please explain the term "NOPAT".

(iv) Please provide the derivation of the discount rate.

(v) Please provide details on the calculation of the capital charge.

(vi) Does the IRR computation take into account the unused CCA value at the end of 2030, i.e. the UCCA value of [redacted] If so, please explain how this is done within the spreadsheet. If not, please explain why not.

(vii) What is the minimum IRR that NSPI would accept and sill recommend this project, i.e. the NSPI "hurdle rate"?

Request IR-16: (cont'd)

(viii) Please provide a calculation where the capital cost of $77.6 million is increased so that the resultant IRR is the NSPI "hurdle rate". What was the percentage increase in capital cost?

Response IR-16:

(a) Please refer to Confidential Attachment 1, filed electronically.

(b) (i) The $77.6 million does not include Administrative Overheads and AFUDC.

(ii) The calculations in Appendix 16 are based on the capital cash spending. Administrative Overheads and AFUDC do not represent cash spending, but qualify as capital costs for regulatory accounting purposes.

(iii) Based on similar projects, NSPI's Corporate Tax Department has examined which costs are eligible for class 43.2, and based on this review and research, estimates that 90 percent of the total capital spending qualifies for class 43.2 tax depreciation.

(iv) The amount classified as class 43.2 is based upon NSPI's Corporate Tax Department's review of class 43.2, specifically on the eligibility of capital costs for wind projects.

(v) Sustaining capital covers the additional expenditures that will likely be required to repair the wind turbines over their 20 year design life.

Response IR-16: (cont'd)

The failure curve for commercially proven wind turbines is expected to be bathtub-shaped. The bathtub curve consists of three time periods - an "infant mortality" period with an initially higher incident rate followed by a decreasing failure rate; a normal life period (or useful life period) with a low, relatively constant failure rate, and a "wear-out" period that exhibits an increasing failure rate.

Failures that occur in the initial period are covered by the manufacturer's warranty. The low-rate of failure that occurs during the useful life period is covered by the O&M arrangements that are in the annual forecast. The budget for sustaining capital is intended to cover the wear-out failures that may occur during the last 5 years of the 20 year design life.

There is little or no data available on large turbines, over 1 MW, which have been deployed for more than 15 years. While there are more than 13,500 GE 1.5 Series turbines installed worldwide, GE did not enter the wind industry until 2002 and the sle turbine has been in serial production since only July 2004. Our approach to maintenance forecasting for later-in-life turbines has been based on discussions with wind consultants, turbine manufacturers, other developers and NSPI's own experience with rotating equipment. Sustaining capital was estimated at 2.5 percent of the initial capital cost of the turbines, during the last five years of the design life – the "wear-out" period. Failures during this time period could include blades, generators and gearboxes.

Response IR-16: (cont'd)

(vi) The ecoENERGY rebate is calculated based on $10/MWh, capped at 35 percent of maximum production for 10 years. The Digby Wind Project is a 30 MW farm. The maximum rebate is calculated as: 30 MW * 24 hours per day * 365 days per year * 35 percent maximum production * $10.00/MWh.

(vii) Please refer to UARB IR-10 Attachment 1.

(c) (i) The calculation of cash taxes is made up of two components, Income Tax and Provincial Capital Tax.

Revenue
Less: Operating Costs
Less: Capital Cost Allowance (tax depreciation)
Less: Provincial Capital Tax
Taxable Income
X - Corporate Tax Rate
Income Tax Payable
Add: Provincial Capital Tax
CASH TAXES

(ii) EVA tax is equivalent to Cash Tax, as calculated in part (c) (i), since there is no deferred tax that affects net earnings.

(iii) The term NOPAT stands for Net Operating Profit After Tax.

(iv) The discount rate is NSPI's pre-tax Weighted Average Cost of Capital.

Response IR-16: (cont'd)

(v) The calculation of the capital charge is based on the opening book value of the asset multiplied by NSPI's after-tax Weighted Average Cost of Capital of [redacted]

(vi) The IRR computation does not take into account the unused CCA value at the end of 2030. The IRR calculates the interest rate that would correspond to a zero net present value for a series of cash flows. The unused CCA is not a true cash flow and is excluded as a component of the IRR calculation.

(vii-viii) NSPI uses its Weighted Average Cost of Capital as a discount rate in calculating the net present value for projects of this nature. NSPI is prepared to make the investments necessary to serve customers, at its allowed rate of return.

REDACTED

Request IR-17:

Reference CONFIDENTIAL Appendix 17, Levelized Cost Analysis

(a) Please provide an electronic copy of the spreadsheet with all formulae intact.

(b) Please explain the calculation of the negative numbers shown for 2010, e.g. electric revenue, operating expense, etc. Include the derivation of the values in your explanation.

(c) Please explain the 9.35% shown for each year.

(d) For the levelized $/MW.h, please explain what row of numbers (i.e. what $ values) is used with the annual MWh production values to compute the $/MW.h.

(e) Please provide the annual total revenue requirement in millions of dollars charged to rate payers assuming NSPI purchased the project's energy output under the PPA. Also provide the annual total revenue requirement in millions of dollars charged to ratepayers under the present application for the NSPI purchase of the project. Provide this annual revenue requirement comparison for each year of the project's life.

Response IR-17:

(a) Please refer to Confidential Attachment 1, filed electronically.

Response IR-17: (cont'd)

(b) The Electric Revenue requirement is calculated based on a Return on Equity of 9.35 percent, and a capital structure of 37.5 percent equity. The Electric Revenue requirement for 2010 is negative due to 2010 being the construction period with net credits in expense. Operating Expenses in 2010 are negative as the project is in the construction phase and there are no OM&G costs except for the Administrative Overheads (AO) credit, recovered during construction. The AFUDC is a credit which represents the allowance for funds used during construction.

(c) The 9.35 percent shown for each year is NSPIs regulated Return on Equity for rate making purposes, based on a capital structure of 37.5 percent equity.

(d) The levelized cost per MWH is calculated using the net present value of the revenue requirement over the life of the project (row 11 - Confidential Attachment 1, filed electronically), divided by the net present value of the energy produced (row 22 – Confidential Attachment 1, filed electronically). This is the same methodology that has been used in prior filings.

(e) Please refer to Confidential Attachment 2.

SKYPOWER

CBCL LIMITED
Consulting Engineers

Digby Wind Power Project (DWPP)

Issued for Tender

June 2009
Contract 090630.00

SKYPOWER

Digby Wind Power Project (DWPP)

Issued for Tender		06/30/09	RO'C
Issued for Final Review	-	06/19/09	RO'C
Issued for Review	-	05/13/09	RO'C
Issue or Revision	***Reviewed By:***	***Date***	***Issued By:***

CBCL LIMITED
Consulting Engineers

ISO 9001
Registered Company

REGISTERED PROFESSIONAL ENGINEER
DATE 06/30/09
R. O'CONNOR
7785
PROVINCE OF NOVA SCOTIA

Issued for Tender
Contract 090630.00

THESE PROJECT DOCUMENTS HAVE BEEN PREPARED FOR USE WITH AND REQUIRE BEING READ IN CONJUNCTION WITH **THE STANDARD SPECIFICATION FOR MUNICIPAL SERVICES** AS PUBLISHED BY THE NOVA SCOTIA ROAD BUILDERS ASSOCIATION - CONSULTING ENGINEERS OF NOVA SCOTIA AND THE **JOINT COMMITTEE ON CONTRACT DOCUMENTS.** COPY OF THIS DOCUMENT IS AVAILABLE FROM THE FTP SITE FOR DOWNLOAD.

SUBJECT	SECTION
BIDDING AND CONTRACT REQUIREMENTS	
Information to Tenderers	00 21 00
Tender Form	00 41 43
Supplementary Tender Information	00 43 00
Form of Agreement (Stipulated Price)	00 53 43
Definitions	00 71 00
General Conditions of the Civil Work Contract – CCDC 18-2001	00 72 45
Supplementary General Conditions	00 73 00
SUPPLEMENTARY SPECIFICATIONS	
General Requirements (revised)	01 10 00
Environmental Protection (revised)	01 57 00
Measurement and Payment (replaced)	01 22 00
General Commissioning (CX) Requirements (new)	01 91 13
Commissioning Forms (new)	01 91 33
Commissioning Training (new)	01 91 41
Concrete Forming and Accessories (new)	03 10 00
Concrete Reinforcing (new)	03 20 00
Concrete (deleted)	03 30 00
Cast-in-Place Concrete (new)	03 30 00
Concrete Unit Masonry (new)	04 22 00
Structural Steel for Buildings (new)	05 12 00
Metal Fabrications (replaced)	05 50 00
Rough Carpentry (new)	06 10 00
Insulation (new)	07 21 00
Air/Vapour Barriers (new)	07 28 00
Firestopping and Smoke Seals (new)	07 80 00
Sealants (new)	07 92 00
Metal Doors and Frames (new)	08 11 14
Gypsum Board (new)	09 21 16
Painting (new)	09 91 23
Prefabricated Buildings (new)	13 34 23
Ventilation (new)	23 00 00

SUBJECT	SECTION
Common Work Results - Electrical (new)	26 05 00
Power Cable and Overhead Conductors (new)	26 05 14
Wire and Box Connectors (0-1000V) (new)	26 05 20
Wires and Cables (0-1000V) (new)	26 05 21
Connectors and Terminations (new)	26 05 22
Grounding - Primary (new)	26 05 27
Grounding - Secondary (new)	26 05 28
Hangers and Supports for Electrical Systems (new)	26 05 29
Splitters, Junction, Pull Boxes and Cabinets (new)	26 05 31
Outlet Boxes, Conduit Boxes and Fittings (new)	26 05 32
Conduits, Conduit Fastenings and Conduit Fittings (new)	26 05 34
Cable Trays for Electrical Systems (new)	26 05 36
Installation of Cables in Trenches and in Ducts (new)	26 05 44
Protection, Control and Communication Panels (new)	26 11 00
Outdoor Substation (new)	26 11 01
Liquid Filled MV Transformers (new)	26 12 13
Liquid Filled Power Transformers (new)	26 12 15
Pad Mounted, Liquid Filled, Medium Voltage Transformers (new)	26 12 19
Isolating Switches (new)	26 13 01
Medium Voltage Circuit Breakers (new)	26 18 00
Medium Voltage Reclosers(new)	26 18 26
Instrument Transformers(new)	26 22 19
Panelboard Breaker Type (new)	26 24 17
Wiring Devices (new)	26 27 26
Fuses - Low Voltage (new)	26 28 14
Moulded Case Circuit Breakers (new)	26 28 21
Medium Voltage Disconnect Switches (new)	26 28 22
Disconnect Switches - Fused and Non-Fused (new)	26 28 23
Wind Turbine Generators (new)	26 32 23
DC Uninterruptible Power Supply (new)	26 33 53
Surge Arresters (new)	26 41 01
Lighting (new)	26 50 00
Unit Equipment for Emergency Lighting (new)	26 52 01
Fibre Optic Cable System	27 05 10
Clearing and Grubbing (new)	31 10 00
Earthwork (revised)	31 20 00
Site Grading (new)	31 22 10
Chain Link Fence and Gate (new)	32 31 13
Passive Oil Containment System (new)	33 05 40
Well (new)	33 20 00
Pipe Culverts (new)	33 40 00
Concrete Encased Duct Banks (new)	33 65 73
Electrical Pole Lines and Hardware (new)	33 71 20

SUBJECT SECTION

APPENDICES

Appendix A1 - Commissioning Forms
Appendix A2 - Electrical Collection System - Standard Installation Drawings Schedule C
Appendix A3 - Electrical Collection System - Pole Schedule B
Appendix A4 - Electrical Schedule A - Bill of Materials
Appendix A5 - Electrical Pre-Purchased Equipment Procurement Specifications

REFERENCE DOCUMENTS

R1 - GE Energy 1.5SLE Technical Exhibits
R2 - GE Energy Installation Instructions, Receiving Reports, Testing, Verification and Check Sheets
R3 – Geotechnical Report

END

BIDDING AND CONTRACT REQUIREMENTS

PROJECT: Digby Wind Power Project

OWNER: SkyPower Corp.
250 Yonge Street, Suite 1602
Toronto, ON M5B 2L7

ENGINEER: CBCL Limited
1489 Hollis Street
PO Box 606
Halifax, NS B3J 2R7

1. Tender Submission

.1 Submit completed Tender Form for above project in sealed envelope marked as follows:

TENDER

Digby Wind Power Project
Contract 090630.00

Closing up to 3:00:00 p.m., Atlantic time, on Thursday, July 23, 2009 and delivered to:

CBCL Limited
1489 Hollis Street
Halifax, NS
B3J 2R7

Attn: Randy O'Connor, P.Eng.

2. Tender Opening

.1 Opening will be private.

3. Accuracy of Referencing

.1 Indexing and cross-referencing are for convenience only.

4. Site Visit

.1 Site visits for Bidders will be scheduled between July 7 and July 11, 2009, by appointment only. Appointments will be held twice a day and will be on a first come, first served basis. Site visits can be arranged by contacting Randy O'Connor, P.Eng., (randyo@cbcl.ca) who will assign a time and meeting place with a SkyPower Representative. Land access will be limited to three Contractor personnel during the site visit. Bidders will be limited to one site visit per Bidder.

5. Conditions of Tendering	.1	Take full cognizance of content of all Contract Documents in preparation of Tender. Refer to Section 00 41 43 – Tender Form, Subsection 3.14 for a complete list of Contract Documents.
6. Tenderers to Investigate	.1	Tenderers will be deemed to have familiarized themselves with existing site and working conditions and all other conditions which may affect performance of the Contract. No plea of ignorance of such conditions as a result of failure to make all necessary examinations will be accepted as a basis for any claims for extra compensation or an extension of time.
7. Clarification and Addenda	.1	Notify Engineer not less than four (4) working days before Tender Closing of omissions, errors or ambiguities found in Contract Documents. If Engineer considers that correction, explanation or interpretation is necessary, a written addendum will be issued. All addenda will form part of Contract Documents.
	.2	Confirm in the Tender Form that all addenda have been received.
8. Preparation of Tender	.1	Complete Tender Form provided with Project Documents in ink. Tender all items and fill in all blanks. Have corrections initialed by person signing Tender.
9. Taxes	.1	Include all taxes except Harmonized Sales Tax (HST) in tender unit prices.
10. Tender Security	.1	Provide Tender Security in amount of ten percent (10%) of the Total Amount Payable with Tender in the form of a Certified Cheque payable to the Owner or a Bid Bond on CCDC Form 220.
11. Contract Security	.1	Refer to Section 00 72 45 - General Conditions, subsection GC11.2 – Contract Security for form of Contract Security. Refer to project documents for amount of contract security and alternate type of contract security, if applicable.

12. Insurance	.1	Refer to Section 00 72 45, General Conditions, subsection GC11.1 - INSURANCE, for insurance required.
13. Form of Agreement	.1	Section 00 53 43 - Form of Agreement is attached for information purposes only.
14. Return of Tender Security	.1	Tender Security will be returned to: .1 All except the three lowest acceptable Tenderers within 30 days of Tender Opening. .2 Two remaining unsuccessful Tenderers within 30 days of date of Award. .3 Successful Tenderer following receipt by Owner of executed Agreement, specified Contract Security, and Insurance documents.
15. Amendment or Withdrawal of Tender	.1	Tenders may be amended or withdrawn by post or facsimile (902) 423-3938.
	.2	Amendment of individual unit prices is the only acceptable price amendment. Amendments shall not disclose either original or revised total price.
	.3	Head amendment or withdrawal as follows: "[Amend-ment]/[Withdrawal] of Tender for SkyPower Corp., Digby Wind Power Project, Contract 090630.00". Sign and seal as required for Tender, and submit at address given for receipt of Tenders. All submissions must be received prior to time of Tender Closing.
16. Informal or Un-balanced Tenders	.1	Tenders which in the opinion of the Owner are considered to be informal or unbalanced may be rejected.
17. Right to Accept or Reject any Tender	.1	Owner reserves right to accept or reject any Tender.
18. Safety Certification	.1	Submit with Tender, a copy of Tenderer's current and valid Certificate of Registration issued by a Workers' Compensation Board approved audit company.
	.2	Out of province and/or out of country companies shall submit, with their Tender, a current and valid Certificate of Registration from their

province/country of origin or from a recognized Safety Association which utilizes an external audit element.

.3 Out of province and/or out of country companies may obtain a Certificate of Registration from a Workers' Compensation Board approved audit company upon submission of documentation verifying training and compliance with the NS OH&S Act and Regulations.

.4 In any event, out of province and/or out of country Tenderers will have to satisfy a Workers' Compensation Board approved audit company in respect to their safety status prior to being awarded a contract.

19. Clearance Letter from Workers Compensation Board

.1 Submit with Tender, a copy of Tenderer's current valid clearance letter, issued by the Workers Compensation Board of Nova Scotia or from their province/country of origin.

20. Pre-Purchase Equipment

.1 Certain equipment has been pre-purchased by the Owner for installation into the Works by the Contractor. Refer to Section 01 10 00 and Division 26 for requirements for pre-purchased equipment. Copies of pre-purchase equipment procurement specifications are attached as Appendix A5.

21. Soils Investigation

.1 Soils investigation has been carried out at the Site. Information from Geotechnical Report entitle "Final Report, Proposed Digby Wind Power Project, Gullivers Cove, NS", prepared by Strum Environmental, dated June 3, 2009, is available on FTP site as Reference Document R3. Any interpretations shall be at the Tenderers own risk and the Engineer shall not be held responsible for the interpretation of this document.

22. Construction Progress Schedule

.1 Submit with Tender, a tentative program and schedule outlining the proposed order of procedure, significant Contract dates, and method in which the Contractor proposes to carry out and complete the Works within time period required by Contract Documents.

.2 Provide information regarding the implementation of the Works and of the Construction Equipment, temporary works, labour and construction crews which the Contractor intends to supply, use or construct as the case may be.

23. Quality Assurance/ Quality Control Plan

.1 Submit with Tender, proposed QA/QC Plan.

24. Extended Warranty

.1 The Contractor shall provide extended warranty for a period of twelve (12) months commencing after termination of the standard one (1) year warranty as specified under GC 12.3 of the General Conditions.

END

1. **SALUTATION:**

.1 To: SkyPower Corp.

.2 For: Digby Wind Power Project
Contract 090630.00

.3 From: _____

2. **TENDERER DECLARES:**

.1 That this tender was made without collusion or fraud.

.2 That the proposed work was carefully examined.

.3 That the Tenderer was familiar with local conditions.

.4 That Contract Documents and Addenda No. ___ to ___ inclusive were carefully examined.

.5 That all the above were taken into consideration in preparation of this Tender.

3. **TENDERER AGREES:**

.1 To enter into a contract to supply all labour, material and equipment and to do all work necessary to construct the Work as described and specified herein for the unit prices stated in Subsection 4 hereunder, Schedule of Quantities and Unit Prices.

.2 That the estimated Contract Price shall be the sum of the products of the tendered unit prices times the estimated quantities in Subsection 4 hereunder.

.3 That the estimated Contract Price will be converted to a Stipulated Contract Price Agreement based on the quantities and prices entered in the Tender Form.

.4 That, in the event, additional quantities of individual items are required as a result of differing site conditions, those additional items will be paid for out of the Contingency Allowance at the unit rates bid in the Tender Form. The Contingency Allowance will only be used once the value of the Contract exceeds the Stipulated Contract Price.

.5 That, in any event, the Contractor will not be paid less that the Stipulated Contract Price, unless the project scope is reduced.

.6 That any balance in the Contingency Allowance will remain with the Owner.

.7 That, in the event, the actual quantities exceed the estimated quantities in the Tender Form, no premium or adjustment of unit rates will apply to the original or additional quantities.

.8 That this Tender is valid for acceptance for eighty (80) days from Tender Closing.

.9 That measurement and payment for items listed in Subsection 4 hereunder shall be in accordance with corresponding items in Section 01 22 00 Measurement and Payment and will be used to process progress payments only.

.10 That the information requested in Section 00 43 00 – Supplementary Tender Information forms part of the Tender. This information will be evaluated and considered in the Award of the Tender.

.11 To execute in triplicate the Agreement and forward same together with the specified contract security and insurance documents to the Owner within 14 days of written notice of award.

.12 That failure to enter into a formal contract and give specified insurance documents and contract security within time required will constitute grounds for forfeiture of certified cheque or enforcement of bid bond.

.13 That if certified cheque is forfeited, Owner will retain difference in money between amount of Tender and amount for which Owner legally contracts with another party to perform the Work and will refund balance, if any, to Tenderer.

.14 That the Contract Documents include:

.1 Standard Specification for Municipal Services listed in Table of Contents Page Dated January 2009.
.2 Tender Form
.3 Form of Agreement
.4 Supplementary Specifications
.5 Appendices – A1, A2, A3, A4 and A5
.6 Drawings

Drawing No.	Drawing Name
C100	COVER SHEET
	CIVIL
C101	SITE PLAN
C102	PLAN-PROFILE WEST SITE ACCESS ROAD STA. 0+000 TO STA. 1+600
C103	PLAN-PROFILE WEST SITE ACCESS ROAD STA. 1+600 TO STA. 3+000
C104	PLAN-PROFILE WEST ACCESS ROAD 1 STA. 0+000 TO STA. 1+500
C105	PLAN-PROFILE WEST ACCESS ROAD 1 STA. 1+500 TO STA. 3+000
C106	PLAN-PROFILE WEST ACCESS ROAD 2 STA. 0+000 TO STA. 0+800

C107	PLAN-PROFILE WEST ACCESS ROAD 3 STA. 0+000 TO STA. 1+200
C108	PLAN-PROFILE EAST SITE ACCESS ROAD STA. 0+000 TO STA. 1+500
C109	PLAN-PROFILE EAST SITE ACCESS ROAD STA. 1+500 TO STA. 2+800
C110	PLAN-PROFILE EAST SITE ACCESS ROAD STA. 2+800 TO STA. 3+700
C111	PLAN-PROFILE EAST ACCESS ROAD 1 STA. 0+000 TO STA. 1+400
C112	PLAN-PROFILE EAST ACCESS ROAD 2 STA. 0+000 TO STA. 1+300
C113	PLAN-PROFILE TURN LOOPS 1 TO 4
C114	DETAILS ACCESS ROAD LAYOUT
C201	TURBINE SITE PLANS No.'s 13, 2 & 9
C202	TURBINE SITE PLANS No.'s 14, 6 & 4
C203	TURBINE SITE PLANS No.'s 10, 1 & 7
C204	TURBINE SITE PLANS No.'s 17, 20 & 5
C205	TURBINE SITE PLANS No.'s 19, 16 & 15
C206	TURBINE SITE PLANS No.'s 12 & 18
C207	TURBINE SITE PLANS No.'s 11 & 8
C208	TURBINE SITE PLAN No. 3
C209	DETAILS WIND TURBINES
C301	PLAN-SUBSTATION
C302	SECTIONS AND DETAILS-SUBSTATION
C401	ROAD CROSS SECTIONS WEST SITE ACCESS ROAD
C402	ROAD CROSS SECTIONS WEST ACCESS ROAD 1 STA. 0+000 TO 1+900
C403	ROAD CROSS SECTIONS WEST ACCESS ROAD 1 STA. 1+900 TO 3+000
C404	ROAD CROSS SECTIONS WEST ACCESS ROADS 2 AND 3
C405	ROAD CROSS SECTIONS EAST SITE ACCESS ROAD STA. 0+000 TO 2+400
C406	ROAD CROSS SECTIONS EAST SITE ACCESS ROAD STA. 2+400 TO 3+700
C407	ROAD CROSS SECTIONS EAST ACCESS ROAD 1
C408	ROAD CROSS SECTIONS EAST ACCESS ROAD 2 AND TURBINE 8 ACCESS ROAD
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S102	WIND TURBINE FOUNDATION REINFORCING PLAN & NOTES
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S203	SUBSTATION MISCELLANEOUS FOUNDATION PLANS, SECTIONS & DETAILS
S204	SUBSTATION GENERAL NOTES & SPECIFICATIONS
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S402	SUBSTATION 34.5kV BUS FRAME STRUCTURAL STEEL SECTIONS & DETAILS
S403	SUBSTATION BUS FRAME STRUCTURAL STEEL DETAILS
S404	SUBSTATION 69kV A-FRAME STRUCTURAL STEEL PLAN, ELEVATION & DETAILS
S405	SUBSTATION 69kV A-FRAME STRUCTURAL STEEL DETAILS
S406	SUBSTATION METERING UNIT FRAME PLAN, ELEVATION & DETAILS
S407	SUBSTATION STATCOM BUS FRAME STRUCTURAL STEEL PLAN, SECTIONS & DETAILS
S408	SUBSTATION STATCOM BUS FRAME STRUCTURAL STEEL SECTIONS

ARCHITECTURAL

A281	CONTROL BUILDING PLAN & SECTIONS

MECHANICAL

M290	MECHANICAL FLOOR PLAN AND SCHEDULES

ELECTRICAL

E100	LEGEND
E101	DIGBY WIND FARM SYSTEM SINGLE-LINE DIAGRAM
E111	INTERCONNECTION P&I SINGLE-LINE DIAGRAM
E112	COLLECTION CIRCUIT No. 411 P&I SINGLE-LINE DIAGRAM
E113	COLLECTION CIRCUIT No. 412 P&I SINGLE-LINE DIAGRAM
E114	VAr COMPENSATION P&I SINGLE-LINE DIAGRAM
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E203	SUBSTATION NORTH/SOUTH ELEVATIONS
E204	SUBSTATION STATCOM NORTH/SOUTH ELEVATIONS
E211	SUBSTATION CONDUIT PLAN
E212	CONDUIT SCHEDULE
E221	SUBSTATION GROUNDING PLAN
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E231	SUBSTATION FOUNDATION PLAN
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E262	34.5kV STATCOM BUS STRUCTURE DETAIL
E263	69kV BUS STRUCTURE DETAIL
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E285	CONTROL BUILDING GENERAL ARRANGEMENT
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E910	COLLECTION SYSTEM SITE PLAN
E911	COLLECTION SYSTEM PLANS “WEST”
E912	COLLECTION SYSTEM PLANS “WEST-EAST”
E913	COLLECTION SYSTEM PLANS “GULLIVER’S COVE & OLD MOUNTAIN ROADS”
E914	COLLECTION SYSTEM PLANS “EAST”
E921	WIND TURBINE CONDUIT PLAN & DETAILS
E931	WIND TURBINE GROUNDING PLAN

.6 Addenda as issued and as confirmed in subsection 2.4 of this section.

4. **SCHEDULE OF QUANTITIES AND UNIT PRICES**

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
EARTHWORKS (A)					
1.	Clearing	ha	8		
2.	Grubbing	ha	26		
3.	Mass Excavation and Embankment				
	.1 Common	m^3	230,000		
	.2 Rock	m^3	123,000		
4.	Mass Excavation - Unsuitable Material	m^3	10,000		
5.	Trench Excavation – Rock	m^3	1,600		
6.	Trench Excavation – Unsuitable Material	m^3	600		
7.	Common Borrow	m^3	20,000		
8.	Granular Material				
	.1 Type 1 Gravel	t	50,000		
	.2 Site Material (75mm minus stone)	t	120,000		
9.	Culverts				
	.1 450mm dia.	m	600		
10.	Drilling Electrical Ground Well	m	1,600		

SUBTOTAL EARTHWORKS (A) $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
WIND TURBINE SITES (B)					
11.	Wind Turbine Generator (WTG) Foundations	ea	20		
12.	Installation of Wind Turbine	ea	20		
13.	Wind Turbine Site Electrical	ea	20		
	SUBTOTAL WIND TURBINE SITES (B) $				
ELECTRICAL (C)					
14.	Control Building	L.S.	1		
15.	Power Collection System	L.S.	1		
16.	Substation	L.S.	1		
	SUBTOTAL ELECTRICAL (C) $				
COMMISSIONING (D)					
17.	Commissioning	L.S.	1		
	SUBTOTAL COMMISSIONING (D) $				

SUMMARY

ESTIMATED CONTRACT PRICE (EXCLUDING HST) [(A) + (B) +(C) + (D)]	**$**
CONTINGENCY ALLOWANCE (E)	$ 800,000
ADD HARMONIZED SALES TAX [13% OF ESTIMATED CONTRACT PRICE + (E)]	$
TOTAL AMOUNT PAYABLE	**$**

Note: All amounts shall be in Canadian funds.

TENDERER'S HST REGISTRATION NO. _____

5. **COMPLETION TIME**

.1 Tenderer agrees to complete the Work within _____ weeks of written notification of award, but in no case later than March 15, 2010. Construction is expected to start in October 2009.

6. **SIGNATURES***

DATED THIS _____ DAY OF_____ , 20 ____.

[Seal]

_____
Name of Firm Tendering

_____
Signature of Signing Officer

_____ _____
Witness Name and Title (Printed)

_____ _____
Witness Signature of Signing Officer

_____
Name and Title (Printed)

_____
Company Address

_____
Telephone No.

_____
Fax No.

**NOTE: Tenders submitted by or on behalf of any Corporation must be signed and sealed in the name of such Corporation by a duly authorized officer or agent.*

END

1. Referee as to Tenderer's financial status:

   Name _____

   _____

   Address _____

   _____

   Contact _____ Telephone _____

2. Name and address of company who has agreed to underwrite the Bonds for Performance and for Labour and Material Payment. Refer to Clause GC 11.2 – Contract Security in the General Conditions.

   Name _____

   _____

   Address _____

   _____ Telephone _____

3. Name and address of company who has agreed to underwrite insurance on this Contract and the type and amount of insurance. Refer to Clause GC 11.1 – Insurance in the General Conditions.

   Name _____

   _____

   Address _____

   _____ Telephone _____

Type of Insurance	Amount

4. Particulars of Tenderer's recent contracts:

The Tenderer shall furnish particulars of at least three, and if possible, five contracts successfully completed or currently being carried to completion. The projects quoted should preferably be approximate in nature to the Works now tendered for and be of comparable or greater size.

1. (a) Owner: _____

(b) Project Description: _____

_____

(c) Start Date: _____ Finish Date: _____

(d) Contract Value: $ _____

2. (a) Owner: _____

(b) Project Description: _____

_____

(c) Start Date: _____ Finish Date: _____

(d) Contract Value: $ _____

3. (a) Owner: _____

(b) Project Description: _____

_____

(c) Start Date: _____ Finish Date: _____

(d) Contract Value: $ _____

5. List of equipment to be used on this project.

_____

_____

_____

_____

_____

6. Tentative program of works:

The Tenderer shall include an outline of the proposed method of operation to ensure completion by the Completion Date set forth in the Tender Form.

7. List of Sub-Contractors to be used:

The Tenderer's attention is drawn to the General Conditions GC 3.8 – Subcontractors and Suppliers. The Tenderer shall enter the name and address of each Sub-Contractor used in making up the tender. Only one Sub-Contractor shall be named for each part of the work to be sublet.

After the tender has been accepted by the Owner, the Contractor shall not be allowed to substitute other sub-contractors in place of those named in the tender without written approval from the Owner.

Sub-Trade	Contractor Name and Address	Scope of Work	Value of Work

8. Project personnel:

The Tenderer shall include below, the names, qualifications and previous experience of those people who will be directly involved with the project. The names shall, for example, include foreman, superintendent, project engineer and/or project manager, commissioning lead.

Name: _____

Position: _____

Years of Experience: _____ Years with Company: _____

Related Experience: _____

Name: _____

Position: _____

Years of Experience: _____ Years with Company: _____

Related Experience: _____

Name: _____

Position: _____

Years of Experience: _____ Years with Company: _____

Related Experience: _____

Name: _____

Position: _____

Years of Experience: _____ Years with Company: _____

Related Experience: _____

Name: _____

Position: _____

Years of Experience: _____ Years with Company: _____

Related Experience: _____

9. Tenderer's Safety Data

The Owner is committed to working with safe contractors. Toward that end, the Owner will rate Tenderers on certain safety criteria. Before the Tenderer or the Tenderer's subcontractor, is allowed to work, safety performance will be reviewed by the Owner. The Owner requires that all Tenderers and subcontractors be registered and in good standing with the Workers' Compensation Board of Nova Scotia.

Recordable Incidents

Furnish a copy of the Tenderer's WCB Accident History, on their letterhead, for the last three years. It is unlikely the Owner can award the work without this information. This information is available from the Nova Scotia Workers' Compensation Board, Assessment Department, (902) 491-8324, or toll free 1-800-870-3331. Out of province and/or out of country Tenderers shall submit WCB Accident History from their province/country of origin.

Indicate Tenderer's Workers' Compensation registration number

_____.

Using the Tenderer's last year's Accident Statements, complete the following:

a. Number of injury related fatalities: _____
b. Number of injuries with lost workdays: _____
c. Number of injuries requiring medical attention, but no lost work days: _____
d. Total number of injuries: _____

Note: No "First Aid" cases should be included in the above.

Number of "First Aid" cases in addition to above: _____

Number of employee hours worked last year:

Field _____
Supervisory _____
Total _____

Safety Program

Do you hold safety meetings for:

	Yes	No	Frequency	Title of Person Conducting Meeting
Employees	____	____	_____	_____
Subcontractors	____	____	_____	_____

Do you conduct job safety inspections? Yes ___ No ___

a. Do you have a formal safety program? Yes ___ No ___

b. If the answer is "yes", please submit a copy with this information.

c. Who will be your designated safety contact person on site?

_____.

List the names of those employees who will be on the Owner's site that are certified in first aid. (Attach a separate list, if necessary.)

Employee Name	Expiry Date of Certificate

This is to certify that the data and information provided is accurate. It also gives permission to the Owner to verify the above information with the Workers' Compensation Board of Nova Scotia.

Signature _____

Name _____

Title* _____

Date _____

* President or senior company officer.

END

This Agreement made on the ___ day of _____ in the year_____.

BY AND BETWEEN

SkyPower Corp.

hereinafter called the "Owner"

and

hereinafter called the "Contractor"

The Owner and the Contractor agree as follows:

ARTICLE A1 - THE WORK

The Contractor shall:

.1 Perform the Work required by the Contract Documents for permitting, procurement, off-loading Owner-supplied equipment, construction and installation for

Digby Wind Power Project, Contract 090630.00

located at Digby, Nova Scotia

for which the Agreement has been signed by the parties, and for

which CBCL Limited

is acting as and is hereinafter called the “Engineer”

and

.2 do and fulfill everything indicated by this Agreement, and

.3 commence the Work by the _____ day of _____in the year _ and attain Substantial Performance of the work as certified by the Engineer by the ___ day of _____in the Year ___.

ARTICLE A2 – AGREEMENTS AND AMENDMENTS

The Contract supersedes all prior negotiations, representations or agreements, either written or oral, relating in any manner to the work, including the bidding documents that are not expressly listed in Article A3 of the Agreement.

ARTICLE A3 - CONTRACT DOCUMENTS

The following is an exact list of the Contract Documents referred to in Article 1, subsection 1 of this Agreement and as defined in subsection 6 of Section 00 71 00 DEFINITIONS. This list is subject to subsequent amendments in accordance with the provisions of the Contract Documents.

.1 STANDARD SPECIFICATION FOR MUNICIPAL SERVICES, Table of Contents Dated January 2009
.2 Tender Form
.3 Form of Agreement
.4 Supplementary Specifications
.5 Appendices – A1, A2, A3, A4 and A5
.6 Drawings:

Drawing No.	Drawing Name
C100	COVER SHEET
	CIVIL
C101	SITE PLAN
C102	PLAN-PROFILE WEST SITE ACCESS ROAD STA. 0+000 TO STA. 1+600
C103	PLAN-PROFILE WEST SITE ACCESS ROAD STA. 1+600 TO STA. 3+000
C104	PLAN-PROFILE WEST ACCESS ROAD 1 STA. 0+000 TO STA. 1+500
C105	PLAN-PROFILE WEST ACCESS ROAD 1 STA. 1+500 TO STA. 3+000
C106	PLAN-PROFILE WEST ACCESS ROAD 2 STA. 0+000 TO STA. 0+800
C107	PLAN-PROFILE WEST ACCESS ROAD 3 STA. 0+000 TO STA. 1+200
C108	PLAN-PROFILE EAST SITE ACCESS ROAD STA. 0+000 TO STA. 1+500
C109	PLAN-PROFILE EAST SITE ACCESS ROAD STA. 1+500 TO STA. 2+800
C110	PLAN-PROFILE EAST SITE ACCESS ROAD STA. 2+800 TO STA. 3+700
C111	PLAN-PROFILE EAST ACCESS ROAD 1 STA. 0+000 TO STA. 1+400
C112	PLAN-PROFILE EAST ACCESS ROAD 2 STA. 0+000 TO STA. 1+300
C113	PLAN-PROFILE TURN LOOPS 1 TO 4
C114	DETAILS ACCESS ROAD LAYOUT
C201	TURBINE SITE PLANS No.'s 13, 2 & 9
C202	TURBINE SITE PLANS No.'s 14, 6 & 4
C203	TURBINE SITE PLANS No.'s 10, 1 & 7
C204	TURBINE SITE PLANS No.'s 17, 20 & 5
C205	TURBINE SITE PLANS No.'s 19, 16 & 15
C206	TURBINE SITE PLANS No.'s 12 & 18
C207	TURBINE SITE PLANS No.'s 11 & 8
C208	TURBINE SITE PLAN No. 3
C209	DETAILS WIND TURBINES
C301	PLAN-SUBSTATION
C302	SECTIONS AND DETAILS-SUBSTATION

C401	ROAD CROSS SECTIONS WEST SITE ACCESS ROAD
C402	ROAD CROSS SECTIONS WEST ACCESS ROAD 1 STA. 0+000 TO 1+900
C403	ROAD CROSS SECTIONS WEST ACCESS ROAD 1 STA. 1+900 TO 3+000
C404	ROAD CROSS SECTIONS WEST ACCESS ROADS 2 AND 3
C405	ROAD CROSS SECTIONS EAST SITE ACCESS ROAD STA. 0+000 TO 2+400
C406	ROAD CROSS SECTIONS EAST SITE ACCESS ROAD STA. 2+400 TO 3+700
C407	ROAD CROSS SECTIONS EAST ACCESS ROAD 1
C408	ROAD CROSS SECTIONS EAST ACCESS ROAD 2 AND TURBINE 8 ACCESS ROAD

STRUCTURAL

S101	WIND TURBINE FOUNDATION PLAN, SECTIONS & DETAILS
S102	WIND TURBINE FOUNDATION REINFORCING PLAN & NOTES
S103	WIND TURBINE FOUNDATION ANCHOR BOLT TENSIONING
S201	SUBSTATION CONTROL BUILDING FOUNDATION PLAN, SECTIONS & DETAILS
S202	SUBSTATION FRAMES FOUNDATION PLANS, SECTIONS & DETAILS
S203	SUBSTATION MISCELLANEOUS FOUNDATION PLANS, SECTIONS & DETAILS
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S403	SUBSTATION BUS FRAME STRUCTURAL STEEL DETAILS
S404	SUBSTATION 69kV A-FRAME STRUCTURAL STEEL PLAN, ELEVATION & DETAILS
S405	SUBSTATION 69kV A-FRAME STRUCTURAL STEEL DETAILS
S406	SUBSTATION METERING UNIT FRAME PLAN, ELEVATION & DETAILS
S407	SUBSTATION STATCOM BUS FRAME STRUCTURAL STEEL PLAN, SECTIONS & DETAILS
S408	SUBSTATION STATCOM BUS FRAME STRUCTURAL STEEL SECTIONS

ARCHITECTURAL

A281 CONTROL BUILDING PLAN & SECTIONS

MECHANICAL

M290	MECHANICAL FLOOR PLAN AND SCHEDULES

ELECTRICAL

E100	LEGEND
E101	DIGBY WIND FARM SYSTEM SINGLE-LINE DIAGRAM
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E112	COLLECTION CIRCUIT No. 411 P&I SINGLE-LINE DIAGRAM
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E203	SUBSTATION NORTH/SOUTH ELEVATIONS
E204	SUBSTATION STATCOM NORTH/SOUTH ELEVATIONS
E211	SUBSTATION CONDUIT PLAN
E212	CONDUIT SCHEDULE
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E222	SUBSTATION GROUNDING & FENCING DETAILS
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E623	FIBRE-OPTIC COLLECTION SYSTEM WEST CONNECTION DIAGRAM
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E910	COLLECTION SYSTEM SITE PLAN
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E914	COLLECTION SYSTEM PLANS “EAST”
E921	WIND TURBINE CONDUIT PLAN & DETAILS
E931	WIND TURBINE GROUNDING PLAN

.6 Addenda

.1 Addendum 1 dated _____

.2 Addendum 2 dated _____

ARTICLE A4 - CONTRACT PRICE

.1 A lump sum stipulated price forms the basis for payment of the Contract Price. The Contract Price is:

_____

_____ /100 dollars $_____

.3 All amounts shall be in Canadian funds. Contract Price **excludes** HST and Contingency Allowance.

ARTICLE A5 - PAYMENT

.1 The Owner shall pay the Contractor in Canadian funds for the performance of the Contract.

.2 The Owner shall make monthly progress payments on account to the Contractor for the Work performed, as certified by the Engineer, subject to a 10% holdback in accordance with Nova Scotia Builder's Lien Act.

.3 The amount of the monthly progress payments shall be calculated in accordance to GC 5.6 of the General Conditions.

.4 Monthly progress payments will be contingent on the Owner receiving the following submission along with the application for payment:
- .1 submission of a Statutory Declaration (CCDC 9a),
- .2 evidence that insurance coverage is maintained,
- .3 evidence of concurrence with Worker's Compensation requirements,
- .4 provision of current monthly progress schedule as follows:
  - .1 Project Schedule shall be completed in Microsoft Project showing all tasks with links to resources, equipment and associate manpower. Project Schedule shall show float where applicable and clearly show the critical path at all times throughout the construction period. Changes to the Schedule are to be clearly identified. Where Schedule items fall behind, the revised Schedule shall show how changes in construction activities will be made to maintain the completion date.
- .5 provision of monthly status report including:
  - .1 Construction Management and overall summary of Site progress.
  - .2 HSE status, including incidents LTI stats, and safety records to date.
  - .3 Status and concern re: civil - roadways
  - .4 Status and concerns re: structural – WT foundations
  - .5 Status and concerns re: collection system
  - .6 Status and concerns re: substation
  - .7 Status and concerns re: communications system
  - .8 Plans and update on procurement of equipment and materials
  - .9 Plans and update on site deliveries (with receiving report to be submitted daily or as deliveries are made)
  - .10 Tools and equipment report (to be submitted daily)
  - .11 Manpower report (to be submitted daily)
  - .12 Listing of NCR's
  - .13 Update of costs

.5 The last day of the payment period shall be the last day of the month.

.6 Upon Substantial Performance of the Work as certified by the Engineer the Owner shall pay to the Contractor the holdback monies then due in accordance with the provisions of Section 00 72 45 - General Conditions, subsection GC5.8 – PAYMENTS OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK.

.7 Upon the issuance of the final certificate for payment, Work as certified by the Engineer the Owner shall pay to the Contractor the balance of monies then due in accordance with the provision of Section 00 72 45 - General Conditions, subsection GC5.10 – FINAL PAYMENT.

.8 In the event of loss or damage occurring where payment becomes due under the property and boiler insurance policies, payment shall be made to the Contractor in accordance with the provisions of Section 00 72 45 - General Conditions, subsection GC11.1 - INSURANCE.

.9 If the Owner fails to make payments to the Contractor as they become due under the terms of the Contract, interest shall be payable as follows:

.1 The annual interest rate applicable to the contract is two percent (2%) compounded semi-annually.

.2 Interest shall be calculated on the overdue balance from the due date.

ARTICLE A6 - RECEIPT OF AND ADDRESSES FOR NOTICES

.1 Notices in writing between the parties or between them and the Engineer shall be considered to have been received by the addressee on the date of delivery if delivered to the individual, or to a member of the firm, or to an officer of the corporation for whom they are intended by hand or by registered post; or if sent by regular post, to have been delivered within 5 Working Days of the date of mailing when addressed as follows:

.1 The Owner at 250 Yonge Street, Suite 1602

Toronto, ON M5B 2L7

.2 The Contractor at _____

_____

.3 The Engineer at 1489 Hollis Street, PO Box 606

Halifax, NS B3J 2R7

ARTICLE A7 - QUANTITIES AND MEASUREMENT

.1 The quantities shown in Section 00 41 43 Tender Form - Schedule of Quantities and Unit Prices will be used to process progress claims and in the event, additional quantities of individual items are required as a result of differing site conditions, those additional items will be paid for out of the Contingency Allowance at the unit rates bid in the Tender Form. The Contingency Allowance will only be used once the value of the Contract exceeds the Stipulated Contract Price.

.2 Measurement for the quantities used to determine payments will be in accordance with Section 01 22 00 - Measurement and Payment.

ARTICLE A8 - SUCCESSION

The aforesaid Contract Documents are to be read into and form part of the Agreement and the whole shall constitute the Contract between the parties and subject to law and the provisions of the Contract Documents shall enure to the benefit of and be binding upon the parties hereto, their respective heirs, legal representatives, successors and assigns.

ARTICLE A9 - RIGHTS AND REMEDIES

No action or failure to act by the Owner, Engineer, or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

ARTICLE A10 - TIME

Time shall be construed as being of the essence of the Contract.

In witness whereof the parties hereto have executed this Agreement and by the hands of their duly authorized representatives.

SIGNED AND DELIVERED
In the presence of:

OWNER

SkyPower Corp.
Name of Owner

WITNESS

Signature

Name and Title of Person Signing

Signature

Name and Title of Person Signing

Signature

Name and Title of Person Signing

CONTRACTOR

Name of Contractor

WITNESS

Signature

Name and Title of Person Signing

Signature

Name and Title of Person Signing

Signature

Name and Title of Person Signing

N.B. Where legal jurisdiction, local practice or Owner or Contractor requirements calls for (a) proof of authority to execute this document, attach such proof of authority in the form of a certified copy of a resolution naming the representative(s) authorized to sign the Agreement for and on behalf of the corporation or partnership; or (b) the affixing of a corporate seal, this Agreement should be properly sealed.

END

These Supplementary General Conditions amend Section 00 71 00 DEFINITIONS and Section 00 72 45 - GENERAL CONDITIONS.

SECTION 00 71 00 - DEFINITIONS

1. Page 7, after definitions for Project, add new definitions for Project Documents as follows:

   Project Documents
   Project Documents are those documents prepared to supplement the Standard Specifications for the Work on a specific Project. Where applicable, they consist of the Information for Tenderers, Tender Form, Form of Agreement, Supplementary Specifications, Appendices, drawings and addenda.

2. Page 7, after definitions for Specifications, add new definitions for Standard Specification as follows:

   Standard Specification
   The Standard Specifications consist of Definitions, General Conditions, Supplementary General Conditions, Measurement and Payment, General Requirements, other Technical Specifications and standard details developed by the Nova Scotia Road Builders Association and the Consulting Engineers of Nova Scotia Joint Committee on Contract Documents and published with the title of Standard Specifications for Municipal Services.

3. Page 7, after definitions for Supplemental Instruction, add new definitions for Supplemental Specifications as follows:

   Supplementary Specifications
   Supplementary Specifications are the specifications for a specific project which amend or add to the Standard Specifications.

4. Page 7, after definitions for Working Day, add new definitions for Total Amount Payable as follows:

   Total Amount Payable
   The Total Amount Payable means the Contract Price in the Tender Form, subject to adjustments made in accordance with the provisions of the Contract Documents plus the amount of Value Added Taxes.

5. Where the term “Consultant” is used throughout the General Conditions, revise to read “Engineer”.

6. Where the term “Owner” is used throughout the General Conditions, revise to read “Developer”.

SECTION 00 72 45 - GENERAL CONDITIONS

1. GC 1.4 – ASSIGNMENT

Page 9, delete clause 1.4.1 in its entirety and add the following:

“1.4.1 The Owner shall have the right to assign the work to a new SkyPower entity once lender’s funds are received.”

2. GC 2.2 – ROLES OF THE CONSULTANT AND OWNER

Page 10, delete clauses 2.2.6, 2.2.7 and 2.2.8 in their entirety and replace the following:

"2.2.6 The Owner will be the interpreter of the requirements of the Design Documents. Interpretations and decisions of the Owner shall be consistent with the intent of the Design Documents and the Contract Documents."

"2.2.7 Questions relating to the performance of the Work or the interpretation of the Contract Documents shall be referred to the Owner in writing for decision which shall be provided by the Owner in writing within ten (10) days of delivery of the referral."

"2.2.8 The Contractor shall submit all questions regarding field conflicts, plan and specification interpretations, etc., to the Owner in writing."

Page 10, add the following new clauses and renumber subsequent.

"2.2.9 A log will be maintained for incoming questions and outgoing responses. Incomplete or unclear questions will be returned to the originator."

"2.2.10 Such questions are intended to be used to expedite the flow of technical information concerning the plans and specifications between the Contractor and the Owner. If the Contractor has a preferred solution to the identified problem, it should be proposed in the request for clarification. This process is not to be used to transmit contractual related issues such as notices of impact or delay, notice of inspection, notice of extra work, etc. This type of information should be transmitted to the Owner by correspondence."

"2.2.11 Should, in the opinion of the Contractor, the Owner's response to a question affects the Contractor's Contract Price or time, the Contractor is to so notify the Owner by correspondence within five (5) days of receipt of the answer and the change will be dealt with in accordance with PART 6 – CHANGES."

3. GC 2.4 – DEFECTIVE WORK

Page 11, clause 2.4.3, add the following sentence at the end of the clause:

"If the Engineer determination is not accepted by either party, then the matter shall be settled in accordance with the requirements of Part 8 of the General Conditions – DISPUTE RESOLUTION."

4. GC 3.7 – LAYOUT OF THE WORK

Page 13, delete clause 3.7.1 in its entirety and replace with the following:

"3.7.1 Before the work of the Contract begins, the Engineer will, once only, provide the data for sufficient reference points to

identify the Works on the ground. The Contractor shall have all reference points established on site by a licensed surveyor, at the place of the Work, at no additional cost to the Owner."

5. GC 3.11 – SHOP DRAWINGS

Page 14, clause 3.11.4, delete second sentence and replace to read:

"Contractor shall prepare and jointly review with Engineer, a schedule of dates for submission of shop drawings."

6. GC 5.4 – BASIS OF PAYMENT FOR COST PLUS WORK

Page 16, after clause 5.4.2, add the following new clause, renumber subsequent clauses:

"5.4.3 The percentage fee as stated in clause 5.4.1 shall be two percent (2%) of the cost plus work, but shall not be applied to the cost of construction equipment when such cost is based on rates which already include overhead and profit."

7. GC 5.5 APPLICATION FOR PROGRESS PAYMENT

Page 17, delete clause 5.5 in its entirety and replace with the following:

"5.5.1 The Lump Sum Price is the total price for the performance of those items of the Work. In no event shall the DEVELOPER be liable to pay more for the performance of the Lump Sum items than the Lump Sum Total Price set out in the Schedule of Lump Sum Prices."

"5.5.2 The Contractor shall, however, be entitled to receive interim payments for the Work for all items, including the Lump Sum items, of the basis on the quantity of the Work performed to the date of the application for payment. All interim payments for the Lump Sum Work shall cease when the Lump Sum Total Price has been reached and the Contractor shall not be entitled to any further payment for that portion of the Work."

"5.5.3 On the 25th day of each month, Contractor will produce a request for payment, in a form to be agreed upon and entitled "Payment Request", recording all quantities, by cost code, including those for any approved Change Orders and return the completed report to the Owner. Upon such date, the Contractor will provide the Owner with evidence of payment of workers' compensation, insurance coverage, statutory declaration, and such other documents as may be reasonably requested by the Owner."

"5.5.4 The Owner will prepare and forward, within ten (10) days of receipt of the Payment Request, to the Contractor a Certificate for Payment which shall indicate the payment amount, being the sum of the products of the quantities by the unit price for each item in accordance with the Schedule of Lump Sum Prices, less any retention under GC 1.7."

"5.5.5 The Owner will issue, within thirty (30) days of the receipt of the Certificate of Payment, including Work performed according

to any approved Change Orders, a cheque in the amount of the Certificate for Payment, less the appropriate retention."

"5.5.6 A ten percent (10%) retainage will be withheld by the DEVELOPER from each of the Contractor's progress payments."

"5.5.7 The Owner shall also be entitled to withhold in excess of the ten percent (10%) retainage set out in GC 1.7, any other amount the Owner is required to expend to remedy any failure by the Contractor to comply with the Contract Documents."

"5.5.8 The Owner shall pay the Contractor interest on any overdue payment at the rate of Bank of Canada's prime business rate which shall be calculated daily not in advance from the date upon which the amount becomes due and payable to and including the date of payment. Such interest shall not be compounded."

Delete 5.6, 5.7, 5.8, 5.9 and 5.10 in their entirety.

8. GC 6.2 – CHANGE ORDER

Page 20, add new clause 6.2.4 as follows:

"6.2.4 If the method of adjustment of the Contract Price presented by the Contractor is a lump sum or a unit price quotation as indicated in 6.2.2.2, the mark-up on changes shall be as follow:

.1 Work performed by Contractor's own forces: cost plus ten percent (10%) overhead plus ten percent (10%) fee.

.2 Work performed by Subcontractor's forces: cost plus ten percent (10%) overhead plus five percent (5%) fee.

9. GC 6.3 – CHANGE DIRECTIVE

Page 21, in clause 6.3.8, add the following sentence at the end of the paragraph:

"If such determination by the Engineer is not accepted by either party, then the decision shall be made in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION."

10. GC 6.7 – QUANTITY VARIATIONS

Page 22, delete GC 6.7 in its entirety.

12. GC 9.5 – CONSTRUCTION SAFETY

Page 22, after GC 9.5.1, add the following:

"9.5.2 W.H.M.I.S. – Workplace Hazardous Materials Information Systems & Hazardous Products Act – Government of Canada

Regulations under the Hazardous Products Act and the regulation regarding the handling and storage of hazardous materials must be complied with (reference: Regulation 88-221). These regulations stipulate that employees must be trained in the proper handling of workplace hazardous material."

13. GC10.1 - TAXES AND DUTIES

Add the following:

10.1.3 The Contractor will indicate on each application for payment, as a separate amount, the appropriate Harmonized Sales Tax the Owner is legally obliged to pay. This amount will be paid to the Contractor in addition to the amount certified for payment under the Contract.

14. GC10.2 - LAWS, NOTICES, PERMITS AND FEES

Add the following:

10.2.8 Various areas of Nova Scotia have requirements for posting non-refundable fees before excavations are carried out within public right-of-way. The Contractor is responsible for the determination of the requirement for each specific project and for the required deposits.

15. GC 11.1 - INSURANCE

Page 29, clause 11.1.1.1, change "$2,000,000" to read "10,000,000".

Page 29, clause 11.1.1.1, change "$2,500" to read $25,000".

Page 29, clause 11.1.1.3, line 4, change "$2,000,000 inclusive" to read "$10,000,000 inclusive".

Page 30, clause 11.1.1.4(1), change "$2,500" to read "$25,000".

16. GC 11.2 - CONTRACT SECURITY

Page 31, delete GC 11.2.1 in its entirety and replace with the following:

"11.2.1 The Contractor shall, prior to commencement of the Work, provide to the Owner a Performance Bond and a Labour and Materials Bond, each in the amount of 50% of the Total Amount Payable. Should it become apparent that the final cost of the project will exceed the Total Amount Payable by more than 10%, the Contractor shall arrange to have his bonds reissued, based on the projected final cost."

Page 31, add new clause GC 11.2.3 as follows:

"11.2.3 The Contract Security will be retained until the expiration of the Warranty Period."

17. GC 12.3 – WARRANTY

Page 32, delete clause 12.3.1 in its entirety and include the following:

"12.3.1 Except for extended warranties as described in paragraph 12.3.6, the warranty period under the Contract is two years from the date of Substantial Performance of the Work."

Page 32, line 1, change "one-year warranty" to read "two-year warranty".

Page 32, add new clause GC 12.3.7 as follows:

"12.3.7 All work of repair or replacement carried out during the Warranty Period shall be maintained for a period of two (2) years from the date of the Engineer's acceptance of the work of repair or replacement notwithstanding that the Warranty Period expires before the expiration of the said year. This clause shall not apply to normal operation maintenance, which shall be carried out by the Owner."

END

SUPPLEMENTARY SPECIFICATIONS

INTENT OF THE SUPPLEMENTARY SPECIFICATIONS

.1 The Work of this Contract is to be constructed in accordance with the Standard Specifications for Municipal Services (2009 Revision) as developed and published by the Nova Scotia Road Builders Association and Nova Scotia Consulting Engineers Association Joint Committee on Contract Documents, except as modified herein.

.2 These Supplementary Specifications modify the specification sections to which they refer.

.3 The Supplementary Specifications take precedence over the Specification to which they refer.

SECTION 01 10 00 - GENERAL REQUIREMENTS

2. Summary of Work

Page 1, delete clause 2 and replace with the following:

.1 This project is located in Digby, Nova Scotia and generally consists of the preparation of site for the complete installation of twenty (20) wind turbines and the construction of access roads.

.2 The Work includes, but is not limited to the following:

.1 Construction of 5m and 11m wide access roads, preparation of lay down areas, preparation of the wind turbine sites, mass excavation and fill for roadways and crane pads, mass excavation and fill for substation, supply and placing gravels, supply and placing pit run gravel, borrow, surge rock and supply and installation of culverts complete with headwalls.

.2 Supply and installation of erosion and sediment control measures, ditching, rock blasting for construction of roads and pads, removal of wet areas and placing required surge, hydraulic seeding, reinstatement of all disturbed areas and required permits.

.3 Supply and installation of collector system complete with poles, wires, insulators, fuses, lighting arrestors, disconnectors, guy wires, underground ducts, pad-mounted transformers, fibre optic distribution system, accessories and special tools.

.4 Supply and installation of 69kV/34.5kV outdoor substation complete with transformers, switching equipment, reactive power compensation equipment, isolation means, protection, control systems, grounding system, underground conduits, control building, accessories and special tools.

.5 Manufacture, deliver and installation of substation building complete with protection and communication panels and equipment, DC UPS

system, electrical distribution, HVAC and fire alarm systems, accessories and special tools.
.6 Installation, start-up and commissioning of all pre-purchased equipment.
.7 Receipt, erection and check out of wind turbines.

.3 Exclusions to Scope of Work: Contractor assumes Developer's scope with the exclusion of cost of the following equipment:
.1 Wind Turbines
.2 Main Transformer
.3 69 KV Breaker
.4 Reactive Power Static Compensator System (STATCOM)

4. Setting Out the Work

Page 1, delete clause 4 and replace with the following:

.1 The Contractor shall set out the work. Before the work of the Contract starts the Engineer will once only provide the data sufficient reference points to identify the site on the ground. Contractor shall have reference points established on-site by a Licensed Surveyor at own cost. Contractor shall maintain these, or re-establish them as required during the Contract period.

Page 3, delete clause 8.1 and replace with the following:

8. Record Drawings

.1 Record Drawings:
.1 After award of Contract, Engineer will provide a set of electronic drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Engineer.
.2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Engineer weekly.
.3 On completion of Work and prior to final inspection, submit record documents to Engineer.
.4 Record drawing review will be conducted monthly by the Engineer. Failure to maintain accurate record drawings will result in progress payment delays.

Page 5, delete clause 11.2 and replace with the following:

.2 All materials furnished by or to the Contractor shall be delivered and distributed at the Site by the Contractor and shall be loaded and unloaded so as to avoid shock or damage or dropping. If, however, any material is damaged, the repair or

replacement shall be made by the Contractor in a manner approved by the Engineer, at no additional cost to the Contract.

.3 Adequately store materials and equipment intended for the work, until it has been incorporated in the completed project. Storage of materials and equipment shall be in accordance with the manufacturer's recommendations.

Page 7, after clause 17, add new clauses as follows:

18. Safety

.1 Observe construction safety measures of Provincial Government, including but not limited to the Occupational Health and Safety Act, Workers' Compensation Board and Municipal authority provided that in any case of conflict or discrepancy the more stringent requirement shall apply.

.2 WHMIS: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada and Health and Welfare Canada.

.3 Ensure that pollution and environmental control of construction activities are exercised as specified and as required during the Work.

.4 Submit to Engineer prior to commencement of Work printed information detailing means and methods so the following will be carried out:
.1 To ensure the health and safety of persons at or near the Work.
.2 To ensure the measures and procedures of the regulatory agencies specified are carried out.
.3 To ensure every employee, self- employed person and employer performing Work under this contract complies with the regulatory agencies specified.

19. Photographs

.1 Prior to commencement of the Works, the Engineer may arrange for photographs to be taken of the site and those properties adjacent to the site.

.2 Accompany Engineer during the taking of photographs to make any comments on the conditions of the site or adjacent properties.

.3 Engineer will retain photographs, together with a written report, on the condition of existing

roads, trees, lawns, and adjacent properties as determined by mutual agreement as a record of existing conditions prior to the start of the Work.

20. Utilities

.1 Do not operate valves, electrical and telephone controls on existing utility systems.

.2 Apply to the utility having jurisdiction for permission to operate such systems if it becomes necessary, and only operate such system in accordance with and in the presence of a representative of the utility company affected.

.3 Include an amount in the contract price to cover the cost of having a utility company representative present when the Work passes under or in close proximity to underground cables, structures or utility poles.

.4 Provide a letter from the utility affected stating that any services damaged during construction have been repaired to the utility company’s approval.

21. Weather Conditions

.1 When work is performed during freezing weather, provide necessary means for heating and all materials required in the work shall be heated. Do not use frozen materials for backfilling and embankment. If there is delay or interruption in the work due to weather conditions, the necessary precautions shall be taken to bond new work to old.

.2 Days lost due to wind and poor weather will need to be made up in the Project Schedule in order to maintain the completion date.

22. Temporary Heating

.1 The Contractor shall arrange and pay for temporary heat used during construction and during equipment storage, including cost of installation, fuel, operation, maintenance and removal of equipment.

.2 Maintain temperatures of minimum 10°C and to the extent necessary to prevent condensation-forming conditions in areas where construction is in progress and in areas where materials and equipment are stored, unless indicated otherwise.

.3 Ventilate heated areas and keep building free of exhaust or combustion gases.

23. Electricity

.1 Provide or arrange for, at own expense, electricity for construction purposes for use in the Works.

24. Handling and Storage

.1 All materials furnished by Owner or the Contractor shall be delivered and distributed at the Site by the Contractor and shall be loaded and unloaded so as to avoid shock or damage or dropping. If, however, any material is damaged, the repair or replacement shall be made by the Contractor in a manner approved by the Engineer, at no additional cost to the Contract.

.2 Adequately store materials and equipment intended for the work, until it has been incorporated in the completed project. Storage of materials and equipment shall be in accordance with the manufacturer's recommendations. Keep interior of pipe, fittings, and other accessories free from dirt and foreign matter at all times.

25. Pre-Purchased Equipment

.1 Certain equipment has been pre-purchased by the Owner for inclusion in the Work and will be delivered to the Site. Pre-purchased equipment is as follows:

.1 Wind turbines and towers.
.2 Wind turbine pad mounted transformers.
.3 69kV Breaker for substation.
.4 Statcom for substation.
.5 69 KV power transformer for substation.

.2 The Contractor will accept these equipment from the Owner, and shall become responsible for them and all costs involved due to damage or loss thereof shall be assumed by the Contractor unless the materials are proven defective through manufacture which will then become the responsibility of the Owner.

.3 Provide handling and storage, and temporary heating for pre-purchased equipment.

.4 The Contractor shall maintain all such material insured, against loss or damage from all causes from the time of taking delivery until incorporation into the Works.

.5 The Contractor shall coordinate commissioning and testing of pre-purchased equipment and pay all costs associated to bring equipment to an operating condition.

26. Operations and Maintenance Manuals

.1 Provide the Owner before the issuance of the Certificate of Substantial Performance and before the Owner takes over the works from the Contractor unless otherwise directed by the Engineer in writing, certificates from the manufacturers of the equipment incorporated into the Works (or from their accredited agents) stating that their qualified representatives have tested the equipment which they supplied and have found everything to be satisfactorily installed and in proper working order.

.2 Towards the completion of the Contract, the Contractor will prepare for the Owner a Manual of Operations and Maintenance. It will include details of all proprietary equipment incorporated into the Works.

.3 Fifteen (15) days before Substantial Performance provide for this purpose four (4) copies of all manufacturer's literature pertaining to such equipment and which shall include descriptions, drawings, specifications, assembly, wiring or other diagrams, material lists, parts lists, installation, operating and maintenance instructions, names and addresses of the manufacturer's local or nearest agency, and like information.

.4 Provide four (4) sets and one (1) electronic copy of operations, installation and maintenance information. Two (2) of the sets shall be provided to the Engineer not less than six (6) weeks prior to commissioning. Contractor shall obtain additional copies of installation and start-up instructions as required at his own expense.

.5 All such material shall be new material. Photocopies of literature provided by manufacturers will not be accepted. Drawings shall be unfolded and page size papers shall be un-perforated at the binding edge if possible.

.6 Provide to the Owner before the issuance of the Certificate of Substantial Performance and before the Owner takes over the works from the Contractor, completed Commissioning Report singed and sealed by a professional engineer licensed to practice in the Province of Nova Scotia.

.7 The Certificate of Substantial Performance will not be issued until this material has been completely provided.

27. Commissioning	.1	Six (6) weeks prior to commissioning provide commissioning plan including schedule of all commissioning-related activities as specified in individual sections.
	.2	Prior to start of Work, submit name of Equipment Supplier's personnel proposed to perform services. Submit documentation to confirm personnel compliance with quality assurance provision.
	.3	Commissioning services shall be as described herein and as specified in the individual specification sections.

SECTION 01 57 00 – ENVIRONMENTAL PROTECTION

Page 1, add new clauses 1 and 2 as follows, and renumber subsequent clauses:

1. Work Included	.1	This section specifies requirements for providing temporary erosion and sedimentation control measures.
2. Related Work	.1	Earthwork: Section 31 20 00

Page 4, add new clause 7.4 as follows:

	.4	When required, erosion and sediment control plans to be submitted for approval of Nova Scotia Environment (NSE) and Owner prior to start of construction and should be reviewed at the project pre-construction meeting.

Page 4, add new clauses as follows:

9. General	.1	Provide and maintain erosion and sedimentation control features where required or as directed, prior to construction. Co-ordinate locations with Engineer. Do not remove control features until authorized by the Engineer.
10. Sediment Control Fence	.1	Sediment Control Fence: preassembled sediment control fence with industrial woven geotextile fabric pre-stapled to wood posts spaced as indicated. .1 Acceptable product: Envirofence as manufactured by Mirafi Inc., Terrafence as manufactured by Terrafix.
	.2	Install sediment control fence in the locations directed and as detailed on Drawings.

.3 Install extra 50 x 75 x 1200 mm long posts midpoints between supplied posts. Attach fence with roofing nails and roofing tins. Provide wood strapping along top of fence as shown.

.4 Excavate 150 x 150 trench along length of fence as indicated. Lay fabric bottom in trench and backfill with selected excavated material.

11. Sediment Control Berm

.1 Sediment Control Berm: 25 and 80 mm clear stone specified in Section 31 20 00.

.2 Geotextile: as specified in Section 31 20 00.

.3 Construct sediement control berms to the cross sections shown, using materials indicated on the Drawings. Locate where and as directed or required.

12. Maintenance of Fence and Berms

.1 Maintain sediment control features throughout the construction period. Repair damage to original condition.

.2 Remove accumulated sediment from behind silt fence and berms when and as directed by the Engineer.

.3 Maintain vertical alignment of silt fence such that it is always plumb and straight.

SECTION 01 22 00 – MEASUREMENT AND PAYMENT

Delete in its entirety and replace with new Section, attached.

SECTION 03 30 00 – CONCRETE

Delete in its entirety and replace with new Sections 03 10 00, 03 20 00 & 03 30 00, attached.

SECTION 05 50 00 METAL FABRICATIONS

Delete in its entirety and replace with new Section, attached.

SECTION 31 20 00 - EARTHWORK

Page 3, delete clause 2.1.1 and replace with the following:

.1 Select Backfill: common material from site excavation, free from stumps, trees, roots, sod, organics, rocks, boulders, masonry and any other deleterious materials. Material to be well graded having a maximum particle size not exceeding 200

mm with 40% to 60% of the material retained on 75 mm sieve. Material to be approved by Engineer prior to use as fill.

Page 5, delete clause 2.1.7 and replace with the following:

.7 Rip-rap: durable field or quarry stone with rough surfaces and angular shape, minimum thickness not less than one third of length or width and having a minimum of two parallel sides and one plane face at right angles to parallel sides. Rounded stone or boulders will not be permitted. Supply rock spalls to fill open voids. Nominal size of rip-rap 100 mm, with gradation as follows:

100% < 150 mm
30% > 100 mm
80% > 75 mm

Page 5, delete clause 2.1.8 and replace it with the following:

.8 Pipe bedding material: well graded, clear stone, graded as follows:

Sieve Size	% Passing
25 mm	100
19 mm	90-100
9.5 mm	20-55
4.75 mm	0-10
2.36 mm	0-5

Page 5, add new clauses 2.1.10 and 2.1.11 as follows:

.10 Pit run gravel: approved by the Engineer for the use intended, well graded pit run fill capable of being compacted to not less than 95% of modified Proctor density, corrected for oversize material. Material shall be graded as follows:

Sieve Size (micrometre)	Percent Passing
40,000	100
20,000	70-90
5,000	30-60
1,250	15-40
315	5-20
080	0-10

.11 Geotextile: non-woven, needle-punched synthetic filter fabric composed of minimum 85% by mass of polyester with inhibitors to resist deterioration.
.1 Acceptable products: Terrafix 270R, or approved equivalent.

Page 8, clause 3.7.7, change …"95% Standard Proctor Density".. to read "…98%

Standard Proctor Density…"

Page 9, delete clause 3.9.8 and replace with the following:

3.8 Mass Excavation and Embankment	.8	When constructing embankment with common material place in uniform layers not exceeding 300 mm in thickness, to full width of embankment. Compact to 98% Standard Proctor Density throughout full width and depth. Maximum rock size: 65% of compacted lift thickness.

Page 10, add new clause 3.12 as follows:

3.12 Placing Rip-rap	.1	Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
	.2	Place rip-rap in accordance with thickness and details as indicated. Take care to not move pipe out of alignment.
	.3	Place stones in manner approved by Engineer to secure surface and create a stable mass. Place larger stones at bottom of slopes.
3.12 Placing Rip-rap *(Cont'd)*	.4	Hand-place rip-rap at end of culverts and pipes on both sides and over end of pipe. Hand-place rip-rap as indicated on the drawings.
	.5	Hand placing: .1 Use larger stones for lower courses and as headers for subsequent courses. .2 Stagger vertical joints and fill voids with rock spalls or cobbles. .3 Finish surface even, free of large openings and neat in appearance.
	.6	Upon completion, remove stones that obstruct normal flow of water from pipe.

SECTION 39 00 00 – STANDARD DETAILS

Delete Standard Details as applicable and replace with new details on Drawings.

ADD THE FOLLOWING NEW SECTIONS

01 91 13 General Commissioning (CX) Requirements
01 91 33 Commissioning Forms
01 91 41 Commissioning Training

03 10 00 Concrete Forming and Accessories
03 20 00 Concrete Reinforcing
03 30 00 Cast-in-Place Concrete

04 22 00 Concrete Unit Masonry

05 12 00 Structural Steel For Buildings
05 50 00 Metal Fabrications

06 10 00 Rough Carpentry

07 21 00 Insulation
07 28 00 Air/Vapour Barriers
07 80 00 Firestopping and Smoke Seals
07 92 00 Sealants

08 11 14 Metal Doors and Frames

09 21 16 Gypsum Board
09 91 23 Painting

13 34 23 Prefabricated Buildings

23 00 00 Ventilation
26 05 00 Common Work Results - Electrical
26 05 14 Power Cable and Overhead Conductors
26 05 20 Wire and Box Connectors (0-1000V)
26 05 21 Wire and Cables (0-1000V)
26 05 22 Connectors and Terminations
26 05 27 Grounding - Primary
26 05 28 Grounding - Secondary
26 05 29 Hangers and Supports for Electrical Systems
26 05 31 Splitters, Junction, Pull Boxes and Cabinets
26 05 32 Outlet Boxes, Conduit Boxes and Fittings
26 05 34 Conduit, Conduit Fastenings and Conduit Fittings
26 05 36 Cable Trays for Electrical Systems
26 05 44 Installation of Cables in Trenches and In Ducts
26 11 00 Protection, Control and Communication Panels
26 11 01 Outdoor Substation
26 12 13 Liquid Filled MV Transformers
26 12 15 Liquid Filled Power Transformers
26 12 19 Pad Mounted, Liquid Filled, Medium Voltage Transformers
26 13 01 Isolating Switches
26 18 00 Medium Voltage Circuit Breakers
26 18 26 Medium Voltage Reclosers
26 22 19 Instrument Transformers
26 24 17 Panelboard Breaker Type
26 27 26 Wiring Devices
26 28 14 Fuses - Low Voltage
26 28 21 Moulded Case Circuit Breakers
26 28 22 Medium Voltage Disconnect Switches
26 28 23 Disconnect Switches - Fused and Non-Fused
26 32 23 Wind Turbine Generators
26 33 53 DC Uninterruptible Power Supply
26 41 01 Surge Arresters
26 50 00 Lighting
26 52 01 Unit Equipment for Emergency Lighting

27 05 10 Fibre Optic Cable System

31 10 00 Clearing and Grubbing
31 22 10 Site Grading

32 31 13 Chain Link Fence and Gate

33 05 40 Passive Oil Containment System
33 20 00 Well
33 40 00 Pipe Culverts
33 65 73 Concrete Encased Duct Banks
33 71 20 Electrical Pole Lines and Hardware

END

GENERAL

1. Unit prices are full compensation for the work necessary to complete each item in the Contract and in combination for all work necessary to complete the Work as a whole.

2. For items include all of the following as required where individual quantities are not provided in the Tender Form: environmental protection, protection of existing trees, common excavation for structures, trenches and underground conduits, shoring, dewatering, diversion ditches, bedding, backfilling, compaction, disposal of surplus common, temporary power supplies and heating, testing, rip rap headwalls, reinstatement and all incidentals.

3. All measurement shall be along a horizontal plane unless otherwise indicated.

4. The numbers of the items described below correspond to the numbers of the items in Section 00 41 43, subsection 4 - Schedule of Quantities and Unit Prices.

ITEMS

1. Clearing

   Unit of Measurement: hectare (ha)

   This item includes: cutting of all trees and disposal of hardwood off site, chipping of brush on site and distribute on site as directed by Engineer.

2. Grubbing

   Unit of Measurement: hectare (ha)

   This item includes: removal of all stumps, roots, downed timber, embedded logs, rootmat, humus, and topsoil and disposal on-site within each property owner’s boundaries.

3. Mass Excavation and Embankment

   .1 Common

   Unit of Measurement: cubic metre (m^3)

   Method of Measurement: average end area method between cross sections taken after grubbing or topsoil removal and lines and elevations indicated.

This item includes: excavation, placement and compaction to lines and elevations indicated, hydroseeding, and disposal of surplus or unsuitable material on-site at approved locations.

.2 Rock

Unit of Measurement: cubic metre (m^3)

Method of Measurement: average end area method between cross sections taken after rock is exposed and lines and elevations indicated. Boulders greater than two cubic metre will be classified as rock. Boulders removed from the excavation shall be measured along the three maximum perpendicular axes.

This item includes: excavation, placement and compaction to lines and elevations indicated, and disposal of surplus or unsuitable material on-site at approved locations.

4. Mass Excavation – Unsuitable Material

Unit of Measurement: cubic metre (m^3)

Method of Measurement: average end area method of volume of unsuitable material between cross sections taken before and after excavation.

This item includes: all excavation of unsuitable material and disposal on-site at approved locations. Written authorization of Engineer required.

5. Trench Excavation – Rock

Unit of Measurement: cubic metre (m^3)

Method of Measurement: Average end area method between changes in rock cross section. Dimensions used to calculate end areas shall be theoretical trench width as indicated in Section 39 00 00 - Standard Detail 01 22 00 - 01, and depth from surface of rock as exposed on sides of trench after excavation to bottom of specified bedding for each pipe/conduit in trench.

Boulders larger than one cubic metre, any portion of which is within theoretical trench, will be classified as rock. Boulders removed from trench shall be measured along the three maximum perpendicular axes.

This item includes: all incremental work for rock excavation and disposal of surplus material over and above cost of common excavation which is included in price for pipe and related items.

6. Trench Excavation – Unsuitable Material

Unit of Measurement:	cubic metre (m^3)
Method of Measurement:	average end area method for volume of unsuitable material less theoretical trench volume.
This item includes:	all excavation of unsuitable material beyond limits of the theoretical trench as indicated in Section 39 00 00 - Standard Detail 01 22 00 - 01, and disposal on-site at approved locations. Written authorization of Engineer required.

7. Common Borrow

Unit of Measurement:	cubic metre (m^3)
Method of Measurement:	average end area method between cross sections taken before placement of borrow and lines and elevations indicated.
This item includes:	supply, placement and compaction of material required to replace unsuitable material and sourced from off-site.

8. Granular Material

Unit of Measurement:	tonne (t)
Method of Measurement:	scale tickets signed by Engineer.
This item includes:	supply, placement and compaction of granular materials as indicated.

9. Culverts

Unit of Measurement:	metre (m)
Method of Measurement:	along centreline of pipe.
This item includes:	pipe, excavation and backfilling, pipe bedding, rip rap, and pipe screens.

10. Drilling Electrical Ground Well

Unit of Measurement:	metre (m)
This item includes:	borehole drilling, management and containment of cuttings and drilling fluids, identification of water bearing zones, casing air-lift yield testing, borehole logging. All required supplies and equipment shall be the responsibility of the driller.

11. Wind Turbine Generator (WTG) Foundations

Unit of Measurement:	each (ea)
This item includes:	all earthworks, site preparation including clearing, grubbing and rock/till excavation, construction drainage measures, backfill, engineered fill and compaction. Also includes formwork, steel reinforcement, cast-in-place concrete, curing and finishing, the embedded anchorage ring and anchors including leveling and alignment, requirements to suit WTG reinforced concrete gravity foundations.

12. Installation of Wind Turbine

Unit of Measurement:	each (ea)
This item includes:	receipt and off-loading of wind turbines, including inspection of equipment before taking receipt of equipment. Once the Contractor is ready to receive the first turbine all twenty units will be delivered to the site. Staging and storage of equipment on site, loading, crating and shipping containers on SkyPower transportation for return, manpower and equipment required to install the 80 meter towers, turbines and rotor blades. Installation and termination of electrical and control equipment within the towers and turbines. Mechanical installation of all equipment associated with wind turbine and tower. Completion of all GE: Receiving forms, check out sheets, inspection sheets and verification reports. GE documents are to be completed and signed by a professional engineer licensed in the Province of Nova Scotia.

13. Wind Turbine Site Electrical

Unit of Measurement:	each (ea)
This item includes:	installation of: conduits from terminal pole to pad-mounted transformer and wind turbine; concrete protection of conduits at terminal pole; grounding at terminal pole, in conduit trench and at wind turbine; grounding in wind turbine base including radials and drilled ground well; concrete Pad for pad-mounted transformer; installation of pad-mounted transformer and associated ground and conductors; high voltage terminations; installation of fibre optic cables from terminal pole and wind turbine and associated terminations; termination of 690 volt cables, and ground cables in tower base.

14. Control Building

Unit of Measurement:	lump sum (L.S.)
This item includes:	all earthworks, site preparation including clearing, grubbing and rock/till excavation, construction drainage measures, engineered file and backfill, concrete slab, prefabricated build, siding, insulation, wall liners, painting and associated finishes, doors, block partition walls, carpentry, electrical distribution system, ventilation system, drainage around building, lighting, grounding and signage.

15. Power Collection System

Unit of Measurement:	lump sum (L.S.)
This item includes:	all earthworks, site preparation including clearing, grubbing and rock/till excavation, trench excavation, all materials and labour for the complete supply and installation of collector system for twenty (20) wind turbine generators, duct installation, backfill, formwork, steel reinforcement, cast-in-place concrete, curling and finishing, pole installations, high voltage and fiber optic cable installation and termination, switching and protection equipment, splice boxes and patch panels installation and commissioning. Collection system measurement will end at each wind turbine terminal pole.

16. Substation

Unit of Measurement:	lump sum (L.S.)
This item includes:	all materials and labour for the complete supply and installation of 69kV/34.5kV outdoor substation, including all earthworks, clearing, grubbing, site preparation, trench excavation, duct installation, backfill, formwork, steel reinforcement, fencing, cast-in-place concrete, curling and finishing, installation of transformers, switching equipment, reactive power compensation equipment, isolation means, protections and controls, grounding system, accessories and special tools, wiring and termination, transformer, oil containment system and steel structures.

17. Commissioning

Unit of Measurement:	lump sum (L.S.)
This item includes:	planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished project. Verification of equipment, systems and integrated systems are installed in accordance with Contract Documents. Providing inspection and quality assurance activities as construction progresses, including startup and demonstrations, performance verification and fine tuning. Fully document all tests and inspections performed during the construction at startup and during performance verification. Training on all systems.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems and integrated systems.

.2 Related Sections:
.1 Section 01 10 00 - General Requirements.
.2 Section 01 91 33 - Commissioning (CX) Forms.
.3 Section 01 91 41 - Commissioning (CX) Training.
.4 Divisions 2-14
.5 Division 23 - Heating, Ventilation and Air Conditioning (HVAC).
.6 Division 26 - Electrical.
.7 Division 27 - Communications.
.8 Division 33 - Utilities.

.3 Acronyms:
.1 CX - Commissioning.
.2 PI - Product Information.
.3 PV - Performance Verification.

.4 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 CX is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. CX is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
.1 Verify equipment, systems and integrated systems are installed in accordance with contract documents and design criteria and intent.
.2 Provide inspection and quality assurance activities as construction progresses, including start up and demonstration, performance verification and fine tuning.
.3 Bring the facility to a fully operational state and free of deficiencies in the most effective and timely manner available.
.4 Fully document all tests and inspections performed during the construction, at start up, and during performance verification and fine tuning. Incorporate into final commissioning documentation.
.5 Provide direct training to operation and maintenance staff responsible for the operation and maintenance of the substation equipment and systems.

1.2 GENERAL (Cont'd)

.2 Contractor performs and assists in CX process, operating equipment and systems, troubleshooting and making adjustments as required.
.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Bear all costs associated with the required personnel and test equipment as outlined in specification sections and all costs with organizing and managing the activities of the applicable subtrades as identified in this section.

1.3 COMMISSIONING OVERVIEW

.1 CX to be a line item of Contractor's cost breakdown.

.2 CX activities supplement field quality and testing procedures described in relevant technical sections.

.3 CX is conducted in concert with activities performed during stage of project delivery. CX identifies issues in Planning and Design stages which are addressed during Construction and CX stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. CX activities include transfer of critical knowledge to facility operational personnel.

.4 Complete inspection and verification activities as required by the specifications as construction progresses. This includes those activities that are necessary to ensure that the project is substantially complete to permit the execution of the commissioning process for the project.

.5 Take responsibility to:
.1 Review the documentation manuals with the commissioning team.
.2 Complete all items as identified in these manuals. This includes work by subcontractors, test agencies, equipment representatives and manufacturer agents.
.3 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with the Contract Documents.

1.3 COMMISSIONING OVERVIEW (Cont'd)

.5 Take responsibility to:(Cont'd)
.4 Correct contract deficiencies and execute change orders as directed by the Owner's Representative.
.5 Test, adjust and balance equipment and systems identified in Divisions 2-16.
.6 Submit the completed manuals and project record documents as specified.
.7 Update the documentation manuals prior to each project meeting.

.6 The Substantial Completion Certificate will not be issued until the commissioning process is completed and the final reports and commissioning documentation are received.

1.4 COMMISSIONING TEAM

.1 The commissioning team shall consist of:
.1 Commissioning Coordinator (Engineer Team Leader)
.2 Department Representative(s)
.3 User Representatives/Owner.
.4 General Contractor
.5 Contractor's Commissioning Agent
.6 Mechanical Contractor
.7 Controls Contractor
.8 Electrical Contractor
.9 Communications Systems Contractor
.10 Manufacturer's Technicians.
.11 Testing Agencies.

1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during CX, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Owner's Representative, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor.

1.6 PRE-CX REVIEW

.1 Before Construction:
.1 Review contract documents, confirm in writing to Owner's Representative.
.2 Adequacy of provisions for CX.
.3 Aspects of design and installation pertinent to success of CX.

1.6 PRE-CX REVIEW (Cont'd)

.2 During Construction:
.1 Co-ordinate provision, location and installation of provisions for CX.

.3 Before start of CX:
.1 Have completed CX Plan up-to-date.
.2 Ensure installation of related components, equipment, sub-systems, systems is complete.
.3 Fully understand CX requirements and procedures.
.4 Have CX documentation ready.
.5 Understand completely design criteria and intent and special features.
.6 Submit complete start-up documentation to Owner's Representative.
.7 Have CX schedules up-to-date.
.8 Ensure systems have been cleaned thoroughly.
.9 Complete testing, adjusting and balancing procedures on systems, submit testing, adjusting and balancing reports to Owner's Representative for review and approval.
.10 Ensure "As-Built" system schematics are available.

.4 Inform Owner's Representative in writing of discrepancies and deficiencies on finished works.

1.7 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Commissioning Coordinator before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.8 SUBMITTALS

.1 Submit no later than 4 weeks after award of Contract:
.1 Name of Contractor's CX agent.
.2 Preliminary CX schedule.

.2 Ensure certified trades persons, certified testing agencies and/or factory authorized personnel participate in commissioning tasks.

.3 Submit the names of all personnel for approval by the Commissioning Coordinator. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.

.4 Submit documentation to confirm personnel compliance with quality assurance provision.

1.8 SUBMITTALS (Cont'd)

.5 Fifteen days prior to application for Substantial Completion, submit 3 copies of final commissioning manuals on applicable forms.

.6 Submit reports of testing, adjusting and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond the Contractor's control, promptly after execution of those services.

.7 Ensure each form bears signature of recorder and that of the Supervisor of the reporting organization.

1.9 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33 - Commissioning (CX) Forms for requirements and instructions for use.

.2 Complete commissioning documentation manuals. Manuals will be provided to the Contractor by the Equipment Vendors during the construction stage.

.3 Commissioning Coordinator to review and approve CX documentation.

.4 Provide completed and approved CX documentation to Commissioning Coordinator.

.5 Final Commissioning documents to be submitted in electronic form to Engineer for review.

1.10 COMMISSIONING SCHEDULE

.1 Provide detailed CX schedule as part of construction schedule.

.2 Provide adequate time for CX activities prescribed in technical sections and commissioning sections including:
.1 Approval of CX reports.
.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.11 COMMISSIONING MEETINGS

.1 Convene CX meetings following project meetings and as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to CX.

1.11 COMMISSIONING MEETINGS (Cont'd)

.3 Continue CX meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage Commissioning Coordinator to call a separate CX scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for CX. Issues at meeting to include:
.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter CX meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Commissioning Coordinator. Contractor will record minutes and submit to Owner's Representative for review and approval. Approved minutes will be returned for approval.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent CX meetings and as required.

1.12 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.13 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Owner's Representative and Commissioning Coordinator to witness start-up and testing.

.3 Contractor's CX Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.14 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: manufacturer to:
.1 Coordinate time and location of testing.
.2 Provide testing documentation for approval by Commissioning Coordinator.
.3 Arrange for Commissioning Coordinator to witness tests.

1.14 MANUFACTURER'S INVOLVEMENT (Cont'd)

.1 (Cont'd)
.4 Obtain written approval of test results and documentation from Commissioning Coordinator before delivery to site.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Commissioning Coordinator.
.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:
.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:
.1 Experienced in design, installation and operation of equipment and systems.
.2 Ability to interpret test results accurately.
.3 To report results in clear, concise, logical manner.

1.15 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and CX.

.2 Conduct start-up and testing in following distinct phases:
.1 Included in delivery and installation:
.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
.2 Visual inspection of quality of installation.
.2 Start-up: follow accepted start-up procedures.
.3 Operational testing: document equipment performance.
.4 System Performance Verification: include repetition of tests after correcting deficiencies.
.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Commissioning Coordinator after distinct phases have been completed and before commencing next phase.

1.15 PROCEDURES (Cont'd)

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Commissioning Coordinator. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
.1 Minor equipment/systems: implement corrective measures approved by Commissioning Coordinator.
.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Commissioning Coordinator.
.3 If evaluation report concludes that major damage has occurred, Commissioning Coordinator shall reject equipment.
.1 Rejected equipment to be remove from site and replace with new.
.2 Subject new equipment/systems to specified start-up procedures.

1.16 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Commissioning Coordinator for approval before commencement of commissioning.

.2 Start-up documentation to include:
.1 Factory and on-site test certificates for specified equipment.
.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports.

.5 Step-by-step description of complete start-up procedures, to permit Commissioning Coordinator to repeat start-up at any time.

1.17 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit to Commissioning Coordinator for approval before implementation.

.3 Operate and maintain systems for minimum 21 days for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of Substantial Completion

1.18 TEST RESULTS

.1 If start-up, testing and/or performance verification produce unacceptable results, repair, replace or repeat specified starting and/or performance verification procedures until acceptable results are achieved.

.2 Provide personnel, resources and materials, assume all costs for re-commissioning.

1.19 START OF COMMISSIONING

.1 Notify Commissioning Coordinator at least 14 days prior to start of CX.

.2 Start CX after elements of building affecting start-up and performance verification of systems have been completed.

1.20 INSTRUMENTS/ EQUIPMENT

.1 Submit to Commissioning Coordinator for review and approval:
.1 Complete list of instruments proposed to be used.
.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide all required equipment to complete commissioning.

1.21 COMMISSIONING PERFORMANCE VERIFICATION

.1 Conduct commissioning once identified pre-requisite activities are completed for a system and approved by the Commissioning Coordinator.

.2 Commissioning Coordinator to issue a commissioning plan based on the complexity of building systems. Contractor to develop and implement a detailed schedule of commissioning related activities.

.3 Test all building systems including architectural, structural, civil, mechanical and electrical components and operating procedures by challenging these systems to realistic operating conditions and train operational staff.

.4 Notwithstanding all-inclusive requirements specified in this section, additional separate commissioning may be required at a later date for equipment and systems whose full operation is dependent on seasonal conditions. Job conditions for Peak Performance Verification are as follows: (1) Summer sequence commissioning to take place between June 1 and

1.21 COMMISSIONING PERFORMANCE VERIFICATION (Cont'd)

.4 (Cont'd) September 15 when outside ambient temperatures are at least 22°C; (2) Winter sequence commissioning to take place between November 1 and March 31 when outside ambient temperature is no greater than minus 10°C.

.5 Carry out CX:
.1 Under actual operating conditions, over entire operating range, in all modes.
.2 On independent systems and interacting systems.

.6 CX procedures to be repeatable and reported results are to be verifiable.

.7 Follow equipment manufacturer's operating instructions.

.8 EMCS trending to be available as supporting documentation for performance verification.

.9 At completion of commissioning, scan completed manuals to electronic format on CD(s) in PDF format as required and submit to Commissioning Coordinator.

1.22 WITNESSING COMMISSIONING

.1 Commissioning Coordinator along with Owner designated representatives to witness activities and verify results.

1.23 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Commissioning Coordinator and Owner's Representative within 5 days of test and with CX report.

1.24 EXTRAPOLATION OF RESULTS

.1 Where CX of weather, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Commissioning Coordinator in accordance with equipment manufacturer's instructions, using manufacturer's

1.24 EXTRAPOLATION OF RESULTS (Cont'd)

.1 (Cont'd)
data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

.1 Provide manpower and instrumentation to verify most critical reported results.

.2 Number and location to be at discretion of Commissioning Coordinator.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies found in more than 20 % of reported results.

.5 Perform additional commissioning until results are acceptable to Commissioning Coordinator.

1.26 REPEAT VERIFICATIONS

.1 Assume costs incurred by Owner's Commissioning representative for third and subsequent verifications where:
.1 Verification of reported results fail to receive Commissioning Coordinator 's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Commissioning Coordinator deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as CX proceeds.

.2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and CX to satisfaction of Commissioning Coordinator.

.2 Report problems, faults or defects affecting CX to Commissioning Coordinator in writing. Stop CX until problems are rectified. Proceed with written approval from Commissioning Coordinator.

1.29 COMPLETION OF COMMISSIONING

.1 Upon completion of CX leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in CX specifications, complete CX prior to application for Substantial Completion.

.3 CX to be considered complete when contract CX deliverables have been submitted and accepted by Commissioning Coordinator.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during CX process, provide updated CX form for affected item.

1.31 TRAINING

.1 In accordance with Section 01 91 41 - Commissioning Training.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:
.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria to be as specified in the Equipment Specification or the applicable standards.

.2 Instrument accuracy tolerances:
.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:
.1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.34 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Commissioning Coordinator will not relieve Contractor from compliance with specified start-up and testing procedures.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 SCHEDULE

.1 Provide a detailed schedule for on-site verification activity by the commissioning team based on the commissioning plan provided by the Owner's Representative. Be responsible for resource allocation respecting the exact number and duration for personnel required to perform the tasks required.

3.2 COMMISSIONING TASKS

.1 The following section summarizes the tasks to be conducted for the commissioning process with further specifics being provided within applicable specification sections and installations checks, verification activities and performance checks given within the manuals and commissioning forms provided by the Owner's Representative.

3.3 DISCIPLINE: CIVIL SYSTEMS TO BE COMMISSIONED

.1 Site Earth Works
.1 Confirm removal of all unsuitable materials.
.2 Confirm compliance with Geotechnical Report.
.3 Confirm construction of engineered rock mattresses.
.4 Ensure backfilling is compacted in lifts equally, inside and outside foundation walls.
.5 Ensure site grading is done in lifts and compacted to meet contract documents.
.6 Ensure materials quality compliance of sub-grade and bedding materials, supported by laboratory test reports.
.7 Ensure site sloped away from building
.8 Ensure site sloped to drainage system components.
.9 Provide reports on compaction testing results.

.2 Site Storm Drainage
.1 Confirm pipe size and materials
.2 Confirm and record location and elevation of pipe/culvert inverts.
.3 Confirm proper pipe bedding installation and inspection prior to backfilling.
.4 Provide results of infiltration and exfiltration testing for piped storm sewers.
.5 Confirm cleaning of storm sewers.
.6 Confirm culvert headwall and gratings are properly installed.

3.3 DISCIPLINE: CIVIL SYSTEMS TO BE COMMISSIONED (Cont'd)

.2 (Cont'd)
.7 Verify slopes of drainage channels at culvert locations.
.8 Review system with facility operator.

.3 Foundation/Underslab Drainage
.1 Confirm weeping tiles operational prior to backfilling.
.2 Confirm pipe size and materials.
.3 Confirm proper grade for piping and proper bedding/filter fabric placed prior to backfilling.
.4 Confirm location of all clean outs and end plugs.
.5 Clean all piping prior to use.

.4 Hard Landscaping - Asphalt/Concrete
.1 Confirm subbase, base granulars, asphalt, and concrete meet specification requirements.
.2 Provide records of acceptable compaction results for subbase and base granulars.
.3 Provide record of concrete strength, mix design, and temperature at time of placement.
.4 Provide records of asphalt testing results.
.5 Verify placement of control joints in concrete walkways, curbs and other exterior on grade concrete slabs.
.6 Confirm placement of concrete reinforcements.
.7 Ensure no ponding on asphalt areas.
.8 Ensure proper slope to drainage.
.9 Ensure all permanent markings are installed for parking stalls, handicap accessibility and directional signage.

3.4 DISCIPLINE: STRUCTURAL TO BE COMMISSIONED

.1 Foundations
.1 Confirm footing and top of wall elevations meet contract requirements.
.2 Confirm footings, concrete piers and walls have required reinforcement, anchor bolts and embedded parts, installed and correctly located.
.3 Confirm proper placement and construction of concrete/ piers and walls.
.4 Confirm concrete meets quality requirements and incorporate test results.

.2 Structural Steel Frame
.1 Provide copy of erector's certification before construction begins.
.2 Confirm base plates are shimmed, level, grouted, and anchor bolts are correctly aligned.
.3 Confirm steel is properly primed and painted or galvanized as applicable.
.4 Confirm structural steel is properly welded to meet contract requirements.

3.4 DISCIPLINE: STRUCTURAL TO BE COMMISSIONED (Cont'd)

.2 (Cont'd)
.5 Confirm structural bracing is in place in accordance with erection drawings.
.6 Confirm all welds are primed and painted or galvanized as applicable.
.7 Confirm metal deck is correctly welded.
.8 Confirm structural third party inspection has been completed satisfactorily.
.9 Record all on site test results and project record information prior to structural steel being covered by other trades.
.10 Provide certification of quality compliance from fabricator.

.3 Concrete Slabs on Grade
.1 Confirm concrete meets quality requirements and incorporate test results.
.2 Confirm location and installation of thickened slabs meet contract requirements.
.3 Confirm location and installation of control joints, anchor bolts and all embedded parts.

.4 Confirm concrete slab/floor curing (and sealer) applied as per manufacturer's instructions and compatible with finish flooring materials.

.5 Confirm reinforcement is correctly placed in slab/floor.

.6 Provide records of curing conditions for the first 14 days of the initial placement.

.7 Provide survey of finished floor elevations to confirm compliance with project requirements.

3.5 DISCIPLINE: ARCHITECTURAL SYSTEMS TO BE COMMISSIONED

.1 Thermal and Moisture Protection
.1 Provide records of compliance regarding moisture content of building materials.
.2 Confirm insulation types and values meet contract requirements.
.3 Confirm rigid insulation is adhered as per manufacturer's instructions.
.4 Ensure mechanical protection is provided for exposed insulation.
.5 Certify continuity of air barriers and vapour retarders.
.6 Provide records of independent leakage testing for air barrier assembly.
.7 Provide certificate of product quality compliance for insulation, air barriers, vapor retarders, etc.

3.5 DISCIPLINE: ARCHITECTURAL SYSTEMS TO BE COMMISSIONED (Cont'd)

.2 Roof Assembly
.1 Confirm integrity of roof installation.
.2 Perform flood testing if required by the specifications.
.3 Verify slopes of roof provide positive water flow to roof drains. Ensure no ponding of water on roof.
.4 Confirm all flashing is in place and sealing is complete.
.5 Ensure the installation of all roofing accessories.
.6 Ensure the installation and weather tightness of roof access hatches.
.7 Include inspection reports from manufacturer representative as specified indicating all warranties are in place.
.8 Ensure that walkway traffic provisions are in place.

.3 Exterior Wall Assemblies
.1 Verify continuity of air/vapour retarders.
.2 Ensure weep and vent holes are open and clear of debris.
.3 Verify insect blocks are installed.

.4 Exterior Cladding (Note: Develop to suit materials incorporated in project.)

.5 Doors and Windows
.1 Doors:
.1 Confirm operation of all mechanical door hardware.
.2 Ensure tightness and continuity of smoke/sound stripping and accessories.
.3 Ensure keying in place and properly recorded.
.4 Confirm sign over to Client for use.
.5 Provide training and warranties.
.2 Entrances and Exits
.1 Confirm correct operation of all doors.
.2 Confirm lock assembly operates as required.
.3 Verify door closers operate correctly.
.4 Confirm if doors are/can be affected by wind conditions.
.5 Confirm door entrance grilles free of debris and secure.
.6 Confirm all weatherstripping in place and properly secured.
.7 Demonstrate maintenance required.
.8 Provide warranties.
.3 Room Fit-up and finishes
.1 Occupant Safety and Accessibility

3.5 DISCIPLINE: ARCHITECTURAL SYSTEMS TO BE COMMISSIONED (Cont'd)

.5 (Cont'd)
.3 (Cont'd)
.1 (Cont'd)
.1 Fire Separations
.1 Verify fire stopping and smoke seals in place.
.2 Verify sleeves in hollow walls around piping.
.3 Verify installation of angle iron around duct work installed as specified.
.4 Verify continuity and ratings of fire separations.
.5 Verify proper fire separations at firewalls, including parapets.
.6 Confirm fire ratings for door assemblies complies with door schedule.
.7 Confirm door closures, smoke sweeps, hardware complies with hardware schedule.
.2 Doors in Fire Separations
.1 Verify smoke sweeps/seals installed properly.
.2 Verify door closures/hardware hinges installed properly and operating.
.3 Verify door closure installed properly and operating
.4 Verify hinges as per specification installed properly.
.5 Verify doors closures meet Code requirements.
.6 Verify ULC labels attached to door and frame.

3.6 DISCIPLINE: MECHANICAL TO BE COMMISSIONED

.1 Ventilation System
.1 Fans
.1 Confirm correct installation as per manufacturer's instructions.
.2 Confirm correct rotation.
.3 Measure and record motor amperage.
.4 Verify (if applicable) belt tension.
.5 Verify bearings are lubricated. Record lubrication from start-up to final turn over to Owner.
.6 Verify no vibration exists.
.7 Confirm balancing completed. Verify results.

3.7 DISCIPLINE: ELECTRICAL TO BE COMMISSIONED

.1 Substation Power Transformer:
.1 Verify that transformer components have been located and installed in accordance with the contract documents.
.2 Confirm wiring and installation in accordance with design documents
.3 Confirm transformer grounding as indicated by design drawings
.4 Check all connections for tightness
.5 Confirm oil containment system proper installation
.6 Check for oil leakages
.7 Check protections for correctness and coordination
.8 Confirm identification installed.
.9 Confirm all testing as required completed and documented.
.10 Commissioning and start-up to be conducted by certified contractor.
.11 Provide copies of test results.
.12 Provide copy of warranty.

.2 Statcom:
.1 Check all factory made connections for tightness
.2 Remove all dirt and debris from inside enclosures.
.3 Check fuse size and breaker settings for correctness and coordination.
.4 Verify I/O and interconnection with SCADA system.
.5 Confirm all testing as required completed and documented
.6 Confirm identification installed.
.7 Training of staff by factory representative.
.8 Commissioning and start-up to be conducted by factory trained technician.
.9 Provide copies of test results.
.10 Provide copy of warranty.

.3 Protection and Control Panels:
.1 Verify that system components have been located and installed in accordance with the contract documents.
.2 Check all connections for tightness
.3 Remove all dirt and debris from inside enclosures.
.4 Check protections for correctness and coordination.
.5 Confirm all testing as required completed and documented
.6 Confirm identification installed.
.7 Training of staff by factory representative Commissioning and start-up to be conducted by factory trained technician.

3.7 DISCIPLINE: ELECTRICAL TO BE COMMISSIONED (Cont'd)

.3 Protection and Control Panels:(Cont'd)
.8 Provide copies of test results.
.9 Provide copy of warranty.

.4 Communication System:
.1 Verify that system components have been located and installed in accordance with the contract documents.
.2 Confirm all testing as required completed and documented.
.3 Verify receipt of final certification documentation.
.4 Commissioning to be conducted by factory trained technician.
.5 Provide copies of test results.
.6 Provide copy of warranty.

.5 Padmount Switchgear
.1 Check all connections for tightness
.2 Inspect all insulators.
.3 Check fuses/protections for correctness and type.

.6 Exterior Load Break Switches:
.1 Check operation over eight (8) hour period at least ten (10) times
.2 Check all connections, including grounding.
.3 Demonstrate maintenance requirements.

.7 Exterior Isolation Switches:
.1 Check all connections, including grounding.
.2 Demonstrate maintenance requirements.
.3 Confirm identification installed.

.8 Circuit Breakers and Reclosers:
.1 Check all factory made connections
.2 Check all field made connections, including grounding.
.3 Remove all dirt and debris from inside enclosures.
.4 Check fuse size and breaker settings.
.5 Check door operation.
.6 Perform load tests

.9 Conductors:
.1 Confirm installation on poles, in cable tray, conduits and ducts.
.2 Confirm cables are undamaged.
.3 Confirm type of cold shrink termination
.4 Megger all conductors.

.10 Station Service Transformers.
.1 Confirm proper installation as per design drawings.

3.7 DISCIPLINE: ELECTRICAL TO BE COMMISSIONED (Cont'd)

.10 (Cont'd)
.2 Confirm proper materials for installation used as per the specifications.
.3 Megger all cables.
.4 Confirm cables undamaged.
.5 Measure and record amperage and voltage on primary and secondary of transformer under normal load.
.6 Confirm cables properly installed.
.7 Confirm routing of primary and secondary cables.
.8 Confirm proper grounding.
.9 Confirm transformer not damaged.

.11 Pad Mount Distribution Transformers.
.1 Megger all cables.
.2 Confirm cables undamaged.
.3 Measure and record amperage and voltage on primary and secondary of transformer under normal load.
.4 Confirm conduits properly installed.
.5 Confirm concrete as per detail.
.6 Confirm rebar installed as pre detail.
.7 Confirm crushed stone installed.
.8 Confirm routing of primary and secondary conduits.
.9 Confirm proper grounding.
.10 Confirm transformer not damaged.

.12 Surge Arrestors.
.1 Confirm all electrical connections.
.2 Confirm conductor installation.

.13 Overhead Lines.
.1 Megger all conductors.
.2 Confirm attachment height.
.3 Inspect all conduits and supports.
.4 Drain and seal all LB fittings.
.5 Verify attachment method and support systems.

.14 Underground Lines.
.1 Megger all conductors.
.2 Inspect trenches for foreign materials and sharp obstacles.
.3 Confirm proper conduit bedding and installation. (i.e. glue, support)
.4 Confirm conduit sizes, spare conduit and pull rope.
.5 Confirm trench/conduit depth.
.6 Confirm marking system installed.
.7 Confirm proper backfill procedure.

.15 Power Factor Capacitors.
.1 Confirm proper operation.

3.7 DISCIPLINE: ELECTRICAL TO BE COMMISSIONED (Cont'd)

.15 (Cont'd)
.2 Record resulting PF under normal load conditions.
.3 Confirm rating of capacitors.
.4 Confirm operation of switching system.
.5 Confirm all connections torqued.
.6 Verify protections for correctness and coordination.
.7 Confirm identification installed.

.16 Service Entrance Equipment.
.1 Megger all cables.
.2 Measure and record voltage and amperage on all conductors under normal load.
.3 Confirm grounding and bonding.
.4 Confirm all connections properly torqued.
.5 Confirm identification installed.
.6 Confirm final cleaning.
.7 Confirm rating of OCP devices and adjustments as per specifications.

.17 Distribution and Lighting Panelboards.
.1 Megger all feeder conductors.
.2 Measure and record voltage and amperage on all feeder conductors under normal load.
.3 Confirm grounding and bonding.
.4 Confirm all connections properly torqued.
.5 Confirm panel identification installed.
.6 Confirm final cleaning.
.7 Confirm panel directory correct.

.18 Disconnect/Safety Switches.
.1 Megger all conductors.
.2 Measure and record voltage and amperage on all conductors under normal load.
.3 Confirm grounding and bonding.
.4 Confirm all connections properly torqued.
.5 Confirm identification installed.
.6 Confirm final cleaning.
.7 Confirm proper rating of overcurrent devices installed.

.19 Equipment Enclosures, Splitters, Junction Boxes.
.1 Confirm all conduit and cable connections seated properly in enclosure.
.2 Confirm locknuts and bushings on all conduit connections. Double locknuts on RGS.
.3 Confirm proper grounding and bonding.
.4 Confirm proper support.
.5 Confirm identification installed.

.20 Wiring Devices.
.1 Confirm devices installed in proper location.
.2 Confirm switches installed on latch side of doors.

3.7 DISCIPLINE: ELECTRICAL TO BE COMMISSIONED (Cont'd)

.20 (Cont'd)
.3 Confirm proper voltage/amperage rating.
.4 Confirm proper polarity.
.5 Confirm cover plate installed flush on wall.
.6 Confirm identification completed.

.21 Circuit Breakers.
.1 Confirm breaker size as specified.
.2 Confirm breaker properly torqued to panel bus.
.3 Confirm load conductors properly torqued to breakers.
.4 Confirm GFCI breakers operate properly.
.5 Confirm voltage and amperage load on all circuit breakers. Record results.

.22 Electric Heating.
.1 Confirm heater wattage and voltage are correct.
.2 Confirm heater connected to circuit indicated.
.3 Confirm heater controls operate properly.
.4 Confirm heater fastened securely to building.
.5 Measure voltage and amperage at heaters. Record results.

.23 Conduits.
.1 Confirm all conduits proper size and type.
.2 Confirm all conduits properly supported.
.3 Confirm conduit fill not exceeded.
.4 Confirm all in slab conduits noted on as-builts.
.5 Confirm pull ropes installed in all spare conduits.
.6 Confirm bonding conductor installed in all conduits.

.24 Motor Starters
.1 Confirm motor starters securely mounted.
.2 Verify all field power and control connections properly torqued.
.3 Confirm overload heaters installed.
.4 Verify operation of all units.
.5 Verify lubrication of all moving parts.
.6 Operate starters in sequence to confirm satisfactory performance.
.7 Perform start/stop functions and verify sequencing actions.
.8 Provide manufacturer's representative for commissioning.
.9 Demonstrate maintenance procedures and training.
.10 Provide certification from manufacturer of installation.

.25 Grounding

3.7 DISCIPLINE: ELECTRICAL TO BE COMMISSIONED (Cont'd)

.25 (Cont'd)
.1 Confirm all grounding system installed and connections made are secure. (Primary and secondary grounds.)
.2 Verify connections and conductors protected from mechanical injury.
.3 Ensure compliance with the specification.
.4 Confirm bonding wire used in all conduit systems.
.5 Confirm all grounding buses installed correctly.
.6 Perform continuity and resistance tests.
.7 Demonstrate normal maintenance requirements for grounding system.
.8 Confirm substation steel grounded.
.9 Check main systems ground.
.10 Check data system ground.
.11 Check telephone system ground.

.26 Electrical Outlets
.1 Verify lamcoid labels are correct.
.2 Test receptacles.
.3 Verify test results report meets CSA requirements.
.4 Confirm installation meets specification.
.5 Provide copy of test results.

.27 Lighting
.1 Confirm all lighting systems are properly supported
.2 Confirm all fixture alignments.
.3 Confirm operation of all fixtures.
.4 Demonstrate maintenance procedures.
.5 Confirm spare parts are provided as specified.

.28 Fire Alarm
.1 Verify that system components have been located and installed in accordance with the contract documents.
.2 Verify all wiring connections completed.
.3 Verify operation of all devices.
.4 Coordinate interconnection with Substation Automation System.
.5 Test alarm operations for all areas and devices.
.6 Confirm location of Certificate of Compliance from manufacturer.
.7 Verify system maintenance procedures.
.8 Training provided
.9 Warranties supplied
.10 Maintenance materials supplied
.11 Check tags for fire department, phone numbers at all pull stations.
.12 Check all acoustic signal devices are audible from all locations.

3.7 DISCIPLINE: ELECTRICAL TO BE COMMISSIONED (Cont'd)

.29 Uninterruptible Power Supply
.1 Verify UPS performance meets specification.
.2 Provide factory representative testing of this system.
.3 Verify system maintenance procedures and demonstrate training.
.4 Provide copy of test results and Certification Certificate.
.5 Commissioning to be conducted by factory trained technician.
.6 Provide copy of warranty.

.30 Telephone Systems
.1 Verify that system components have been located and installed in accordance with the contract documents.
.2 Confirm all testing as required completed and documented.
.3 Verify receipt of final certification documentation.
.4 Confirm handicap accessibility requirements are met.
.5 Commissioning to be conducted by factory trained technician.
.6 Provide copy of warranty.

.31 Data Cable Systems
.1 Verify that system components have been located and installed in accordance with the contract documents.
.2 Confirm all testing as required completed and documented.
.3 Verify receipt of final certification documentation.
.4 Commissioning to be conducted by factory trained technician.
.5 Provide copies of data cable test results.
.6 Provide copy of warranty.

.32 Exit Lighting Systems
.1 Verify that system components have been located and installed in accordance with the contract documents.
.2 Verify all exit lights installed correctly and are operational.
.3 Confirm breaker for exit lights locked in on position.
.4 Confirm operation of integral batteries.
.5 Confirm integral emergency lighting heads are aimed properly.
.6 Demonstrate maintenance procedures.
.7 Confirm spare parts are provided as specified.

3.7 DISCIPLINE: ELECTRICAL TO BE COMMISSIONED (Cont'd)

.33 Emergency Lighting Systems
.1 Verify that system components have been located and installed in accordance with the contract documents.
.2 Verify all emergency lighting units installed correctly and are operational.
.3 Confirm breaker for emergency lighting units locked in on position.
.4 Confirm batteries are fully charged.
.5 Confirm remote heads operational.
.6 Confirm conductor size to remote heads.
.7 Demonstrate maintenance procedures.
.8 Confirm spare parts are provided as specified.

.34 Cable Tray Systems
.1 Confirm all cable tray proper size and type.
.2 Confirm all cable tray supported in accordance with manufacturer's instructions.
.3 Confirm cable tray fill not exceeded.
.4 Confirm all system dividers in place where applicable.
.5 Confirm identification installed on all cables at intervals as specified.
.6 Confirm bonding conductor installed in all tray and connecting all tray sections.

.35 Control Wiring
.1 Confirm conductor size and type in accordance with specification.
.2 Confirm cable shields grounded at source end only.
.3 Confirm wiring installed in accordance with specification.

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Commissioning forms to be completed for equipment, systems and integrated systems.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - Commissioning (Cx) Requirements.

.3 Section 01 91 41 - Commissioning Training.

.4 Appendix A1 - Commissioning Forms.

1.3 INSTALLATION/ START-UP CHECK LISTS

.1 Include the following data:
.1 Product manufacturer's installation instructions and recommended checks.
.2 Special procedures as specified in relevant technical sections.
.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Commissioning Coordinator supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Owner's Representative for inclusion in Commissioning Manual at completion of project.

.5 Use of check lists will be stringently used for equipment pre-start and start-up procedures.

1.4 SAMPLES OF COMMISSIONING FORMS

.1 Owner's Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with but not limited to the following:
.1 Nameplate Data.
.2 Pre-testing checks

1.4 SAMPLES OF COMMISSIONING FORMS (Cont'd)

.1 (Cont'd)
.3 Testing Data
.4 Post Testing Checks

.2 Revise items on Commissioning forms to suit project requirements.

.3 Samples of Commissioning forms and a complete index of produced to date are attached in Appendix A1.

1.5 CHANGES AND DEVELOPMENT OF NEW COMMISSIONING FORMS

.1 When additional forms are required but are not available, the Commissioning Coordinator will develop and submit to Engineer for review and approval prior to use.
.1 Additional commissioning forms to be in same format as provided by Owner's Representative.

1.6 COMMISSIONING FORMS

.1 Owner's Representative may develop and provide to Contractor required project-specific Commissioning plan/check list/forms.

.2 Completed Commissioning forms to be submitted to Commissioning Coordinator and Engineer for review and approval.

.3 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.4 Strategy for Use:
.1 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
.2 Confirm operation as per design criteria and intent.
.3 Identify variances between design and operation and reasons for variances.
.4 Verify operation in specified normal and emergency modes and under specified load conditions.

.5 Record analytical and substantiating data.

.6 Verify reported results.

.7 Form to bear signatures of recording technician and reviewed and signed off by Owner's Representative.

.8 Reported results in true measured SI unit values.

.9 Provide Commissioning Coordinator with originals of completed forms.

1.6 COMMISSIONING FORMS (Cont'd)

.10 Maintain copy on site during start-up, testing and commissioning period.

.11 Forms to be both hard copy and electronic format with typed written results.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies roles and responsibilities of Commissioning Training.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - Commissioning (Cx) Requirements.

.3 Section 01 91 33 - Commissioning (Cx) Forms.

1.3 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees may be available for training during any stages of construction for purposes of familiarization with systems.

1.4 INSTRUCTORS

.1 Owner's Representative will arrange to provide:
.1 Descriptions of systems.
.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
.1 Start-Up, operation, shut-down of equipment, components and systems.
.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:
.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out performance verification tests.

1.5 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:
.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.6 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:
.1 "As-Built" Contract Documents.
.2 Operating Manual.
.3 Maintenance Manual.
.4 TAB and PV Reports.

.3 Owner's Representative will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

1.7 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be determined in Commissioning meetings.

.3 Training to be completed prior to acceptance of facility.

1.8 Responsibilities

.1 Be responsible for:
.1 Implementation of training activities,
.2 Coordination among instructors,
.3 Quality of training, training materials,

.2 Owner's Representative will evaluate training and materials.

1.8 Responsibilities (Cont'd)

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Owner's Representative.

1.9 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:
.1 Functional requirements.
.2 System philosophy, limitations of systems and emergency procedures.
.3 Review of system layout, equipment, components and controls.
.4 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
.5 System operating sequences, including step-by-step directions for starting up, shut-down, operation of breakers, reclosers, switches, adjustment of control settings and emergency procedures.
.6 Maintenance and servicing.
.7 Trouble-shooting diagnosis.
.8 Inter-Action among systems during integrated operation.
.9 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 03 20 00 - Concrete Reinforcement.

.2 Section 03 30 00 - Cast-In-Place Concrete.

.3 Section 31 20 00 - Earthwork.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
- .1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA-A23.2-04, Methods of Test for Concrete.
- .3 CAN/CSA-A23.3-04, Design of Concrete Structures.
- .4 CAN/CSA-O86-01, Engineering Design in Wood (Limit States Design) and 086S1-05, Supplement#1.
- .5 CSA O121-M1978 (R2003), Douglas Fir Plywood.
- .6 CSA O151-04, Canadian Softwood Plywood.
- .7 CSA O153-M1980 (R2003), Poplar Plywood.
- .8 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
- .9 CAN/CSA-S269.3-M92 (R2003), Concrete Formwork.

.2 Council of Forest Industries of British Columbia (COFI)
- .1 COFI Exterior Plywood for Concrete Formwork.

1.3 SHOP DRAWINGS

.1 If requested by the Owner's Representative, submit shop drawings for formwork and falsework.

.2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

.3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

.4 Indicate sequence of erection and removal of formwork/falsework as directed by the Owner's Representative.

.5 Each shop drawing submission shall bear the stamp and signature of a qualified Professional Engineer registered or licensed to practice in the Province of Nova Scotia, Canada.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with an approved Waste Management and Disposal Plan.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Formwork materials:
.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86 and CSA -O153.

.2 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material. Spiral pattern not to show in hardened concrete.

.3 Form ties:
.1 Use snap-off metal ties complete with plastic cones and light grey concrete plugs.

.4 Form liner:
.1 Plywood: Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151, Poplar to CSA O153, Construction grade, T & G edge, 19 mm (3/4 in.) thick

.5 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.

.6 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal, 15 to 24 mm2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.7 Falsework materials: to CSA S269.1.

PART 3 - EXECUTION

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain approval of the Owner's Representative for use of earth forms framing openings not indicated on drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.

.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.6 Do not place shores and mud sills on frozen ground.

.7 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.

.9 Align form joints and make watertight. Keep form joints to minimum.

.10 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.

.11 Use 25mm chamfer strips on external corners and/or 25mm fillets at interior corners , joints, unless specified otherwise.

.12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.13 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.14 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will

3.1 FABRICATION AND ERECTION (Cont'd)

.14 (Cont'd)
not protrude beyond surfaces designated to receive applied finishes, including painting.

.15 Line forms for following surfaces:
.1 Exposed faces of abutments, wing walls, piers and pylons. Do not stagger joints of form lining material. Align joints to obtain uniform pattern.

.16 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

.17 If slip forming, flying forms or vibratory forms are used, submit details of equipment and procedures for approval by the Owner's Representative.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.
.1 Three (3) days for walls and sides of beams.
.2 Three (3) days for columns.
.3 Seven (7) days for beam soffits, elevated slabs, decks and other structural members.
.4 Three (3) days for footings and abutments.

.2 For concrete members subject to bending stresses where the member relies upon forms for vertical support, forms shall remain in place until the concrete has reached a minimum of 75% of its specified twenty-eight (28) day compressive design strength, based on test cylinders from the batch of concrete placed, or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000 mm apart.

.5 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 30 00 - Cast-In-Place Concrete.

.3 Section 31 20 00 - Earthwork.

1.2 REFERENCES

.1 American Concrete Institute (ACI)
.1 ACI 315R-80, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.

.2 American National Standards Institute/American Concrete Institute (ANSI/ACI)
.1 ANSI/ACI 315-99, Details and Detailing of Concrete Reinforcement.

.3 Canadian Standards Association (CSA)
.1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
.2 CAN3-A23.3-04, Design of Concrete Structures for Buildings.
.3 CSA G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
.4 CAN/CSA-G30.18-M92 (2007), Billet-Steel Bars for Concrete Reinforcement.
.5 CAN/CSA-G40.20-04/G40.21- 04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.3 SHOP DRAWINGS

.1 Submit shop drawings including placing of reinforcement.

.2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Owner's Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.

.3 Detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated. Provide Type B (top) tension lap splices unless otherwise indicated.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with an approved Waste Management and Disposal Plan.

PART 3 - PRODUCTS

3.1 MATERIALS

.1 Reinforcing steel: billet steel, Grade 400 MPa, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.

.2 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.

.3 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.

.4 Mechanical splices: subject to approval of Owner's Representative.

3.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise.

.2 Obtain Owner's Representative's approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

3.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Owner's Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum four (4) weeks prior to commencing reinforcing work.

.2 Upon request, inform Owner's Representative of proposed source of material to be supplied.

PART 3 - EXECUTION

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Owner's Representative.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on approved placing drawings and in accordance with CAN/CSA-A23.1.

.2 Prior to placing concrete, obtain Owner's Representative 's approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour. Cover shall be 75mm when concrete is to be cast against or permanently exposed to earth, and 60mm for all other conditions.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 20 00 - Concrete Reinforcing.

.3 Section 05 50 00 - Metal Fabrications.

.4 Section 31 20 00 - Earthwork.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
.2 CAN/CSA-A23.2-04, Methods of Test for Concrete.
.3 CSA A23.3-04, Design of Concrete Structures.
.4 CAN/CSA A3000-03, Cemetitious Materials Compendium.

.2 American Society for Testing and Materials International, (ASTM)
.1 ASTM C260-06, Specification for Air-Entraining Admixtures for Concrete.
.2 ASTM C494/C494M-08, Specification for Chemical Admixtures for Concrete.
.3 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.4 ASTM D4819-96(2005), Standard Specification for Flexible Cellular Materials Made From Polyolefin Plastics.

1.3 SAMPLES

.1 If requested by the Owner's Representative, submit samples for review.

.2 At least 2 weeks prior to commencing work, inform Owner's Representative of proposed source of aggregates and provide access for sampling if requested.

1.4 CERTIFICATES

.1 Submit material certificates.

.2 Minimum 2 weeks prior to starting concrete work, submit to the Owner's Representative, manufacturer's test data and certification by qualified independent inspection and testing laboratory that all materials will meet specified requirements.

1.4 CERTIFICATES (Cont'd)

.3 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.

.4 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

1.5 QUALITY ASSURANCE

.1 Minimum 2 weeks prior to starting concrete work, submit proposed quality control procedures for approval by the Owner's Representative for the following items:
.1 Hot weather concrete.
.2 Cold weather concrete.
.3 Curing.
.4 Finishes.
.5 Formwork removal.
.6 Joints.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with an approved Waste Management and Disposal Plan.

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate a cleaning area subject to the approval of the Owner's Representative for tools to limit water use and runoff.

.4 Carefully coordinate the specified concrete work with weather conditions.

.5 Ensure emptied containers are sealed and stored safely for disposal away from children.

.6 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non- combustible material and remove for disposal. Dispose of all waste in accordance with applicable federal, provincial and municipal regulations.

.7 Choose least harmful, appropriate cleaning method which will perform adequately.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Portland cement: to CAN/CSA-A3000, Type GU. Refer to 2.2, Mix Proportions and Design of this Section.

.2 Water: to CAN/CSA-A23.1.

.3 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.

.4 Air entraining admixture: to ASTM C260.

.5 Chemical admixtures: to ASTM C494. Concrete mix design Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.

.6 Concrete retarders: to ASTM C494 water based. Do not allow moisture of any kind to come in contact with the retarder film.

.7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
.1 Compressive strength: 50 MPa at 28 days.
.2 Consistency:
.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30s.
.2 Flowable: to ASTM C827. Flow table, 5 drops in 3s, (ASTM C109, applicable portion) 125 to 145%.
.3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125 %.
.4 Dry pack to manufacturer's requirements.

.8 Curing compound: to CAN/CSA-A23.1 white and to ASTM C309, water based.

.9 Pre-moulded joint fillers:
.1 Closed-cell, polyethylene joint filler with peel-off tape such as Foam Tech as manufactured by Engineered Site Products Ltd., or approved equal, in accordance with ASTM D4819. For concrete surfaces in contact with hot asphalt use Foam Tech H.

.10 Joint sealer/filler:
.1 A two component, polysulphide sealant, Duoflex SL (self-levelling) for slabs and Duoflex NS (non-sag) for walls as manufactured by Sika or approved equal complete with compatible foam back rod and primer (TPR-415) as required in accordance with the manufacturer's written instructions.

2.2 MIXES

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give following quality concrete as indicated.

.1 Cement:

.1 Type GU Portland cement.

.2 Minimum compressive strength at 28 days: 35 MPa.

.3 Class of exposure: C-1.

.4 Nominal size of coarse aggregate: 20mm.

.5 Slump at time and point of discharge: 100 mm +/- 25mm.

.6 Air content: 5 to 8 % at time of placement.

.7 Chemical admixtures: Air entraining and water reducing admixtures shall be compatible products of the same manufacturer and acceptable to the concrete mix design Engineer. No calcium chloride shall be added.

.8 Maximum water/cement ratio: 0.40

.9 A concrete mix design shall be provided by the Contractor based on trial mixes that have been designed and tested by a qualified Professional Engineer registered or licensed to practice in the Province of Nova Scotia and submitted for review to the Owner's Representative.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Obtain approval of Owner's Representative before placing concrete. Provide 24 hours notice prior to placing of concrete.

.2 Pumping of concrete is permitted only after approval of equipment and mix.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Prior to placing of concrete obtain approval of Owner's Representative of proposed method for protection of concrete during placing and curing.

.5 Maintain accurate records of placed concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.6 Do not place load upon new concrete until authorized by the Owner's Representative.

.7 Vertical height of freefall for concrete placement shall not exceed 1.5 m (5.0 ft.). Utilize purpose

3.1 PREPARATION (Cont'd)

.7 (Cont'd)
made chutes, spouts and/or approved pumping apparatus of compatible and non-reactive materials with the uncured concrete.

.8 Cold Weather Requirements:
.1 If cold weather conditions are encountered, implement the applicable requirements of CAN/CSA-A23.1 with respect to the heating of materials, subgrade protection, protected insulated coverings, heating enclosures and all other aspects of cold weather concrete placement and curing.
.2 Ensure that all adequate measures are used to prevent the freezing and frost penetration of the founding material.

3.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.

.2 Concrete shall be dense, homogenous and free of cold joints, voids and honeycombing. Concrete shall be fully bonded to all reinforcing steel, anchors and embedded parts.

.3 Concrete shall be consolidated using a mechanical form vibrator method complete with mechanical hand held vibrators, if required, and subject to the approval of the Owner's Representative.

.4 Concrete shall be placed in consolidated lifts and kept approximately horizontal and evenly distributed throughout the formed assembly. The rate of placement shall be such that each successive lift shall be vibrated into the preceding lift to ensure proper bonding.

.5 All concrete placement and vibrating activities shall be in accordance with the formwork design data, limitations and parameters provided by the Contractor.

.6 Sleeves and inserts.
.1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by the Owner's Representative.
.2 Where approved by the Owner's Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100mm x 100mm not indicated, must be approved by the Owner's Representative.

3.2 CONSTRUCTION (Cont'd)

.6 (Cont'd)
.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Owner's Representative before placing of concrete.
.4 Check locations and sizes of sleeves and openings shown on drawings.
.5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.7 Anchor bolts (General).
.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
.2 With approval of the Owner's Representative, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100mm diameter. Drilled holes to be larger in diameter than bolts used to manufacturer's recommendations.
.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
.4 Set bolts and fill holes with shrinkage compensating grout or adhesive as specified.
.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.8 WTG Anchor Bolts.
.1 Wind Turbine Generator (WTG) foundation anchor bolts and the associated embedded lower ring plate shall be set in place, aligned and levelled utilizing an upper ring template that the Contractor has fabricated in accordance with the dimensions and specifications as provided by GE Energy. The Contractor shall follow the requirements and permissible tolerances as set out in the documents technical specification. Wind Turbine Generator Systems, All Types Foundations Part I of V, General Civil Design and V of V, Site Construction by GE Energy (2007).

.9 Drainage holes and weep holes:
.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
.2 Install weep hole tubes and drains as indicated.

.10 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

3.2 CONSTRUCTION (Cont'd)

.11 Finishing.

.1 Finish concrete in accordance with CAN/CSA-A23.1.

.2 Use procedures acceptable to Owner's Representative or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.

.3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

.4 Cut back form ties and plug openings in a manner acceptable to the Owner's Representative.

.5 Repair holes and surface defects to the satisfaction of the Owner's Representative.

.6 Remove honeycombed or otherwise defective concrete and repair in a manner approved and to the satisfaction of the Owner's Representative.

.7 Ensure that all exposed concrete has neatly formed, 45 degree bevelled, 25 mm (1") chamfered edges in accordance with Section 03 10 00 - Concrete Forming and Accessories.

.12 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Owner's Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.2 Locate and form isolation, construction and expansion joints as indicated. Install joint filler.

.3 Use thick joint filler to separate floor from vertical surfaces. Use in accordance with the manufacturer's written instructions.

.13 Curing and protection:

.1 Curing compounds shall not be used where bond is required for subsequent topping or coating.

.2 Use curing compound Sealtight 3100 by W. R. Meadows of Canada or approved equal, in accordance with the manufacturer's written instructions.

.14 Specialized Coating Systems:

.1 The exposed horizontal and vertical concrete surfaces of the transformer and Statcom Equipment foundations shall receive a protective coating system composed of one (1) coat of Sikadur WDE primer and two (2) coats of Fastflor CR as manufactured by Sika Canada Ltd. Apply as a broadcast or seeded system with No. 50 Silica sand. All products shall be applied in strict conformance to the manufacturer's written instructions with specific attention to substrate surface preparation, corner coving, temperature, humidity and curing requirements.

3.3 SITE TOLERANCE

.1 Concrete tolerance in accordance with CAN/CSA-A23.1

3.4 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory provided by the Contractor in accordance with CAN/CSA-A23.2. Test results are to be recorded in accordance with 01 91 33.

.2 The Contractor will pay for costs of concrete testing.

.3 The Owner's Representative may wish to take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.4 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.

.5 Inspection or testing by the Owner will not augment or replace the Contractor for quality control nor relieve the Contractor of contractual responsibility.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forming and Accessories.

.2 Section 03 20 00 - Concrete Reinforcing.

.3 Section 03 30 00 - Cast-In-Place Concrete.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA A165 Series 04, CSA Standards on Concrete Masonry Units.
.2 CSA A179-04, Mortar and Grout for Unit Masonry.
.3 CSA A370-04, Connectors for Masonry.
.4 CSA A371-04, Masonry Construction for Buildings.
.5 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
.6 CAN/CSA-G30.18-M92 (2007), Billet-Steel Bars for Concrete Reinforcement.
.7 CAN/CSA S304.1-04, Design of Masonry Structures.

.2 ASTM C260-06, Specification for Air-Entraining Admixtures for Concrete.

.3 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.4 ASTM A153/A153M-05, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.5 ASTM C494/C494M-08, Specification for Chemical Admixtures for Concrete.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with an approved Waste Management and Disposal Plan.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with the Waste Management and Disposal Plan.

.4 Divert damaged or unused concrete materials from landfill to local facility approved by the Owner's Representative.

1.4 SHOP DRAWINGS

.1 If requested by the Owner's Representative, submit shop drawings for, temporary bracing, formwork and falsework.

.2 Submit shop drawings for masonry reinforcement and connectors including sizes, spacing, location, bar bending details and quantities of reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Standard concrete block units: to CSA A165 Series.
.1 Classification: H/15/A/M.
.2 Size: 190 mm x 190 mm x 390 mm.
.3 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.

.2 Acceptable concrete block manufacturers: Shaw Group, South Shore Ready Mix Limited, V.J. Rice Limited or approved equal.

.3 Concrete grout for core and bond block infill: Proportion normal density concrete in accordance with CSA A23.1, Alternative 1 to give the following properties for grouting of concrete masonry block:
.1 Cement: Type GU.
.2 Minimum compressive strength at 28 days: 20 MPa.
.3 Class of Exposure: N.
.4 Nominal size of aggregate: 10 mm.
.5 Slump at time and point of discharge: 200mm.
.6 Air content: 3%.
.7 Chemical admixtures: type as approved and in accordance with ASTM C494.

.4 Mortar: Type S to proportion specifications of CSA A179.

.5 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.

.6 Colour: ground coloured natural aggregates unless indicated otherwise.

.7 Use the same brand of materials and source of aggregate for the entire project.

2.1 MATERIALS (Cont'd)

.8 All exterior block shall contain the recommended amount of Dry-Block Mortar Admix for water repellency and to ensure proper bond strength.
.1 Acceptable product: Dry-Block System, Block Admix, as manufactured by Forrier Chemical Company and as supplied by the Shaw Group.

.9 Masonry reinforcing: horizontal joint reinforcing to CSA A370, welded, truss or ladder type, fabricated from 4.76 mm diameter steel wire to ASTM A82, deformed for longitudinal wires and smooth for cross wires, with loops for box ties where faced with masonry veneer, hot dip galvanize after fabrication to ASTM A153/A153M, Class B, 458 g/m^3 zinc coating.
.1 For exterior cavity walls; use Blok-Trus II Bl37 by Blok-Lok Limited, extra heavy duty.
.2 Load bearing interior masonry walls; use extra heavy duty Blok-Trus BL-30 truss type by Blok-Lok Limited for single wythe masonry walls.
.3 Non-load bearing interior masonry walls: use standard duty BL-10 (ladder) or BL-30 (truss type) by Blok-Lok Limited for single wythe masonry walls.

.10 Reinforcing steel for core-filled masonry: to CAN/CSA G30.18, Grade 400 and as specified in Section 03 20 00 - Concrete Reinforcing.

.11 Joint sealer/filler:
.1 A two component, polysulphide sealant, Duoflex NS (non-sag) for walls as manufactured by Sika or approved equal complete with compatible foam back rod and primer (TPR-415) as required in accordance with the manufacturer's written instructions.

.12 Bond block:
.1 Individual concrete bond block units may be used to construct lintels and bond beams.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Construct masonry work as required by jurisdictional authorities and in accordance with the engineered drawings.

.2 Before commencing masonry work, verify that site conditions will allow construction of masonry within required limitations of wall heights, wall thicknesses, openings, bond, anchorage, lateral support and compressive strength of masonry units and mortars.

3.1 INSTALLATION (Cont'd)

.3 Protection.
.1 Protect masonry materials and installed works from marking and other damage.
.2 Deliver materials to the site in the dry condition and store under waterproof cover on pallets or plank platforms held off of the ground.
.3 Protect completed work from mortar droppings. Use non-staining coverings.
.4 Use all appropriate and approved procedures in accordance with CSA A371 to suit cold, hot and wet weather conditions.
.5 Provide temporary bracing of masonry work during and after erection until permanent lateral support system is in place.

.4 Concrete block units.
.1 Bond: running.
.2 Coursing height: 200 mm for one block and one joint.
.3 Jointing: concave where exposed or where paint or other finish coating is specified.

.5 Concrete block lintels and bond beams.
.1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
.2 End bearing: not less than 200 mm as indicated on drawings.
.3 All concrete block lintels shall be braced and supported with falsework in accordance with Section 03 10 00 - Concrete Forming and Accessories until the concrete grout has reached the design strength.
.4 As a minimum, all top courses of masonry walls shall have a continuous bond beam composed of concrete filled bond block reinforced with 2 - 15M reinforcing bars.

.6 Workmanship.
.1 Build masonry plumb, level and true to line with vertical joints in alignment.
.2 Layout coursing and bond to achieve correct coursing heights and continuity of bond above and below openings with a minimum of cutting.
.3 Exercise care to provide full mortar joint coverage on all bearing surfaces of masonry. Replace masonry that does not meet above requirement.
.4 Allow joints to set sufficiently to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints unless otherwise indicated.
.5 Cut out neatly for electrical switches, outlet boxes and other recessed or built-in objects.
.6 Make cuts straight, clean and free from uneven edges.

3.1 INSTALLATION (Cont'd)

.6 (Cont'd)

.7 Verify that accessories, frame anchors, guards and such items specified in other Sections are available for building in before work commences. Cooperate in the setting and aligning of built-in work and provide for later installation of items which are included in the work of other Sections, to avoid cutting, fitting and patching.

.8 Prevent displacement of built-in items during construction.

.9 Conduct all work in accordance with CSA A371.

.7 Reinforcement, connectors, joints and lintels.

.1 Supply and install masonry reinforcement and connectors in accordance with CSA A370, CSA A371, CAN/CSA-A23.1 and CSA S304.1 unless indicated otherwise.

.2 Prior to placing concrete, mortar or grout obtain the approval from the Owner's Representative of placement of reinforcement and connectors.

.3 Reinforcement will not be continuous across joints designed for movement unless otherwise indicated.

.4 Install masonry reinforcing ties in accordance with CSA A370 and CSA A371. In case of conflict between these two standards, the more stringent requirements will apply.

.5 Place reinforcement continuously in horizontal joints at 400 mm vertically on centre, beginning with the course above bearing, unless otherwise specified or indicated.

.6 Place additional joint reinforcement at a spacing of 200 mm vertically on centre in courses above and below openings and extending 800 mm beyond jambs of openings.

.7 Install vertical reinforcing steel in cores of hollow masonry units where indicated.

.8 Install reinforcing steel and concrete in core fills, lintels and bond beams where indicated.

.9 Install continuous joint fillers and sealant in control joints at locations indicated.

.10 Leave a 38 mm space between the top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.11 Provide joint fillers and sealant at the top of masonry walls where indicated.

.12 Caulk corner joints of all block work where walls butt into continuous walls, at dissimilar material intersections (concrete walls and columns) and at the intersection of masonry walls with floor slabs. Caulking to be done prior to painting activities. Rake the vertical mortar joint during installation so as to provide a slight slot for caulking.

3.1 INSTALLATION (Cont'd)

.7 (Cont'd)

.13 Install steel and concrete lintels, centred over the opening to the specified end bearing.

3.2 CLEANING

.1 Standard block: Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 07 21 00 - Insulation.

.2 Section 07 28 00 - Air/Vapour Barriers.

.3 Section 07 80 00 - Firestopping and Smoke Seals.

.4 Section 07 92 00 - Sealants.

.5 Section 08 11 14 - Metal Doors and Frames.

.6 Section 13 34 23 - Prefabricated Buildings.

1.2 REFERENCES

.1 National Building Code of Canada 2005 (NBC 2005), Volumes 1 and 2 and Structural Commentaries.

.2 Canadian Standards Association (CSA)
.1 CAN/CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel.
.2 CAN/CSA-S16-01 Consolidation (R2007), Limit States Design of Steel Structures and S16S1-05, Supplement #1 to CAN/CSA-S16-01.
.3 CSA S136-07, North American Specification for the Design of Cold-Formed Steel Structural Members.
.4 CSA S136.1-07, Commentary on , North American Specification for the Design of Cold-Formed Steel Structural Members.
.5 CSA W47.1-03 (R2008), Certification of Companies for Fusion Welding of Steel.
.6 CAN/CSA-W48-06, Filler Metals and Allied Materials for Metal Arc Welding
.7 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.
.8 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).
.9 CAN/CSA-A660-04 (R2009), Certification of Manufacturers of Steel Building Systems.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
.2 CAN/CGSB 1-210-2003, Quick Drying Alkyd Primer for Structural Steel.
.3 CAN/CGSB 85.10-99, Protective Coatings for Metals.
.4 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.

1.2 REFERENCES (Cont'd)

.4 American Society for Testing and Materials International, (ASTM)
.1 ASTM 123/123M-08, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM 153/153M-05, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
.3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
.4 ASTM A325-07a, Specification for Structural Bolts Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
.5 ASTM A325M-09 Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
.6 ASTM A500-07, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
.7 ASTM A572/A572M-07, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
.8 ASTM A1011/A1011M-09, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low- Alloy with Improved Formability, and Ultra- High Strength.

.5 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
.1 CISC/CPMA 1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.
.2 CISC/CPMA 2-75, Quick-Drying, Primer for use on Structural Steel.

.6 Master Painters Institute
.1 MPI-INT 5.1-98, Structural Steel and Metal Fabrications.
.2 MPI-EXT 5.1-98, Structural Steel and Metal Fabrications.

.7 The Society for Protective Coatings (SSPC)
.1 SSPC - SP1, Solvent Cleaning.
.2 SSPC - SP3, Power Tool Cleaning.
.3 SSPC - SP6, Commercial Blast Cleaning.

1.3 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with requirements of CAN/CSA-S16 to resist axial forces, moments, shears and allow for movements indicated.

1.3 DESIGN REQUIREMENTS (Cont'd)

.2 Shear connections:
.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
.2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
.3 Submit sketches and design calculations stamped and signed by a qualified Professional Engineer registered or licensed to practice in the Province of Nova Scotia, Canada for non standard connections.

1.4 SHOP DRAWINGS

.1 Submit shop drawings including fabrication and erection documents and materials list.

.2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:
.1 Description of methods.
.2 Sequence of erection.
.3 Type of equipment used in erection.
.4 Temporary bracings.

.3 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified Professional Engineer registered or licensed to practice in the Province of Nova Scotia, Canada.

1.5 SAMPLES

.1 If requested, submit material samples.

1.6 QUALITY ASSURANCE

.1 If requested, submit four (4) copies of mill test reports two (2) weeks prior to fabrication of structural steel.
.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
.2 Provide mill test reports certified by metallurgists qualified to practice in the Province of Nova Scotia, Canada.

.2 Provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with an approved Waste Management and Disposal Plan.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling in accordance with the Waste Management and Disposal Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by the Owner's Representative.

.5 Divert unused paint material from landfill to official hazardous material collections site approved by the Owner's Representative.

.6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Frames, beams and columns: Hot- rolled structural steel conforming to CAN/CSA-G40.20/G40.21, Grade 350W (Fy = 350 MPa) or alternatively ASTM A992 (Fy = 345 MPa) for wide flange shapes and Grade 300W (Fy = 300 MPa) for channels, plates and angles. Hollow Structural Sections (HSS) shall be Class C, Grade 350W (Fy = 350 MPa) or alternatively ASTM A500, Grade C (Fy = 345 MPa). Pipe for railings and bollards shall conform to ASTM A53, Grade 240W (Fy = 240 MPa).

.2 Purlins and girts: Cold-formed structural steel conforming ASTM A1011 HSLAS, Grade 350 (50 ksi), material tolerances to CAN/CSA-S136 and fabrication tolerances to CAN/CSA-A660.

.3 Anchor bolts: to ASTM A307.

.4 Bolts, nuts and washers: to ASTM A325/ASTM A325M.

.5 Welding materials: to CSA W59 and certified by Canadian Welding Bureau; Electrodes: E49XX.

.6 Shop paint primer: to CISC/CPMA2- 75; Colour: gray; Carbozinc 11 by Carboline Co. or approved equal.

2.1 MATERIALS (Cont'd)

.7 Hot dip galvanizing: galvanize steel, where indicated, to ASTM A123/123M and ASTM A153/153M, minimum zinc coating of 600 g/m^2.

.8 Galvanized primer: two component, zinc rich; Colour; gray; Cathacoat 304L by Devoe Coatings or approved equal.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136, CAN/CSA-A660 and in accordance with approved shop drawings.

.2 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush where indicated without compromising design weld profile or size.

.3 Provide weep holes to suit hot dip galvanizing where required.

2.3 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel in accordance with MPI-INT 5.1/EXT 5.1 except where members are to be encased in concrete.

.2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surfaces according to SSPC - SP1 and SP6.

.3 Apply two (2) coats of primer in shop to steel surfaces to achieve a minimum dry film thickness of 3 mils for each coat, except:
.1 Surfaces to be encased in concrete.
.2 Surfaces to receive field installed stud shear connections.
.3 Surfaces and edges to be field welded.
.4 Faying surfaces of friction-type connections.
.5 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 - EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16, CAN/CSA-S136 and CAN/CSA-A660.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Owner's Representative for direction before commencing fabrication.

3.3 MARKING

.1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.4 ERECTION

.1 All construction activities including the erection, use, moving and dismantling of approved and certified staging must be by qualified and experienced personnel and shall conform to the Occupational Health and Safety Act and Construction Safety Regulations for the Province of Nova Scotia.

.2 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 CAN/CSA-S136 and CAN/CSA-A660 and in accordance with approved erection drawings.

.3 Field cutting or altering structural members: to approval of the Owner's Representative.

.4 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.5 Continuously seal members by continuous welds where indicated. Grind smooth.

3.5 FIELD QUALITY CONTROL

.1 If requested, inspection and testing of materials and workmanship will be carried out by testing laboratory designated by the Owner's Representative.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by the Owner's Representative.

.3 Submit test reports to the Owner's Representative within two (2) weeks of completion of inspection.

3.6 FIELD PAINTING

.1 Touch-up damaged surfaces and surfaces without shop coat with primer to SSPC-SP6/SP3 as required and to Part 2.3 Shop Painting except as specified otherwise.

.2 Clean with mechanical brush and touch-up with an approved, compatible zinc rich primer any damage to the galvanized finish to bolts, rivets, welds and burned or scratched surfaces at the completion of erection/field work.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 13 34 23 - Prefabricated Building.

1.2 REFERENCES

.1 National Building Code of Canada 2005 (NBC 2005), Volumes 1 and 2.

.2 Canadian Standards Association (CSA)
.1 CAN/CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel.
.2 CAN/CSA-S16-01 Consolidation (R2007), Limit States Design of Steel Structures and S16S1-05, Supplement #1 to CAN/CSA-S16-01.
.3 CSA S136-07, North American Specification for the Design of Cold- Formed Steel Structural Members.
.4 CSA S136.1-07, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.
.5 CSA W47.1-03 (R2008), Certification of Companies for Fusion Welding of Steel
.6 CAN/CSA-W48-06, Filler Metals and Allied Materials for Metal Arc Welding
.7 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.
.8 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
.2 CAN/CGSB 1-210-2003, Quick Drying Alkyd Primer for Structural Steel.
.3 CAN/CGSB 85.10-99, Protective Coatings for Metals.
.4 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.

.4 American Society for Testing and Materials International, (ASTM)
.1 ASTM A29/A29M-05, Steel Bars Carbon and Alloy, Hot-wrought General Requirements for.
.2 ASTM 123/123M-08, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.3 ASTM 153/153M-05, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.2 REFERENCES (Cont'd)

.4 (Cont'd)

.4 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.5 ASTM A325-07a, Standard Specification for Structural Bolts Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.6 ASTM A325M-09, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).

.7 ASTM A449-07b, Standard Specification for Hex Cap Screws, Bolts and Studs, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.

.8 ASTM A480/A480M-08, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

.9 ASTM A484/A484M-06b, Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings.

.10 ASTM A722/A722M-07, Uncoated High-Strength Steel Bars for Prestressing Concrete.

.11 ASTM F436-09, Hardened Steel Washers.

.5 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).

.1 CISC/CPMA 1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.

.2 CISC/CPMA 2-75, Quick-Drying, Primer for use on Structural Steel.

.6 The Society for Protective Coatings (SSPC)

.1 SSPC - SP1, Solvent Cleaning.

.2 SSPC - SP3, Power Tool Cleaning.

.3 SSPC - SP6, Commercial Blast Cleaning.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's:

.1 For finishes, coatings, primers and paints.

.2 Shop Drawings

.1 Submit shop drawings. Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Storage and Protection:
.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with an approved Waste Management and Disposal Plan.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling in accordance with the Waste Management and Disposal Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Owner's Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Hot rolled carbon steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 350W (Fy = 350 MPa) or alternatively ASTM A992 (Fy = 345 MPa) for wide flange shapes and Grade 300W (Fy = 300 MPa) for channels, plates and angles. Hollow Structural Sections (HSS) shall be Class C, Grade 350W (Fy = 350 MPa) or alternatively ASTM A500, Grade C (Fy = 345 MPa). Pipe for railings and bollards shall conform to ASTM A53 Grade 240W (Fy = 240 MPa).

.2 Welding materials: to CSA W59.

.3 Welding electrodes: to CSA W48 Series.

.4 Bolts for structural steel: to ASTM A307 and A325 as indicated.

.5 Stainless steel: to AISI, Type 304 or better.

.6 Adhesive Anchors: Tube injected system such as Hilti HIT-HY150 MAX complete with HAS SS 304 threaded rods. Installation to be in accordance with the written instructions and training as provided by the manufacturer.

.7 Expansion Anchors: Hilt Kwik Bolt 3 or approved equal. Installation to be in accordance with the written instructions and training as provided by the manufacturer.

.8 WTG Anchors: Anchor bolts for embedment in wind turbine generator (WTG) foundations shall be round steel bar in accordance with ASTM A722/A722M, Grade 150 (1035MPa), acceptable product: Williams R71 150ksi bars as manufactured by Williams Form Engineering Corp. or approved equivalent. Matching nuts shall be R73 hex nuts and R73-JN jam nuts in accordance with ASTM A29/A29M. Matching washer shall be R9F hardened washers in accordance with ASTM F436. All anchors shall be complete with a factory installed coating of protective grease within a PVC sleeve sealed at both ends. The exposed outer threads above the foundation pedestal shall have a matching PVC end cap.

.9 Denso petrolatum tape systems shall consist of denso paste (petrolatum tape primer) and densyl tape (petrolatum inpregnated, non-woven, synthetic fabric). Use all products in accordance with the manufacturer's written instructions.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble finished work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush where indicated without compromising design weld profile or size.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to ASTM A123 and ASTM A153.

.2 Shop coat primer: to CAN/CGSB-1.40, 1.210 and CISC/CPMA 2-75 compatible with finish coat.

.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181 and compatible with finish coat.

.4 Finish coat: Amercoat 220 by Ameron International or approved equal. Colour to be coordinated with and approved by the Owner's Representative.

2.4 ISOLATION COATING

.1 Isolate aluminium from the following components, by means of bituminous paint or another approved system:
.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
.2 Concrete, mortar and masonry.
.3 Wood.

2.5 PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

.4 Apply two shop applied finish coats (minimum 2 mils DFT each) to previously primed metal fabrications. Field touch-ups with same.

2.5 PAINTING (Cont'd)

.5 Utilize all paint products in accordance with the manufacturer's written instructions.

2.6 FRAMES AND SUPPORTS

.1 Fabricate by saw cutting, welding and/or bolting form structural steel, sizes and dimensions as indicated on the drawings or as modified to suit field conditions.

.2 Prime and finish coat all steel not designated as galvanized on the drawings.

PART 3 - EXECUTION

3.1 ERECTION

.1 All construction activities including the erection, use, moving and dismantling of approved and certified staging must be by qualified and experienced personnel and shall conform to the Occupational Health and Safety Act and Construction Safety Regulations for the Province of Nova Scotia.

.2 Do welding work in accordance with CSA W59. The Contractor shall submit and follow a detailed work plan. These will include all measures for field touch- up of all resulting bare steel and weld metal surfaces with a compatible paint system equal to or better than that on existing or pre-fabricated assemblies.

.3 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.4 Provide anchorage acceptable to the Owner's Representative and as noted on the drawing(s) in accordance with the manufacturer's written instructions.

.5 Exposed fastening devices to match finish and be compatible with material through which they pass.

.6 Provide components for building by other sections in accordance with shop drawings and schedule.

.7 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.8 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with the approved paint system.

3.1 ERECTION (Cont'd)

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 FRAMES AND SUPPORTS

.1 Install steel frames and supports to openings and locations as indicated on the approved shop drawings and following approved procedures and as directed by the Owner's Representative.

.2 Coordinate all appetures with Electrical shop drawings for steel structures in the substation. Failure to do so will require Contractor to remove item in field, make modifications and have unit refinished.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies requirements for supplying, transporting and installing all items of rough carpentry.

1.2 RELATED WORK

.1 Insulation: Section 07 21 00

.2 Sealants: Section 07 92 00

.3 Painting: Section 09 91 23

1.3 REFERENCES

.1 ASTM C1186-02, Flat Non-Asbestos Fiber-Cement Sheets.

.2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.3 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.4 CSA O80 Series-97(R2002), Wood Preservation.

.5 CAN/CSA-O86-01, (Consolidation), Engineering Design in Wood.

.6 CSA-O112 Series-M1977(R2006), CSA Standards for Wood Adhesives.

.7 CSA O121-M1978(R2003), Douglas Fir Plywood.

.8 CAN/CSA-O141-05, Softwood Lumber.

.9 CAN/CSA-O325.0-92(R2003), Construction Sheathing.

.10 CSA O151-04, Canadian Softwood Plywood.

.11 National Lumber Grades Owner (NLGA) Standard Grading Rules for Canadian Lumber 2003.

1.4 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

PART 2 - PRODUCTS

2.1 FRAMING AND STRUCTURAL MATERIALS

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
.1 CAN/CSA-O141.
.2 NLGA Standard Grading Rules for Canadian Lumber 2003.

.2 Glued end-jointed (finger-jointed) lumber is not acceptable.

.3 Machine stress-rated lumber is acceptable for all purposes.

.4 Framing and Board members: in accordance with NBC 2005.

.5 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
.1 S2S or S4S is acceptable.
.2 Board sizes: "Standard" or better grade.
.3 Dimension sizes: "Standard" light framing or better grade.
.4 Post and timbers sizes: "Standard" or better grade.

.6 Lumber: unless specified otherwise, softwood kiln dried, spruce-pine-fir and cedar (where indicated) species, S4S, moisture content 15% or less in accordance with the following standards:
.1 CAN/CSA O141.
.2 NLGA Standard Grading Rules for Canadian Lumber 2003.

.7 All lumber in contact with ground or concrete to be pressure-treated.

2.2 PANEL MATERIALS

.1 Douglas fir plywood (DFP): to CSA O121, standard construction, thickness indicated.

.2 Canadian softwood plywood (CSP): to CSA O151, standard construction, thickness indicated. Exterior grade.

.3 Panel standards: type, grade and thickness as indicated and in accordance with the following standards:
.1 Canadian Softwood Plywood (CSP): to CAN/CSA O151-04, standard construction.

2.2 PANEL MATERIALS (Cont'd)

.4 Construction sheathing: to CAN/CSA O325.
.1 Ceiling sheathing to be 19 mm exterior grade Douglas Fir plywood sheathing.
.2 Roof sheathing to be 19 mm exterior grade tongue and groove plywood sheathing.

2.3 ACCESSORIES

.1 Sealants: as specified in Section 07 92 00.

.2 Nails, spikes and staples: to CSA-B111, galvanized for exterior work, plain finish for interior work.

.3 Bolts: 12 mm diameter unless indicated otherwise, complete with nuts and washers.

.4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.5 General purpose adhesive to CSA-O112.

.6 Sill gasket: purpose made compressible sill gasket by "TrueFoam", or approved equivalent.

2.4 FINISHES

.1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work, interior highly humid areas and pressure-preservative treated lumber as indicated.

2.5 WOOD PRESERVATIVE

.1 Surface-applied wood preservative: clear copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Use pressure preservative treated wood to CAN/CSA O80, water borne for stained finish, where indicated and as follows:
.1 Treat plywood to CAN/CSA-O80.9 using CCA or ACA preservative to obtain minimum net retention of 4.0 kg/m^3 of wood.
.2 Treat lumber to CAN/CSA-O80.2 using CCA or ACA preservative to obtain minimum net retention of 4.0 kg/m^3 of wood.
.3 Following water-borne preservative treatment, kiln dry material.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Comply with requirements of NBC 2005, Division B, Part 9 supplemented by following paragraphs.

.2 Install members true to line, levels and elevations, square and plumb.

.3 Construct continuous members from pieces of longest practical length.

.4 Install spanning members with "crown-edge" up.

.5 Install furring and blocking as required to space-out and support casework, cabinets, electrical equipment mounting boards, and other work as required.

.6 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.7 Sheathing to be installed as and where indicated on the Drawings.

.8 Cutting of holes by trades or splices in members not indicated shall not be permitted.

.9 All posts and studs shall be continuous in end grain bearing through all required levels of the framing.

.10 Provide such temporary bracing as is required by his erection procedures and arrangement of the load bearing units with the roof sheathing, trusses and truss bracing until final bridging is installed. Gable end trusses shall be temporarily braced from the ground with raking shores.

.11 Roof sheathing nailing pattern to be as follows: provide 50 mm long nails at 150 mm c/c along panel edges and at 300 mm c/c along intermediate framing unless noted otherwise on the plans.

3.2 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

.3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.3 SCHEDULES

.1 Sheathing:
.1 Plywood, DFP or CSP, exterior grade, pressure treated, square edge, thickness indicated.
.2 Interior and exterior applications as indicated on the Drawings.

.2 Electrical equipment backboards: Canadian softwood plywood to CSA O151, standard construction, CSP/S1S, 19 mm thick. Overall dimensions to suit equipment layout and arrangement. Install wood support framing as required. Painting of panel in Section 09 91 23.

.3 Treatment Plant sign: Canadian softwood plywood to CSA O151, standard construction, CSP/S1S, 25 mm thick of the size indicated on the Drawings. Install on two (2) pressure treated 200 x 200 posts set in concrete footings as indicated. Paint signage as indicated with exterior paints specified in Section 09 91 23.

.4 Peg Board: 3mm thick MDF board, 2400 wide x 1200 high. Install on wood strapping at 600 o.c. and around perimeter. Painting of panel in 09 91 23.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies requirements for furnishing all materials, labour, tools and equipment necessary to complete spray applied polyurethane, batt insulation and rigid insulation as indicated and as specified.

1.2 RELATED WORK

.1 Rough Carpentry: Section 06 10 00

.2 Hollow Metal Doors and Frames: Section 08 11 14

1.3 REFERENCES

.1 CAN/ULC-S701-05, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings.

.3 CAN/ULC-S705.1-2001, Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.

.4 CGSB 71-GP-24M-83, Adhesive, Flexible for Bonding Cellular Polystyrene Insulation.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Package insulation materials and label them to designate manufacturer, type, density and insulation value, and reference standard specification number if applicable.

.2 Store insulation materials in dry areas, protected from wetting and traffic.

.3 Store insulation board flat, on a flat surface, to prevent edge damage and placing of materials on top of stored boards.

.4 Ensure that insulation board, and adhesives are stored at a minimum temperature of 4°C for 12 hours before installation, and that freezable adhesives are stored only at temperatures above 0°C at all times.

1.5 JOB CONDITIONS

.1 Install insulation materials subject to damage by water, freezing, sunlight or similar adverse environmental conditions with adequate protection against damage.

.2 Protect polystyrene insulation from sunlight at all times until permanent cover is installed.

1.6 PROTECTION

.1 Ventilate area to receive spray applied polyurethane insulation by introducing fresh air and exhausting air continuously during and 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.

.2 Provide temporary enclosures to prevent spray applied polyurethane insulation from contaminating air beyond application area.

.3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Ensure that all materials of an insulation system and the construction with which it is in contact are compatible.

.2 Ensure that others whose Work is affected are informed of the thickness and installation methods of insulation to be installed.

2.2 MATERIALS

.1 Batt insulation: to CAN/ULC-S702, Type 1.

.2 Spray applied polyurethane insulation: to CAN/ULC-S705.1.
.1 Type 1: single component polyurethane air barrier foam sealant, non-shrinking, moisture curing, closed cell, CFC free.
.1 Acceptable product: Enerfoam by Abisko Manufacturing, or approved equivalent.
.2 Type 2: two component polyurethane foam sealant, chemical curing, closed cell, CFC free.
.1 Acceptable product: Enerfoam 2 by Abisko Manufacturing, Walltite by BASF, or approved equivalent.

2.2 MATERIALS (Cont'd)

.3 Vapour barrier type adhesive: to CGSB 71-GP-24, Type 2, Class as recommended by manufacturer and compatible with polystyrene insulation.

2.3 PERFORMANCE REQUIREMENTS

.1 Fit insulation within construction elements and dimensions indicated on Drawings, without compression.

PART 3 - EXECUTION

3.1 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tightly around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and other protrusions.

.4 Do not enclose insulation until it has been inspected and approved by the Engineer.

3.2 EXAMINATION

.1 Examine substrates and immediately inform Engineer in writing of defects.

.2 Prior to commencement of work ensure:
.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.
.2 Surfaces have not been coated with releasing agents, and other contaminants which would affect positive bonding of polyurethane insulation.

.3 Report, in writing, to Engineer defects or conditions which would affect work. Do not proceed with work until conditions have been rectified.

3.3 BATT INSULATION INSTALLATION

.1 Pack insulation in door frames as indicated.

3.4 SPRAY-APPLIED POLYURETHANE INSULATION

.1 Ensure surface is clean and dry before beginning application. Remove loose mortar, dust, oil, grease, solvents and other contaminants.

.2 Protect adjacent surfaces from marking and foam overflow.

.3 Apply foam sealant in accordance with manufacturer's printed instructions

.4 Foam sealant:

.1 Fill joints, pockets and openings in building envelope, including around doors, windows, louvres, etc., using dispensing gun. Allow for post-expansion of foam.

.2 Cut back excess foam sealant after curing, flush with surrounding surfaces, unless otherwise directed or indicated.

.3 Ensure foam sealant is cut back or recessed to allow for installation of backing rod and building sealant where building sealant is to be applied over foam sealant to obtain/maintain air/vapour barrier.

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for supplying and installing the sheet membrane air/vapour barrier system to exterior building walls and ceilings where shown on the Drawings and herein specified.

1.2 RELATED WORK

.1 Rough Carpentry: Section 06 10 00

.2 Sealants: Section 07 92 00

.3 Hollow Metal Doors and Frames Section 08 11 14

1.3 REFERENCES

.1 CAN/CGSB-51.34-M86 Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

.2 CAN/CGSB-51.32-M77 Sheathing, Membrane Breather Type.

PART 2 - PRODUCTS

2.1 SHEET VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34-M86, Type 1, 6 mil thick interior ceiling and under-slab vapour barrier.

.2 Exterior wall building wrap: single ply spunbonded polyolefin type.
.1 Acceptable product: Tyvek by Dupont, Air-Gard by Fabrene Inc., or approved equal.

2.2 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50mm wide for lap joints and perimeter seals, 25mm wide elsewhere.

.2 Sealants: as specified in Section 07 92 00.

.3 Staples: minimum 6mm leg.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder ceiling assemblies prior to installation of plywood to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed to the satisfaction of the Engineer.

3.2 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:
.1 Apply continuous bead of sealant to substrate at perimeter of sheets.
.2 Lap sheet over sealant and press into sealant bead.
.3 Install staples through lapped sheets at sealant bead into wood substrate.
.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:
.1 Attach first sheet to substrate.
.2 Apply continuous bead of sealant over solid backing at joint.
.3 Lap adjoining sheet minimum 150mm and press into sealant bead.
.4 Install staples through lapped sheets at sealant bead into wood substrate.
.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
.1 Install moulded box vapour barrier.
.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.6 OPENINGS

.1 Equip window frames with factory site installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder.
.1 Material: compatible with building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control.
.2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for supplying and applying firestopping and smoke seal material as required for wall/floor/ ceilings in areas/rooms which are fire-rated, gas sealed or sound stopped, as noted in Room Finish Schedule.

1.2 RELATED WORK

.1 Firestopping and smoke seals within mechanical assemblies assemblies (i.e. inside ducts, dampers and electrical assemblies (i.e. inside conduits) are specified in Division 23 and 26 respectively.

1.3 REFERENCES

.1 ASTM E2174-04, Standard Practice for On-site Inspection of Installed Fire Stops.

.2 ULC-S115-05, Method of Fire Tests of Firestop Systems.

.3 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

.4 National Building Code.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 10 00.

.2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.5 SUBMITTALS

.1 Submit shop drawings and product and safety data in accordance with Section 01 10 00.

.2 Submit shop drawings to show proposed material, including composition and limitations, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

.3 Manufacturer's engineering judgments identification number and drawing details when no ULC or UL system is available for an application. Engineered judgments must include both project name and contractor's name who will install firestop system as described in drawing.

1.5 SUBMITTALS (Cont'd)

.4 Submit material safety data sheets provided with product delivered to job site.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Firestopping and smoke seal systems: in accordance with ULC-S115.
.1 Asbestos-free materials and systems capable of maintaining an effective barrier in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended.
.2 Firestop system rating: F.

.2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No. 40 U19.

.3 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed firestopping assembly in accordance with NBC.

.5 Firestopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Firestopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

.11 Acceptable manufacturers:
.1 Hilti Canada Corporation
.2 3M
.3 A/D Fire Protection Systems

PART 3 - EXECUTION

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interuption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 COORDINATION

.1 Coordinate location and proper selection of cast-in-place firestop devices with trade responsible for the work. Ensure device is installed before placement of concrete.

.2 Responsible trade is to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interference.

3.3 INSTALLATION

.1 Install firestopping material and components in accordance with ULC certification and manufacturer's instructions.

.2 Install firestopping and smoke seal material and components at all walls, floors and ceilings in fire rated rooms as noted on Room Finish Schedule on Drawings and also for all floor to floor penetrations.

.3 Install firestopping and smoke seal on both sides of wall or slab where penetration or opening exists in fire rated rooms.

.4 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

3.3 INSTALLATION (Cont'd)

.5 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.6 Tool or trowel exposed surfaces to a neat finish.

.7 Remove excess compound promptly as work progresses and upon completion.

3.4 INSPECTION

.1 Notify Engineer when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.5 SCHEDULE

.1 Firestop and smoke seal at:
.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
.2 Top of fire-resistance rated masonry and gypsum board partitions.
.3 Intersection of fire-resistance rated masonry and gypsum board partitions.
.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
.5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
.6 Openings and sleeves installed for future use through fire separations.
.7 Around mechanical and electrical assemblies penetrating fire separations.
.8 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of firestopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.6 FIELD QUALITY CONTROL

.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Keep areas of work accessible until inspection by applicable code authorities.

.3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E2174 or other recognized standard.

.4 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.6 FIELD QUALITY CONTROL (Cont'd)

.5 Install a warning card that is clearly visible adjacent to all large and medium openings that may be re-penetrated. This card should contain the following information:
.1 Warning that the opening has been firestop protected.
.2 Indicate the firestop system used (ULC or cUL).
.3 F rating or FT rating.
.4 Firestop product(s) used.
.5 Person to contact and phone number in case of modification or new penetration of firestop system.

3.7 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of firestopping and smoke seal materials.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies requirements for supplying, and applying sealants as indicated.

1.2 RELATED WORK

.1 Cast-in-place Concrete: Section 03 30 00

.2 Hollow Metal Doors and Frames: Section 08 11 14

1.3 REFERENCES

.1 ASTM C920-05, Specification for Elastomeric Joint Sealants.

.2 CAN/CGSB-19.13-M87 Sealing Compound, One Component, Elastomeric, Chemical Curing.

.3 CAN/CGSB-19.24-M90 Multi-component, Chemical Curing Sealing Compound.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels intact. Protect from freezing, moisture and water.

1.5 ENVIRONMENTAL AND SAFETY REQUIREMENTS

.1 Sealant and substrate materials to be minimum 5°C.

.2 Should it become necessary to apply sealants below 5°C, consult sealant manufacturer and follow their recommendations.

.3 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada.

.4 Conform to manufacturer's recommended temperatures, relative humidity and substrate moisture content for application and curing of sealants including special conditions governing use.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Primers: type recommended by sealant manufacturer.

.2 Joint fillers:
.1 General: compatible with primers and sealants, outsized 30 to 50%.
.2 Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20.

.3 Bond breaker: pressure sensitive plastic tape, which will not bond to sealants.

.4 Sealants:
.1 Interior and exterior caulking around perimeter of pressed steel frames and to base of frames to flooring: to CAN/CGSB-19.13, one-component, moisture curing, modified polyurethane, paintable, normal temperature range dry conditions, movement range to 10%.
.1 Acceptable product: DyMonic by Tremco Limited, or approved equivalent.
.2 Interior control and expansion joints in cast-in-place concrete floor surfaces: to CAN/CGSB-19.24 multi-component sealant, self levelling, for joint movement up to 25%.
.1 Acceptable product: Duoflex SL by Sternson Division of Sika Canada Inc., THC-900 for horizontal joints and THC-901 for vertical joints by Tremco Limited, or approved equivalent.
.3 Interior locations including: at corner joints where masonry walls butt into continuous walls, at masonry walls and concrete floor slabs, and at equipment pads to floor slabs, except where another sealant is specified: to CGSB 19.13.
.1 Acceptable product: DyMonic by Tremco Limited, or approved equivalent.
.4 Mildew resistant silicone sealant for use around countertops, sinks and washroom fixtures.
.1 Acceptable product: Tremsil 200 with mildew resistant properties by Tremco Limited, or approved equivalent. Colour to be selected by Engineer from six standard colours.

.5 Joint cleaner: xylol, methylethyleketon or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Remove by brushing, scrubbing, scraping or grinding loose mortar, dust, oil, grease, oxidation, mill scale, coatings and all other materials affecting bond of compounds from surfaces to which sealant compounds must adhere, except for painted surfaces.

.3 Clean down caulked metal surfaces with clean cellulose sponges or rags soaked in solvent recommended by sealant manufacturer, and wipe dry with clean cloths. Ensure that solvent is not injurious to painted surfaces.

.4 Ensure that releasing agents, coatings or other treatments have either not been applied to joint surfaces, or that they are entirely removed.

.5 Ensure joint surfaces are dry and frost free.

3.2 APPLICATION

.1 Apply sealant products where indicated on the Drawings and as outlined in Clause 2.1 of this Section.

.2 Where necessary to prevent staining, mask adjacent surfaces before priming and caulking.

.3 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

.4 Apply sealants, primers, joint fillers, and bond breaker if required, to manufacturer's instructions. Apply sealant using gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.

.5 Form surfaces of sealant with full bead, smooth, free from ridges, wrinkles, sages, air pockets, embedded impurities. Neatly tool surface to a slight concave joint.

3.3 CURING

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealant until proper curing has taken place.

3.4 CLEANING

.1 Clean adjacent surfaces immediately and leave work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

.4 Do not use chemicals, scrapers, or other tools which would damage surfaces of caulked materials when excess compounds or droppings are removed. Repair Work damaged by cleaning.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 13 34 23 - Prefabricated Buildings.

1.2 REFERENCES

.1 National Building Code of Canada 2005 (NBC 2005), Volumes 1 and 2 and Structural Commentaries.

.2 American Society for Testing and Materials (ASTM International)
.1 ASTM 123/123M-08, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM 153/153M-05, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
.3 ASTM A653/A653M-08, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.4 ASTM E152-81a, Methods for Fire Tests of Door Assemblies.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
.3 CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
.4 CGSB 51-GP-21M-78, Thermal Insulation, Urethane and Isocyanurate, Unfaced.

.4 Canadian Standards Association (CSA International)
.1 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CAN/CSA-S16-01 Consolidation (R2007), Limit States Design of Steel Structures and S16S1-05, Supplement #1 to CAN/CSA-S16-01.
.3 CSA S136-07, North American Specification for the Design of Cold- Formed Steel Structural Members.
.4 CSA S136.1-07, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.
.5 CSA W47.1-03 (R2008), Certification of Companies for Fusion Welding of Steel.
.6 CAN/CSA-W48-06, Filler Metals and Allied Materials for Metal Arc Welding
.7 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.
.8 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).

1.2 REFERENCES (Cont'd)

.4 (Cont'd)
.9 CAN/CSA-A660-04 (R2009), Certification of Manufacturers of Steel Building Systems.

.5 Canadian Steel Door Manufacturers' Association, (CSDMA).
.1 CSDMA, Specifications for Commercial Steel Doors and Frames, 1990.
.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.

.6 National Fire Protection Association (NFPA)
.1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
.2 NFPA 252-99, Standard Methods of Fire Tests of Door Assemblies.

.7 Underwriters' Laboratories of Canada (ULC)
.1 CAN4-S104-80(R1985), Fire Tests of Door Assemblies.
.2 CAN4-S105-85(R1992), Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 DESIGN REQUIREMENTS

.1 Design to suit the climatic conditions associated with this site in accordance with Part 1.8, Structural Design Criteria of Section 13 34 23 - Prefabricated Building.

.2 Design all doors, frames and related hardware from durable, corrosion resistant materials consistent with those required for industrial usage and exposure consistent with a material recovery facility.

.3 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to +40°C.

.4 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

.5 Design door for a 2 hour fire rating.

1.4 SHOP DRAWINGS

.1 Submit shop drawings.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware and fire rating and finishes.

1.4 SHOP DRAWINGS (Cont'd)

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing and fire rating finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings.

.5 Submit test and engineering data, and installation instructions.

1.5 REGULATORY REQUIREMENTS

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M and CAN4- S105M for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104, ASTM E152 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with an approved Waste Management and Disposal Plan.

.2 Dispose of packaging materials at appropriate recycling facilities as directed by Owner's Representative.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with the Waste Management and Disposal Plan.

.4 Separate for reuse and recycling and place in designated containers all steel, metal and plastic waste in accordance with the Waste Management and Disposal Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with Federal, Provincial and Municipal regulations.

1.6 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.7 Ensure emptied containers are sealed and stored safely.

.8 Divert unused paint and sealant materials from landfill to official hazardous material collections site approved by Owner's Representative.

.9 Unused sealant and paint related materials must not be disposed of into sewer systems, into streams, lakes, onto ground or in other locations where it will pose a health or environmental hazard.

.10 Fold up metal and plastic banding, flatten and place in designated area for recycling.

.11 Divert unused wood materials from landfill to recycling, reuse and composting facility approved by Owner's Representative.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Doors and frames shall be suitably packaged to prevent damage during delivery and shipping.

.2 They shall be carefully stored on the building site under protective cover and elevated above the ground or floor surface to prevent damage and corrosion.

1.8 WARRANTY

.1 The Contractor warrants the performance of all door materials, hardware, operators and installation for a period of two (2) years.

.2 This warranty shall include and protect against all weather seals and leakage, coating failures, structural failures, corrosion and deformation.

.3 The warranty shall include the full cost of all labour and materials to correct deficiencies to the satisfaction of the Owner's Representative.

1.9 MEASUREMENT AND PAYMENT

.1 There shall be no separate payment made under this Section. Include costs in the lump sum pricing applicable to Section 13 34 23 - Prefabricated Buildings.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Doors shall be full flush with no face seams and fabricated from 1.2 mm or 18 gauge base core thick, hot- dipped galvanized steel sheet with a minimum zinc coating of 120 g/m^2.

.2 All doors shall have a 3 mm bevel in 51 mm on hinge and latch edges and 2 mm or 14 gauge thick galvanized end, top and bottom channels welded to the door skins at 50 mm on centre. The top channel is to be flush and the bottom channel inverted.

.3 Each single door shall be 915 mm wide x 2134 mm high x 45 mm thick.

.4 Door frames shall be fabricated from 1.6 mm or 16 gauge base core thick, hot-dipped galvanized steel sheet with a minimum zinc coating of 120 g/m^2.

.5 Door frames shall be mortised, reinforced, drilled and tapped for hardware as required and shall be provided with all necessary anchors and rubber silencers.

.6 Each door shall be reinforced to suit a surface mounted, upper interior closer complete with a compatible door stop to enable the doors to be held open as required. The hardware shall be in an anodized aluminum finish (US28).

.7 Non-locking interior doors shall be complete with a passage lever hand set in a dull chromium finish (US26D).

.8 Exterior doors and locking interior doors shall be complete with locking lever hand sets in a dull chromium finish (US26D). They shall be keyed the same with two keys each door.

.9 All doors shall be equipped with interior exit panic hardware in an anodized aluminum finish (US28).

.10 Each door shall have two pairs of steel, ball bearing butt hinges, approximately 114 mm x 114 mm in a dull chromium finish (US26D).

.11 All doors and door frames shall be chemically treated to promote proper paint adhesion to the galvanized surface. The doors shall be primed and finish colour coated with a compatible paint system consisting of a minimum of two (2) coats of approved exterior, rust inhibitive enamel applied in

2.1 MATERIALS (Cont'd)

.11 (Cont'd) accordance with the manufacturer's written instructions. Colour to be approved by the Owner.

.12 Weather stripping and aluminum exterior thresholds shall be provided to give a positive weather seal around all doors. All weather stripping and thresholds shall be adjustable and secured with corrosion resistant screws.

2.2 DOOR CORE MATERIALS

.1 Stiffened: face sheets insulated core.
.1 Polyurethane: to CAN/ULC-S704 rigid, modified polyisocyanurate, closed cell board. Density 32 kg/m^3.

2.3 ADHESIVES

.1 Polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PAINT TOUCH-UP

.1 Touch-up rust inhibitive primer and finish coats to CAN/CGSB-1.181.

2.5 FINISH

.1 Protect weather stripping from paint. Provide final finish shall be free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Metallic paste filler: to manufacturer's standard.

.4 Fire labels: metal riveted.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames shall be welded type construction.

2.7 FRAMES FABRICATION GENERAL (Cont'd)

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cut outs with steel guard boxes.

.6 Prepare frame for door silencers, three (3) in jamb for each single door.

.7 Reinforce frames with unsupported width of 1200 mm using 1.9 mm or 14 gauge formed steel channel full width and thickness, welded to head.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied zinc rich, touch up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate exterior frame components with foam-in-place polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

2.9 FRAMES: WELDED TYPE (Cont'd)

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush.

.2 Exterior doors: hollow steel with voids between stiffeners filled with polyurethane insulation.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware.

.5 Factory prepare holes 13 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.6 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.8 Provide fire labelled doors. Test such products in strict conformance with CAN4-S104, ASTM E152 and NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.9 Manufacturer's nameplates on doors are not permitted.

2.11 HOLLOW STEEL CONSTRUCTION

.1 Form each face sheet for exterior doors from 1.2 mm or 18 gauge sheet steel.

.2 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.

.3 Fill voids between stiffeners of exterior doors with polyurethane core.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 The Contractor shall verify all openings and dimensions to suit the doors in accordance with the Prefabricated Building supplier prior to the preparation of shop drawings.

.2 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.3 Install doors and frames to CSDMA Installation Guide.

.4 Install all doors in accordance with approved shop drawings and to the satisfaction of the Owner's Representative.

.5 The Contractor shall utilize only experienced personnel qualified to install doors.

3.2 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Install door silencers.

3.2 FRAME INSTALLATION (Cont'd)

.6 Caulk perimeter of frames between frame and adjacent material.

3.3 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
.1 Hinge side: 1.0 mm.
.2 Latch side and head: 1.5 mm.
.3 Finished floor: 13 mm.

.3 Adjust operable parts for correct function.

3.4 FINISH REPAIRS

.1 Touch up with approved, compatible primer and finish paint surfaces damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.5 CLEANING AND ADJUSTMENT

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces with an approved non-abrasive cleaner in accordance with manufacturer's instructions.

.3 Clean doors and frames, removing traces of excess primer, caulking etc.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

.5 Repair or replace any faulty or damaged materials and assemblies to the satisfaction of the Owner's Representative.

.6 Adjust door operating components to ensure smooth opening and closing of doors within the manufacturer's specifications and parameters.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies requirements for supplying and installing gypsum board on ceiling and exteriot wall in the Battery Room (102).

1.2 RELATED WORK

.1 Rough Carpentry: Section 06 10 00

.2 Sealants: Section 07 92 00

.3 Painting: Section 09 91 23

1.3 REFERENCES

.1 ASTM C36/C36M-03, Standard Specification for Gypsum Wallboard.

.2 ASTM A653/A 653M-06, Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron (Galvannealed) by the Hot-Dip Process.

.3 ASTM C475-01, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.4 ASTM C840-06, Standard Specification for Application and Finishing of Gypsum Board.

.5 ASTM C1002-01, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.6 ASTM C1047-05, Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.7 ASTM C1396-06, Standard Specification for Gypsum Board.

.8 CAN/CSA G164-M1992, Hot Dip Galvanzing of Irregularly Shaped Articles.

.9 CAN/ULC-S102-03, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.

.2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10°C, maximum 21°C, for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fire-rated gypsum board: 1-hour fire-rated, to ASTM C1396, 15.9 mm thick, 1200 mm wide x maximum practical length, dense gypsum core.

.1 Standard of Acceptance: CGC Sheetrock Firecode Core gypsum board panels.

.2 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.3 Steel drill screws: to ASTM C1002.

.4 Laminating compound: as recommended by manufacturer, asbestos-free.

.5 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, 0.5 mm base thickness commercial grade sheet steel with Z275 zinc finish to ASTM A653, perforated flanges; one piece length per location.

.6 Joint compound: to ASTM C475, asbestos-free.

PART 3 - EXECUTION

3.1 ERECTION

.1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

.2 Install work level to tolerance of 1:1200.

.3 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers and grilles.

3.2 APPLICATION

.1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.

.2 Apply single layer gypsum board to metal furring using screw fasteners. Maximum spacing of screws 300 mm oc.

3.3 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm oc.

.2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.3 Splice corners and intersections together and secure to each member with 3 screws.

.4 Install access doors to electrical and mechanical fixtures specified in respective Sections.
.1 Rigidly secure frames to furring or framing systems.

.5 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.6 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

3.3 INSTALLATION (Cont'd)

.7 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.8 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.9 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.10 Mix joint compound slightly thinner than for joint taping.

.11 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.12 Allow skim coat to dry completely.

.13 Remove ridges by light sanding or wiping with damp cloth.

.14 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies requirements for providing all labour, tools, equipment and materials to complete all painting including preparation, painting and touch-up.

1.2 RELATED WORK

.1 Metal Fabrications: Section 05 50 00

.2 Rough Carpentry: Section 06 10 00

.3 Hollow Metal Doors and Frames: Section 08 11 14

.4 Gypsum Board: Section 09 21 16

1.3 REFERENCES

.1 Canadian Painting Contractors' Architectural (CPCA).
.1 Painting Specifications Manual 1998.

.2 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-1.146-99, Cold Curing, Glass Epoxy Coating.
.2 CAN/CGSB-1.38-2000, Interior Enamel Undercoat.
.3 CAN/CGSB-1.57-03, Interior Alkyd Semigloss Enamel.
.4 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
.5 CAN/CGSB-1.81-M90 CORR, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
.6 CAN/CGSB-1.188-04, Emulsion Type Filler Masonry Block.
.7 CAN/CGSB-1.195-99, Interior Latex Semigloss Paint.
.8 CAN/CGSB-1.213-04, Etch Primer (Pretreatment Coating or Tie Coat) for Steel and Aluminium.
.9 CAN/CGSB-85.100-93, Painting.
.10 CAN/CGSB-85.10-99, Protective Coatings for Metals.

.3 CAN/CSA 1.119-2000, Interior Latex Primer-Sealer.

1.4 QUALITY ASSURANCE

.1 Painting Contractor shall provide the Engineer with affadavits stating only "first-line" products have been used on this Contract.

.2 Paint manufacturer shall be represented by a qualified technical representative, trained as a paint inspector, with a minimum 5 years experience.

1.4 QUALITY ASSURANCE (Cont'd)

.3 The manufacturer's technical representative shall make a minimum of one inspection prior to and during application to ensure proper application.

.4 After inspection the manufacturer's representative shall provide a written report to the Engineer within 5 working days.

1.5 START-UP MEETING

.1 After award of Contract and prior to the painting and coating work, a start-up meeting shall be held with the following people present.
.1 The Owner.
.2 The Engineer.
.3 The applicator and his designated inspectors and crew supervisors who will be working on site on this project.
.4 The paint manufacturer's trained paint inspector.

.2 The purpose of the meeting shall be to discuss the specifications, job conditions, and painting and coating work to be done with reference to the most recent product data sheets and application instructions.

1.6 SURFACE AND ENVIRONMENTAL CONDITIONS

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Do not apply exterior paint finishes in unsuitable weather conditions.

.3 Do not apply paint finishes when relative humidity exceeds 85%, when condensation has formed or is likely to form, or immediately following rain, frost, or formation of dew.

.4 Provide adequate ventilation or isolation measures to protect against toxic fumes.

.5 Apply paint only to adequately prepared surfaces.

.6 Apply paint only when previous coat of paint is dry or adequately cured.

.7 Additional Interior Application Requirements:
.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

1.7 DELIVERY, HANDLING AND STORAGE

.1 Deliver, store and handle materials in accordance with Section 01 10 00.

.2 Labels shall clearly indicate:
.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Engineer. After completion of operations, return areas to clean condition to approval of Engineer.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:
.1 Provide fire extinguisher adjacent to storage area.
.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.8 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 10 00.

.2 Submit the names of paint manufacturers and local supplier. Confirm painting requirements and submit colour schedule for approval as per Section 01 10 00 prior to ordering of products

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
.1 Product name, type and use.
.2 Manufacturer's product number.
.3 Colour numbers.
.4 Manufacturer's Material Safety Data Sheets (MSDS).

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Paint products as manufactured by Glidden/Devoe Coating, and Pittsburgh Paint Ltd (PPG) or approved equivalent.

.2 Use only "first line" products produced by the manufacturer. Use only products of manufacturer whose best quality lines meet or exceed CGSB specifications for finishing materials as specified in the Paint Formulae, except where otherwise specified.

.3 Paint materials for each coating formula to be products of a single manufacturer.

PART 3 - EXECUTION

3.1 WORKMANSHIP

.1 All painting application and methods to be done in strict accordance with the recommendation of the applicable CGSB Standards, manufacturer's instructions and subject to the approval of the Engineer.

.2 Do not paint when temperature is below 10°C.

.3 Before painting equipment mask manufacturer's name plates and any other name plates carrying informational data pertaining to equipment. Do not paint nameplates.

3.1 WORKMANSHIP (Cont'd)

.4 Paint to be well mixed and kept stirred while being applied. Do not thin paint unless approved by the Engineer, and only with such materials and to such extent as not to damage paint.

.5 Spread paint to coverage not greater than that recommended by paint manufacturer.

.6 Paint to be well forced into pores, angles and crevices of well cleaned surfaces and in such manner as will assure a continuous even coat making contact with all parts of the surface and producing a film free of air bubbles, skips and thin spots.

.7 Paint thickness for each coat to be minimum as recommended by the applicable CGSB specifications or as recommended by the manufacturer of the material subject to approval of the Engineer.

.8 Defective painting and finishing Work resulting from application to unsatisfactory surfaces shall be considered the responsibility of those performing the Work of this Section.

3.2 PREPARATION OF SURFACES

.1 In general:

.1 Vacuum clean interior areas immediately before finishing Work commences.

.2 Remove from surfaces grease, oil, dirt, dust, ridges, and other soil and materials that would adversely affect the adhesion or appearance of finish coatings.

.3 Rust on surfaces primed under Work of other Sections shall be removed and the areas reprimed under the Work of those Sections.

.4 Finish, patch and smooth surfaces to remove cracks, holes, ridges, and similar blemishes.

.5 Touch up damaged prime coats on shop primed metals with same priming material.

.6 Neutralize high alkaline surfaces to receive latex paints. Remove residue before painting.

.7 Scrub mildewed surfaces with a bleach solution and rinse with clean water.

.8 In the case of existing coatings, hand tool clean to remove all loose flaking point and rust and feather sand edges.

.9 Degloss existing paint coatings by scuff sanding.

.10 Blast-track to remove existing floor coatings, adhesives, etc., where noted in finish schedules or noted on Drawings.

.2 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be

3.2 PREPARATION OF SURFACES (Cont'd)

.2 (Cont'd)
painted. Report to Engineer damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.3 Touch up shop paint primer on steel with same type primer as originally used.

.4 Prepare wood surfaces to CAN/CGSB-85-100.
.1 Sand surfaces smooth; clean soiled surfaces and remove dust and dirt.
.2 Use vinyl sealer over knots and resinous areas.
.3 Apply wood paste filler to nail holes and cracks.

.5 Drywall:
.1 Fill minor holes and depressions, caused by accidental damage, with drywall joint compound, and sand smooth when it is set, taking care not to raise nap of paper cover.

.6 Prepare galvanized steel and zinc coated surfaces to CAN/CGSB-85-10.

.7 Prepare masonry and concrete block surfaces to CAN/CGSB-85-100.

.8 Equipment pads, concrete floor surfaces preparation:
.1 Clean and etch with muriatic acids.

.9 PVC piping surfaces preparation:
.1 Scuff sand, clean soiled surfaces, and remove dust and dirt.

.10 Interior steel, ductwork, piping:
.1 Vacuum clean to remove all dust, dirt and other contaminants from all surfaces.
.2 Remove from surfaces grease, oil, dirt, dust, ridges and other soil and materials that would adversely affect the adhesion or appearance of finish coating.
.3 Hand tool clean SSPC-SP2 to remove any, dirt, rust, loose paint, etc.
.4 Ensure in all areas where rust is encountered to use a rust inhibitor covering prior to applying finish coat.
.5 Ensure all black iron piping i.e. Sprinkler lines, mains, etc. are prepared and primed prior to finish coat of paint.

3.3 APPLICATION

.1 Sand and dust between each coat to remove defects visible from distance up to 1500 mm.

.2 Finish bottoms, edges, tops and cutouts of doors after fitting as specified for door surfaces.

.3 Finish all surfaces exposed to view, requiring finish for preservation of material, or to facilitate maintenance.

.4 Apply number of coats of specified paints to designated surfaces as indicated in Painting Formulae and manufacturer's recommendations.

.5 Protect and cover machinery and equipment and adjacent surfaces during painting operations.

.6 Special care shall be taken during paint application to ensure disconnects and unions remain properly operable once painting operations completed.

3.4 MECHANICAL, AND ELECTRICAL

.1 Paint inside of ductwork where visible with primer and one coat of matte black paint.

.2 Leave factory-finished electrical equipment in original finish except for touch-up as required, unless otherwise indicated.

.3 Paint exposed conduits, pipes, fittings, fasteners and hangers. Colour to match adjacent surfaces, except as noted otherwise. Paint pipe hangers to match piping.

.4 Paint valves and miscellaneous devices to match adjacent piping. Where adjacent piping is not painted, paint valves to match adjacent machinery, as directed by the Engineer.

.5 Paint both sides and edges of plywood backboards for electrical equipment before installation.

.6 Paint all concrete equipment pads, plinths, curbs and concrete pipe supports. Colour to match adjacent floor unless noted otherwise.

.7 Do not paint over nameplates.

.8 Keep sprinkler heads free of paint.

3.5 PAINTING FORMULAE

.1 Formula 1: for exterior galvanized and zinc coated ferrous metals, including metal doors, and exhaust/intake weatherhoods apply: 1 coat galvanized steel primer CAN/CGSB-1.213 (Devoe 4120, PPG 97-687) 2 coats semi-gloss enamel CAN/CGSB-1.59 (Devoe 4308, PPG 54 line)

.2 Formula 2: for interior galvanized and zinc coated metal apply:

1 coat galvanized steel primer to CAN/CGSB-1.213 (Devoe 4120, Pittsburgh 97-687)
2 coats semi-gloss enamel to CAN/CGSB-1.57 (Glidden 94410-0, Pittsburgh 6-90)

.3 Formula 3: for interior galvanized and zinc coated metal doors electrostatically apply:

2 coats single component epoxy to CAN/CGSB-1.146, apply:

1 coat Devoe 205 or PPG 95-245 Series epoxy primer, 2 to 4 mils DFT.
1 coat Devoe 235 or PPG 95-1 Series epoxy at 3 to 4 mils DFT.

.4 Formula 4: for interior machinery and equipment (not coated by equipment manufacturer) apply:

1 coat alkyd primer CAN/CGSB-1.81 (PPG 94-269, Devoe 4160)
2 coats semi-gloss latex CAN/CGSB-1.195 (Devoe 4206, PPG 19 line)

.5 Formula 5: for interior concrete block walls (unless noted otherwise), Dry Areas, apply:

1 coat block filler CAN/CGSB-1.188 (Glidden 36250, PPG 6-7 B/F)
2 coats semi-gloss enamel CAN/CGSB-1.57 (Glidden 94410-0, PPG 6-90)

.6 Formula 6: for interior concrete block walls exposed to moist environments (open tank areas and open channel areas), apply:

1 coat block filler (Devoe 4010, PPG 16-90)
2 coats semi-gloss industrial enamel, 3 mil DFT (Devoe 4216HP, Pitt-Tech 90-474 Series)

3.5 PAINTING FORMULAE (Cont'd)

.7 Formula 7: for interior concrete and ceilings (Dry Areas), apply:

1 coat primer alkali resistant (PPG 6-603, Dulex 250 Gripper)
2 coats semi-gloss enamel CAN/CGSB-1.57 (Glidden 94410-0, PPG 6-90)

.8 Formula 8: for interior concrete and ceilings (Moist Environments and Exterior), apply:

1 coat primer alkali resistant (PPG 6-603, Dulex 250 Gripper)
2 coats satin industrial enamel (Pitt-Tech 90-474 Series, Devoe 4210)

.9 Formula 9: for interior primed ferrous metals, apply:

1 coat spot priming same type as originally used.
2 coats semi-gloss enamel CAN/CGSB-1.57 (Glidden 9440-0, PPG 6-90)

.10 Formula 10: for interior plywood (equipment backboards, ceiling etc.) apply:

1 coat enamel undercoat CGSB-1.38 (Glidden 9431-0, PPG 6-6) 2 coats semi-gloss enamel CAN/CGSB-1.57 (Glidden 94410-0, PPG 6-90)

.11 Formula 11: for ductile iron piping coated with manufacturer's asphalt sealer:

1 coat BIN pigmented white shellac sealer
2 coats semi-gloss enamel CAN/CGSB-1.59 (Glidden 4308, PPG 54 line)

.12 Formula 12: for interior copper and black iron piping and fittings, including insulated piping:

1 coat tinted enamel undercoat CGSB-1.38 (Glidden 250, PPG 6-6)
2 coats semi-gloss enamel CAN/CGSB-1.57 (Glidden 9440-0, PPG 6-90)

3.5 PAINTING FORMULAE (Cont'd)

.13 Formula 13: for interior PVC piping apply:

1 coat polyamide - epoxy, 5 - 7 mils DFT (PITT-GUARD DTR Series 97-145, two components, Devoe 233H)
1 coat high gloss industrial enamel, 3 mils DFT (PITT-TECH Series 90-300, Devoe 4208).

.14 Formula 14: for interior epoxy painted miscellaneous metals:

SSPC-SP-5 white metal surface preparation
1 coat inorganic zinc 2.5 - 3.0 mils DFT (PPG Metalhide 1001, Devoe 302HA).
2 coats epoxy finish coat minimum 5 mils DFT/coat (PPG 97-130/97-139, Devoe 235)

.15 Formula 15: for concrete floors and equipment pads; and concrete block 200 high bases (where noted in Room Finish Schedules) apply:
.1 2 coats of aquapon water base epoxy at 2 to 3 mils DFT per coat (PPG 98-1 Series, Devox Tru-Glaze-WP4406)

.16 Formula 16: for existing previously coated interior concrete block and precast concrete walls and ceilings, apply:

1 coat primer alkali resistant (PPG 6-603) spot prime to prepared bare concrete
2 coats Satin Industrial Enamel (Pitt-tech 90-474 series)

.17 Formula 17: for existing previously coated interior concrete floors, apply:

2 coats aquapon water base epoxy at 2 to 3 mils DFT per coat (PPG 98-1 series, Devox Tru-Glaze-WB4406)

.18 Formula 20: for previously coated miscellaneous metals, apply:

1 coat DTR epoxy (Pitt-Guard 97-946 series) spot prime to prepared exposed metal
2 coats gloss industrial enamel (Pitt-Tech 90-374 series)

.19 Formula 21: for interior gypsum board apply:

3.5 PAINTING FORMULAE (Cont'd)

.19 Formula 21:(Cont'd)

1 coat primer-sealer to CAN/CGSB-1.119
(Glidden 36600, Pittsburgh 6-2),
2 coats semi-gloss latex to CAN/CGSB-1.195M
(Glidden 9480-0, Pittsburgh 19 line)

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Materials, fabrication and performance criteria for prefabricated buildings.
.2 Sustainable requirements for construction and verification.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements

.2 Section 01 57 00 - Environmental Protection.

.3 Section 05 12 00 - Structural Steel for Buildings.

.4 Section 07 21 00 - Insulation.

.5 Section 07 28 00 - Air/Vapour Barriers.

.6 Section 07 80 00 - Firestopping and Smoke Seals.

.7 Section 07 92 00 - Sealants.

.8 Section 08 11 14 - Metal Doors and Frames.

1.3 REFERENCES

.1 National Building Code of Canada 2005 (NBC 2005), Volumes 1 and 2 and Structural Commentaries.

.2 American Society for Testing and Materials International, (ASTM).
.1 ASTM 123/123M-08, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM 153/153M-05, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
.3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
.4 ASTM A325M-09, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength [Metric].
.5 ASTM A653/A653M-08, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.6 ASTM A792/A792M-08, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

1.3 REFERENCES (Cont'd)

.2 (Cont'd)

.7 ASTM A1011/A1011M-09, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low- Alloy with Improved Formability, and Ultra- High Strength.

.8 ASTM D4637-08, Standard Specification for EPDM Sheet Used in Single Ply Roof Membrane.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB 41-GP-6M-83, Sheets, Thermosetting Polyester Plastics, Glass Fiber Reinforced.

.4 Canadian Standards Association (CSA International).

.1 CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA-S16-01 Consolidation (R2007), Limit States Design of Steel Structures and S16S1-05, Supplement #1 to CAN/CSA-S16-01.

.3 CSA S136-07, North American Specification for the Design of Cold- Formed Steel Structural Members.

.4 CSA S136.1-07, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.

.5 CSA W47.1-03 (R2008), Certification of Companies for Fusion Welding of Steel.

.6 CAN/CSA-W48-06, Filler Metals and Allied Materials for Metal Arc Welding

.7 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.

.8 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).

.9 CAN/CSA-A660-04 (R2009), Certification of Manufacturers of Steel Building Systems.

.10 CSA A3000-08, Cementitious Materials Compendium.

.5 Canadian Sheet Steel Building Institute (CSSBI).

.1 CSSBI 30M-06, Standard for Steel Building Systems.

.2 CSSBI Bulletin B15-07, NBC 2005: Snow, Wind and Earthquake Load Design Criteria for Steel Building Systems.

.3 CSSBI Sheet Steel Fact Sheet # 3 (SSF 3), Care and Maintenance of Prefinished Sheet Steel Building Products.

.4 CSSBI S8-08: Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.

1.4 SYSTEM DESCRIPTION

.1 Provide building structure and enclosure to physical dimensions shown on drawings and anchored on existing concrete foundations provided by Others.

.2 Building occupancy as defined by National Building Code of Canada 2005:
.1 Group F, Division 2, Medium Hazard Industrial Occupancy.

.3 Building Importance Category as per the National Building Code of Canada 2005:
.1 Post-Disaster

.4 The building is intended to enclose substation electrical control equipment.

.5 Building Type:
.1 Insulated, metal clad, clear spanning, structural steel rigid frames with steel beams, columns and bracing in the end walls.
.2 Multiple personnel access doors.

.6 Roof slope: 2:12 pitch (1 Vertical to 6 Horizontal).

.7 Exterior wall system: single skin, preformed metal panels complete with cold-formed steel girts, insulation and integral vapour barrier.

.8 Battery Room:
.1 Wall System: reinforced concrete masonry walls; cold-formed, light weight steel framing (LSF) complete with Type X, fire rated gypsum board.
.2 Roof System: structural steel channel framing complete with light weight steel framing (LSF) and Type X, fire rated gypsum board.

.9 Roof system: single skin, preformed metal panel, complete with cold-formed steel purlins, insulation and integral vapour barrier.

.10 Interior fire rated wall assembly: 2 hours.

1.5 EXISTING CONDITIONS AND COORDINATION

.1 The Prefabricated Building Contractor shall coordinate their design, fabrication and erection with the Concrete Foundation Contractor to ensure mutual compatibility with respect to building loads, dimensions, anchor bolt locations, alignment and access of the Works to the satisfaction of the Owner's Representative.

.2 No building erection activities, directly on the foundations, will occur until the concrete has attained compressive strength equal to the greater of

1.5 EXISTING CONDITIONS AND COORDINATION (Cont'd)

.2 (Cont'd)
ten (10) days or 85% of the specified twenty-eight (28) day compressive strength.

.3 The Prefabricated Building Contractor will be required to coordinate activities to suit the ongoing, construction activities of the Owner following a detailed plan and procedures submitted to and approved by the Owner's Representative. The nature of the work may require the Contractor to provide extended hours of construction, additional labour and equipment and all such amenities including site lighting required to accomplish the work in a safe and timely manner. No additional claims or financial compensation outside of the method of payment provided under this Contract will be encumbered on the Owner by the Contractor to complete the specified Works.

1.6 GENERAL DESIGN REQUIREMENTS

.1 The steel building system including all pre- formed metal panels and all associated fasteners and supports shall be designed, within acceptable deflection limitations, for the site climatic loading conditions for wind, rain, snow and earthquake in accordance with NBC 2005 and the requirements of all other applicable codes and standards.

.2 Design building walls and roof to allow for thermal movement of component materials caused by ambient temperature range from -35°C to +40°C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects to fasteners, assemblies and finishes.

.3 Building shall be watertight.

.4 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with Rain Screen Principles, as described by NRC/IRC.

.5 Vapour seal building enclosure to withstand, without failure, design RH at design ambient temperature condition, maintained against interior atmospheric pressure of 250 Pa (1 inch of water).

.6 Design building enclosure elements to accommodate, by means of expansion joints, movement in wall and structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, water penetration, twisting or deformations to door and overhead door frames.

1.6 GENERAL DESIGN REQUIREMENTS (Cont'd)

.7 Design, assemble and secure building elements to building frame to ensure stresses in sealants and seals are within sealant manufacturer's recommended maximum.

.8 Design building assembly to permit easy replacement of components.

.9 Allow for ceiling, piping, conduit and other interior/exterior mechanical and electrical dead and live loads imposed on this structure.

.10 Provide access doors to sizes and locations indicated that are weather resistant, insulated, weather stripped and fire resistant with a 2 hour rating.

1.7 PERFORMANCE REQUIREMENTS

.1 Maximum deflection, plumbness and alignment of component members for metal cladding assemblies, girts, purlins and structural steel frames, beams and columns will be as defined in Part 1.8, Structural Design Criteria and as per the recommendations of NBC 2005 and the referenced design standards.

.2 Maintain the following tolerances for building structure and enclosure elements.
.1 Maximum variation from plane or location shown on shop drawings: 1 mm/1 m of length and up to 6 mm/30 m maximum.
.2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

1.8 STRUCTURAL DESIGN CRITERIA

.1 Structural design shall be in accordance with NBC 2005, Volume 1, Division B, Part 4, Structural Design and CAN/CSA-S16 and CSA S136. Connection design by the fabricator shall be in accordance with these same standards and as noted in Section 05 12 00 - Structural Steel for Buildings.

.2 Structural design shall be based on Limit States Design. The anticipated loads with respect to safety shall be applied in the ultimate limit states (ULS) combinations of principal and companion loads in accordance with NBC 2005. The anticipated loads with respect to limiting function due to deflection, vibration, permanent deformation and localized cracking shall be applied in the serviceability limit states (SLS) combinations in accordance with NBC 2005.

1.8 STRUCTURAL DESIGN CRITERIA (Cont'd)

.3 The Prefabricated Building Supplier is to coordinate and ensure that all mechanical and electrical hanger and equipment support loads, all building gravity loads and the loads due to wind, snow and earthquake have been accounted for in the structural design to the satisfaction of the Owner's Representative and in accordance with NBC 2005 and all applicable regulatory agencies.

.4 Climatic reference design data shall be taken from NBC 2005, Volume 2, Division B, Appendix C, Climatic and Seismic Information for Building Design in Canada, Table C-2, based on the location of Digby, Nova Scotia as being representative of the conditions for the project site and are as noted below.

.5 The following design values shall be used to determine structural design loads:

.1 Roof Snow Loads:
- .1 Ground Snow Load (1 in 50 year), Ss = 2.2 kPa
- .2 Rain Load (1 in 50 year), Sr = 0.6 kPa
- .3 Importance Factor, Is = 1.25 (ULS), Is = 0.9 (SLS)
- .4 Basic Roof Snow Load Factor, Cb = 0.8
- .5 Wind Exposure Factor, Cw = 1.0
- .6 Slope Factor, Cs = 1.0
- .7 Shape Factor, Ca = 1.0

.2 Wind Loads:
- .1 Reference Velocity Pressure (1 in 50 year), q = 0.55 kPa
- .2 Importance Factor, Iw = 1.25 (ULS), Iw = 0.75 (SLS)
- .3 Exposure Factor, Ce = 1.0
- .4 Gust Factor (External), Cge = 2.0 (structural members)
- .5 Gust Factor (External), Cge = 2.5 (cladding)
- .6 Gust Factor (Internal), Cgi = 2.0 (large openings)
- .7 External Pressure Coefficient, Cpe = varies
- .8 Internal Pressure Coefficient, Cpi = varies

.3 Seismic Loads:
- .1 Site Class B. Refer to NBC 2005.
- .2 Importance Factor, IE = 1.5 (ULS), IE = SLS - As per User's Guide - NBC 2005, Structural Commentaries (Part 4 of Division B), Commentary J.

.4 Dead Load:
- .1 The structure shall include the self weight of all building system components including but not limited to the roof assembly, framing, insulation, cladding, finishes and

1.8 STRUCTURAL DESIGN CRITERIA (Cont'd)

.5 (Cont'd)
.4 Dead Load:(Cont'd)
.1 (Cont'd)
fasteners and any loads imposed on this facility from other adjacent structures.
.2 Additional dead loads other than those from building components shall include allowances for mechanical and electrical equipment. For those values not directly indicated on the drawings, allow a minimum specified dead load of 1.0 kPa (21 psf).
.5 Maximum Deflections (based on span, L, unless noted otherwise):
.1 Roof cladding: L/240
.2 Wall cladding: L/240
.3 Structural members and frames: L/240
.4 Lateral building sway: 1/400 of building height

1.9 SUBMITTALS

.1 Provide shop drawings for all fabricated and manufactured components.

.2 Product Data:
.1 Submit WHMIS MSDS for the following:
.1 Sealants.
.2 Tape.
.3 Proprietary Joints.
.2 Include application instructions for sealants and primers etc.

.3 Submit shop drawings prior to fabrication that have been stamped and signed by signature of a qualified Professional Engineer registered or licensed to practice in the Province of Nova Scotia, Canada for fabricator designed assemblies, components and connections.

.4 Indicate plans and grid lines, structural members and connection details, bearing and anchorage details, roof and wall cladding details, framed openings, doors, accessories, schedule of materials and finishes, camber and loadings, fasteners, welds, and roof curbs for ventilation.

.5 Describe requirements of other systems of components related to this Work but provided by others.
.1 Obtain necessary information required to detail this Work including methods of integration and securing.

.6 Submit erection drawings to Owner's Representative for approval, before construction.

1.9 SUBMITTALS (Cont'd)

.7 Erection drawings shall indicate:
.1 Dimensions of the structure, grid lines, member mark references, member sizes, erection methods and all other information necessary for the erection of the assembly.
.2 Indicate the permanent and temporary load resisting elements essential to the integrity of the partially completed structure.
.3 Summary of structural design criteria values specific to this building.
.4 Unfactored and factored primary frame and column dead and live load reactions.
.5 Anchor bolt sizes and layout.
.6 Roof curbs.

.8 Manufacturer's Field Reports: submit to Owner's Representative manufacturer's written report, within three (3) days of review, verifying compliance of Work, as described in Part 3.2 - Field Quality Control.

1.10 SAMPLES

.1 If requested, submit samples in accordance with approved Submittal Procedures.

1.11 QUALITY ASSURANCE

.1 Site Meetings: as part of Manufacturer's Services described in Part 3.2 - Field Quality Control, schedule site visits, to review Work, at stages listed.
.1 After delivery and storage of products, and when preparatory work is complete but before installation begins.
.2 Twice (2) during progress of Work at 25% and 60% complete.
.3 Upon completion of Work, after cleaning is carried out.

1.12 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with an approved Waste Management and Disposal Plan.
.2 Dispose of packaging materials at appropriate recycling facilities as directed by Owner's Representative.
.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with the Waste Management and Disposal Plan.

1.12 DELIVERY, STORAGE AND HANDLING (Cont'd)

.1 (Cont'd)

.4 Separate for reuse and recycling and place in designated containers all steel, metal and plastic waste in accordance with the Waste Management and Disposal Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with Federal, Provincial and Municipal regulations.

.7 Ensure emptied containers are sealed and stored safely.

.8 Unused sealant and paint related materials must not be disposed of into sewer systems, into streams, lakes, onto ground or in other locations where it will pose a health or environmental hazard.

.9 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.13 WARRANTY

.1 Contractor warrants the work of this section for ten (10) years.

1.14 MEASUREMENT AND PAYMENT

.1 Payment for this section shall be on a single, lump sum basis and shall include the complete supply, fabrication, delivery and erection of all materials and labour necessary for a Prefabricated Building described herein.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Hot-rolled and cold-formed structural steel, welding and bolting shall be in accordance with Section 05 12 00, Structural Steel for Buildings.

.2 Lightweight Steel Framing (LSF): Cold-formed structural steel conforming CSSBI and CAN/CSA-S136, Grade 275 (40 ksi). 18 gauge galvanized sheet steel with a zinc coating designation of Z275 on both sides in accordance with ASTM A653M.

.3 Fire resistive building elements shall conform to flame spread, fuel contributed and smoke developed requirements of NBC 2005.

.4 Preformed, profiled roof and wall cladding shall conform to:

2.1 MATERIALS (Cont'd)

.4 (Cont'd)
.1 Galvanized sheet steel having a zinc coating designation of Z275 on both sides in accordance with ASTM A653/A653M.
.2 Base steel nominal thickness (single span condition) of 0.76 mm.
.3 Grade 230, minimum yield strength of 230 MPa.
.4 Prefinished Colorite HMP (High Molecular weight Polyester) coating system by Vicwest or approved equal.
.5 Profile and colour: CL840, QC-1508-Bone White by VicWest or approved equal.
.6 Flashing materials to be of same materials and match accordingly.

.5 Fixed Ventilation Louvres - Aluminum
.1 Construction: welded with exposed joints ground flush and smooth.
.2 Material: extruded aluminum alloy 6063-T5.
.3 Blades: stationary, storm proof pattern with drainable gutters, reinforcing bosses and maximum blade length of 610 mm, depth of 152 mm and spaced at 114 mm.
.4 Frame, head, sill and jamb: 152 mm deep one piece extruded aluminum, minimum 2.06 mm thick with approved caulking slot, integral to unit and shall incorporate drainable gutters. Flanged frame or flush frame as required, 610 mm wide x 610 mm high. Visible vertical mullions.
.5 Free Area: 0.17 sq.m.
.6 Fastenings: stainless steel SAE-19-8f with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, stainless steel washer and aluminum body.
.7 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm diameter wire aluminum bird screen on inside face of louvers in formed U-frame.
.8 Finish: factory applied weather resistant acrylic enamel; Colour: to Owner's approval.
.9 Model: Drainable Louver Type K6776 as manufactured by The Airolite Company or approved equal.

.6 Interior wall and ceiling liner shall conform to:
.1 Gypsum wall board 16 mm thick) shall conform to ASTM C36 and CAN/CSA-A82.27 and shall be Type X, fire rated Sheetrock as manufactured by Canadian Gypsum Co. Inc. or approved equal.
.2 Fasteners to secure gypsum wall board to LSF framing shall be #6, Type S, bugle or wafer head, coarse thread, self-drilling drywall steel screws (black oxide finish) at 200 mm c/c ends and edges and 300 mm elsewhere.
.3 Gypsum wall board joints shall be taped with a self adhesive fibreglass mesh (min. 50mm wide) and

2.1 MATERIALS (Cont'd)

.6 (Cont'd)
.3 (Cont'd)
the joints and all counter sunk screw head locations shall be finished with one base coat of Durabond 90 joint compound and a top coat of premixed CGC joint compound. Sand all filled surfaces to a smooth finish and prime and top coat finish with an approved acrylic latex paint system. Colour to be coordinated with the Owner's Representative.
.4 The base perimeter of all finished walls shall have an adhered vinyl trim subject to the approval of the Owner's Representative.

.7 Flexible Flashing shall be:
.1 Single-ply EPDM (ethylene propylene diene monomer) to ASTM D4637.

.8 Fasteners for cladding shall conform to:
.1 Type AB #14 stainless steel (AISI Type 304/305), self-tapping, hexagonal head screws complete with an integrated EPDM and matching stainless steel washer or approved equivalent.
.2 The screw head shall be colour coded to match the paint finish.

.9 Sealants shall conform to the following:
.1 Tube applied sealants shall be a polyurethane based, non-sag elastomeric such as Sikaflex 1a complete with primer, if required, and as manufactured by Sika Canada Inc. or approved equal. Colour match to the cladding.
.2 Butyl tape shall be a 100% solid content butyl polyisobutylene tape, 3 mm thick x 13 mm wide.

.10 Thermal insulation shall conform to the following:
.1 Glass fibre metal building insulation with a minimum density of 17.6 kg/cu.m
.2 Minimum thermal resistance value, R20
.3 Minimum 140 mm thick
.4 Complete with an integral vapour barrier of minimum 8 mil thick polyethylene

.11 Foam closures shall be closed- cell flexible PVC to suit the same shape of the cladding profile and applicable to the site climatic location.

.12 Metal closures to match the colour, gloss, pattern, and thickness of the profiled cladding material.

.13 Shrinkage compensating grout shall be premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
.1 Compressive strength: 50 MPa at 28 days.

2.1 MATERIALS (Cont'd)

.13 (Cont'd)

.2 Consistency:

.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30s.

.2 Flowable: to ASTM C827. Flow table, 5 drops in 3s, (ASTM C109, applicable portion) 125 to 145%.

.3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125 %.

.4 Use in accordance with the manufacturer's written instructions.

.5 Acceptable products: MBT Construction Grout as manufactured by Degussa Building Systems or approved equal.

.14 Personnel access doors and frames shall be in accordance with Section 08 11 14 - Metal Doors and Frames.

2.2 FABRICATION

.1 Maintain vapour and thermal barrier where specified throughout building enclosure elements.

.2 Locate vapour barrier on warm side of thermal insulation.

.3 Complete enclosure assembly with exterior skin, access units (doors, etc.), inner air/vapour seal membrane, thermal insulation and interior finish.

.4 Shop fabricate structural members and cladding assemblies in accordance with approved shop drawings.

.5 Reinforce openings, brace frames and members including all required bridging and struts to maintain structural integrity of the design.

.6 Provide structural framing to suit all personnel door and overhead door units.

.7 Size anchor bolts to resist shear, bending and uplift loads induced by the building assembly and coordinate with the foundation contractor for installation.

.8 Accurately fit and rigidly frame together joints, corners and mitres.

.1 Match components carefully to produce continuity of line and design.

.2 Make joints and connections toward exterior weather tight.

.3 Provide hairline joints for materials in contact.

2.2 FABRICATION (Cont'd)

.8 (Cont'd)

.4 Co-ordinate location of visible joints.

2.3 FINISHES

.1 Clean, prepare and shop paint designated carbon steel surfaces in accordance with Section 05 12 00 - Structural Steel for Buildings.

.2 Galvanize designated carbon steel surfaces in accordance with Section 05 12 00 - Structural Steel for Buildings.

.3 Ensure integrity of the coating system for the interior and exterior prefinished metal cladding surfaces in accordance with the manufacturer's written specifications.

.4 Provide protection to all finished surfaces during fabrication, delivery, storage, erection and until acceptance of the completed Works by the Owner.

PART 3 - EXECUTION

3.1 ERECTION

.1 All construction activities including the erection, use, moving and dismantling of approved and certified staging must be by qualified and experienced personnel and shall conform to the Occupational Health and Safety Act and Construction Safety Regulations for the Province of Nova Scotia.

.2 Do prefabricated metal building work to CSSBI 30M.

.3 Erect building structure and enclosure elements.

.4 Grout under base plates using shrinkage compensating grout.

.5 For field welding, remove previous coating system by grinding and reinstate with field painting using procedures and coatings in accordance with Section 05 12 00 - Structural Steel for Buildings and to the satisfaction of the Owner's Representative.

.6 Do field touch-up to damaged surfaces and surfaces without shop coat in accordance with Section 05 12 00 - Structural Steel for Buildings and to the satisfaction of the Owner's Representative.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Part 1.9 - Submittals.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in Part 1.11 - Quality Assurance.

.2 Verification requirements shall include:
.1 Materials and resources.
.2 Storage and collection of recyclables.
.3 Construction waste management.
.4 Local/regional materials.
.5 Low-emitting materials.

3.3 CLEANING

.1 Remove excess sealant or paint touch-up by moderate use of low VOC mineral spirits or other solvent as directed by the manufacturer.

.2 Clean surfaces to the satisfaction of the Owner's Representative.

3.4 PROTECTION

.1 Provide protection to finished surfaces with strippable coatings, strippable wrappers, plywood or sheet materials as required before acceptance of Work.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 The work to be done under this Section consists of furnishing all materials, labour, scaffolding, tools and equipment and performing all operations necessary to complete all ventilation systems as shown on the Drawings and as herein specified.

.2 The ventilation system shall include, but not limited to all fans, duct work and heat recovery ventilators, all as specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 91 41 - Commissioning and Training

.2 Section 13 34 23 - Prefabricated Buildings

.3 Section 26 28 22 - Medium Voltage Disconnect Switches

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Submit shop drawings and descriptive material of the following.
- .1 Registers, Grilles, Diffusers, Louvres.
- .2 Exhaust Fans.
- .3 Duct Insulation.

PART 2 - PRODUCTS

2.1 GALVANIZED STEEL DUCTWORK

.1 Ductwork shall be fabricated from first quality ASTM A653, G90 smooth finish cold rolled galvanized steel and guaranteed to double seam without fracture.

.2 The minimum metal thickness to be used in the construction of new duct work shall be as shown in accordance with SMACNA duct construction standards.

.3 Where structural conditions require shape to be modified, ducts MUST have same cross- sectional area indicated.

.4 Ducts up to 600 mm wide shall have reinforced ribs formed by pocket slip spaced not more than 2500 mm

2.1 GALVANIZED STEEL DUCTWORK (Cont'd)

.4 (Cont'd) apart or as indicated in SMACNA, whichever is most stringent.

.5 Ducts shall be supported from building structure with 25 x 2 mm galvanized steel 'U' bands passing under ductwork. Maximum size duct supported by strap hanger: 500 mm wide.

.6 Hanger configuration: to SMACNA, Section 4, galvanized steel angle with galvanized steel rods.

.7 For rectangular ducts, longitudinal seams shall be lock seam. Transverse joints shall be flat drive and S cleats.

2.2 FITTINGS

.1 Fabrication: To SMACNA and ASHRAE.

.2 Radiused elbows: standard radius and/or short radius with single thickness turning vanes as indicated. Centreline radius: 1.5 times width of duct. Long sweep elbows where sufficient space permits in lieu of turning vanes and short elbows.

.3 Branches:
.1 Rectangular main and branch: with radius on branch 1.5 times width of duct; 45° entry on branch.
.2 Provide volume control damper, (i.e., balancing damper) in branch duct near connection to main duct.

.4 Transitions:
.1 Diverging: 20° maximum included angle.
.2 Converging: 30° maximum included angle.

.5 Offsets:
.1 Full radiused elbows as indicated.

2.3 DUCT SEAL CLASSIFICATION

.1 SMACNA seal classification; all ductwork:
.1 Class A: longitudinal seams, transverse joints, wall penetrations and connections made airtight with sealant, tape, or combination thereof.

2.4 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.

.2 Hanger configuration: to ASHRAE and SMACNA.

2.4 HANGERS AND SUPPORTS (Cont'd)

.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA.

.4 Upper hanger attachments:
.1 For steel joist: manufactured joist clamp or steel plate washer.
.2 For steel beams: manufactured beam clamps.

2.5 WATERTIGHT DUCT

.1 Provide watertight ductwork for fresh air intakes.

.2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer.

.3 All fresh air intake plenums to be complete with a sloped bottom to a drain connection.

2.6 DUCT SEALANTS

.1 Water soluble, flexible, non-toxic duct sealant with maximum flame spread rating 25, smoke development rating 50, to be used in conjunction with woven fabric tape.

.2 Solvent based sealant will not be accepted.

.3 Self-adhesive duct tape will not be acceptable.

.4 Install on all ductwork to achieve seal specified.

.5 Acceptable material: Trans Continental Multi-purpose Sealant; Foster 30-32; Duro-Dyne S-2; Dyn Air SHUB-1; Bakor.

2.7 TAPE

.1 Polyvinyl treated, open weave, fibreglass tape, minimum 50 mm wide.

2.8 FIRESTOPPING

.1 Retaining angles all around duct, on both sides of fire separation; break-away joints.

.2 Firestopping material and installation must not distort duct.

2.9 DUCT ACCESS DOORS

.1 Low leakage die formed .70 mm galvanized sheet steel with rounded corners, insulated sandwich construction. For aluminum or stainless steel ducting, use nails to match ducting.

.2 Zinc Camlock closure (2) hardware on each side of port. Closed cell neoprene gasket for positive seal. Safety retaining cable.

.3 Size 300 mm x 150 mm with pre-punched perimeter frame for exterior mounting on insulated duct.

.4 Acceptable manufacturer: ductmate.

2.10 FLEXIBLE DUCT CONNECTORS

.1 For fan connections: 75 mm wide 0.70 mm galvanized sheet metal frames, double lock seam clenched to 75 mm wide fire resistant, self extinguishing neoprene coated glass fabric, temperature rated at minus -40°C to plus 95°C.

.2 Acceptable material: Duro Dyne, Metal Fab, Dyn Air Neoprene NT.

2.11 DUCT INSULATION

.1 Rigid mineral fibre board with vapour barrier to CAN/CGSB-51.10-92 suitable for temperature from -20° to 150°F -28° to +65°C to be applied to cold rectangular ducting.

.2 A thickness of 25 mm insulation to be applied to the following:
.1 Outside air and supply air intake ducts.
.2 Exhaust air ducts from outside wall back 3.0 m from exterior wall.
.3 And as indicated on the drawings.

.3 Fastening method to be either self-adhesive aluminum tape, contact adhesive or quick setting asbestos free lap seal adhesive, in combination with 2 mm weld pins applied before the insulation on rectangular ducts, capped with 37 mm square nylon retaining clips.

.4 Canvas jacket material to be ULC listed plain weave, cotton fabric at 220 g/m^2 for all interior areas. Fastened with washable asbestos-free adhesive.

.5 Acceptable material: Knauf; Manson; Manville; Schuller; Owens Corning.

2.12 FANS AND VENTS

.1 Supply and install fans and vents complete in all respects as specified, shown on the Drawings, and as noted.

.2 Fans shall be statically and dynamically balanced.

.3 Back draft damper blades shall be 0.6 mm thick aluminum, set in nylon bushings, linked to operate all blades in unison, and shall provide tight shut-off when closed.

.4 Fan bearings shall be ball or roller type, grease lubricated, with a minimum service life of 200,000 hr.

.5 Refer also to drawings for fan performance and other details.

.6 Acceptable material: Greenheck, Cook, Penn.

2.13 DIFFUSERS AND GRILLES

.1 General:
.1 Provide standard product to meet capacity, throw, noise level, outlet velocity similar to the indicated Acceptable Materials. Size and capacity as shown on the Drawings.
.2 Provide full perimeter gaskets, concealed fasteners and damper operators.

.2 Frames:
.1 Extruded aluminum frames shall be mitred with completely closed mechanically fastened corners. Standard lacquered finish.

.3 See also schedules on drawings.

.4 Acceptable material: Nailor, E.H. Price, Titus.

2.14 STATIONARY LOUVRES

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof drainable blade with dual water troughs, reinforcing bosses and maximum blade length of 1520 mm (5') between supports.

.4 Frame, head, sill and jamb: 150 mm (6") deep one piece extruded aluminum, maximum 12 ga. thick with approved caulking slot, integral to unit and sill extension as indicated. Sill drain piped to outside. Unit to come with flanged front.

2.14 STATIONARY LOUVRES (Cont'd)

.5 Screen: 12 mm x 12 mm (1/2" x 1/2") openings, 2 mm (5/64") dia. wire aluminum birdscreen on inside face of louvres in formed U-frame (removable).

.6 Finish: pre-finished paint finish. Colour to be selected by Architect.

.7 Acceptable material: Alumavent Industries AL630-DF, EH Price, Aerolite, McGill, Ventex.

2.15 FIRE DAMPERS

.1 Fire dampers: listed and bear label of ULC, meet requirements of provincial fire authority and NFPA 90A.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation complete with m.s. mounting sleeve. Use 316 stainless steel on any systems with aluminum or stainless steel ducting.

.3 Static interlocking type; roll door type, guillotine type, sized to maintain full duct cross section where possible (Style "B").

.4 Fusible link actuated, lock in closed position when released, having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 37 x 37 x 1.6 mm retaining angle frame, on full perimeter of fire damper mounting sleeve, on both sides of fire separation being pierced and as shown.

.6 Acceptable material: Controlled Air; Hart Cooley; Kerr-Hunt; Nailor-Hart; Ruskin.

PART 3 - EXECUTION

3.1 WORKMANSHIP

.1 All material and equipment shall be installed by workers thoroughly experienced in the installation of such equipment, aligned carefully and connected properly to other associated equipment, pipework or ductwork.

.2 All material and equipment shall be carefully examined for defects and shall be cleaned of all dirt and debris before installation.

.3 All mechanical equipment shall be installed to elevations and locations as shown on the Drawings.

3.1 WORKMANSHIP (Cont'd)

.4 All mechanical equipment shall be mounted in strict accordance with the manufacturer's recommendations. Tolerances greater than that recommended by the manufacturer will not be permitted.

.5 The complete installation shall be vibration free under operating conditions.

3.2 DUCTWORK

.1 Determine exact duct locations in the building as the work proceeds and accurately locate duct sleeves or openings in walls and roof.

.2 All joints shall be air-tight with laps in direction of air flow and gauge markings on exterior of duct.

.3 Supports and hangers shall be furnished and installed for the proper and secure erection of ductwork and equipment. Use solid galvanized straps.

.4 Caulk internally between motorized damper frames and ductwork to make full perimeter airtight.

3.3 DUCT INSULATION

.1 Apply insulation only after required tests have been performed, and on only clean dry surfaces.

.2 Apply all materials in accordance with manufacturer's recommendations.

.3 Use weld pins on rectangular duct insulation at 203 mm centres and no less than 2 rows on sides and bottom.

.4 Vapour barrier and insulation on ductwork to be continuous over full length of duct.

.5 Apply canvas finish to all exposed duct insulation. Paint 2 coats of fire retardant primer over canvas prior to finish paint (by Contractor).

3.4 DUCT ACCESS DOORS

.1 Locate duct access doors to allow full inspection and cleaning of inside face of weather louvre birdscreen and to inspect automatic control damper blades.

3.5 FLEXIBLE CONNECTIONS

.1 Install in accordance with SMACNA and as indicated, with all joints lapped, screwed and sealed.

.2 Provide at all inlets and outlets of fans.

3.6 SHEET METAL INTAKE PLENUMS

.1 Fabricate to SMACNA standard to provide smooth airflow through all components.

.2 Apply sealer into all seams prior to assembly. Secure perimeter channels on 610 mm centres for full length and height of casing.

.3 Paint inside casing surfaces with corrosion resistance paint to CAN/CGSB-1.181-99 +Amdt-Mar-78 prior to installation of plenum insulation.

3.7 GRILLES REGISTERS AND DIFFUSERS

.1 Install in accordance with Manufacturer's instructions and complete with full perimeters gasket.

.2 Use cadmium plated or stainless steel fasteners throughout to prevent corrosion, and with countersunk holes where fastenings are visible.

3.8 COMMISSIONING

.1 Start up all equipment and demonstrate the workability of each system to the approval of the Engineer.

3.9 TESTING, ADJUSTING AND BALANCING

.1 Provide final testing, adjusting and balancing of all systems specified herein.

.2 Balancing Contractor shall be completely familiar with procedures outlined by the American Association of Balancing Contractors (AABC).

.3 Conduct balancing for all HVAC systems.

.4 Submit three copies of the final test report to the Engineer for review.

.5 Test report must contain the following information:
.1 Equipment manufacturer and model number.
.2 Motor types and sizes.
.3 Equipment electrical information.
.4 Design and recorded performance data for airflow rates, motor rpms, motor amps, and pressure drops.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 23, Division 27 and Division 33.

1.2 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
.2 CAN/CSA-22.3 No. 1, Overhead Systems.
.3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

1.3 CARE, OPERATION AND START-UP

.1 Instruct Owner's Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Operating instructions to include following:
.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
.3 Safety precautions.
.4 Procedures to be followed in event of equipment failure.
.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.5 SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 10 00.

.2 Include accurate as-built drawings.

.3 Manufacturer's installation instructions: submit instructions for installation and operation of products, components, and assemblies.

.4 Submit operation and maintenance manuals for electrical and electronic equipment. Including details of design elements, component function and maintenance requirements to effectively operate, maintain or repair.

.5 Include technical data, product data, component illustrations, technical descriptions and parts list, wiring and schematic diagrams not considered proprietary, test and verification reports.

.6 Single Line Electrical Diagrams
.1 Provide single line electrical diagram in glazed frames as follows:
.1 Electrical distribution system: locate in the Control Building.

.7 Submit test results of installed electrical systems and instrumentation.

.8 Submit, upon completion of Work, load balance report as described in Part 3 - Load Balance.

.9 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owner's Representative.

.10 Contractor's Field Reports: submit to Engineer within 7 days of review, verifying compliance of Work

1.5 SUBMITTALS (Cont'd)

.10 Contractor's Field Reports:(Cont'd)
and electrical system and instrumentation testing, as described in Part 3.

1.6 QUALITY ASSURANCE

.1 Site Meetings:
.1 Site Meetings: as part of Contractor's Field Services schedule site visits, to review Work, at stages listed.
.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
.2 Twice during progress of Work at 25% and 60% complete.
.3 Upon completion of Work, after cleaning is carried out.

1.7 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Owner's Representative will provide electronic copy of drawings and specifications required by Electrical Inspection Division and Supply Authority for printing by Contractor.

.4 Notify Owner's Representative of changes required by Electrical Inspection Division prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Owner's Representative.

1.8 CO-ORDINATION

.1 Co-ordinate work with work of other divisions to avoid conflict.

.2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.

.3 Locate all existing underground services and make all parties aware of their existence and location. Provide GPS coordinates of underground cable at 5 m intervals.

1.8 CO-ORDINATION (Cont'd)

.4 Do not install cables beneath crane pads at wind turbine sites.

.5 Where interference occurs, Owner's Representative must approve relocation of equipment and materials regardless of installation order.

.6 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Owner's Representative shall decide the extent of relocation required.

1.9 CUTTING AND PATCHING

.1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.10 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark all live parts

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.11 RECORD DRAWINGS

.1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.

.2 Submit record drawings within 30 days prior to start of commissioning.

1.12 INSPECTION OF WORK

.1 The Owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.13 SCHEDULING OF WORK

.1 Work shall be scheduled in phases as per other divisions of the construction specifications.

.2 Become familiar with the phasing requirements for the work and comply with these conditions.

.3 No additional monies will be paid for contractor's requirement to comply with work phasing conditions.

1.14 FIRE RATING OF PENETRATIONS

.1 Maintain fire ratings around conduits passing through fire rated walls.

.2 Use 3M brand or equal fire barrier products at each penetration.

.3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.

.4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project..

1.15 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Engineer with schedule within 2 weeks after award of Contract.

1.16 MANUFACTURER'S SERVICES

.1 Engage manufacturer's representative to review work, installation or application of products, protection required, and final product cleaning.
.1 Submit written reports to Engineer to verify compliance with project requirements.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

1.16 MANUFACTURER'S SERVICES (Cont'd)

.1 (Cont'd)
.3 Schedule manufacturer site visits to review work, at following stages as minimum:
.1 After delivery and storage of products, when preparation is complete, but prior to installation.
.2 Once during equipment installation.
.3 Upon completion of Work, after cleaning is complete.
.4 Obtain manufacturer's review reports within 3 days of review, and submit to Engineer.

1.17 SYSTEM START-UP

.1 Instruct Engineer and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 10 00.

.2 Equipment:
.1 CSA approved and ULC certified where applicable.
.2 Where CSA or ULC designation is not available, obtain approval from local authority having jurisdiction. Approvals are to be in written form and to be submitted to the Owner for review.

.3 Ensure labels are visible and legible after equipment is installed.

.4 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings, where applicable.

.2 Control wiring and conduit: in accordance with Section 26 05 21 - Wires and Cables (0-1000 V) and to be as indicated by design drawings.

2.3 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Owner's Representative.

.2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

.3 Supply and installation of ARC flash warning signs on all electrical equipment. Signage information will be submitted during construction.

2.4 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring 1000 V or below to be suitable for copper conductors only.

.2 Lugs, terminals, screws used for termination of wiring 1001 V and above to be suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:
.1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.
.2 Sizes as follows:

NAMEPLATE SIZES
Size 1 10 x 50 mm 1 line 3 mm high letters
Size 2 12 x 70 mm 1 line 5 mm high letters
Size 3 12 x 70 mm 2 lines 3 mm high letters
Size 4 20 x 90 mm 1 line 8 mm high letters
Size 5 20 x 90 mm 2 lines 5 mm high letters
Size 6 25 x 100 mm 1 line 12 mm high letters
Size 7 25 x 100 mm 2 lines 6 mm high letters

.2 Labels:
.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

2.5 EQUIPMENT IDENTIFICATION (Cont'd)

.3 Wording on nameplates and labels to be approved by Owner's Representative prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate and label.

.5 Identification to be in English.

.6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system name and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages and transformer number.

2.6 WIRING IDENFITICATON

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1, Canadian Electrical Code.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Conduit System	Prime Color	Auxiliary Color
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
up to 46 kV	Yellow	Black
Telephone	Green	
Other Communication		

2.7 CONDUIT AND CABLE IDENTIFICATION (Cont'd)

.3 Colours:(Cont'd)

Conduit System	Prime Color	Auxiliary Color
Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security System	Red	Yellow

2.8 FINISHES

.1 Metal enclosure surfaces shall be shop finished by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
.1 Outdoor electrical equipment and indoor switchgear and distribution enclosures shall be painted light gray to EEMAC 2Y-1.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

.3 Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions, MSDS, and product datasheets.

.4 Protect electrical equipment from dust and dirt. Plug or cap openings in conduit, fixtures and equipment during construction with Engineer approved materials.

.5 Conceal conduit in finished areas, unless otherwise authorized. Run exposed conduit parallel to building lines, and maintain maximum headroom.

.6 Install lighting fixtures, outlets, plates and other visible items parallel to building lines. Line up exposed raceways, parallel and at right angles to building walls, partitions, and ceilings.

.7 Set equipment and components plumb and level, accurate to position intended, and position hanger rods plumb.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

.2 ARC flash labels are to be visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200mm.

.3 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: 1400 mm.

.6 Fire alarm stations: 1400 mm.

3.5 MOUNTING HEIGHTS (Cont'd)

.3 (Cont'd)
.7 Exit lights: 2400 mm.
.8 Emergency lighting heads: 2400 mm.
.9 ARC flash labels: 1600 mm.

.4 Attach electricl equipment, components and devices directly to structure and structural supporting elements.

3.6 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 All electricalork to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of th division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.

.3 Furnish manufurer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.4 Perform tests Accordance with this section as noted and Section 01 91 13 - Commissioning (Cx) Requirements.

.5 Load Balance:
.1 Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

3.7 FIELD QUALITY CONTROL (Cont'd)

.6 Conduct the following tests:
.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Motors, heaters and associated control equipment including sequenced operations of systems where applicable.
.5 Systems: fire alarm system, communications.

.7 Insulation resistance testing.
.1 Megger and record circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger and record 350 - 600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Megger and record 5 kV and above circuits, feeders and equipment with a 5 kV instrument.
.4 Check resistance to ground before energizing and record value.

.8 Conduct Hipot testing for all 5 kV and above cables.

.9 All substation equipment to be field tested as indicated by the Equipment procurement specifications, the applicable sections of this specification and/or the commissioning forms.

.10 Carry out test in presence of Owner's Representative.

.11 Provide instnts, meters, equipment and personnel required to conduct tests during and conclusion of project.

.12 Submit test results for Owner's Representative's review and include in Commissioning Manuals specified in Section 01 91 13 - Commissioning (Cx) Requirements.

3.8 CLEANING

.1 Clean and touch-up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and paint exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for power cable and overhead conductors 1001 V and over.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (Cx) Requirements.

.3 Section 26 05 22 - Connectors and Terminations.

.4 Section 26 05 44 - Installation of Cables in Trenches and in Ducts.

.5 Section 27 05 10 - Fibre Optic Cable System.

.6 Section 33 71 20 - Electrical Pole Lines and Hardware.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CAN/CSA-C49.1-M87 (R1999), Round Wire, Concentric Lay, Overhead Electrical Conductors.
.2 CAN/CSA-C68.3 -97 (R2006) Shielded and Concentric Neutral Power Cables Rated 5-46 kV

.2 Insulated Cable Engineers Association (ICEA)
.1 ICEA S-93-639/NEMA WC74, 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.
.2 ANSI/ICEA S-94-649 (2004) Standard for Concentric Neutral Cables Rated 5 through 46 kV

1.4 SUBMITTALS

.1 Provided manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRIMARY OVERHEAD CONDUCTORS 34.5 KV

.1 Bare aluminum conductors AASC (Aluminum Alloy Stranded Conductor), size #336.4 kcmil "Tulip": to CAN/CSA-C49.1 for collector system and inside the substation.

.2 Bare aluminum conductors concentrically stranded about a steel core ACSR (Aluminum Conductor Steel Reinforced), size #336.4 kcmil "Linnet": to CAN/CSA-C49-1 for collector system on some locations as specified by design drawings.

2.2 CONCENTRIC NEUTRAL POWER CABLE 5-46 KV

.1 Single concentric stranded aluminum conductor, complete with helically applied copper neutral wires, size as indicated.
.1 Extruded semi-conducting strand shield.

.2 Insulation: cross-linked polyethylene to ANSI/ICEA S-94-649, rated 90°C/-40°C and 5-46 kV to CAN/CSA-C68.3, 100% insulation level.

.3 Extruded semi-conducting thermosetting insulation shielding layer.

.4 Copper neutral wires applied helically over insulation shield sized in accordance to CAN/CSA-C68.3.

.5 Separator tape over neutral wires.

.6 Extruded black PVC or LLDPE jacket rated minus 40°C.

.7 Standard of acceptance: General Cable, EmPowr

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install primary conductors on pole lines in accordance with Section 33 71 20 - Electrical Pole Lines and Hardware and as indicated by design drawings. All terminal details will be supplied on the "Issued for Construction" drawings.

.2 Install primary cables in ducts in accordance with Section 26 05 44 - Installation of Cables in Trenches and in Ducts and as indiated by design drawings.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

.2 Section 26 05 21 - Wires and Cables (0-1000V).

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
.2 CSA C22.2 No.65, Wire Connectors.

.3 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.4 National Electrical Manufacturers Association (NEMA)

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
.1 Connector body and stud clamp for stranded copper conductors.
.2 Clamp for copper bar.
.3 Stud clamp bolts.
.4 Bolts for copper bar.
.5 Sized for conductors and bars as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for wires and cables (0-1000V).

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

.2 Section 26 05 20 - Wire and Box Connectors (0-1000 V).

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
.2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 and RWU90 as indicated. Provide RWU90 rated cable for underground wiring. Related to new service entrance feeders and site lighting circuits. RWU90 not required under interior floor slabs.

.3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V, typically used for insulated ground wires.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

2.2 TECK CABLE (Cont'd)

.2 Conductors:
.1 Grounding conductor: copper.
.2 Circuit conductors: copper, size as indicated.

.3 Insulation:
.1 Type: ethylene propylene rubber.
.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking, aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:
.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
.2 Channel type supports for two or more cables at 1500 mm centers.
.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:
.1 Watertight and/or type approved for TECK cable.

2.3 POWER CABLE

.1 600 V type: Class B stranded bare copper conductors, sizes as indicated with, (XLPE) type RW90 insulation, temperature rating: 90°C, low flame spread, low acid gas, PVC FT-4 rated jacket, ground wire in accordance with Table 16 of CEC, Approval: CSA C22.2 No. 38 and C22.2 No. 230, standard of acceptance: Anixter 2TF.

2.4 CONTROL CABLES

.1 600 V type: stranded copper conductors, #14 AWG, (XLPE) type RW90 insulation, temperature rating: 90°C, low flame spread, low acid gas, PVC FT-4 rated jacket, Approval: CSA C22.2 No.38, CSA C22.2 No.230, standard of acceptance: Anixter 2TD.

.2 300V type: twisted shielded single pair cable, stranded copper conductors, #16 AWG, PVC TW75 insulation, low flame spread, low acid gas, PVC FT-4 rated jacket, Approval: CSA C22.2 No.239, standard of acceptance: Anixter 323-521.

.3 300V type: twisted shielded single multipair cable, stranded copper conductors, sizes as indicated, individual and overall shield, PVC TW75 insulation, low flame spread, low acid gas, PVC FT-4 rated

2.4 CONTROL CABLES (Cont'd)

.3 300V type:(Cont'd)
jacket, Approval: CSA C22.2 No.239, standard of acceptance: Anixter 323.

2.5 INSTRUMENT TRANSFORMERS CABLE

.1 600 V type: stranded bare copper conductors, sizes as indicated with, XLPE insulation type, unshielded, temperature rating: 90°C, black PVC FT-4 rated jacket, Approval: CSA C22.2 No. 239, standard of acceptance: Anixter 2AX.

PART 3 - EXECUTION

3.1 GENERAL

.1 Refer to design drawings for wiring type required under different applications.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Fastenings and Fittings.

.2 In cabletroughs in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.3 In underground ducts and trenches in accordance with Section 26 05 44 - Installation of Cables in Trenches and Ducts.

.4 In surface and lighting fixture raceways in accordance with Section 26 50 00- Lighting.

3.3 INSTALLATION OF TECK CABLE 0-1000V

.1 Install cables.
.1 Group cables wherever possible on channels.

.2 Install cable in trenches and in ducts in accordance with Section 26 05 44 - Installation of Cables in Trenches and Ducts.

.3 Lay cable in cabletroughs in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.4 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors (0-1000) V.

3.4 INSTALLATION OF POWER CABLES

.1 Install power cables in conduit, cable troughs or underground ducts as indicated by design drawings.

.2 Install cable in trenches and in ducts in accordance with Section 26 05 44 - Installation of Cables in Trenches and Ducts.

.3 Lay cable in cabletroughs in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.4 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors (0-1000) V.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit, cable troughs or underground ducts as indicated by design drawings.

.2 Install cable in trenches and in ducts in accordance with Section 26 05 44 - Installation of Cables in Trenches and Ducts.

.3 Lay cable in cabletroughs in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.4 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors (0-1000) V.

.5 Ground control cable shield as applicable.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (Cx) Requirements.

.3 Section 26 11 01 - Outdoor Substation.

.4 Section 27 05 10 - Fibre Optic Cable System.

.4 Section 33 71 20 - Electrical Pole Lines and Hardware.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.65-03, Wire Connectors.

.2 CSA C22.2 No.41- M1987 (R2004), Grounding and Bonding Equipment.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 10 00.

1.5 CERTIFICATES

.1 Obtain inspection certificate of compliance covering high voltage stress coning from manufacturer's approved agent and include it with as-built drawings.

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

.1 Aluminum power lug type compression connectors to CSA C22.2 No.65 as required sized for conductors. Standard of Acceptance: Burndy Wejtap.

.2 Aluminum dead-end clamp type compression connectors to CSA C22.2 No.65 as required sized for conductors. Standard of Acceptance: Burndy CUW-R-E.

2.1 CONNECTORS AND TERMINATIONS (Cont'd)

.3 Tin pated copper long barrel 2-hole compression grounding connectors to CSA C22.2 No.41 as required sized for conductors.

.4 Tool-free cold-applied medium voltage termination kit for single conductor cable. Rated for outdoor installation. Suitable for shielded and non-shielded cable applications. To IEEE-48 (1996), Class 1 termination requirements as required sized for conductors. Standard of Acceptance: Tyco TFT-R.

.5 Contact aid for aluminum cables where applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install termination kits and connectors in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No.41.

.3 Install all cables in a continuous run, splices shall not be acceptable.

.4 Clean and score Aluminum Conductors prior to terminating.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for primary grounding.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - Commissioning.

.3 Section 26 05 22 - Connectors and Terminations

.4 Section 26 11 01 - Outdoor Substation

.5 Section 33 71 20 - Electrical Pole Lines and Hardware

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE).
.1 ANSI/IEEE Std. 837, Qualifying Permanent Connections Used in Substation Grounding.

.3 Canadian Standards Association (CSA)
.1 CSA C22.2 No.0.4-04, Bonding and Grounding of Electrical Equipment (Protective Grounding).
.2 CSA C22.2 No.41, Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Rod electrodes: copper clad steel, 19 mm dia by 3 m long.

.2 Conductors: bare, stranded, untinned soft annealed copper wire, size 250 MCM, No 4/0 AWG and 2/0 AWG for ground bus, electrode interconnections, metal structures, ground mats, transformers, switchgear, ground connections, wind turbines.

.3 Conductors: pvc insulated coloured green, stranded untinned soft annealed copper wire, size No. 4 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.

2.1 MATERIALS (Cont'd)

.4 Conductors: pvc insulated coloured green, stranded untinned soft annealed copper wire No. 10 AWG for grounding meter and relay cases.

.5 Conductors: No. 4/0 AWG and larger extra flexible copper conductor for connection of switch mechanism operating rod to ground mat, fence gates.

.6 Bolted removable test links.

.7 Ground mat: copper, size 1200 x 1800 mm, 50 x 50 mm mesh and 2 mm thick.

.8 Accessories: non-corroding, necessary for complete grounding system, type, size material as indicated, including:
.1 Protective type clamps,
.2 Bolted type conductor connectors,
.3 Bonding jumpers, straps,
.4 Pressure wire connectors.

.9 Wire connectors and terminations: to Section 26 05 22 - Connectors and Terminations and as indicated on construction drawings.

.10 Conductor: size as indicated on drawings, PVC insulators coloured green, stranded untinned soft annealed copper between wind turbine and terminal pole.

PART 3 - EXECUTION

3.1 GROUNDING INSTALLATION

.1 Install continuous grounding system including, electrodes, conductors, connectors and accessories in accordance with CSA C22.2 No.0.4 and requirements of local authority having jurisdiction.

.2 Ground fences to grounding grid independent of station ground.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to electrodes, structural steel work, using permanent mechanical connectors to ANSI/IEEE 837.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

3.1 GROUNDING INSTALLATION (Cont'd)

.7 Use No. 4/0 AWG bare copper cable for main ground bus of substation, No. 2/0 AWG bare copper cable for taps on risers from main ground bus to equipment and 250 MCM bare copper for wind turbine grounds.

.8 Use tinned copper conductors for aluminum structures and for installation on reinforcing steel in foundations.

3.2 ELECTRODE INSTALLATION

.1 Install ground rod electrodes. Make grounding connections to station equipment.

.2 Install ground rod electrodes at transformer and switchgear locations.

.3 Install grounding mats. Connect mats to station ground electrode and switch mechanism operating rods.

.4 Make special provision as shown on construction drawings for installing electrodes that will give acceptable resistance to ground value, where rock or sand terrain prevails. Install drilled ground wells at each wind turbine location.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections as indicated to typical station equipment including: line sky wire, neutral, grounding mats. Non current carrying parts of: transformers, circuit breakers, reclosers, current transformers, statcom, substation structure, frames of gang-operated switches and fuse cutout bases, cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers, meter and relay cases. Any exposed building metal, within or forming part of station enclosure. Sub-station fences, pothead bodies. Outdoor lighting.

.2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

.3 Connect metallic piping (water, oil, air, etc.) inside station to main ground bus at several locations, including each service location within station. Make connections to metallic water pipes outside station if available to assist in reduction of station ground resistance value.

3.4 POLE MOUNTED SWITCHING DEVICE GROUNDING

.1 Drive four ground rods 3 m long at base of each pole on which group-operated line switching devices are mounted.

.2 Arrange rods in square formation with 3 m sides, located so that operator must stand within square to operate switch.

.3 Interconnect ground rods with No. 4/0 AWG stranded annealed copper conductor and join to switch operating handle ground wires.

.4 Connect operating handle of switch to handle base with No. 4/0 AWG extra flexible copper conductor.

.5 Refer to Drawings for additional requirements.

3.5 CABLE SHEALTH GROUNDING

.1 Bond single conductor, metallic sheathed cables together at one end only. Break sheath continuity by inserting insulating sleeves in cables.

.2 Use No. 6 AWG flexible copper wire soldered, not clamped, to cable sheath.

.3 Connect bonded cables to ground with No. 2/0 AWG copper conductor.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction.

.3 Perform test before energizing electrical system.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for secondary grounding system.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (CX) Requirements.

.3 Section 26 05 00 - Common Work Results - Electrical.

.4 Section 26 05 27 - Grounding - Primary

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
.1 ANSI/IEEE Std. 837, Qualifying Permanent Connections Used in Substation Grounding.

.3 Canadian Standards Association, (CSA)
.1 CSA C22.2 No.0.4-04, Bonding and Grounding of Electrical Equipment (Protective Grounding).
.2 CSA C22.2 No.41, Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as indicated to grounding electrodes.

.2 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.3 Grounding conductors: bare stranded copper where in contact with earth, soft annealed, size as indicated.

.4 Insulated grounding conductors: green, type RW90. Install grounding condictor in all conduits. Minimum size #14 AWG or as indicated in Table No. 16 of C.E.C., whichever is larger. Using of ACM type conductors is not permitted.

2.1 EQUIPMENT (Cont'd)

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors, as indicated.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

2.2 ACCEPTABLE MANUFACTURERS

.1 FCI - Burndy Corporation, Erico Inc., Thomas & Betts.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories as indicated to confirm to requirements of Engineer, and local authority having jurisdiction over installation.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to electrodes, using copper welding by thermit process or inspectable copper crimp type compression connection as indicated by design drawings.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

3.1 INSTALLATION GENERAL (Cont'd)

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.

.13 Ground secondary service pedestals.

.14 Install a green insulated copper ground wire in all conduit runs.

3.2 ELECTRODES

.1 Install rod, electrodes and make grounding connections as indicated.

.2 Bond separate, multiple electrodes together.

.3 Use copper conductors, size as indicated for connections to electrodes.

.4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 208 V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, distribution panels, outdoor lighting.

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical/control room.

.2 Ground items of electrical equipment in control building to ground bus with individual bare stranded

3.5 GROUNDING BUS (Cont'd)

.2 (Cont'd)
copper connections size as required by code and/or as indicated.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Intercommunication systems as indicated.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END

PART 1 - GENERAL

1.1 Section

.1 Materials and installation for hangers and support for electrical systems.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical

.3 Section 26 11 01 - Outdoor Substation

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings unless otherwise indicated.

.2 Standard rolled structural steel shapes and plates or prefabricated structural systems.

.3 Unless otherwise indicated use hot dipped galvanized steel after fabrication.

.4 Use stainless steel outside.

2.2 CABLE TIES

.1 Nylon flame retardant, low smoke cable tie, size as required.

.2 Nylon flame retardant, low smoke cable tie mounting bracket. Mechanical fastening type only; adhesive mounts not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with stainless steel toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
.2 Two-hole steel straps for conduits and cables larger than 50 mm.
.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.
.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing, wood blocking, plastic strap or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

3.1 INSTALLATION (Cont'd)

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.13 Provide beam clamps to secure conduits and cable tray to exposed steel work.

.14 Where galvanized steel supports are exposed to moisture, touch-up all field cut surfaces with galvanizing paint.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 10 00.

.2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Nova Scotia, Canada.

PART 2 - PRODUCTS

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Indoor: Welded steel construction with screw-on flat covers for surface mounting.

.2 Outdoor: NEMA 4X, PVC construction with hinged covers with means of installing padlock.

2.3 INDOOR CABINETS

.1 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm fir plywood backboard for surface flush mounting.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.5 Install galvanized steel support bracket/structures for installation of exterior enclosures.

3.3 IDENFITICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name voltage and phase.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for outlet boxes, conduit boxes and fittings.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 05 29 - Hangers and Supports for Electrical Systems.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Fittings.

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CSA C22.1, Canadian Electrical Code, Part 1.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

2.2 GALVANIZED STEEL OUTLET BOXES (Cont'd)

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 CONDUIT BOXES

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

.7 Label all devices with circuit number and panel number.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for conduits, conduit fastening and conduit fittings.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical

.3 Section 26 11 01 - Outdoor Substation

.4 Section 27 05 10 - Fibre Optic Cable Systems

.4 Section 33 71 20 - Electrical Pole Lines and Hardware

1.3 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware, a National Standard of Canada.

.2 CSA C22.2 No. 45, Rigid Metal Conduit.

.3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 83, Electrical Metallic Tubing.

.5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.4 SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and datasheets.
.1 Submit cable manufacturing data.
.2 Quality assurance submittals:
.1 Test reports: submit certified test reports.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.3 Instructions: submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.4 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90°, 45° or 22.5° bends are required for 25 mm and larger conduits.

.3 Ensure conduit bends other than factory

.4 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any part of the installed system components or the CSA/UL certification of these components.

.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.3 Surface mount conduits.

.4 Use rigid hot dipped galvanized steel threaded conduit for exposed work outside.

.5 Use electrical metallic tubing (EMT) within control building.

.6 Use rigid pvc conduit underground and buried in or under concrete slab on grade.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.

.8 Use explosion proof flexible connection for connection to explosion proof motors and devices.

.9 Install conduit sealing fittings in hazardous areas. Fill with compound.

.10 Minimum conduit size for lighting and power circuits: 19 mm. 12 mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.

.11 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.12 Mechanically bend steel conduit over 19 mm dia.

3.2 INSTALLATION (Cont'd)

.13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.14 Install fish cord in empty conduits.

.15 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab. Use rigid PVC conduit.

.2 Protect conduits from damage where they stub out of concrete. Use rigid steel conduit for stub-up and adapt to in floor rigid PVC conduit.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.6 CLEANING

.1 On Completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CAN/CSA C22.1 No. 126.1 - Metal Cable Tray Systems.

.3 National Electrical Manufacturers Association (NEMA).
.1 NEMA VE 1, Metal Cable Tray Systems.

1.3 SUBMITTALS

.1 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.2 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.3 Identify types of cable tray used.

.4 Show actual cable tray installation details and suspension system.

PART 2 - PRODUCTS

2.1 CABLE TRAY

.1 Cable tray and fittings: to NEMA VE 1 as referenced in Item 1.2.2 above.

.2 Ladder type, Class D1 as indicated in CAN/CSA C22.2 No.126.

.3 Trays: extruded aluminum, width and depth as indicated.

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion

2.1 CABLE TRAY (Cont'd)

.4 Fittings:(Cont'd)
joints and reducers where required, manufactured accessories for cable tray supplied.
.1 Radii on fittings: 900 mm minimum.

.5 Solid covers for complete cable tray system including fittings.

.6 Barriers where different voltage systems are in same cable tray.

2.2 SUPPORTS

.1 Provide supports as indicated by design drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install cable trays as a complete system using fittings or other means to provide adequate cable support and bending radius before the conductors are installed.

.2 Use the design drawings for reference.

.3 Keep the minimum clearances for cable trays as specified in CEC.

.4 Support cable tray on both sides.

.5 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.6 Provide grounding and bonding using 2/0 AWG green insulated copper wire clamped at 2 m intervals.

3.2 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray. Use rollers when necessary to pull cables.

.3 Secure cables in cable tray at 6 m centres, with nylon ties.

.4 Identify cables every 30 m with size 2 nameplates in accordance with Section 26 05 00 - Common Work Results - Electrical.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation of cables in trenches and in ducts.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 31 20 00 - Earthwork.

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

PART 2 - PRODUCTS

2.1 CABLE PROTECTION

.1 38 x 140 mm planks pressure treated with copper napthenate or 5% pentachlorophenol solution, water repellent preservative

2.2 MARKERS

.1 Red plastic marker tape.

2.3 MATERIALS

.1 Selected backfill material: approved material from site excavation or borrow pits. Such material shall be free from stumps, trees, roots, sod, muck or other deleterious material, and shall not contain rock, boulders or masonry larger than 150 mm. The material shall be free from frost, and shall not be placed on frozen ground or in water. It must have a moisture content that will allow compaction to the specified densities.

2.3 MATERIALS (Cont'd)

.2 Structural fill: as approved by Engineer for use intended, well graded, sound, durable, granular material, free from clay, frozen lumps, organic, or deleterious matter, graded as follows:

(Cont'd)

Sieve Size	Cum. % Passing
4.75 mm	100
0.150 mm	0-5

PART 3 - EXECUTION

3.1 DIRECT BURIAL OF CONDUITS

.1 Excavate trenches for conduits and related excavations of sufficient width and depth at all points.

.2 After sand bed is in place, lay conduit maintaining 75 mm clearance from each side of trench to nearest cable.

.3 Place surround material. Backfill trench using materials indicated on the drawings. Place backfill in 300 mm layers and thoroughly compact each layer before placing next layer.

.4 Provide offsets for thermal action and minor earth movements. Offset conduits 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.5 Underground cable splices not acceptable.

.6 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.7 Cable separation:
.1 Maintain 75 mm minimum separation between cables of different circuits.
.2 Maintain 300 mm horizontal separation between low and high voltage cables.
.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
.5 Install treated planks on lower cables 0.6 m in each direction at crossings.

3.1 DIRECT BURIAL OF CONDUITS (Cont'd)

.8 Installation of conduits under the crane pad at the wind turbine sites will not be accepted.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.
.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Bury red plastic marker tape 300 mm below finished grade and above the cables.

3.4 REINSTATEMENT

.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects as directed by Owner's Representative.

.2 Reinstate disturbed areas to condition, elevation and thickness equal to or better than that, which existed before excavation.

.3 Clean and reinstate areas affected by work as directed by Owner's Representative.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

3.5 FIELD QUALITY CONTROL (Cont'd)

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests.
.1 After installing cable but before splicing and terminating, perform insulation resistance test with each phase conductor. Test shall be performed at 500V for cables with 300V insulation, at 1000V for cables with 600V insulation and 5kV for 34.5kV cables.
.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests
.1 Ensure that terminations and accessory equipment are disconnected.
.2 Ground shields, ground wires, metallic armour and conductors not under test.
.3 High Potential (Hipot) Testing.
.1 Conduct hipot testing at 100 % of original factory test voltage in accordance with manufacturer's recommendations.
.4 Leakage Current Testing.
.1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
.2 Hold maximum voltage for specified time period by manufacturer.
.3 Record leakage current at each step.

.7 Provide Owner's Representative with list of test results showing location at which each test was made, circuit tested and result of each test. Include results in Commissioning Manual.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Purchase, deliver to the Place of the Installation and install three (3) Protection and Control, one (1) Communication and one (1) Spare (for NSPI) Panels suitable for indoor mounting, complete with protection relays, lock-out relays, switches, accessories and special tools as defined herein.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 01 91 13 - General Commissioning (Cx) Requirements

.4 Section 01 91 33 - Commissioning (Cx) Forms

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 CSA Standards
.1 CSA C22.1, Canadian Electrical Code Part

.3 ANSI/IEEE Standards
.1 ANSI C37.90, IEEE Standard for Relays and Relay Systems of Associated with Electric Power Apparatus

.4 NEMA Standards
.1 NEMA ICS-6, Industrial Controls and Systems Enclosures.

.5 ISO Standards
.1 9000: 2000, Quality Management

.6 Unless otherwise noted, CSA Standards shall be given precedence when and where conflicts arise.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 10 00.

.2 Manufacturers' Drawings
.1 Protection, Control and Communication Panels assembly drawings submitted for review showing assembly, details, and layout shall show anchor bolts, openings for cables, and all pertinent support structure loading details.

1.4 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.2 (Cont'd)

.2 The manufacturer shall furnish a set of drawings complete with a bill of material and showing: typical front views and open side views as well as typical components, their positions, and available space for cable termination; and an anchor bolt plan with dimensions.

.3 Vendor's drawings submitted for review shall show all terminals, wire and terminal numbering and incorporate equipment schematic details.

.4 All drawings need to be submitted in ACAD format to the Engineer.

.3 Operation and Maintenance Manuals

.1 The manufacturer shall furnish a comprehensive instruction manual covering installation of the panels and operation of the various components.

.2 Instruction manuals shall describe in detail the construction and recommend procedures for assembling, dismantling, maintaining and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturers, of component parts of the equipment, properly catalogued for easy reference.

PART 2 - PRODUCTS

2.1 PANELS

.1 General

.1 The Protection and Control Panels shall be supplied as specified in this specification. Each panel shall have its own design based upon a set of drawings provided. The Type and Model Number for the main protection relays and the auxiliary relays are included within this specification.

.2 The Communications Panel shall be supplied as specified in this specification. The Type and Model Number for the routers, switches, etc. are included with this specification.

.3 Panel Layout, Wiring Diagram and a complete panel Material List for each panel shall be supplied by the Vendor. The Panel Layout, Wiring Diagrams and Material Lists shall be submitted to the Engineer for review prior to material ordering and manufacturing of the panels.

.2 Construction

.1 The panel structures shall be built in accordance with Drawings E401, E402 and E621. Panels shall be furnished complete with all instrumentation

2.1 PANELS (Cont'd)

.2 (Cont'd)

.1 (Cont'd)

and wiring devices as shown on the drawings and indicated in this specification.

.1 Flanged openings shall be provided at the base of each panel structure for interconnection. The left opening of panel #1 and the right opening of panel #5 shall be sealed.

.2 The typical panel dimensions shall be 700 mm wide, 915 mm deep and 2300 mm high, open rack type suitable for front mounted equipment.

.3 Paint shall be polyester (powder electrostatic) with 2-3 mils to support salt spray chamber for 1000 hrs per ASTM B-117-97. Color outside and inside color shall be the same ANSI 61 or ANSI 70.

.4 All panel exterior mounted relays, meters and devices shall be semi-flush mounted, and all panel interior mounted relays, meters and devices shall be surface mounted, front connected. Details of cutouts for relays, switches, meters, etc., shall be the responsibility of the Vendor.

.5 Instruments shall consist of protective relays, lock-out relays, auxiliary relays, control switches, push buttons, terminal blocks, fuses, fuse blocks, and indication lights. All instrumentation shall be provided and installed by the Vendor, unless otherwise specified and prewired to interface terminal blocks.

.6 All panels shall be provided with a slotted copper ground bus that shall run the full length of the panel at the bottom. All noncurrent carrying metal parts of these panels and equipment shall be grounded. All switches, meters and relays shall be grounded to the panel by use of internal lock washers on the head and nut. All bolts and nuts shall be plated. All microprocessor relays shall be grounded to the ground bus with a braided copper ground jumper.

.7 All protective relays shall be manufactured by SEL, types and models as defined per design drawings, respectively SEL-487E for transformer protection, and SEL-351S for 34.5xV breaker protection and control.

.8 A programmable automation controller SEL-2411 shall be used for substation control.

.9 A communications processor SEL-2032 shall be installed in accordance with the design drawings.

.10 All lock-out relays shall be Electroswitch Series 24 as defined per the design drawings.

.11 All control switches shall be Electroswitch series 24.

2.1 PANELS (Cont'd)

.2 (Cont'd)

.1 (Cont'd)

.12 All Test Blocks shall be ABB type FT-1. Test blocks shall be provided for all CT and PT input signals to all provided signals.

.13 All panel equipment inputs/outputs (I/O) shall be pre-wired inside the panels to dedicated to the eqiuipment interface terminal strips with 25% spare terminal blocks. Space for 25% future terminal blocks shall be available on the rails.

.14 Ten (10) spare interposing relays with 120 VAC coils, two (2) Form "C" contacts on each relay shall be wired to terminal blocks.

.15 The communication equipment inside the communication panel shall consist of switches, routers, telephone interface equipment, patch panels, patch cords, terminal blocks and any necessary cabling with manufacturer and model numbers as defined per the drawings. All communication equipment shall be provided and installed by the Vendor, unless otherwise specified on the drawings. The Owner will confirm all model numbers at the time of the award.

.3 Wiring

.1 All wiring shall inside the panels shall consist of 600 volt stranded copper wire, moisture resistant or thermosetting and shall be as follows:

.1 AWG 12 for currents

.2 AWG 12 for potentials

.3 AWG 14 for control and digital I/O

.2 Use 19 strand conductors for #14 AWG and larger wire.

.3 Terminate all wires on devices with compression type connectors. Do not use spade lugs or soldered terminals. Do not connect more than three wires to any one stud or terminal. All CT terminals shall be double screw type or ring type.

.4 Use type written, heat shrink sleeve wire markers through out.

.4 Provide complete AutoCAD drawings of the asembly with shop drawings for review.

2.2 EQUIPMENT IDENTIFICATION

.1 General

.1 Every Protection, Control and Communication Panels shall be provided with securely fastened external rating nameplate and identifying nameplate.

.2 Each and every device in the Protection, Control and Communication Panels shall be provided

2.2 EQUIPMENT IDENTIFICATION (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

with a clearly visible rating plate, inscribed with the required standard information.

.3 Each and every device in the Protection, Control and Communication Panels shall be provided with a clearly visible identifying nameplate of weatherproof material, inscribed with the Owner-assigned device number.

.2 Ratings Nameplates

.1 The Protection, Control and Communication Panels rating nameplate shall indicate the following information:

- .1 Manufacturer's Name
- .2 Type
- .3 Manufacturer's Serial Number
- .4 Voltage and Current Ratings (as applicable)
- .5 Frequency Rating (Hz)
- .6 Total Weight
- .7 Date of Manufacture (Month and Year)
- .8 CSA or cUL classification markings

.3 Identifying Nameplate

.1 The Protection, Control and Communication Panels shall be provided with one (1) nameplate, engraved on 3mm thick plastic lamicoid, with the function of the panel and Owner's numerical designation.

.2 The identifying nameplate shall be secured to the panel using permanent adhesive or permanent mechanical connection, suitable for permanent indoor usage in the given atmospheric conditions.

.3 The panel identifying nameplates shall be white lettering on a black background. Letters shall be 38mm high, width as required.

.4 The device identifying nameplates shall be white lettering on a black background. Letters shall be 10mm high, width as required.

.5 Panel and device designation shall be provided by the Engineer after awarding of contract, prior to delivery.

2.3 MATERIALS

.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

2.4 WARRANTY

.1 All equipment, including accessories and tools, shall have a minimum two (2) year warranty against manufacturer's defects effective from the earlier date of the following:
.1 Substantial completion of the work.
.2 Six (6) months following delivery to the Place of the Installation.

.2 The Owner, through the Engineer, shall promptly give the Vendor notice in writing of observed defects and deficiencies that occur during the warranty period.

.3 The Vendor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

.4 The Vendor shall administer the waranty claims when indicated by Owner.

.5 The Vendor shall name the Owner as beneficiary of the Warranty. Warranty with transfer to the new Owner if the facility is sold.

2.5 FACTORY (FUNCTIONAL) TESTS

.1 On a per-panel basis, functional testing shall be performed from the interface terminal blocks per the following:
.1 Current and voltage injection to verify proper operation of relays, meters, etc.
.2 Verification of performance against ac and dc schematics, including controls switches, lock-out relays, and pulsing of all relays, inputs, outputs, test switches, indicating lights, etc.
.3 Acceptance Test Reports shall be submitted to the customer prior to panel arriving at the Place of the Installation and also included in instruction manuals

.2 The Vendor shall provide evidence that the manufacturing quality assurance program in accordance with ISO 9001 is estanlished and maintained.

PART 3 - EXECUTION

3.1 PANEL INSTALLATION

.1 Install panels as indicated by design drawings.

.2 Install panels and mount plumb, true and square to the building lines.

3.2 TESTING AND COMMISSIONING

.1 Overview

.1 General

.1 In general, provide electrical services in the testing and commissioning of the Protection, Control and Communication Panels in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Section 01 91 33 - Commissioning (Cx) Forms.

.2 The scheduling of all work shall be co-ordinated with Owner and Purchaser to ensure that no delays are caused by interference between persons operating on site under different contracts. The Contractor shall allow a minimum of five (5) Working Days for the Testing and Commissioning, weather-permitting.

.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.

.4 Should any test results be deemed unacceptable, whether due to test conditions, Contractor error, or required correction of an equipment deficiency, the Contractor shall be responsible for repeating the applicable test or tests.

.5 The Contractor and the Engineer shall review all tests prior to the testing personnel leaving the site.

.2 Compliance with Standards and Codes

.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

.2 The Contractor shall adhere to the following standards during the process of testing and commissioning:

.1 Nova Scotia Provincial Standards

.2 Nova Scotia Occupational Health and Safety Act

.3 Nova Scotia Workers' Compensation Act.

.4 CSA Standards

.1 C22.1-06 Canadian Electrical Code Part I

3.2 TESTING AND COMMISSIONING (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

.2 (Cont'd)

.2 C22.3 Canadian Electrical Code Part III

.3 Z462-08 Workplace Electrical Safety

.5 ANSI/IEEE Standards

.1 ANSI C37.90 IEEE Standard for Relays and Relay Systems of Associated with Electric Power Apparatus

.2 Std. No. 472 Guide for Surge Withstand Capability (SWC) Tests

.3 Equipment

.1 The Contractor shall be responsible for the supply of all required test equipment.

.2 Test Procedures

.1 General

.1 The Contractor shall test the Protection, Control and Communication Panels to the satisfaction of the Engineer as defined herein; the Contractor shall indicate and include any additional Vendor-recommended tests. additional

.2 The Contractor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.

.3 The Contractor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.

.4 All test results shall be provided to the Engineer in written form within 24 hours of completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.

.5 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

.6 All test reports shall include the following information:

.1 Name of testing firm.

.2 Date of test.

.3 Ambient temperature at time of test.

.4 Relative humidity at time of test.

.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).

.6 Confirmation that test results are acceptable.

.7 Initialled by Contractor.

3.2 TESTING AND COMMISSIONING (Cont'd)

.3 Documentation

.1 Official Test Results

.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Contractor shall provide six (6) copies of final, official test reports, type-written with the Contractor's signature of approval, to the Engineer following the completion of Testing.

.2 The Contractor shall include the results of all on-site testing described herein.

.3 The Contractor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.

.4 The Contractor shall accompany the official test report with written approval that the field test results have been reviewed and the Protection, Control and Communication Panels and all accessories have been found acceptable for energization and operation.

PART 1 - GENERAL

1.1 THIS SECTION INCLUDES

.1 Equipment and materials supply, installation, testing and commissioning of one (1) 33 MVA outdoor type substation including:
- .1 Concrete Forming and Accessories
- .2 Concrete Reinforcing
- .3 Cast-in-Place Concrete
- .4 Fences
- .5 Substation Structure Installation
- .6 Equipment Installation
- .7 Power and Control Wiring
- .8 Grounding
- .9 Testing and Commissioning

1.2 RELATED SECTION

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (CX) Requirements.

.3 Section 03 10 00 - Concrete Forming and Accessories

.4 Section 03 20 00 - Concrete Reinforcing

.5 Section 03 30 00 - Cast-in-Place Concrete.

.6 Section 05 50 00 - Metal Fabrications.

.7 Section 32 31 13 - Chain Link Fences and Gates

.8 Section 26 05 27 - Grounding - Primary

.9 Section 26 05 22 - Connectors and Terminations

.10 Section 27 05 10 - Fibre Optic Cable System

.11 Section 33 71 20 - Electrical Pole Lines and Hardware

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
- .1 ANSI/IEEE C57.12.90 Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating
- .2 ANSIC29.9, Wet-Process Porcelain Insulators (Apparatus, Post Type).

1.3 REFERENCES (Cont'd)

.3 Canadian Standards Association (CSA International)
.1 CAN/CSA-G40.21, Structural Quality Steels.
.2 CAN/CSA-S16.1, Limit States Design of Steel Structures.

1.4 SUPPLY SYSTEM DATA

.1 Supply system data: 69 kV, 600 A, 60Hz, three (3) phase, three (3) wire, 3500 MVA, symmetrical fault capacity, 350 kV BIL.

.2 Verify coordination of substation protection with supply authority's protection. Data shall be provided by the Owner's Representative.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Obtain certification from inspecting authority, for integrated items indicated on plot plan.

.3 Indicate:
.1 Floor anchoring method and dimensioned foundation drawings.
.2 Foundation loadings under loaded conditions.
.3 Dimensioned position and size of bus bars and connections showing electrical clearances.
.4 Identified dimensioned layout of components.
.5 Protection co-ordination time current characteristics.

.4 Submit structure design criteria for Engineer's review.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for substation for incorporation into manual specified in Section 01 10 00.

.2 Submit three (3) paper copies and one (1) electronic copy in PDF format of maintenance data for complete substation including components in combined manual.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 10 00.

.2 Three power fuse refills, non-expulsion type, of each type installed.

1.7 EXTRA MATERIALS (Cont'd)

.3 Three fuses of every type.

1.8 DELIVERY AND STORAGE

.1 Ship foundation anchoring devices in advance of substation structure.

.2 For substation equipment delivery details refer to the related sections or the equipment procurement specification.

1.9 PROTECTION COORDINATION

.1 Co-ordinate time-current characteristics of protective fuses and relays as per provided by the Owner's Representative protection settings.

PART 2 - PRODUCTS

2.1 PRE-PURCHASED EQUIPMENT

.1 General:
.1 All items scope of Part 2.1 are pre-purchased equipment supplied and delivered by the Owner and installed by the Contractor.

.2 Circuit Breakers:
.1 One (1) 69kV, 600A outdoor circuit breaker assembly complete with accessories and special tools as defined in Equipment Specifications #090630-SP-E01 in Appendix A5.
.2 Site testing of the circuit breaker following installation and prior to energization shall be provided by the manufacturer. Contractor will be responsible to coordinate and schedule all activities and failure to do so will incur lost time costs. Include test data sheets in Commissioning Report.

.3 Substation Transformer
.1 One 20/27/33 MVA, 69 kV/34.5 kV substation transformer assembly complete with accessories. For details refer to the applicable manufacturer's documentation. Refer to Section 26 12 15.

.4 Pad Mounted Transformers
.1 Twenty (20) three (3) phase, 34.5kV/690V, 1750kVA pad mounted transformer assemblies complete with accessories as defined in equipment procurement specifications #090630-SP-E07, refer to Appendix A5.

2.1 PRE-PURCHASED EQUIPMENT (Cont'd)

.5 Reactive Power Compensation System (STATCOM)

.1 One (1) Reactive Power Static Compensator (STATCOM) System assembly complete with inverters, connection transformer(s), capacitors bank(s), switching equipment, protection and control devices, accessories, as defined in Equipment Specifications #090630-SP-E06 in Appendix A5 for Reactive Power Static Compensator (STATCOM) System.

.2 Site testing of the Reactive Power Static Compensator (STATCOM) System assembly following installation and prior to energization shall be provided by the manufacturer. Contractor will be responsible to coordinate and schedule all activities and failure to do so will incur lost time costs. Include test data sheets in Commissioning Report.

2.2 CONTRACTOR-SUPPLIED PRODUCTS

.1 General

.1 All items listed in Part 2.2 products shall be supplied and installed by the Contractor in accordance with the applicable construction specifications and per design drawings.

.2 All related documents shall be provided by the contractor and submitted to the Owner's Representative as specified in this document.

.3 Site testing of the circuit breakers following installation and prior to energization shall be provided by the manufacturer.

.2 Circuit Breakers

.1 One (1) 34.5kV, 600A outdoor circuit breaker assembly complete with accessories and special tools as defined in Section 26 18 00.

.2 Site testing of the circuit breakers following installation and prior to energization shall be provided by the manufacturer.

.3 Reclosers

.1 Two (2) substation-mounted 34.5 kV three-phase microprocessor-controlled automatic circuit recloser assemblies, each complete with control unit, accessories, and special tools as defined in Section 26 18 26.

.2 Site testing of the reclosers following installation and prior to energization shall be provided by the manufacturer.

.4 Disconnect Switches

.1 One (1) 69 kV, 600A three-phase group-operated motorized disconnect assembly, complete with accessories and special tools as defined in Section 26 28 22.

2.2 CONTRACTOR-SUPPLIED PRODUCTS (Cont'd)

.4 (Cont'd)
.2 One (1) 34.5 kV, 1200A load-break group handle operated disconnect assembly complete with auxiliary contacts, accessories, special tools, and provisals per Section 26 28 22.
.3 One (1) 34.5 kV, 600A load-break group handle operated disconnect assembly complete with auxiliary contacts, accessories, special tools, and provisals per Section 26 28 22.
.4 One (1) 34.5 kV, 600A non-load group handle operated disconnect assembly complete with auxiliary contacts, accessories, special tools, and provisals per Section 26 28 22.

.5 Instrument Transformers
.1 Three (3) protection class 69 (39.8 kV) kV potential transformers, two (2) protection class 34.5 kV potential transformers and six (6) protection class 34.5 (19.92) kV potential transformers, suitable for outdoor mounting, complete with accessories and special tools as defined in Section 26 22 19.
.2 Three (3) single phase metering class revenue metering units shall be delivered in accordance with Section 26 12 19 and installed by the Contractor as indicated on design drawings.
.3 Revenue meters shall be provided by NSPI and installed by the contractor inside the substation building in dedicated panel provided by the Contractor.

.6 DC UPS System
.1 One (1) 125 VDC Uninterruptible Power Supply System suitable for indoor installation, complete with charger, battery racks, distribution panelboard, fused disconnect switch, accessories and special tools as defined in Section 26 33 53.
.2 Site testing of the Uninterruptible Power Supply System assembly following installation and prior to energization shall be provided by the manufacturer.

.7 Materials
.1 High tensile, hot dipped galvanized, bolts, nuts, washers: to CAN/CSA S16.1.
.2 Support insulators, station post type, coloured grey: to ANSIC29.9.

.8 Isolating Switches
.1 Refer to Section 26 13 01 - Isolating Switches.

.9 Fuse Cutouts
.1 Non explosion type, with grey station post type insulators, operating hook stick and mounting bracket.

2.2 CONTRACTOR-SUPPLIED PRODUCTS (Cont'd)

.10 Station Service Transformers
.1 Three (3) 50 kVA single phase pole- mounted type Station Service transformers. Refer to Section 26 12 13 - Liquid Filled Medium Voltage Transformers.

.11 Cable Terminations
.1 Refer to Section 26 05 22 - Connectors and Terminations.

.12 Surge Arresters
.1 Refer to Section 26 41 01 - Surge Arresters.

.13 Substation Fence
.1 Refer to Section 32 31 13 - Chain Link Fences and Gates.
.2 For substation fence grounding refer to Section 26 05 27 - Grounding - Primary and the applicable design drawings.

.14 Lighting
.1 Refer to Section 26 50 00 - Lighting.

.15 Grounding
.1 Refer to Section 26 05 27 - Grounding - Primary.

.16 Insulators
.1 Refer to Section 33 71 20 - Electrical Pole Lines and Hardware.

.17 Substation Structure
.1 For Substation Structure details refer to Section 05 50 00 - Metal Fabrications.

.18 Transformer Oil Containment System
.1 For substation transformer and STATCOM System Connection Transformer Oil Containment System refer to Section 33 05 40.

.19 Bus and Connections
.1 Three phase aluminum bus bars and connections suitably supported on insulators, including connectors.
.2 Flexible phase and ground connections to components.
.3 Identify phases of bus bar and connections by marking and/or by coloured paint.
.4 Support clamps for busbars and connections.

.20 Warning Signs
.1 Provide warning signs in accordance with Section 26 05 00 - Common Work Results - Electrical.
.2 Warning signs to caution against fuse changing.
.3 Arc flash labels and signs in compliance with CSA-Z462.

2.2 CONTRACTOR-SUPPLIED PRODUCTS (Cont'd)

.20 (Cont'd)
.4 Danger signs, warning against high voltage as required by inspection department.

.21 Substation Building
.1 Provide prefabricated substation building to accommodate all protection, control, communication and power distribution equipment.
.2 The substation building electrical design and shall be as specified in the applicable sections of Division 26 and as indicated by design drawings.
.3 The protection, control and communication panels located inside the substation building shall be built in accordance with the design drawings provided by the Owner's Representative.

PART 3 - EXECUTION

3.1 GENERAL

.1 All listed in PART 2 - PRODUCTS, Subsection 2.2 shall be supplied and installed by the Contractor in accordance with the applicable sections from Division 26 and per design drawings.

.2 All related documents shall be provided by the contractor and submitted to the Owner's Representative as specified in this document.

3.2 MATERIALS

.1 High tensile, hot dipped galvanized, bolts, nuts, washers: to CAN/CSA-S16.1.

.2 Support insulators, station post type, coloured grey: to ANSIC29.9.

3.3 INSTALLATION

.1 Install substation grounding grid as indicated by design drawings.

.2 Install cable ducts as indicated by design drawings.

.3 Build concrete slabs accurately in accordance with the design drawings and per the applicable sections.

.4 Set and secure substation structure in place rigid, plumb and square and as indicated.

.5 Install all substation equipment in accordance with manufacturer's recommendations and design drawings.

3.3 INSTALLATION (Cont'd)

.6 Install substation cables and make field connections.

.7 Connect equipment, surge arresters, structure to station ground system.

.8 Co ordinate connection to supply, with power supply authority. Identify phases.

3.4 FIELD QUALITY CONTROL

.1 Perform all equipment field tests as specified in the Equipment Specifications and the related sections.

.2 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and Section 01 91 13 - General Commissioning (Cx) Requirements.

.3 Apply all standard tests per ANSI/IEEE C57.12.90 to the Substation Transformer. Optional tests may be provided under Owners request at no additional cost.

.4 Arrange for pre service inspection, oil sample and insulation test.

.5 Operate interrupter closing and tripping mechanism and verify correct functioning.

.6 Simulate instrument transformer, transducer signal sources of protective relays, check relays for correct operation, calibration, settings.

.7 Perform dc voltage test for medium voltage power cables.

.8 Check insulation of substation assembly with 1000V megger with feeder cables and connections disconnected.

.9 Conduct high potential tests on substation assembly to Engineer's written instructions.

.10 Verify phase rotation of each feeder.

.11 Check continuity of each feeder.

3.5 ISOLATING SWITCHES

.1 Refer to Section 26 13 01 - Isolating Switches.

3.6 FUSE CUTOUTS	.1	Non-explosion type, with grey station post type insulators, operating hook stick and mounting bracket.
3.7 STATION SERVICE TRANSFORMERS	.1	Three (3) 50 kVA single phase pole-mounted type Station Service transformers. Refer to Section 26 12 13 - Liquid Filled Medium Voltage Transformers.
3.8 CABLE TERMINATIONS	.1	Refer to Section 26 05 22 - connectors and Terminations.
3.9 LIGHTNING ARRESTERS	.1	Refer to Section 26 41 01 - Lightning Arresters.
3.10 SUBSTATION FENCE	.1	Refer to Section 32 31 13 - Chain Link Fences and Gates.
	.2	For substation fence grounding, refer to Section 26 05 27 - Grounding - Primary and the applicable design drawings.
3.11 LIGHTING	.1	Refer to Section 26 50 00 - Lighting.
3.12 GROUNDING	.1	Refer to Section 26 05 27 - Grounding - Primary.
3.13 INSULATORS	.1	Refer to Section 33 71 20 - Electrical Pole Lines and Hardware.
3.14 TRANSFORMER OIL CONTAINMENT	.1	Install Transformer Oil Containment System for the Substation Transformer and for the STATCOM System Connection Transformer in accordance with Section 33 05 40.

3.15 BUS AND CONNECTIONS

.1 Three-phase aluminum bus bars and connections suitably supported on insulators, including connectors.

.2 Flexible phase and ground connections to components.

.3 Identify phases of bus bar and connections by marking and/or by coloured paint.

.4 Support clamps for bus bars and connections.

3.16 WARNING SIGNS

.1 Provide warning signs in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Warning signs to caution against fuse changing.

.3 Arc flash labels and signs in compliance with CSA-Z462.

.4 Danger signs, warning against high voltage as required by inspection department.

3.17 SUBSTATION BUILDING

.1 Provide prefabricated substation building to accommodate all protection, control, communication and power distribution equipment.

.2 The substation building electrical construction shall be as specified in the applicable sections of Division 26 and as indicated on design drawings.

.3 The protection, control and communicatin panels located inside the substation building shall be built in accordance with the design drawings.

END

PART 1 - GENERAL

1.1 RELATED WORK

.1 Purchase, deliver to place of installation and install three (3) single phase 37.5kVA, station service transformers in three phase Y/Y configuration on substation structural frame.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (Cx) Requirements.

.3 Section 26 11 01 - Outdoor Substation

.4 Section 26 05 22 - Connectors and Terminations

.5 Section 26 05 27 - Grounding - Primary

.6 Section 33 71 20 - Electrical Pole Lines and Hardware

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA International)
.1 CAN/CSA-C2, Single-Phase and Three-Phase Distribution Transformers, Types ONAN and LNAN.

.3 Electrical Equipment Manufacturers Association of Canada (EEMAC)
.1 EEMAC L9-3, Interchangeability of HV Bushings on Pole Type Distribution Transformers.

.4 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
.1 C57.12.31, IEEE standard for pole mounted equipment - enclosure integrity.

1.4 SOURCE QUALITY CONTROL

.1 Submit production test certificates to Engineer.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Indicate:
.1 Dimensioned positions of mounting devices.
.2 Dimensioned positions of terminations.

.3 Identified internal and external component layout on assembly drawing.

.4 Insulating liquid capacity.

.5 Insulating liquid type, specificationss and performance criteria.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for liquid cooled transformers for incorporation into manual specified in Section 01 10 00.

.2 Include insulating liquid maintenance data.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 10 00.

1.8 DELIVERY AND STORAGE

.1 Ship transformers complete with first fill of liquid.

.2 Unit shall be banded, blocked or bolted to a suitable skid with 100 mm of clearance for shipment.

PART 2 - PRODUCTS

2.1 TRANSFORMER CHARACTERISTICS

.1 Transformers: to CSAC2.

.2 Liquid cooled, outdoor, distribution transformers type ONAN.

.3 Primary voltage: 19.92 kV, 60Hz, single phase, two (2) bushings.

.4 Secondary voltage: 120/208/240 V, single phase.

.5 Capacity: 50 kVA.

.6 Basic impulse level (BIL), primary: 150 kV.

2.1 TRANSFORMER CHARACTERISTICS (Cont'd)

.7 Basic impulse level (BIL), secondary 30 kV.

.8 Polarity: additive.

.9 Impedance: standard.
.1 Single phase transformers with same impedance, from same manufacturer, when used in multi-phase configuration.

.10 No load losses not to exceed 2% of kW rating.

.11 Full load losses not to exceed 3% of kW rating.

2.2 TANK

.1 The tank shall include a pressure relief device as a means to relieve pressure in excess of pressure resulting from normal operation. The venting and sealing characteristics as follows:
.1 Cracking Pressure: 10 psig ± 2 psig
.2 Resealing Pressure: 6 psig minimum
.3 Zero leakage from reseal pressure to -8 psig
.4 Flow at 15 psig: 35 SCFM minimum

.2 Tank coating shall meet all requirements in ANSI C57.12.31 including:
.1 Salt Spray Test
.2 Crosshatch Adhesion Test
.3 Humidity Test
.4 Impact Test
.5 Oil Resistance Test
.6 Ultraviolet Accelerated Weathering Test
.7 Abrasion Resistance - Taber Abraser

.3 The tank provided shall have a recessed tank bottom for protection when sliding over rough surfaces.

.4 The tank shall have an internal mark, indicating the proper fluid level.

.5 The tank shall be provided with a mild steel cover ring with stainless steel cover ring loops and a stainless steel bolt. A bronze nut shall also be provided to eliminate corrosion problems and avoid galling.

.6 The tank shall include arrester mounting pads, grounding provisions, heavy-duty double support lugs (hanger brackets) and lift lugs.

2.3 MOUNTING	.1	Transformers suitable for substation structural frame installation.
2.4 VOLTAGE TAPS	.1	Four-2.5% taps, 2-FCAN, 2-FCBN.
2.5 TAP CHANGER	.1	Externally operated off-load tap changer.
2.6 HIGH VOLTAGE BUSHINGS	.1	Bushings: to EEMAC L9-3.
	.2	Two high voltage bushings on each single phase transformers.
	.3	The bushing terminals provided shall be tin plated to accommodate both aluminum and copper conductors.
2.7 INSULATING LIQUID	.1	Insulating liquid: transformer oil, less-flammable, non-toxic, non-bioaccumulating and readily and completely biodegradable per EPA OPPTS 835.3100.
2.8 ACCESSORIES	.1	Stainless steel nameplate.
	.2	25 mm drain valve with plug.
	.3	Automatic pressure relief device.
	.4	Wet process porcelain high voltage bushings resistant to high voltage corona.
	.5	Polymer low voltage bushings.
	.6	Non-PCB Decal (white on blue)
	.7	Factory install accessories.
2.9 FINISH	.1	Finish tank exterior in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.10 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Owner's equipment reference label: size 7 identification plate attached to the substation structure below the transformer.

2.11 ACCEPTABLE MANUFACTURERS

.1 Cooper Power Systems.

.2 Moloney Electric Inc.

.3 Carte International Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install transformers only after other work in area is completed and in accordance with manufacturer's instructions and as indicated on design drawings.

.2 Use spreader bars on slings when lifting transformers into place.

.3 Set and secure transformers in place rigid, plumb.

.4 Ensure internal connections are mechanically tight.

.5 Make connections as indicated on design drawings.

.6 Connect transformer ground terminal to system ground.

.7 Set taps to produce rated secondary voltage at no-load.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical, Section 01 91 13 - General Commissioning (Cx) Requirements and per CAN/CSA-C2.

.2 Carry out following insulation tests using megger with 20,000 megohm scale and resulting insulation resistance corrected to base of 20°C.
.1 High voltage to ground with secondary grounded for duration of test.
.2 Low voltage to ground with primary grounded for duration of test.
.3 High to low voltage.

3.2 FIELD QUALITY CONTROL (Cont'd)

.3 Inspect primary and secondary connections for tightness and for signs of overheating.

.4 Inspect and clean bushings and insulators.

.5 Check oil level and temperature indicators.

.6 Set transformer taps to rated voltage as specified.

.7 Inspect for oil leaks and excessive rusting.

.8 Inspect oil level.

.9 Check fuses for correctness of type and size.

.10 Check for grounding and neutral continuity between primary and secondary circuits of transformer.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Receive, inspect, off load, report and installation of one (1) three phase 20/27/33 MVA, 69 kV/34.5 kV liquid filled power transformer supplied by Owner.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 11 01 - Outdoor Substation

.3 Section 26 05 22 - Connectors and Terminations

.4 Section 26 05 27 - Grounding - Primary

.5 Section 01 91 13 - General Commissioning (Cx) Requirements

.6 Section 01 91 33 - Commissioning (Cx) Forms

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 CSA Standards
.1 C88-M, Power Transformers & Reactors
.2 C13, Instrument Transformers
.3 C50, Insulating Oil, Electrical, for Transformers and Switches
.4 C22.2 #94, Special Purpose Enclosures 2, 3, 4, and 5
.5 W47.1, Certification of companies for fusion welding of steel structures
.6 W59, Welded steel construction (Metal-Arc Welding)
.7 C22.1, Canadian Electrical Code Part

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.3 EEMAC Standards
.1 GL1-3, Transformer and Apparatus Bushings

.4 ANSI/IEEE Standards
.1 C57.12.00, Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
.2 C57.12.70, Terminal Markings and Connections for Distribution and Power Transformers
.3 C57.12.80, Terminology for Power and Distribution Transformers

1.3 REFERENCES (Cont'd)

.4 (Cont'd)
.4 C57.12.90, Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
.5 C57.19.00, General Requirements and Test Procedures for Outdoor Power Apparatus Bushings
.6 C57.19.01, Performance Characteristics and Dimensions for Outdoor Apparatus Bushings
.7 C57.19.100, Guide for Application of Power Apparatus Bushings
.8 C57.92, Guide for Loading Mineral-Oil-Immersed Power Transformers Up to 100MVA with 55°C or 65°C Average Winding Rise
.9 C57.100, Test Procedure for Thermal Evaluation of Liquid-Immersed Distribution and Power Transformers
.10 C57.10, 4Guide for the Interpretation of Gases Generated in Oil- Immersed Transformers
.11 C57.106, Guide for Acceptance and Maintenance of Insulating Oil in Equipment
.12 C57.109, Guide for Transformers Through-Fault-Current Duration
.13 C57.11, 1Guide for Acceptance of Silicone Insulating Fluid and Its Maintenance in Transformers
.14 C57.113, Guide for Partial Discharge Measurement in Liquid-Filled Power Transformers and Shunt Reactors
.15 C57.114, Seismic Guide for Power Transformers and Reactors
.16 C57.120, Loss Evaluation Guide for Power Transformers and Reactors
.17 B21, Pipe Threads (except dryseal)
.18 Std. No. 472, Guide for Surge Withstand Capability (SWC) Tests

.5 NEMA Standards
.1 TR-1 0.06, Transformers, Regulators and Reactors (noise level requirements only)
.2 TR-98, Guide for Loading Power Transformers, Oil-Immersed, with 65oC Average Winding Rise

.6 ISO Standards
.1 9000: 2000, Quality Management

.7 Unless otherwise noted, CSA Standards shall be given precedence when and where conflicts arise.

1.4 CLOSEOUT SUBMITTALS

.1 Provide as builds, test reports and inspection certificates for substation transformer as specified in Section 01 10 00.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 TRANSFORMER CHARACTERISTICS

.1 Primary Winding (HV)
- .1 Rated line-to-line voltage kV rms 69Y/39.8
- .2 Rated (maximum) voltage kV rms 72.5
- .3 Basic impulse level (BIL) kV 350
- .4 Connection configuration rounded wye
- .5 Nominal frequency Hz 60
- .6 ONAN base rating MVA 20
- .7 Neutral bushing (H0) brought out and grounded
- .8 Basic impulse level of neutral (BIL) kV 200

.2 Secondary Winding (XV)
- .1 Rated line-to-line voltage kV rms 34.5Y/19.92
- .2 Rated (maximum) voltage kV rms 36.2
- .3 Basic impulse level (BIL) kV 200
- .4 Connection configuration grounded wye
- .5 Nominal frequency Hz 60
- .6 ONAN base rating MVA 20
- .7 Neutral bushing (X0) brought out and grounded
- .8 Basic impulse level of neutral (BIL) kV 110

.3 Buried Tertiary Winding (YV)
- .1 Rated line-to-line voltage kV rms N/A
- .2 Rated (maximum) voltage kV rms N/A
- .3 Basic impulse level (BIL) kV N/A
- .4 Connection configuration delta
- .5 Nominal Frequency Hz 60
- .6 ONAN base rating MVA N/A
- .7 One (1) winding corner brought out and grounded

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Owner's equipment reference label: size 7 identification plate attached to the substation structure below the transformer.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Compliance with Standards and Codes

.1 The installation, testing, and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

.2 The Vendor shall adhere to the following standards during the process of testing and commissioning:

.3 Nova Scotia Standards

.1 Nova Scotia Occupational Health and Safety Act

.2 Nova Scotia Labour Act

.4 CSA Standards

.1 C22.1-06, Canadian Electrical Code Part I

.2 C22.3, Canadian Electrical Code Part III

.3 C88-M, Power Transformers & Reactors

.5 ANSI/IEEE Standards

.1 C57.12.90, Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers

.2 C57.19.00, General Requirements and Test Procedures for Outdoor Power Apparatus Bushings

.3 C57.12.90, Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers

.4 C57.19.00, General Requirements and Test Procedures for Outdoor Power Apparatus Bushings

.5 Std. No. 472, Guide for Surge Withstand Capability (SWC) Tests

.2 Scope of Work

.1 Install Substation Transformer in accordance with the Installation Manual and as indicated by design drawings.

.2 The Contractor shall identify in the Quotation all Subcontractors to be used in the Installation process.

.3 It is strongly recommended that the Contractor gain familiarity with the site prior to bidding.

.4 Install transformers only after other work in area is completed and in accordance with manufacturer's instructions and as indicated on design drawings.

.5 Use spreader bars on slings when lifting transformers into place.

.6 Set and secure transformers in place rigid, plumb.

.7 Install and dress power transformers as defined herein.

.1 Dressing shall include installation of all necessary components shipped loose with the transformer. Contractor shall be responsible for

3.1 INSTALLATION (Cont'd)

.2 (Cont'd)

.7 (Cont'd)

supply and placement of the crane for off-loading the transformer, lift procedure, including, but not limited to, the addition and removal of temporary fill for the use of out-riggers.

.2 Dressing shall include installation of the provided surge arresters and grounding of the arresters to the tank.

.3 Termination of high- and medium-voltage phase conductors.

.8 Provide windings moisture assessment and dry out if required using manufacturer approved mthod.

.9 Fill and filter the transformer with oil from standard tanker truck following its arrival. The Contractor shall be solely responsible for co-ordination of the delivery of the transformer oil to the Place of Installation.

.10 Install lamicoid nameplates on the substation transformer as indicated.

.11 All sundry materials, components and parts required for the on- site installation shall be supplied by the Contractor.

.1 All sundry materials, components and parts required for the on-site installation shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

.12 Ensure internal connections are mechanically tight.

.13 Make connections as indicated on design drawings.

.14 Connect transformer ground terminal to system ground.

.15 Set taps to produce rated secondary voltage at no-load.

.16 Dry transformer to manufacturer's specifications.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical, Section 01 91 13 - General Commissioning (Cx) Requirements.

.2 Supply of all test equipment including but not limited to the following:

.1 10kV Doble Test Set.

.2 Meggar Test Set (or equivalent).

.3 Fluke Meter (or equivalent).

3.2 FIELD QUALITY CONTROL (Cont'd)

.2 (Cont'd)
.4 Three-phase generator.
.5 Current meter.
.6 Voltage meter.
.7 Testing cables.
.8 Disconnect switch.
.9 Current transformer tester.

.3 General
.1 The Contractor shall test the power transformer, insulating oil, and all accessories to the satisfaction of the Owner's Representative as defined herein; the Vendor shall indicate and include any additional Vendor-recommended tests.
.2 The Contractor shall provide the qualifications of the field testing team to the Owner's Representative prior to engagement of the testing agency.
.3 The Contractor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.
.4 All test results shall be provided to the Owner's Representative in written form within 24 hours of completion by fax or email. If neither method is readily available, the Owner's Representative shall be informed and the results forwarded to the Owner's Representative at the first available opportunity.
.5 Submittal of the test results notwithstanding, the Owner's Representative shall be informed immediately of any readily-apparent deficiencies noted by the tests.
.6 All test reports shall include the following information:
.1 Name of testing firm.
.2 Date of test.
.3 Ambient temperature at time of test.
.4 Relative humidity at time of test.
.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).
.6 Confirmation that test results are acceptable.
.7 Initialed by Contractor.

.4 Visual Inspection
.1 Inspect primary and secondary connections for tightness and for signs of overheating.
.2 Inspect and clean bushings and insulators.
.3 Check oil level and temperature indicators.
.4 Set transformer taps to rated voltage as specified.
.5 Check whether all oil valves are in correct position, closed or open as required. Inspect for oil leaks and excessive rusting.
.6 Check that no air pockets are left in the tank.

3.2 FIELD QUALITY CONTROL (Cont'd)

.4 (Cont'd)

.7 Check that all thermometers pockets are filled with oil.

.8 Check whether grounding connections have been properly done.

.9 Check that the transformer is properly installed and there is no possibility of any movement during operation.

.5 Transformer and its auxiliary devices test procedures:

.1 Winding Tests

.1 Insulation/Power Factor Testing

.1 Using Doble test set at a 10kV test voltage, measure the power factors/capacitances of each transformer winding (H1, H2, H3, X0, X1, X2, X3, Y3) in picofarads.

.2 Dielectric Testing

.1 Required test results measured at one (1) minute for five (5) equally spaced voltage levels not exceeding two-thirds of the energized winding's rated voltage:

.1 Leakage current (micro-Amperes).

.2 Insulation resistance (mega-Amperes).

.3 Energized winding to tank (Volts).

.4 Energized winding to grounded winding or windings (Volts).

.3 Repeat test procedure for each of the following conditions:

.1 Test No. 1:

.1 HV shorted and energized.

.2 XV and YV shorted and grounded.

.2 Test No. 2:

.1 HV shorted and energized.

.2 XV shorted and guarded.

.3 YV grounded.

.3 Test No. 3:

.1 HV shorted and energized.

.2 XV shorted and grounded.

.3 YV guarded.

.4 Test No. 4:

.1 XV shorted and energized.

.2 HV and YV shorted and grounded.

.5 Test No. 5:

.1 XV shorted and energized.

.2 HV shorted and grounded.

.3 YV guarded.

.6 Test No. 6:

.1 XV shorted and energized.

.2 HV shorted and guarded.

.3 YV grounded.

3.2 FIELD QUALITY CONTROL (Cont'd)

.5 (Cont'd)
.1 (Cont'd)
.3 (Cont'd)
.7 Test No. 7:
.1 YV energized.
.2 HV and XV shorted and grounded.
.8 Test No. 8:
.1 YV energized.
.2 XV shorted and grounded.
.3 HV shorted and guarded.
.9 Test No. 9:
.1 YV energized.
.2 XV shorted and guarded.
.3 HV shorted and grounded.
.2 Magnetization Current Measurement
.1 Required test results:
.1 Red-phase current (IR, milli-Amperes).
.2 Yellow-phase current (IY, milli-Amperes).
.3 Blue-phase current (IB, milli-Amperes).
.4 Phase-to-phase voltage (Volts).
.2 Vector Grouping Test
.1 Required test results (H1 connected to X1):
.1 Voltage H2 - X3 (V).
.2 Voltage H3 - X2 (V).
.3 Voltage H1 - H2 (V).
.4 Voltage H2 - X2 (V).
.3 Positive Sequence Impedance Test
.1 Required test results
.1 %Z(H - X)1:
.4 Zero Sequence Impedance Test
.1 Required test results:
.1 %Z(H - X)0.
.2 %Z(H - Y)0.
.3 %Z(X - YT)0.
.5 Turns Ratio Test
.1 Test transformer ratio; confirm all tap changer tap ratios.

.6 Core Ground
.1 Megger Test
.1 Using the Megger Test set (or equivalent), measure the impedance from the core to ground in addition to the same test performed prior to off-loading at the Place of Installation.

.7 Current Transformer Tests
.1 The Vendor shall perform the following tests on each transformer CT, for all taps, based on the Manufacturer's recommended test procedures:
.1 Ratio Test
.2 Magnetization Curve Test

3.2 FIELD QUALITY CONTROL (Cont'd)

.7 (Cont'd)
.1 (Cont'd)
.3 Secondary Resistance Test

.8 Bushings
.1 Insulation/Power Factor Testing
.1 Using Doble test set at a 10kV test voltage, measure the power factors/capacitances of each transformer bushing (H1, H2, H3, X0, X1, X2, X3, Y3) in picofarads.

.9 Winding Temperature Gauges
.1 Operational Test
.1 Test each set point and reset point for all winding temperature gauges and record the results.
.2 Record discrepancies between the listed and actual winding temperature gauge settings.

.10 Oil Temperature Gauges
.1 Operational Test
.1 Test each set point and reset point for all winding temperature gauges and record the results.
.2 Record discrepancies between the listed and actual winding temperature gauge settings.

.11 Liquid Level
.1 Operational Test
.1 Test the operate and reset points of the main tank liquid level indicator and record the results.
.2 Test the operate and reset points of the tap changer liquid level indicator and record the results, if applicable.

.12 Gas Alarm and Trip
.1 Operational Test
.1 Test the operate and reset points of the rapid pressure rise alarm contact and record the results.
.2 Test the operate and reset points of the rapid pressure rise trip contact and record the results.

.13 Radiator Fan Motors
.1 Operational Test
.1 Test the performance of the stage 1 fan bank and record the voltage and current of each phase during operation.
.2 Test the performance of the stage 2 fan bank and record the voltage and current of each phase during operation.

3.2 FIELD QUALITY CONTROL (Cont'd)

.14 Hot Spot Compensation Current Transformers
.1 Functional Test
.1 Apply current to the winding monitored by the Hot Spot Compensation CT.
.2 Observe the temperature of the winding at elapsed times of 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, and 50 minutes.

.15 Tap Changer Tests
.1 Functional Tests
.1 Manually confirm operation of the tap changer and exercise the device by raising and lowering the tap positions through their full range of operation.
.2 Confirm correct automatic operation of the on-load tap changer throughout the tap changer's full range of operation.
.1 Give the Engineer one (1) week notification prior to commencement of testing of the on-load tap changer.
.2 Enter the following setpoints, provided by the Engineer, into the tap changer control mechanism:
.1 Band centre (volts).
.2 Bandwidth (volts).
.3 Time delay (seconds).
.3 Apply a simulated voltage signal to the on-load tap changer control and observe that the operation is in accordance with the above mentioned setpoints.
.4 Test the automatic operation of the on-load tap changer through the full range of operation, both raising and lowering.
.5 In addition to testing the operating handle mechanism, test the operation of the electrically-controlled Manual Raise and Lower pushbuttons through the full range of tap positions.
.2 CSA-C88 Defined Tests
.1 Include the tap changer in all listed transformer tests or otherwise repeat the test for the tap changer.

.16 Oil Testing
.1 Dielectric Strength Test.
.2 Oil Power Factor Test.
.3 Contaminant Test
.1 Following all other required tests, a sample of the transformer insulating oil shall be drawn and tested for moisture and dissolved gas content, including but not limited to the following:
.1 Hydrogen (H_2).
.2 Oxygen (O_2).
.3 Methane (CH_4).

3.2 FIELD QUALITY CONTROL (Cont'd)

.16 (Cont'd)
.3 (Cont'd)
.1 (Cont'd)
.4 Carbon Monoxide (CO).
.5 Carbon Dioxide (CO_2).
.6 Ethylene (C_2H_4).
.7 Ethane (C_2H_6).
.8 Acetylene (C_2H_2).

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Installation for pad mounted, liquid filled, medium voltage transformers pre-purchased and supplied by the Owner. Contractor will receive, store, install, test and commission.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (CX) Requirements.

.3 Section 03 30 00 - Cast-in-Place Concrete.

.4 Section 33 71 20 - Electrical Pole Lines and Hardware

1.3 REFERENCES

.1 ANSI/IEEE386-1985, Separable Insulated Connector Systems for Power Distribution Systems above 600V.

.2 CAN/CSA-C2-M91, Single-Phase and Three Phase Distribution Transformers, Types ONAN and LNAN.

.3 CAN/CSA-C227.2-88, Three-Phase, Live Front, Pad Mounted Distribution Transformers.

.4 CSAC227.4-M1978 (R1987), Three-Phase Dead Front Pad-Mounted Distribution Transformers.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Transformers shall be delivered under Equipment Specification #090630-SP-E07, refer to Appendix A5.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Nameplate showing information in accordance with CSAC2.

2.3 WARNING SIGNS

.1 Provide warning signs in accordance with Section 26 05 00 - Common Work Results - Electrical.

PART 3 - EXECUTION

3.1 INSPECTION

.1 Check factory made connections of transformer unit for mechanical security and electrical continuity.

.2 Check transformer insulating liquid for correct quantity and specification according to manufacturer's instructions.

3.2 INSTALLATION

.1 Ensure concrete pad is fully cured before transformer is installed.

.2 Set and secure transformer unit in place, rigid, plumb and square.

.3 Make connections.

.4 Connect transformer unit ground bus to system ground.

.5 Ensure care is taken to prevent contamination of liquid and components when field filling transformers.

.6 Use only metal hose when field-filling transformer with oil: never, under any circumstances, use rubber hose.

.7 Set taps to produce rated secondary voltage at no-load.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and as per NSPI Bulletin B-36-000 (2009).

.2 Carry out following insulation tests using megger with 20,000 megohm scale and resulting insulation resistance corrected to base of 20EC.
.1 High voltage to ground with secondary grounded for duration of test.
.2 Low voltage to ground with primary grounded for duration of test.
.3 High to low voltage.

3.3 FIELD QUALITY CONTROL (Cont'd)

.3 Inspect primary and secondary connections for tightness and for signs of overheating.

.4 Inspect and clean bushings and insulators.

.5 Check oil level and temperature indicators.

.6 Set transformer taps to rated voltage as specified.

.7 Inspect for oil leaks and excessive rusting.

.8 Inspect oil level.

.9 Check fuses for correctness of type and size.

.10 Check for grounding and neutral continuity between primary and secondary circuits of transformer.

.11 Perform test in accordance with Section 26 05 00 - Common work Results - Electrical and Section 01 91 13 - General Commissioning (CX) Requirements.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials for outdoor isolating switches.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (CX) Requirements.

.3 Section 26 11 01 - Unit Substation.

.4 Section 33 71 20 - Electrical Pole Lines and Hardware.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.58-M1989 (R2005), High-Voltage Isolating Switches.

.2 National Electrical Manufacturers Association (NEMA)

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 10 00.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for isolating switches for incorporation into manual specified in Section 01 10 00.

.2 Technical data to cover operating mechanism of group operated switches.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 ISOLIATING SWITCH

.1 Isolating switch: to CSA C22.2 No.58.

.2 Outdoor, single pole, hook stick operated, vertical break with arcing horns, structure mounted, continuous rating 900 A at 34.5 kV, manual operating mechanism,

.3 Standard of acceptance: S&C Loadbuster Disconnects

PART 3 - EXECUTION

3.1 INSTALLATION

.1 As indicated by design drawings and Collection System Installation Standards.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Purchase, deliver to the Place of the Installation and install one (1) 34.5kV outdoor circuit breaker assembly complete with accessories and special tools as defined herein.

.2 Site testing of the circuit breaker assembly defined herein following installation and prior to energization, including all tests defined herein.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 11 01 - Outdoor Substation

.3 Section 26 05 22 - Connectors and Terminations

.4 Section 26 05 27 - Grounding - Primary

.5 Section 01 91 13 - General Commissioning (Cx) Requirements

.6 Section 01 91 33 - Commissioning (Cx) Forms

1.3 REFERENCES

.1 The Circuit Breaker Assembly shall conform to or exceed the applicable requirements of the latest edition standards and recommended practices referenced herein.

.2 CSA Standards
.1 C13-M83 Instrument Transformers
.2 C22.2 No. 94 Special Purpose Enclosures 2, 3, 4, 5
.3 W47.1-03 Certification of companies for fusion welding of steel structures
.4 W59-03 Welded steel constructions (Metal-Arc Welding)
.5 G164 Hot Dipped Galvanized or Irregularly Shaped Articles
.6 C22.1-06 Canadian Electrical Code Part I
.7 C22.2 NO 31-04(R2009) Switchgear Assemblies

.3 EEMAC Standards
.1 GL1-3 Transformer and Apparatus Bushings

.4 ANSI/IEEE Standards
.1 C37.04-1999 IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

1.3 REFERENCES (Cont'd)

.4 (Cont'd)
.2 C37.06-2000 Standard for Switchgear - AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities
.3 C37.06.1-2000 Guide for High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis--Designated "Definite Purpose for Fast Transient Recovery Voltage Rise Times"
.4 C37.09-1999 IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
.5 C37.081-1981 (R1988) IEEE Guide for Synthetic Fault Testing of AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
.6 C37.081a-1997 Supplement to C37.081-1981
.7 C37.082-1982 (R2000) IEEE Standard Methods for the Measurement of Sound Pressure Levels of AC Power Circuit Breakers
.8 C37.11-1997 IEEE Standard Requirements for Electrical Control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
.9 C37.12-1991 Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
.10 C37.90.1 American National Standard Guide for Surge Withstand Capability (SWC) Tests
.11 ASME BPVC Boiler and Pressure Vessels Code
.12 100 IEEE Standard Dictionary of Electrical and Electronics Terms
.13 34.53 Recommended Practice for Seismic Design of Substations
.14 1125 - 1993 IEEE Guide for Moisture Measurement and Control in SF6 Gas-Insulated Equipment
.15 693 Recommended Practice for Seismic Design of Substations

.5 IEC Standards
.1 60376 Ed. 2.0 b: 2005 Specification of technical grade sulfur hexafluoride (SF6) for use in electrical

.6 ISO Standards
.1 9000: 2000 Quality Management

1.4 SUBMITTALS

.1 Provide maintenance data for the circuit breaker assembly for incorporation into manual as specified in Section 01 10 00.

.2 Manufacturers' Drawings
.1 Circuit breaker assembly drawings submitted for review showing assembly, details, and layout shall show anchor bolts, openings for cables, and all pertinent support structure loading details.

1.4 SUBMITTALS (Cont'd)

.2 (Cont'd)

.2 The manufacturer shall furnish, with each circuit breaker assembly, a set of drawings complete with a bill of material and showing: typical front views and open side views as well as typical components, their positions, and available space for cable termination; an anchor bolt plan with dimensions; a one-line diagram; and appropriate wiring diagrams.

.3 Vendor's drawings submitted for review shall show all terminals, wire and terminal numbering and incorporate equipment schematic details.

.4 The Vendor shall supply three phase AC schematic diagrams and panel wiring diagrams for the circuit breaker assembly to be supplied.

.3 Operation and Maintenance Manuals

.1 The manufacturer shall furnish a comprehensive instruction manual covering installation of the circuit breaker assembly and operation of the various components.

.2 Instruction manuals shall describe in detail the construction and recommend procedures for assembling, dismantling, maintaining and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturers, of component parts of the equipment, properly catalogued for easy reference.

.3 Instruction manuals shall be accompanied by copies of all Vendor's Drawings in AutoCAD format.

1.5 SHIPPING

.1 General

.1 Prior to shipment, the following values shall be tested and recorded:

.1 Ambient temperature in °C.

.2 SF6 Gas Pressure in PSI (as applicable).

.2 Responsibility for delivery shall belong to the Contractor, who shall provide for all delivery costs from factory to the Place of Installation, including but not limited to the following:

.1 Complete delivery from the Place of Manufacture to the Place of Installation at Digby County, Nova Scotia.

.2 Transportation of all accessories, including SF6 gas canisters if applicable, and parts to be shipped separately to the Place of Installation.

.3 All necessary permits and regulatory costs involved in the transport of the Circuit breaker, including but not limited to those imposed by the following bodies (such costs and requirements based

1.5 SHIPPING (Cont'd)

.1 (Cont'd)
.3 (Cont'd)
on the size, weight, point of origin, and materials of the final product):
.4 Canada Border Services Agency.
.5 Transport Canada.
.6 Nova Scotia Department of Transportation and Infrastructure Renewal.
.7 Following delivery to the Place of Installation but prior to off-loading, the Vendor shall be responsible for the following:
.8 Test and record the following values:
.1 Ambient temperature in degrees Celsius.
.2 SF6 gas shipping pressure in PSI, if applicable.
.3 Visually inspect the Works to ensure no superficial damage during the transportation process.

.2 The Constractor shall include offloading of the Circuit breakers to a location within the confines of the Place of Installation, as directed by the Purchaser.

.3 Any and all intermediate off-loading and on-loading of the Circuit breakers as required between the Manufacturer's Plant and the Place of Installation remains the responsibility of the Contractor.

.4 Provisions
.1 All auxiliary current transformers shall be shipped shorted and grounded at the terminals located in the breaker control cabinet/frame.

.5 Follow-up
.1 Provide to the Engineer one (1) reproducible copy of the following within 24 hours of off-loading at the Place of the Installation:
.1 Ambient temperature in °C (before shipment and before off-loading).
.2 SF6 gas shipping pressure in PSI, if applicable (before shipment and before off-loading).
.3 List of any and all noted visible defects noted prior to off-loading.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials and spare parts in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 CIRCUIT BREAKER .1 Ratings

.1 The distribution system shall be solidly grounded.

.2 The ratings for the circuit breaker assembly shall be as designated below or greater:

.1 kV, Nominal 34.5
.2 kV, Maximum 38
.3 kV, BIL, 200
.4 kV, Dry Withstand (60Hz) 105
.5 kV, Wet Withstand (10 sec) 105
.6 Amperes, Rated Continuous Current 600
.7 Amperes, Short-Circuit Ratings (minimum):
.1 Interrupting Current, RMS Symmetrical 30,000
.2 Close and Latch, Peak 70,000 amperes
.8 Cycles, Interrupting Time, Maximum
.9 Cycles, Closing Time Maximum 6
.10 ± Per Cent, Current Sensor Accuracy 0.3 or higher
.11 Operating Temperature Range -40°C to 40°C
.12 Control Voltage 120AC, 125DC

.2 General

.1 The MV circuit breaker shall be capacitor bank switching rated, sulfur hexafluoride (SF6) type or vacuum type assembly with common manifold gas system for all three poles or individual pole systems c/w adjustible height doghouse style equipment enclosure.

.2 The circuit breaker assembly shall consist of a self-contained, three-phase 34.5kV circuit-interrupting, load-breaking apparatus and a low-voltage control apparatus allowing local control and connection to a microprocessor-controlled multi-function protection relay, monitoring, and communications equipment.

.3 The interrupting function of the circuit breaker assembly shall be accomplished by SF6 or vacuum interruption within a solid insulating medium, one assembly per phase.

.4 The assembly shall have clear external indicator of the assembly status (i.e. open or closed). The indicator shall be visible to persons within visual range of the assembly without accessing the control device.

.5 The assembly shall be capable of manual operation in the event of failure of all low-voltage control equipment, either via an integral switch handle assembly or hot-stick operation.

2.1 CIRCUIT BREAKER (Cont'd)

.3 Functional Requirements

.1 The circuit breaker shall be furnished with dual alarm and control schemes which monitor the operating system and the SF6 gas system (as applicable). The dual alarm and control schemes shall be mechanically and electrically independent with each alarm and control scheme wired into a separate trip coil circuit

.2 The circuit breaker shall be equipped with all the necessary interface terminal blocks, auxiliary contacts, switches, relays, coils and other auxiliary equipment connected to the control system, to permit remote control and indication.

.3 All alarm, auxiliary and spare contacts, control system remote outputs, AC and DC control and station service power supplies shall be grouped and prewired to dedicated interface terminal strips. Minimum 25% spare terminal blocks to be available on each terminal strip.

.4 Alarm signals shall include but not be limited to the following:

.1 Low SF6 Alarm 1 (as applicable)
.2 Low SF6 Alarm 2 (as applicable)
.3 Loss of Vacuum Alarm (as applicable)
.4 Motor Thermal Overload
.5 Motor Not Ready
.6 Trip Coil 1 Alarm
.7 Trip Coil 2 Alarm
.8 Local/Remote Control
.9 Control Power Failure
.10 Low Pressure - Hydraulic Operating Mechanism
.11 Control Cabinet Temperature Out Of Limits

.5 Remote Control signals shall include but not be limited the following:

.1 Trip Coil 1
.2 Trip Coil 2
.3 Close Control

.6 The terminal strips and blocks shall be clearly labeled and the purpose or function of each connection shall be identified.

.4 Operating Mechanizm

.1 The MV Circuit Breaker shall be provided with one operating mechanism for all three poles and shall be suitable for three-pole group opening and closing operations.

.2 The operating mechanism shall be fully-integrated spring, hydraulic or spring-hydraulic operating mechanism. It shall be hermetically sealed to the atmosphere to eliminate corrosion and help providing maintenance-free performance with long term stability. The operating mechanism shall include all auxiliary devices and other accessories for the operating mechanism

2.1 CIRCUIT BREAKER (Cont'd)

.4 (Cont'd)

.2 (Cont'd)

furnished. The mechanism, shall be electrically trip-free and shall include anti-pump auxiliary relays and devices.

.1 NEMA 3R (minimum) compartment with door gaskets shall be furnished to house the operating mechanism, including its associated charging motor, pump, or compressor. The compartment shall contain minimum of one (1) space heater with sheaths of high-temperature chrome steel to maintain air circulation inside the enclosure, complete with thermostat.

.2 The operating mechanism shall be furnished with two separate and electrically independent DC trip coils. The two coils shall be arranged so that energization of either coil or of both coils simultaneously, or energization of either coil with the other coil shorted, will produce proper tripping. The primary trip coil and the close circuit shall be included in one control circuit. The secondary trip coil shall be included in a separate control circuit. The MV circuit breaker control switch shall only operate the primary trip coil for trip operations

.3 If hydraulic operating mechanism is used it shall include a pressure gauge and pressure switch with two alarm contacts that close to alarm low oil/nitrogen gas pressure. A low-pressure cutout switch (with two alarm contacts) shall be provided to prevent initiating a close signal should the operating pressure be below the minimum required for a complete close-open operation. The low-pressure cutout device shall not prevent a complete close-open operation should pressure drop after the close-open operation is initiated.

.4 Operating mechanism equipment including piping and linkages shall be factory installed as completely as possible. The supplier shall provide all materials for connections which must be installed in the field.

.5 Phasing

.1 Each phase shall be clearly identified by means of a color code. The color code shall be as follows:

.1 Phase A - Red

.2 Phase B - Black

.3 Phase C - Blue

.6 Grounding & Bonding

.1 A ground bus of short-circuit rating equal to that of the integrated assembly shall be provided, maintaining electrical continuity throughout the circuit breaker assembly.

2.1 CIRCUIT BREAKER (Cont'd)

.6 (Cont'd)

.2 The ground bus shall consist of copper bar, square edge, hard temper per ASTM B187. Bolted copper-to-copper connections shall have silvered interfaces and shall be made with stainless-steel bolts.

.7 Insulating Media

.1 All insulating media shall be contained within an epoxy resin system with characteristics and restrictions as follows:

.1 Adequate leakage distance established by test per IEC publication 507, First Edition, 1975.

.2 Adequate strength for short-circuit stress established by test.

.3 Conformance with applicable ANSI standards.

.8 Control Compartment

.1 All controls shall be housed within a low-voltage, self-contained, gasketed compartment, separate from all high-voltage components to provide isolation, and shall be arranged to allow complete accessibility for operation without exposure to high voltage.

.2 A rotary type pistol grip handle control switch (ElectroSwitch Series 24, or equivalent, with

.3 A two-position, rotary type control switch shall be provided in the control compartment for locally enabling and disabling remote output functions.

.4 The AC and DC power supply voltages shall be as specified in Section 1.2, Ratings. The AC and DC power will be provided by Others.

.5 Separate auxiliary circuit breakers shall be provided for charging motor, convenience receptacle/control compartment light and compartment heater circuits.

.6 Two unfused, double-pole, single-throw, knifeblade-type, disconnect switches shall be provided for isolating both Trip Coil DC control power circuits during maintenance.

.7 The control cabinet shall be painted light gray per ANSI Standard Z55.1 No. 61 or No. 70; or Munsell 5.0 BG 7.0/0.4.

.8 The control compartment shall contain minimum of one (1) space heater with sheaths of high-temperature chrome steel to maintain air circulation inside the enclosure, complete with thermostat.

.9 Control compartment door shall have provision for pad-locking and placement of utility tags for safety and procedure identification.

2.1 CIRCUIT BREAKER (Cont'd)

.8 (Cont'd)

.10 All external fasteners and hardware (such as bolts, screws, hinges, and handles) shall be stainless steel.

.11 All external auxiliary power and control wiring will be routed in conduit or feed-through wireway to the control cabinet.

.12 Grounding provisions shall be provided for the control cabinet.

.13 The compartment shall be furnished with one 120 VAC, 20 amp, duplex convenience receptacle and control compartment light.

.14 The interior of the control compartment shall be painted white.

.9 Loss of vacuum detector/monitor (as applicable)

.1 Loss of vacuum detector/monitor to be provided with the vacuum type MV circuit breaker. It shall give real time status of the vacuum interrupters through a visual indicator and/or dry alarm contacts to the control system.

.2 The vacuum detector/monitor may be located inside the MV circuit breaker control compartment or outside the MV circuit breaker enclosure.

.10 Auxiliary Power and Control Wiring

.1 All auxiliary power and control wiring shall consist of 600 volt stranded copper switchboard wire, moisture resistant or thermosetting and shall be #14 AWG minimum.

.2 Use 7 strand or 19 strand conductors for #14 AWG and larger wire.

.3 Terminate all wires on devices with compression type connectors. Do not use spade lugs or soldered terminals. Do not connect more than three wires to any one stud or terminal.

.4 Use type written, heat shrink sleeve wire markers through out.

.5 Leave stud terminals for medium-voltage connections.

.11 Bushings

.1 Bushings shall be porcelain or polymer, ANSI Standard Z55.1 No. 61 or No. 70; or Munsell 5.0 BG 7.0/0.4 light gray colour.

.2 Bushings shall have a minimum flange seat to lower end length (strike distance) of 900 mm, with a minimum creepage distance of 1725 mm.

.3 The bushing BIL rating shall meet or exceed the breaker's BIL rating.

.12 Current Transformers

.1 The manufacturer shall provide one (1) bushing transformer on each circuit breaker bushing, both load and line side.

2.1 CIRCUIT BREAKER (Cont'd)

.12 (Cont'd)

.2 All bushing current transformers shall have 5A nominal secondary ratings.

.3 All bushing current transformers shall have multi-ratio primary ratings with a minimum of 200A, 300A, 800A, and 1200A.

.4 All bushing current transformers shall be of C400 relaying accuracy or better at all tap settings.

.5 CT wiring shall be brought back to terminal blocks located within the transformer control cabinet.

.6 All current transformers shall be left connected at the 300:5A ratio.

.13 Accessories

.1 Each operating mechanism shall be equipped with 20 spare auxiliary switch contacts (10 Form-A and 10 Form-B) used for indicating, interlocking, and alarming, wired to a separate terminal block in the control compartment. The auxiliary contacts shall be rated for 2 amps at 125 V DC.

.2 The circuit breaker shall be equipped with a mechanical operation counter arranged to count opening operations.

.3 The circuit breaker shall have a visual mechanical position indicator effectively connected to the operating mechanism. The indicator shall consist of a suitable sign utilizing green with the word "OPEN" when in the open position, and red with the word "CLOSED" when in the closed position.

.4 A SF6 temperature compensated gas pressure indicator(s) shall be provided (as applicable) for two stage alarm, indication and block of operation in the event of a loss of gas pressure. The first stage alarm shall indicate abnormal but safe SF6 pressure. The second stage alarm shall indicate a critical pressure. At the critical pressure each pole shall still have full current interrupting and overvoltage ratings. Each mechanism shall be wired to allow the option of having the mechanism remain in its current state for critical SF6 pressure on any pole, or having the mechanism trip when the critical pressure occurs on any pole.

.5 Pole tank heaters with controls shall be provided if required for the specific ambient temperature conditions specified herein.

.6 The circuit breaker shall have standard NEMA 4-hole, 4 inch x 4 inch flat terminal pad line terminals. The terminals shall be either tin-plated bronze or copper. NEMA 6-hole terminal pad line terminals is also acceptable.

.7 The operating mechanism shall have a latch check switch or hydraulic latch valve, as applicable.

2.1 CIRCUIT BREAKER (Cont'd)

.14 Enclosure Construction

.1 The overall assembly enclosure shall provide protection from ingress of rodents, insects, and moisture; and the possibility of arcing faults within the enclosure.

.2 The material for all external sides of the control enclosure and internal circuitry housing shall be minimum 12 gauge steel sheet.

.3 Access to all internal components from the front of the components' enclosure only.

.4 There shall be no access to medium voltage through side or rear sheets.

.5 All hardware (including door fittings, fasteners, etc.), all operating-mechanism parts, and other parts subject to abrasive action from mechanical motion shall be of either nonferrous materials, or galvanized or zinc-nickel-plated materials.

.6 Externally accessible hardware shall not be used for support of medium-voltage components or switch-operating mechanisms within the interrupting device.

.7 Grounding provisions shall also be provided for all assembly enclosures.

.8 Breaker housing shall be rated NEMA 3R and/or NEMA 4.

.9 Control cabinet shall be rated NEMA 4X.

.15 Outdoor Finish

.1 All enclosures shall be complete with a finish that shall conform to or exceed the applicable requirements of ANSI C57.12.28.

.2 During fabrication, the areas of structural parts that may later become inaccessible shall be given an anticorrosion primer to ensure that all surfaces are protected.

.3 Representative test specimens coated by the enclosure manufacturer's finishing system shall satisfactorily pass the following tests:

.1 2000 hours of exposure to salt-spray testing per ASTM B 117 with:

.2 Underfilm corrosion not to extend more than 1/32

.3 Loss of adhesion from bare metal not to extend more than 1/8

.4 1000 hours of humidity testing per ASTM D 4585 with no blistering as evaluated per ASTM D 714.

.5 500 hours of ultraviolet accelerated weathering testing per ASTM G 53 using lamp UVB-313 with no chalking as evaluated per ASTM D 659, and no more than a 10% reduction of paint gloss as evaluated per ASTM D 523.

.6 Crosshatch adhesion testing per ASTM D 3359 Method B with no loss of paint.

2.1 CIRCUIT BREAKER (Cont'd)

.15 (Cont'd)
.3 (Cont'd)
.7 160-inch-pound impact adhesion testing per ASTM D 2794 with no paint chipping or cracking.
.8 Oil resistance testing consisting of a 72-hour immersion bath in mineral oil with no shift in color, no streaking, no blistering, and no loss of hardness.
.9 3000 cycles of abrasion testing per ASTM 4060 with no penetration to the substrate.
.4 Certified test abstracts substantiating the above capabilities shall be furnished upon request.
.5 Touch-up materials-with complete instructions-shall be included for touch-up in the field.
.6 The finish shall be light gray, satisfying the requirements of ANSI Standard Z55.1 or No. 61 or No. 70; or shall be olive green, Munsell 7GY3.29/1.5.
.7 All elements of the support structure (i.e. legs, frame) not forming part of the breaker or control cabinet housing shall be hot-dipped galvanized steel.

.16 Enclosure Ventilation
.1 The enclosure shall be ventilated to prevent condensation.
.2 Vents shall be rain-resistant and corrosion-resistant.
.3 Each vent shall have an inside screen and baffle to exclude insects, to filter dust, and to protect against insertion of foreign objects.

.17 Gasketing and Sealing
.1 Door openings and openings for hinged bolted panels (and bolted panels providing access to low-voltage components) shall have resilient compression gasketing to prevent water from entering the enclosure.

.18 Low-Voltage Components
.1 All low-voltage components, shall be located in grounded metal enclosures separate from all medium-voltage components to provide isolation, and shall be arranged to allow complete accessibility for operation without exposure to medium voltage.
.2 Space heaters, where used, shall have a grounded, perforated, galvanized steel guard.
.3 To provide isolation from medium voltage, low-voltage wiring, except for short lengths such as at terminal blocks or at secondaries of sensing devices, shall be in grounded conduit or raceways.

.19 Physical Assembly
.1 The bottom plates of the structure shall be properly coated for mounting on concrete footings.

2.1 CIRCUIT BREAKER (Cont'd)

.19 (Cont'd)
.2 All exposed high-voltage unguarded live parts shall be a minimum of 3.7 vertical meters above the base of the assembly.
.3 Two diagonally located a two-hole NEMA grounding pads shall be supplied with the assembly. The terminals shall be either aluminium, tin-plated bronze or copper.

.20 Wind and Seismic Requirements
.1 The circuit breaker assembly performance shall meet the wind and seismic requirements of IEEE Standard 693 and shall be capable of remaining operational following the wind or the seismic event without need for immediate assistance.
.2 The Vendor shall perform wind and seismic analyses and shall supply three (3) copies of the analysis with the final equipment drawings.

2.2 EQUIPMENT IDENTIFICATION

.1 General
.1 Each and every device shall be provided with a clearly visible rating plate of weatherproof material, inscribed with the minimum information defined herein.
.2 Each and every device shall be provided with a clearly visible nameplate of weatherproof material, inscribed with the Owner-assigned device number.

.2 Warning Signs
.1 All external doors and hinged bolted panels providing access to medium or high voltage shall be provided with

.3 Rating Nameplates
.1 All devices supplied shall include all information as required by the ruling CSA Standards on an external nameplate, including the following where applicable:
.1 Manufacturer's name.
.2 Manufacturer's catalog number.
.3 Manufacturer's serial number.
.4 Operating voltage class.
.5 Basic impulse level (BIL) rating.
.6 Rated maximum continuous ampacity.
.7 Maximum withstand voltage and fault current.
.8 Where a device is one of a series of similar devices part of a larger production line, the batch number of the device shall be included on an external nameplate as an indication of the production line.

2.2 EQUIPMENT IDENTIFICATION (Cont'd)

.3 (Cont'd)
.1 (Cont'd)
.8 (Cont'd)
.1 The batch number shall not be required where the serial number can be used to identify the device production run.
.9 Short-circuit interrupting, and closing ratings (amperes, RMS symmetrical and MVA three-phase symmetrical at rated nominal voltage).
.10 Identification of insulating medium.
.11 Quantity of SF6 gas (where applicable) in litres.
.12 Mass in kilograms.
.13 Ratings of all internal auxiliary current transformers.
.14 Maximum tank pressure/vacuum strength.
.15 Year of manufacture.
.16 Space for Owner's serial number.
.17 Reference to Instruction Manual.
.18 Momentary withstand ratings (amperes, RMS asymmetrical).
.19 CSA and/or UL classification markings.
.20 Any and all information defined herein.

.4 Identifying Nameplate
.1 The Circuit Breaker assembly shall be provided with one (1) nameplate, engraved on 3mm thick plastic lamicoid, with the Owner's numerical designation for the Circuit Breaker.
.2 The identifying nameplate shall be secured to the Circuit Breaker control cabinet using permanent adhesive or permanent mechanical connection, suitable for permanent outdoor usage in the given atmospheric conditions.
.3 The identifying nameplate shall be 200mm long x 50mm high, white lettering on a black background. Letters shall be 38mm high, width as required.
.4 Designation shall be of the form:

2.3 MATERIALS

.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

2.4 WARRANTY

.1 All equipment, including accessories and tools, shall have a minimum three (3) year warranty against manufacturer's defects effective from the earlier date of the following:
.1 stantial completion of the work.
.2 (6) months following delivery to the Place of the Installation.

.2 Owner, through the Engineer, shall promptly give the Vendor notice in writing of observed defects and deficiencies that occur during the warranty period.

.3 Vendor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

.4 Vendor shall administer the waranty claims when indicated by Owner. The Owner shall have the right to assign the woranties to:
.1 The Project Company.
.2 The Purchasser of all or substantially all of the project assets.

.5 The Vendor shall name the Owner as beneficiary of the Warranty.Execution

2.5 FACTORY TESTS

.1 Circuit Breaker
.1 All standard tests as defined by CSA Standard C22.2 No. 31-04.

.2 Auxiliary Devices
.1 Current Transformers
.1 All Current Transformers shall be tested in accordance with CSA Standard C13 and shall include the secondary lead burdens.
.2 Tests shall include the following:
.3 Induced dielectric voltage test.
.4 Accuracy test.
.5 Polarity test.
.6 Ratio test.
.7 Winding impedance.
.2 Bushings
.1 All bushings shall be tested in accordance with applicable ANSI/IEEE standards and certified by the bushing manufacturer.
.2 All bushing test results shall be stamped on the bushing nameplate and recorded in the test results.
.3 Wiring
.1 Secondary circuit wiring of all auxiliary devices shall be checked to ensure correct functioning from initiating source (i.e.

2.5 FACTORY TESTS (Cont'd)

.2 (Cont'd)

.3 (Cont'd)

Purchaser's connection point) to component operation.

.2 Auxiliary wiring insulation tests shall include dielectric tests in accordance with ANSI Standard C37.20.

.3 Results

.1 All test results shall be recorded as performed.

.2 Official final documentation of the Factory Test results notwithstanding, the Vendor shall provide all test results to the Engineer in written form within 24 hours of completion by fax or email, and the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

.3 All test reports shall include the following information:

.1 Date of test.

.2 Confirmation that test results are acceptable.

.3 Initialled by Vendor.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Set and secure circuit breaker assembly in place on concrete pad, rigid, plumb and square.

.2 Make field connections in accordance with manufacturer's recommendations and design drawings.

.3 Connect ground bus to substation grounding grid.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Check instrument transformer ratings against shop drawings.

3.2 TESTING AND COMMISSIONING

.1 Overview

.1 General

.1 In general, provide electrical services in the testing and commissioning of the Circuit Breaker.

.2 The scheduling of all work shall be co-ordinated with Owner. The Contractor shall allow a minimum of five (5) Working Days for the Testing and Commissioning, weather-permitting.

3.2 TESTING AND COMMISSIONING (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.

.4 Should any test results be deemed unacceptable, whether due to test conditions, Contractor error, or required correction of an equipment deficiency, the Contractor shall be responsible for repeating the applicable test or tests.

.5 The Contractor, Commissioning Agent and the Engineer shall review all tests prior to the testing personnel leaving the site.

.2 Compliance with Standards and Codes

.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

.2 The Contractor shall adhere to the following standards during the process of testing and commissioning:

.1 Nova Scotia Provincial Standards

.1 Nova Scotia Occupational Health and Safety Act

.2 Nova Scotia Workers' Compensation Act.

.2 CSA Standards

.1 C22.1-06 Canadian Electrical Code Part I

.2 C22.3 Canadian Electrical Code Part III

.3 Z462-08 Workplace Electrical Safety

.3 ANSI/IEEE Standards

.1 .09-1999 IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

.2 . No. 472 Guide for Surge Withstand Capability (SWC) Tests

.3 Equipment

.1 The Contractor shall be responsible for the supply of all test equipment including but not limited to the following:

.1 10kV Doble Test Set.

.2 Meggar Test Set (or equivalent).

.3 Fluke Meter (or equivalent).

.4 Three-phase generator.

.5 Current meter.

.6 Voltage meter.

.7 Testing cables.

.8 Disconnect switch.

.9 Current transformer tester.

3.2 TESTING AND COMMISSIONING (Cont'd)

.2 Test Procedures

.1 General

.1 The Contractor shall test the circuit breaker and all accessories to the satisfaction of the Engineer as defined herein; the Contractor shall indicate and include any additional Vendor-recommended tests.

.2 The Contractor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.

.3 The Contractor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.

.4 All test results shall be provided to the Engineer in written form within 24 hours of completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.

.5 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

.6 All test reports shall include the following information:

.1 Name of testing firm.

.2 Date of test.

.3 Ambient temperature at time of test.

.4 Relative humidity at time of test.

.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).

.6 Confirmation that test results are acceptable.

.7 Initialled by Contractor.

.2 Circuit Breaker Testing

.1 The Contractor shall be required to provide the following tests, as a minimum, in addition to a visual inspection, on the Breaker and its auxiliary devices:

.1 Contact Resistance Test

.2 Breaker Timing Test (including all contact status states)

.3 Doble Insulation Test on each phase and to ground potential (frame)

.4 Current Transformer Tests

.1 The Contractor shall perform the following tests on each transformer CT, for all taps, based on the Manufacturer's recommended test procedures:

.1 Radio Test

.2 Magnetization Curve Test

.3 Secondary Resistance Test

3.2 TESTING AND COMMISSIONING (Cont'd)

.2 (Cont'd)
.2 (Cont'd)
.1 (Cont'd)
.5 Operational Test of all Gauges and Contacts

.3 Documentation
.1 Official Test Results
.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Contractor shall provide six (6) copies of final, offical test reports, type-written with the Contractor's signature of approval, to the Engineer following the completion of Testing. Submit electronic copy of results as well.
.2 The Contractor shall include the results of all on-site testing described herein.
.3 The Contractor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.
.4 The Contractor shall accompany the official test report with written approval that the field test results have been reviewed and the circuit breaker and all accessories have been found acceptable for energization and operation.

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Purchase, deliver to the Place of the Installation and install two (2) substation-mounted 34.5 kV three-phase microprocessor-controlled automatic circuit recloser assemblies, each complete with control unit, accessories, and special tools as defined herein.

.2 As a possible alternative will be considered the substitution of the aforementioned recloser assemblies with two (2) outdoor 34.5 kV three-phase circuit breaker assemblies. Each recloser shall meet or exceed the electrical ratings defined by this document. Each recloser shall be complete with associated current transformers and directional overcurrent relay required to create a complete MV recloser system.

.3 Site testing of the Recloser assemblies defined herein following installation and prior to energization, including all tests defined herein.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (Cx) Requirements

.3 Section 01 91 33 - Commissioning Forms

.4 Section 26 11 01 - Outdoor Substation

.5 Section 26 05 22 - Connectors and Terminations

.6 Section 26 05 27 - Grounding - Primary

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 CSA Standards
.1 C13-M83 Instrument Transformers
.2 C22.2 No. 94 Special Purpose Enclosures 2, 3, 4, 5
.3 W47.1-03 Certification of companies for fusion welding of steel structures
.4 W59-03 Welded steel constructions (Metal-Arc Welding)
.5 G164 Hot Dipped Galvanized or Irregularly Shaped Articles

1.3 REFERENCES (Cont'd)

.2 (Cont'd)
.6 C22.1-06 Canadian Electrical Code Part I
.7 C22.2 NO 31-04(R2009) Switchgear Assemblies

.3 EEMAC Standards
.1 GL1-3 Transformer and Apparatus Bushings

.4 ANSI/IEEE Standards
.1 C37.60 IEEE Standard Requirements for Overhead, Pad Mounted, Dry Vault, and Submersible Automatic Circuit Reclosers and Fault Interrupters for AC Systems
.2 Std. 321 IEEE Standard Guide for the Application, Operation, and Maintenance of Automatic Circuit Reclosers-Description
.3 C37.85-1989 American National Standard for Switchgear-Alternating-Current High-Voltage Power Vacuum Interrupters-Safety Requirements for X-Radiation Limits - Description
.4 C37.90 IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus
.5 C37.90.1 American National Standard Guide for Surge Withstand Capability (SWC) Tests
.6 C37.90.2 Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Tranceivers
.7 ASME BPVC Boiler and Pressure Vessels Code
.8 100 IEEE Standard Dictionary of Electrical and Electronics Terms
.9 1125 - 1993 IEEE Guide for Moisture Measurement and Control in SF6 Gas-Insulated Equipment
.10 693 Recommended Practice for Seismic Design of Substations

.5 IEC Standards
.1 60068-2-30 International Electromechanical Commission Standard for Basic Environmental Testing Procedures-Damp Heat, Steady State
.2 60255-2-5 Insulation Tests for Electrical Relays
.3 61000-4-2/60255-22-2 Electromagnetic Compatibility (EMC-Electrostatic Discharge Immunity Tests)
.4 60376 Ed. 2.0 b: 2005 Specification of technical grade sulfur hexafluoride (SF6) for use in electrical

.6 ISO Standards
.1 9000: 2000 Quality Management

.7 Unless otherwise noted, CSA Standards shall be given precedence when and where conflicts arise.

1.4 SUBMITTALS

.1 Provide operation and maintenance data for reclosers for incorporation into manual as specified in Section 01 10 00.

.2 Include:
- .1 Circuit Interrupter.
- .2 Operating mechanism.
- .3 Electronic controls.
- .4 Manual controls.
- .5 Accessories.
- .6 Software required to configure the units.

.3 Manufacturers' Drawings
- .1 Recloser assemblies drawings submitted for review showing assembly, details, and layout shall show anchor bolts, openings for cables, and all pertinent support structure loading details.
- .2 The manufacturer shall furnish, with each Recloser assembly, a set of drawings complete with a bill of material and showing: typical front views and open side views as well as typical components, their positions, and available space for cable termination; an anchor bolt plan with dimensions; a one-line diagram; and appropriate wiring diagrams.
- .3 Vendor's drawings submitted for review shall show all terminals, wire and terminal numbering and incorporate equipment schematic details. Drawings shall be submitted in AutoCAD format for review.
- .4 The Vendor shall supply three phase AC schematic diagrams and panel wiring diagrams for the Recloser assembly to be supplied.

.4 Operation and Maintenance Manuals
- .1 The manufacturer shall furnish a comprehensive instruction manual covering installation of the Recloser assembly and operation of the various components.
- .2 Instruction manuals shall describe in detail the construction and recommend procedures for assembling, dismantling, maintaining and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturers, of component parts of the equipment, properly catalogued for easy reference.
- .3 Instruction manuals shall be accompanied by copies of all Vendor's Drawings in AutoCAD format.

1.5 SHIPPING

.1 General
- .1 Prior to shipment, the following values shall be tested and recorded:
  - .1 Ambient temperature in °C.
  - .2 SF6 Gas Pressure in PSI (as applicable).

1.5 SHIPPING (Cont'd)

.1 (Cont'd)

.2 Responsibility for delivery shall belong to the Contractor, who shall provide for all delivery costs from factory to the Place of Installation, including but not limited to the following:

.1 Complete delivery from the Place of Manufacture to the Place of Installation at Digby County, Nova Scotia.

.2 Transportation of all accessories, including SF6 gas canisters if applicable, and parts to be shipped separately to the Place of Installation.

.3 If shipment of accessories and parts is to be made prior to delivery of the Recloser, the Vendor shall make arrangement with the Owner, through the Engineer, for an alternate delivery point.

.4 All necessary permits and regulatory costs involved in the transport of the Recloser, including but not limited to those imposed by the following bodies (such costs and requirements based on the size, weight, point of origin, and materials of the final product):

.5 Canada Border Services Agency.

.6 Transport Canada.

.7 Nova Scotia Department of Transportation and Infrastructure Renewal.

.2 Provisions

.1 All auxiliary current transformers shall be shipped shorted and grounded at the terminals located in the breaker control cabinet/frame.

.3 Follow-up

.1 Provide to the Engineer one (1) reproducible copy of the following within 24 hours of off-loading at the Place of the Installation:

.1 Ambient temperature in °C (before shipment and before off-loading).

.2 SF6 gas shipping pressure in PSI, if applicable (before shipment and before off-loading).

.3 List of any and all noted visible defects noted prior to off-loading.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials and spare parts in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 RECLOSERS

.1 Ratings

.1 The distribution system shall be solidly grounded.

.2 The ratings for the Recloser assembly shall be as designated below or greater:

.1 kV, Nominal 34.5

.2 kV, Maximum 38

.3 kV, BIL Minimum 150

.4 Amperes, Rated Continuous Current 800

.5 Amperes, Short-Circuit Ratings (minimum):

.1 Interrupting Current, RMS Symmetrical 12,500

.2 Close and Latch, Peak 30,000

.6 Cycles, Interrupting Time, Maximum 3

.7 Cycles, Closing Time Maximum 6

.8 Seconds, Reclosing Interval Time 0-60

.9 Seconds, Sequence Reset Time 10-120

.10 ± Per Cent, Current Sensor Accuracy 0.3 or higher

.1 Operating Temperature Range -40°C to 40°C

.2 V, Control Voltage 120AC, 125DC

.2 General

.1 The Recloser assembly shall consist of a self-contained, three-phase 34.5kV circuit-interrupting, load-breaking apparatus and a low-voltage microprocessor control apparatus providing protection, monitoring, control, and communications functions to the interrupting device.

.2 The interrupting function of the Recloser assembly shall be accomplished by SF6 or vacuum interruption within a solid insulating medium, one assembly per phase.

.3 The protection function of the assembly shall be accomplished by a local self-contained recloser control or enclosed directional overcurrent relay device with integral current transformers monitoring the level of current passing through the interrupting portion of the assembly, capable of remote operation.

.4 The assembly shall have clear external indicator of the assembly status (i.e. open or closed). The indicator shall be visible to persons within visual range of the assembly without accessing the control device.

.5 The assembly shall be capable of manual operation in the event of failure of all low-voltage control equipment, either via an integral switch handle assembly or hot-stick operation.

2.1 RECLOSERS (Cont'd)

.3 Protection, Communication, and Control

.1 The Recloser assembly shall be capable of integral directional overcurrent protection of an electrical distribution feeder without external involvement.

.2 The Recloser assembly shall be programmable to a minimum of all ANSI, IEC, and Recloser standard protection time-current curves.

.3 The Recloser assembly shall be capable of remote operation via SCADA using a set of binary input contacts and a remote communications module with RS232/485 outputs as a minimum.

.4 The Recloser assembly shall have an integral

.5 The Recloser control panel shall have an illuminated LCD display with keypad, pushbutton trip and close settings, and Hot-Line/Hold-Off Tag indicator. The LCD display shall allow access to real-time load monitoring, fault data, and protective functions, and shall be password protected.

.6 Special consideration shall be given to control units allowing load metering, fault recording, and fault locating.

.7 The following control and indication devices shall be provided localy at the control cabinet:

.1 A manual control switch to allow manual trip and lockout and manual close of the Recloser. This feature shall also allow "cold load" pickup.

.2 A reclosing

.3 A reclosing

.4 LED Indicator of "lockout" condition

.8 The Recloser shall be equipped with all the necessary interface terminal blocks, auxiliary contacts, switches, relays, coils and other auxiliary equipment connected to the control system, to permit remote control and indication.

.9 All alarm, auxiliary and spare contacts, control system remote outputs, AC and DC control and station service power supplies shall be grouped and prewired to dedicated interface terminal strips. Minimum 25% spare terminal blocks to be available on each terminal strip.

.4 Operating Mechanizm

.1 The Reclosers shall be provided with one operating mechanism for all three poles and shall be suitable for three-pole group opening and closing operations.

.2 The operating mechanism shall be fully-integrated and hermetically sealed to the atmosphere to eliminate corrosion and help providing maintenance-free performance with long term stability. The operating mechanism shall include all auxiliary devices and other accessories for the operating mechanism furnished. The mechanism, shall

2.1 RECLOSERS (Cont'd)

.4 (Cont'd)

.2 (Cont'd)

be electrically trip-free and shall include anti-pump auxiliary relays and devices.

.3 The operating mechanism enclosure shall contain minimum of one (1) space heater with sheaths of high-temperature chrome steel to maintain air circulation inside the enclosure, complete with thermostat.

.4 Operating mechanism equipment including piping and linkages shall be factory installed as completely as possible. The supplier shall provide all materials for connections which must be installed in the field.

.5 Control Cabinet

.1 All controls shall be housed within a low-voltage, self-contained, grounded NEMA 4X cabinet, separate from all high-voltage components to provide isolation, and shall be arranged to allow complete accessibility for operation without exposure to high voltage.

.2 The AC and DC power supply voltages shall be as specified in Section 1.2, Ratings. The AC and DC power will be provided by Others.

.3 One unfused, double-pole, single-throw, knifeblade-type, disconnect switch shall be provided for isolating the Trip Coil DC control power circuit during maintenance.

.4 The terminal strips and blocks shall be clearly labeled and the purpose or function of each connection shall be identified.

.5 The control cabinet shall contain minimum of one (1) space heater with sheaths of high-temperature chrome steel to maintain air circulation inside the enclosure, complete with thermostat.

.6 Control cabinet door shall have provision for pad-locking and placement of utility tags for safety and procedure identification.

.7 All external fasteners and hardware (such as bolts, screws, hinges, and handles) shall be stainless steel.

.8 All external auxiliary power and control wiring will be routed in conduit or feed-through wireway to the control cabinet.

.9 The cabinet shall be furnished with one 120 VAC, 20 amp, duplex convenience receptacle and control cabinet light.

.10 The interior of the control cabinet shall be painted white.

.11 The cabinet shall be capable of mounting up to 15 m remote from the recloser.

.6 Bushings

2.1 RECLOSERS (Cont'd)

.6 (Cont'd)

.1 Bushings shall be porcelain or polymer, ANSI Standard Z55.1 No. 61 or No. 70; or Munsell 5.0 BG 7.0/0.4 light gray colour.

.2 Bushings shall have a minimum flange seat to lower end length (strike distance) of 900 mm, with a minimum creepage distance of 1725 mm.

.3 The bushing BIL rating shall meet or exceed the breaker's BIL rating.

.7 Current Transformers

.1 The manufacturer shall provide one (1) bushing transformer on each Recloser bushing, both load and line side.

.2 All bushing current transformers shall have 5A nominal secondary ratings.

.3 All bushing current transformers shall have multi-ratio primary ratings with a minimum of 400A, 600A, 800A, and 1200A.

.4 All bushing current transformers shall be of C400 relaying accuracy or better at all tap settings.

.5 CT wiring shall be brought back to terminal blocks located within the transformer control cabinet.

.6 All current transformers shall be left connected at the 800:5A ratio.

.8 Insulating Media

.1 All insulating media shall be contained within an epoxy resin system with characteristics and restrictions as follows:

.1 Adequate leakage distance established by test per IEC publication 507, First Edition, 1975.

.2 Adequate strength for short-circuit stress established by test.

.3 Conformance with applicable ANSI standards.

.9 Wiring and Wiring Materials

.1 All auxiliary power and control wiring shall consist of 600 volt stranded copper switchboard wire, moisture resistant or thermosetting and shall be #14 AWG minimum.

.2 Use 7 strand or 19 strand conductors for #14 AWG and larger wire.

.3 Terminate all wires on devices with compression type connectors. Do not use spade lugs or soldered terminals. Do not connect more than three wires to any one stud or terminal.

.4 Use type written, heat shrink sleeve wire markers through out.

.5 Medium-voltage connections shall be made using 4-hole flat-pad terminals, suitable for up to 1000MCM conductor.

2.1 RECLOSERS (Cont'd)

.10 Outdoor Finish

.1 The finish on painted metal parts shall be light gray, satisfying the requirements of ANSI Standard Z55.1 or No. 61 or No. 70; or Munsell 5.0 BG 7.0/0.4. Supplier shall supply one quart of touch-up paint per circuit breaker.

.2 All elements of the support structure (i.e. legs, frame) not forming part of the breaker or control cabinet housing shall be hot-dipped galvanized steel.

.3 During fabrication, the areas of structural parts that may later become inaccessible shall be given an anticorrosion primer to ensure that all surfaces are protected.

.4 Cast aluminum, aluminum, and stainless steel components shall be left in their natural finish.

.5 All external fasteners and hardware (such as bolts, screws, hinges, and handles) shall be stainless steel and shall not be painted.

.11 Physical Assembly

.1 The bottom plates of the structure shall be properly coated for mounting on concrete footings.

.12 Wind and Seismic Requirements

.1 The Recloser assembly performance shall meet the wind and seismic requirements of IEEE Standard 693 and shall be capable of remaining operational following the wind or the seismic event without need for immediate assistance.

.2 The Vendor shall perform wind and seismic analyses and shall supply three (3) copies of the analysis with the final equipment drawings.

2.2 ACCESSORIES

.1 Recloser control unit or directional overcurrent relay as defined within this document, assembled within a self-contained enclosure (control cabinet) with heating.

.2 Mounting frame accessory, suitable for supporting the complete MV recloser assembly, including both the medium-voltage interrupting apparatus and control cabinet, while maintaining adequate clearances of medium voltage conductors to finished grade of at least 3.7 metres. Frame shall be constructed to be securely fastened to a concrete pad.

.3 Where not integral to the assembly, a total of three (3) instrument current transformers as detailed in this document shall be provided per MV recloser assembly.

2.2 ACCESSORIES (Cont'd)

.4 The Recloser shall be equipped with a mechanical operation counter arranged to count opening operations.

.5 Auxiliary switch (c/w one spare switch) shall be provided for monitoring the position of the recloser main contacts by the recloser control unit.

.6 The Recloser shall have a visual mechanical position indicator effectively connected to the operating mechanism. The indicator shall consist of a suitable sign utilizing green with the word "OPEN" when in the open position, and red with the word "CLOSED" when in the closed position.

.7 Pole tank heaters with controls shall be provided if required for the specific ambient temperature conditions specified herein.

.8 The Recloser shall have standard NEMA 4-hole, 4 inch x 4 inch flat terminal pad line terminals. The terminals shall be either tin-plated bronze or copper. NEMA 6-hole terminal pad line terminals is also acceptable.

2.3 EQUIPMENT IDENTIFICATION

.1 General

.1 Each and every device shall be provided with a clearly visible rating plate of weatherproof material, inscribed with the minimum information defined herein.

.2 Each and every device shall be provided with a clearly visible nameplate of weatherproof material, inscribed with the Owner-assigned device number.

.2 Warning Signs

.1 All external doors and hinged bolted panels providing access to medium or high voltage shall be provided with

.3 Rating Nameplates

.1 All devices supplied shall include all information as required by the ruling CSA Standards on an external nameplate, including the following where applicable:

.1 Manufacturer's name.
.2 Manufacturer's catalog number.
.3 Manufacturer's serial number.
.4 Operating voltage class.
.5 Basic impulse level (BIL) rating.
.6 Rated maximum continuous ampacity.
.7 Maximum withstand voltage (kV) and fault current (amperes, RMS asymmetrical and peak)

2.3 EQUIPMENT IDENTIFICATION (Cont'd)

.3 (Cont'd)

.1 (Cont'd)

.8 Momentary withstand ratings (amperes, RMS asymmetrical).

.9 Where a device is one of a series of similar devices part of a larger production line, the batch number of the device shall be included on an external nameplate as an indication of the production line.

.10 The batch number shall not be required where the serial number can be used to identify the device production run.

.11 .Short-circuit interrupting, and closing ratings (amperes, RMS symmetrical and MVA three-phase symmetrical at rated nominal voltage).

.12 Identification of insulating medium.

.13 Quantity of SF6 gas (where applicable) in litres.

.14 Ratings of all internal auxiliary current transformers.

.15 Maximum tank pressure/vacuum strength.

.16 Mass in kilograms.

.17 Year of manufacture.

.18 Space for Owner's serial number.

.19 Reference to Instruction Manual.

.20 CSA and/or UL classification markings.

.21 Any and all information defined herein.

.4 Identifying Nameplate

.1 The Recloser assemblies shall be provided with one (1) nameplate, engraved on 3mm thick plastic lamicoid, with the Owner's numerical designation for the Power Transformer.

.2 The identifying nameplate shall be secured to the Recloser control cabinet using permanent adhesive or permanent mechanical connection, suitable for permanent outdoor usage in the given atmospheric conditions.

.3 The identifying nameplate shall be 200mm long x 50mm high, white lettering on a black background. Letters shall be 38mm high, width as required.

.4 Designation shall be of the form:

2.4 MATERIALS

.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

2.5 WARRANTY

.1 All equipment, including accessories and tools, shall have a minimum three (3) year warranty against manufacturer's defects effective from the earlier date of the following:
.1 Substantial completion of the work.
.2 Six (6) months following delivery to the Place of the Installation.

.2 The Owner, through the Engineer, shall promptly give the Contractor notice in writing of observed defects and deficiencies that occur during the warranty period.

.3 The Contractor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

.4 The Contractor shall administer the waranty claims when indicated by Owner. The Owner shall have the right to assign the woranties to:
.1 The Project Company.
.2 The Purchasser of all or substantially all of the project assets.

.5 The Contractor shall name the Owner as beneficiary of the Warranty.

2.6 FACTORY TESTS

.1 Recloser
.1 All standard tests as defined by Section 7.0 of the ANSI/IEEE Standard

.2 Auxiliary Devices
.1 Current Transformers
.1 All Current Transformers shall be tested in accordance with CSA Standard C13 and shall include the secondary lead burdens.
.2 Tests shall include the following:
.1 Induced dielectric voltage test.
.2 Accuracy test.
.3 Polarity test.
.4 Ratio test.
.5 Winding impedance.
.6 Injection test.

.3 Bushings
.1 All bushings shall be tested in accordance with applicable ANSI/IEEE standards and certified by the bushing manufacturer.
.2 All bushing test results shall be stamped on the bushing nameplate and recorded in the test results.

2.6 FACTORY TESTS (Cont'd)

.4 Wiring
.1 Secondary circuit wiring of all auxiliary devices shall be checked to ensure correct functioning from initiating source (i.e. Purchaser's connection point) to component operation.
.2 Auxiliary wiring insulation tests shall include dielectric tests in accordance with ANSI Standard C37.20.

.5 Results
.1 All test results shall be recorded as performed.
.2 Official final documentation of the Factory Test results notwithstanding, the Contractor shall provide all test results to the Engineer in written form within 24 hours of completion by fax or email, and the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.
.3 All test reports shall include the following information:
.1 Date of test.
.2 Confirmation that test results are acceptable.
.3 Initialled by Vendor.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Set and secure Recloser assemblies in place on concrete pad, rigid, plumb and square.

.2 Make field connections in accordance with manufacturer's recommendations and design drawings.

.3 Connect Recloser ground pad to substation grounding grid.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Check instrument transformer ratings against shop drawings.

3.2 TESTING AND COMMISSIONING

.1 Overview
.1 General
.1 In general, provide electrical services in the testing and commissioning of the Reclosers in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Section 01 91 33 - Commissioning (Cx) Forms.

3.2 TESTING AND COMMISSIONING (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

.2 The scheduling of all work shall be co-ordinated with Owner's Representative to ensure that no delays are caused by interference between persons operating on site under different contracts. The Contractor shall allow a minimum of five (5) Working Days for the Testing and Commissioning, weather-permitting.

.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.

.4 Should any test results be deemed unacceptable, whether due to test conditions, Contractor error, or required correction of an equipment deficiency, the Contractor shall be responsible for repeating the applicable test or tests.

.5 The Contractor and the Engineer shall review all tests prior to the testing personnel leaving the site.

.2 Compliance with Standards and Codes

.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

.2 The Contractor shall adhere to the following standards during the process of testing and commissioning:

.1 Nova Scotia Provincial Standards

.2 Nova Scotia Occupational Health and Safety Act

.3 Nova Scotia Workers' Compensation Act.

.4 CSA Standards

.1 C22.1-06 Canadian Electrical Code Part I

.2 C22.3 Canadian Electrical Code Part III

.3 Z462-08 Workplace Electrical Safety

.5 ANSI/IEEE Standards

.1 C37.09-1999 IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

.2 Std. No. 472 Guide for Surge Withstand Capability (SWC) Tests

.3 Equipment

.1 The Contractor shall be responsible for the supply of all test equipment including but not limited to the following:

.1 10kV Doble Test Set.

.2 Meggar Test Set (or equivalent).

3.2 TESTING AND COMMISSIONING (Cont'd)

.1 (Cont'd)
.3 (Cont'd)
.1 (Cont'd)
.3 Fluke Meter (or equivalent).
.4 Three-phase generator.
.5 Current meter.
.6 Voltage meter.
.7 Testing cables.
.8 Disconnect switch.
.9 Current transformer tester.

.2 Test Procedures
.1 General
.1 The Contractor shall test the Reclosers and all accessories to the satisfaction of the Engineer as defined herein; the Contractor shall indicate and include any additional Vendor-recommended tests.
.2 The Contractor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.
.3 The Contractor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.
.4 All test results shall be provided to the Engineer in written form within 24 hours of completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.
.5 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.
.6 All test reports shall include the following information:
.1 Name of testing firm.
.2 Date of test.
.3 Ambient temperature at time of test.
.4 Relative humidity at time of test.
.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).
.6 Confirmation that test results are acceptable.
.7 Initialled by Contractor.
.2 Recloser Testing
.1 The Contractor shall be required to provide the following tests, as a minimum, in addition to a visual inspection, on the Recloser and its auxiliary devices:
.1 Contact Resistance Test
.2 Recloser Timing Test (including all contact status states)

3.2 TESTING AND COMMISSIONING (Cont'd)

.2 (Cont'd)

.2 (Cont'd)

.1 (Cont'd)

.3 Doble Insulation Test on each phase and to ground potential (frame)

.4 Current Transformer Tests

.1 The Contractor shall perform the following tests on each transformer CT, for all taps, based on the Manufacturer's recommended test procedures:

.1 Radio Test.

.2 Magnetization Curve Test.

.3 Secondary Resistance Test.

.5 Operational Test of all Gauges and Contacts

.3 Documentation

.1 Official Test Results

.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Contractor shall provide six (6) copies of final, official test reports, type-written with the Contractor's signature of approval, to the Engineer following the completion of Testing.

.2 The Contractor shall include the results of all on-site testing described herein.

.3 The Contractor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.

.4 The Contractor shall accompany the official test report with written approval that the field test results have been reviewed and the Reclosers and all accessories have been found acceptable for energization and operation.

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Purchase, deliver to the Place of the Installation and install three (3) single phase Metering Class 69 kV Revenue Metering Units; three (3) Protection Class 69 (39.8 kV) kV Potential Transformers, two (2) Protection Class 34.5 kV Potential Transformers and six (6) Protection Class 34.5 (19.92) kV Potential Transformers, suitable for outdoor mounting, complete with accessories and special tools as defined herein.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 11 01 - Outdoor Substation

.3 Section 26 05 22 - Connectors and Terminations

.4 Section 26 05 27 - Grounding - Primary

.5 Section 01 91 13 - General Commissioning (Cx) Requirements

.6 Section 01 91 33 - Commissioning (Cx) Forms

1.3 REFERENCES

.1 The Circuit Breaker Assembly shall conform to or exceed the applicable requirements of the latest edition standards and recommended practices referenced herein.

.2 CSA Standards
.1 C13-M83, Instrument Transformers
.2 CSA CAN3-C17, Alternating- Current Electricity Metering

.3 ANSI/IEEE Standards
.1 IEEE C93.1, Power-Line Carrier Coupling Capacitors and Coupling Capacitor Voltage Transformers (CCVT)
.2 IEEE C57.13, IEEE standard requirements for instrument transformers.
.3 ANSI C37.34, Test Code for High Voltage Potential Transformers

.4 IEC Standards
.1 IEC 815, Guide for the Selection of Insulators in Respect of Polluted Conditions

1.3 REFERENCES (Cont'd)

.5 ISO Standards
.1 9000: 2000, Quality Management

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 10 00.

.2 Indicate dimensions and connection details.

1.5 SUBMITTALS

.1 Provide operation and maintenance data for reclosers for incorporation into manual as specified in Section 01 10 00.

.2 Manufacturers' Drawings
.1 Metering Unit and Potential Transformer assembly drawings submitted for review showing assembly, details, and layout shall show anchor bolts, openings for cables, and all pertinent support structure loading details.
.2 The manufacturer shall furnish a set of drawings complete with a bill of material and showing: typical front views and open side views as well as typical components, their positions, and available space for cable termination; and an anchor bolt plan with dimensions.
.3 Vendor's drawings submitted for review shall show all terminals, wire and terminal numbering and incorporate equipment schematic details. Drawings are to be submitted in AutoCAD format for review.

.3 Operation and Maintenance Manuals
.1 The manufacturer shall furnish a comprehensive instruction manual covering installation of the metering equipment and operation of the various components.
.2 Instruction manuals shall describe in detail the construction and recommend procedures for assembling, dismantling, maintaining and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturers, of component parts of the equipment, properly catalogued for easy reference.

1.6 SHIPPING

.1 General
.1 Responsibility for delivery shall belong to the Vendor, who shall provide for all delivery costs from

1.6 SHIPPING (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

factory to the Place of Installation, including but not limited to the following:

.1 Complete delivery from the Place of Manufacture to the Place of Installation at Digby County, Nova Scotia.

.2 Transportation of all accessories and parts to be shipped separately to the Place of Installation.

.3 All necessary permits and regulatory costs involved in the transport of the metering equipment, including but not limited to those imposed by the following bodies (such costs and requirements to be based on the size, weight, point of origin, and materials of the final product):

.1 Canada Border Services Agency.

.2 Transport Canada.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal.

.4 Following delivery to the Place of Installation but prior to off-loading, the Contractor shall be responsible for the following:

.1 Visually inspect the Works to ensure no superficial damage during the transportation process:

.2 Follow-up

.1 The Contractor shall provide to the Engineer one (1) reproducible copy of the following within 24 hours of off- loading at site:

.1 List of any and all noted visible defects noted prior to off-loading.

PART 2 - PRODUCTS

2.1 INSTRUMENT TRANSFORMERS

.1 Ratings

.1 The transmission system shall be a solidly grounded 60 Hz system.

.2 The ratings for the Revenue Metering Units and the Instrument Transformers shall be as designated below or greater:

.1 Three (3) 69 kV Revenue Metering Units

.1 kV, Voltage Rating, Primary: 39.8

.2 V, Voltage Rating, Secondary: 120

.3 kV, BIL: 350

.4 Voltage Transformer Accuracy, %: 0.3

.5 Thermal Burden Rating, (VA): 2000

.6 Rated Current (A): 200

.7 Current Ratio: 200:5

2.1 INSTRUMENT TRANSFORMERS (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

.1 (Cont'd)

.8 Current Transformer Accuracy (@ Rating Factor 1.5): 0.3B1.8

.9 Operating Temperature Range, oC: -40 to +50

.2 Three (3) 69 kV (39.8 kV) Potential Transformers

.1 kV, Voltage Rating, Primary: 39.8

.2 V, Voltage Rating, Secondary: 120

.3 kV, BIL: 350

.4 Voltage Transformer Accuracy, %: 0.3

.5 Thermal Burden Rating, (VA): 2000

.6 Operating Temperature Range, oC: -40 to +50

.3 Two (2) 34.5 kV Potential Transformers

.1 kV, Voltage Rating, Primary: 34.5

.2 V, Voltage Rating, Secondary: 120

.3 kV, BIL: 200

.4 Voltage Transformer Accuracy, %: 0.3

.5 Thermal Burden Rating, (VA): 1000

.6 Operating Temperature Range, oC: -40 to +50

.4 Six (6) 34.5 kV (19.92 kV) Potential Transformers

.1 kV, Voltage Rating, Primary: 19.92

.2 V, Voltage Rating, Secondary: 120

.3 kV, BIL: 200

.4 Voltage Transformer Accuracy, %: 0.3

.5 Thermal Burden Rating, (VA): 1000

.6 Operating Temperature Range, oC: -40 to +50

.2 General

.1 The 69 kV Revenue Metering Units shall be outdoor, single phase, oil- filled metering unit approved by Measurement Canada for revenue metering. The Metering Units shall have two fully insulated coils for both current and voltage measurement.

.2 The 69 kV Potential Transformer shall be outdoor single phase, dual ratio, oil-filled, metering/relaying type.

.3 Non-oil-filled, dry, molded epoxy shall be considered an acceptable alternative.

.4 The 34.5 kV Potential Transformer shall be outdoor, single phase, dual ratio, dry, molded epoxy, metering/relaying type.

.5 All units shall be suitable for installation on galvanized steel substantion structure in an upright position.

2.1 INSTRUMENT TRANSFORMERS (Cont'd)

.3 69 kV Metering Unit and 69 kV Potential Transformer Construction

.1 The overall construction of the 69 kV Metering Unit and 69 kV Potential Transformer shall be corrosion resistant.

.2 The Metering Unit and the Potential Transformer oil tank and expansion chamber shall be epoxy coated galvanized steel, pressure and vacuum tight and hermetically sealed at the factory to prevent breathing and oil contamination.

.3 The Metering Unit dome shall be corrosion resistant aluminum c/w stainless steel expansion bellows to allow for the expansion/contraction of the oil for temperature and load fluctuations.

.4 The primary bushings shall be ANSI 70 grey, high strength porcelain or polymer with high degree of stability for transportation and seismic withstand.

.5 The primary terminal shall be NEMA 4-hole pads able to accept copper or aluminum conductors.

.6 The ground terminal shall be an integral NEMA 2-hole configuration on the tank wall.

.7 The secondary terminals shall be M8 hex head with associated hardware located inside a hinged cover terminal box.

.8 The units shall be fitted with a 5kV Ho terminal, oil level indicator and oil sampling/drain valve.

.4 34.5 kV Potential Transformers Construction

.1 The overall construction of the Potential Transformers shall be corrosion resistant.

.2 The core and coil assembly shall be wound and encapsulated in a high dielectric strength epoxy resin to provide high withstand capabilities.

.3 The primary terminals shall be M12 stud with compression type lug accepting #8 to #2 AWG copper or aluminum conductors.

.4 The secondary terminals shall clamp type c/w associated hardware located inside a hinged cover terminal box.

.5 Insulating Media

.1 Insulating oil shall meet or exceed Envirotemp FR3 according to the following criteria:

.1 Minimum dielectric strength in accordance with ASTM D877.

.2 Maximum viscosity of 33cSt at 40°C, 8.0cSt at 100°C to ASTM D445.

.3 Minimum flash point of 324°C to ASTM D92.

.4 Minimum fire point of 360°C to ASTM D92.

.5 Biodegradable.

2.2 EQUIPMENT IDENTIFICATION

.1 Ratings Nameplates

.1 The Revenue Metering Units and the Instrument Transformers shall be provided with an external nameplate securely fastened indicating the the following information:

- .1 Manufacturer's Name
- .2 Type
- .3 Manufacturer's Serial Number
- .4 Voltage Ratings (nominal; kV, maximum; kV, BIL as applicable)
- .5 Frequency Rating (Hz)
- .6 Schematic Diagram
- .7 Accuracy/Burden
- .8 Total Weight
- .9 Date of Manufacture (Month and Year)
- .10 When the instrument transformer is CSA or UL listed, the external nameplate shall include the classification markings

.2 The potential transformers nameplate shall indicate also the following information:

- .1 Voltage Rating Primary (kV)
- .2 Voltage Rating Secondary (V)
- .3 The voltage ratios available and the connections required for a particular ratio
- .4 Thermal Burden Rating (VA)

2.3 MATERIALS

.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

2.4 WARRANTY

.1 All equipment, including accessories and tools, shall have a minimum two (2) year warranty against manufacturer's defects effective from the earlier date of the following:

- .1 Substantial completion of the work.
- .2 Six (6) months following delivery to site.

.2 The Owner, through the Engineer, shall promptly give the Contractor notice in writing of observed defects and deficiencies that occur during the warranty period.

.3 The Contractor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

2.4 WARRANTY (Cont'd)

.4 The Contractor shall administer the warranty claims when indicated by Owner. The Owner shall have the right to assign the warranties to:
.1 The Project Company.
.2 The Purchaser of all or substantially all of the project assets.

.5 The Contractor shall name the Owner as beneficiary of the Warranty.

2.5 FACTORY TESTS

.1 The Metering Unit and the Potential Transformers shall be individually and completely tested in accordance with CSA Standard C13 and/or IEEE Standard C57.13.

.2 The Vendor shall provide evidence that the manufacturing quality assurance program in accordance with ISO 9001 is established and maintained.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install instrument transformers as indicated by design drawings and Manufacturer's Installation Manuals and ensure accessibility.

3.2 TESTING AND COMMISSIONING

.2 Overview
.1 General
.1 In general, provide electrical services in the testing and commissioning of the Instrument Transformers in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Section 01 91 33 - Commissioning (Cx) Forms.
.2 The scheduling of all work shall be co-ordinated with Owner and Purchaser to ensure that no delays are caused by interference between persons operating on site under different contracts. The Contractor shall allow a minimum of five (5) Working Days for the Testing and Commissioning, weather- permitting.
.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.
.4 Should any test results be deemed unacceptable, whether due to test conditions, Contractor error, or required correction of an equipment deficiency, the Contractor shall be responsible for repeating the applicable test or tests.

3.2 TESTING AND COMMISSIONING (Cont'd)

.2 (Cont'd)
.1 (Cont'd)
.5 The Contractor and the Engineer shall review all tests prior to the testing personnel leaving the site.
.2 Compliance with Standards and Codes
.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.
.2 The Contractor shall adhere to the following standards during the process of testing and commissioning:
.1 Nova Scotia Provincial Standards
.2 Nova Scotia Occupational Health and Safety Act
.3 Nova Scotia Workers' Compensation Act.
.4 CSA Standards
.1 C22.1-06, Canadian Electrical Code Part I
.2 C22.3, Canadian Electrical Code Part III
.3 Z462-08, Workplace Electrical Safety
.4 C13-M83, Instrument Transformers
.5 ANSI/IEEE Standards
.1 IEEE C57.13, IEEE standard requirements for instrument transformers.
.2 ANSI C37.34, Test Code for High Voltage Potential Transformers
.3 Std. No. 472, Guide for Surge Withstand Capability (SWC) Tests
.3 Equipment
.1 The Contractor shall be responsible for the supply of all required test equipment.

.3 Test Procedures
.1 General
.1 The Contractor shall test the Instrument Transformers to the satisfaction of the Engineer as defined herein; the Contractor shall indicate and include any additional Vendor-recommended tests.
.2 The Contractor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.
.3 The Contractor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.
.4 All test results shall be provided to the Engineer in written form within 24 hours of

3.2 TESTING AND COMMISSIONING (Cont'd)

.3 (Cont'd)

.1 (Cont'd)

.4 (Cont'd)

completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.

.5 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

.6 All test reports shall include the following information:

.1 Name of testing firm.

.2 Date of test.

.3 Ambient temperature at time of test.

.4 Relative humidity at time of test.

.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).

.6 Confirmation that test results are acceptable.

.7 Initialed by Contractor.

.4 Documentation

.1 Official Test Results

.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Contractor shall provide six (6) copies of final, official test reports, type-written with the Contractor's signature of approval, to the Engineer following the completion of Testing.

.2 The Contractor shall include the results of all on-site testing described herein.

.3 The Contractor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.

.4 The Contractor shall accompany the official test report with written approval that the field test results have been reviewed and the Instrument Transformers and all accessories have been found acceptable for energization and operation.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 - PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
.1 Install circuit breakers in panelboards before shipment.
.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: bus and breakers rated for 18,000 A (symmetrical) minimum interrupting capacity respectively or as indicated on electrical drawings.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

2.1 PANELBOARDS (Cont'd)

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two keys for each panelboard and key panelboards alike.

.6 Tin plated aluminum bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Bolt-on breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry as indicated. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

.5 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits as indicated.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4 ACCEPTABLE MANUFACTURERS

.1 Cutler-Hammer, Pow-R-Line.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on unistrut channel support frame. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.

.4 Connect panelboard to source transformer or circuit breaker/disconnect switch as indicated.

.5 Connect loads to circuits.

.6 Connect neutral conductors to common neutral bus with respective neutral identified.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
.2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55, Special Use Switches.

.4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-way switches as indicated to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:
.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine moulding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory toggle.
.6 Specification grade.

2.1 SWITCHES (Cont'd)

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable products:
.1 Hubbel HBL 1201 W,
.2 Leviton 1201-2W,
.3 Pass and Seymour.

2.2 RECEPTACLES

.1 Heavy duty, specification grade duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
.1 Urea moulded housing, ivory colour.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.
.6 Nylon face.
.7 Standard of acceptance: Hubbell #HBL5262I.
.8 Acceptable Manufacturers: Hubbel, Pass & Seymour, CWD (Cooper Wiring Devices), Leviton.

.2 Heavy duty, specification grade duplex ground fault circuit interrupter (GFCI) receptacles, CSA type 5 15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
.1 Indicator light,
.2 Test trip function,
.3 Urea moulded housing, ivory colour.
.4 Maximum trip threshold of 5 mA.
.5 Standard of acceptance: Hubbell #GF5262IA.
.6 Acceptable Manufacturers: Hubbel, Pass & Seymour, CWD (Cooper Wiring Devices), Leviton.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

2.3 COVER PLATES (Cont'd)

.3 Brushed stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Electrogalvanized or cast cover plates with gaskets for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Switches:
.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Receptacles:
.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
.2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical.
.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:
.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
.2 Install suitable common cover plates where wiring devices are grouped.
.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Install spring loaded weatherproof cover plates for exterior applications.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CSA C22.2No.248.12 , Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 10 00.

.2 Submit fuse performance data characteristics for each fuse type and size above 100 A. Performance data to include: average melting time-current characteristics.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in moisture free location.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 10 00.

.2 Six spare fuses of each type and size installed.

PART 2 - PRODUCTS

2.1 FUSES GENERAL

.1 Fuses: product of one manufacturer for entire project.

.2 Low voltage fuses, types as specified shall be CSA certified in accordance with CSA Standard C22.2 No.248.

2.2 FUSE TYPES

.1 All fuses shall be high rupturing capacity (HRC) type, minimum 200 kA interrupting rating (momentary RMS).

.2 Class J fuses.
.1 Fuses rated 1 to 600 amperes, 600 VAC, shall be CSA certified class J in accordance with CSA Standard C22.2 No.248.8.
.2 Where a time delay characteristic is required fuses shall be capable of carrying 500% of its rated current for 10 s minimum and shall be clearly labelled

.3 Class CC.
.1 Fuses rated 1 to 30 amperes, 600 VAC, shall be CSA certified class CC in accordance with CSA Standard C22.2 No.248.4.
.2 Where a time delay characteristic is required fuses shall be capable of carrying 200% of its rated current for 12 s minimum.

.4 Standard of acceptance
.1 Class J: Ferraz Shawmut type A4J (non-time delay), AJT (time delay) and HSJ (time delay).
.2 Class CC: Ferraz Shawmut type ATMR (non-time delay), ATDR (time delay) and ATQR (time delay).

2.3 FUSE CABINET

.1 Provide wall mounted fuse cabinet to house spare fuses. Size appropriate for quantity of spare fuses.

2.4 ACCEPTABLE MANUFACTURERS

.1 Ferraz Shawmut.

.2 Bussman.

.3 Litlefuse.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Ensure fuse size is correctly identified on equipment.

.5 For feeder circuit fuses, use fast acting Class J fuses unless otherwise noted.

.6 For full voltage non-reversing motor starters, full voltage reversing motor starters, full voltage multi-speed motor starters and transformers, use time delay Class J fuses.

.7 For 600 VAC control circuits use Class CC type fuses. Use time delay Class CC fuses upstream of control transformers and solenoids.

.8 Provide 10% spare fuses of each type and capacity (minimum amount shall be three). Place spare fuses in spare fuse cabinet.

.9 Fuse cabinet to be wall mounted with top no higher than 2 meters.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for moulded-case circuit breakers.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 11 01 - Unit Substation.

.4 Section 26 24 17 - Panelboard Breaker Type

1.3 References

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA International).
.1 CSA-C22.2 No., Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 10 00.

.2 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with

2.1 BREAKERS GENERAL (Cont'd)

.3 (Cont'd) adjustable trips to range from 3-8 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of 18,000 A symmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 Provide ground fault interrupter type for circuits as indicated.

2.3 MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time short time, instantaneous tripping for phase and ground fault short circuit protection. Trip unit shall have independent adjustable long time and short time pick-up and delay, instantaneous pick-up, ground fault pick-up and ground fault delay.

2.5 OPTIONAL FEATURES

.1 Include as indicated by the design drawings:
.1 Shunt trip.

.2 Auxiliary switch.

.3 Under-voltage release.

.4 On-off locking device.

.5 Handle mechanism.

2.6 ENCLOSURE .1 Provide NEMA 1 type enclosure, sprinkler proof as indicated.

2.7 ACCEPTABLE MANUFACTURERS .1 Cutler-Hammer.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install circuit breakers as indicated.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Purchase, deliver to the Place of the Installation and install one (1) 69 kV three-phase group-operated motorized disconnect assembly, complete with accessories and special tools as defined herein. The switch shall be 600A (minimum) continuous current, three-phase group-operated load- break/load-make to the extent indicated herein, suitable for upright mounting, with motorized switch operator and auxiliary status contacts.

.2 Purchase, deliver to the Place of the Installation and install four (4) designs of 34.5 kV three-phase group- operated disconnect assembly,

.1 Design "A" suitable for upright mounting, complete with accessories and special tools as defined herein. The switch shall be 1200A (minimum) continuous current, three-phase group-operated load break disconnect assembly with auxiliary status contacts.

.2 Design "B" suitable for vertical mounting, complete with accessories and special tools as defined herein. The switch shall be 600A (minimum) continuous current, three-phase group- operated load break disconnect assembly.

.3 Design "C" suitable for vertical mounting, complete with accessories and special tools as defined herein. The switch shall be 600A (300A also acceptable) continuous current, three- phase group-operated load break disconnect assembly.

.1 Two (2) 3 m insulated hooksticks suitable for operation of design "C" switches.

.4 Design "D" suitable for vertical mounting, complete with accessories and special tools as defined herein. The switch shall be 600A (minimum) continuous current, three-phase group- operated non-load disconnect assembly.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements

.2 Section 26 11 01 - Outdoor Substation

.3 Section 26 05 22 - Connectors and Terminations

.4 Section 26 05 27 - Grounding - Primary

.5 Section 01 91 13 - General Commissioning (Cx) Requirements

.6 Section 01 91 33 - Commissioning (Cx) Forms

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 CSA Standards
.1 C156.1, Ceramic and Glass Station Post Insulators
.2 G164, Hot Dipped Galvanized or Irregularly Shaped Articles
.3 W59, Welded Steel Construction (metal-ark welding)

.3 NEMA Standards
.1 Std. SG-6, Power Switching Equipment

.4 ANSI/IEEE Standards
.1 C37.30, Requirements for High-Voltage Air Switches
.2 C37.32, Preferred Ratings and Manufacturer Specs for High-Voltage Switches
.3 C37.33, Rated Control Voltages and Ranges for High-Voltage Switches
.4 C37.34, Test Code for High- Voltage Air Switches
.5 C37.90.1, American National Standard Guide for Surge Withstand Capability (SWC) Tests

.5 ISO Standards
.1 9000: 2000, Quality Management

.6 Unless otherwise noted, CSA Standards shall be given precedence when and where conflicts arise.

1.4 SUBMITTALS

.1 Provide operation and maintenance data for disconnect switches for incorporation into manual as specified in Section 01 10 00.

.2 Manufacturers' Drawings
.1 Disconnect Switch assembly drawings submitted for review showing assembly, details, and layout shall show anchor bolts, openings for cables, and all pertinent support structure loading details.
.2 The manufacturer shall furnish a set of drawings complete with a bill of material and showing: typical front views and side views as well as typical components, their positions, and available space for cable termination; and an anchor bolt plan with dimensions.
.3 Vendor's drawings submitted for review shall show all terminals, wire and terminal numbering and incorporate equipment schematic details.

1.4 SUBMITTALS (Cont'd)

.3 Operation and Maintenance Manuals

.1 The manufacturer shall furnish a comprehensive instruction manual covering installation of the disconnect switch assembly and operation of the various components.

.2 Instruction manuals shall describe in detail the construction and recommend procedures for assembling, dismantling, maintaining and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturers, of component parts of the equipment, properly catalogued for easy reference.

1.5 SHIPPING

.1 General

.1 Responsibility for delivery shall belong to the Contractor. who shall provide for all delivery costs from factory to the Place of Installation, including but not limited to the following:

.1 Complete delivery from the Place of Manufacture to the Place of Installation at Digby County, Nova Scotia.

.2 All necessary permits and regulatory costs involved in the transport of the switches, including but not limited to those imposed by the following bodies (such costs and requirements to be based on the size, weight, point of origin, and materials of the final product):

.1 Canada Border Services Agency.

.2 Transport Canada.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal.

.3 Following delivery to the Place of Installation but prior to off-loading, the Contractor shall be responsible for the following:

.1 Visually inspect the Works to ensure no superficial damage during the transportation process:

.2 The Contractor shall include offloading of the disconnect assembly at the Place of Installation.

.1 Any and all intermediate off-loading and on-loading of the disconnect assembly as required between the Manufacturer's Plant and the Place of Installation remains the responsibility of the Contractor.

.2 Follow-up

.1 The Vendor shall provide to the Engineer one (1) reproducible copy of the following within 24

1.5 SHIPPING (Cont'd)

.2 (Cont'd)
.1 (Cont'd)
hours of off- loading at the Place of the Installation:
.1 List of any and all noted visible defects noted prior to off-loading.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials and spare parts in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 69 KV DISCONNECT SWITCH

.1 Ratings
.1 The ratings for the integrated high-voltage disconnect shall be as designated below or greater:
.1 kV, Nominal: 69
.2 kV, Maximum: 72.5
.3 kV, BIL: 350
.4 Amperes, Rated Continuous Current: 600
.5 kilo-Amperes, Momentary Current (minimum): 30
.6 Operating Temperature Range: -40 C to 40 C

.2 General
.1 The 69 kV high-voltage disconnect shall be fully load-make and load-break rated.
.2 The 69 kV high-voltage disconnect shall be upright-mounting, rotating blade, vertical-break air disconnect switch, transformer switching class, with the three-poles being manually gang operated.
.1 Consideration will be given to side-break switches where the switches can be installed with the steel support structure approximately one (1) meter from the centreline of the outer switch poles, under the requirements of the Canadian Electrical Code Parts I & III Table 30 regarding minimum clearances between live parts (790 mm minimum) and live parts to grounded metal support structures (740 mm minimum)ùnote that all switches may be potentially energized from either pole.
.3 The switch gang-operating handle shall be constructed to prevent any incidental contact with the high-voltage source, with provisions for grounding and locking in both the open and closed position.
.4 A counter balance assembly shall provide uniform opening and closing stroke.
.5 The 69 kV disconnect switch shall be mounted on the pre-fabricated galvanized steel support structure

2.1 69 KV DISCONNECT SWITCH (Cont'd)

.2 (Cont'd)
.5 (Cont'd)
with support brackets. Details are provided in the Contract Documents (including connection plates for operating handle). The Contractor shall, in the Quotation Submission, clearly indicate acceptance of this mounting arrangement, and include for any and all adaptor plates required to allow installation to proceed; site drilling and welding of the structure shall not be acceptable. The Contractor shall assume an operating pipe that is nine (9) meter long vertically, and one (1) meter from the support structure on the horizontal, with three points of support for the operating pipe.
.6 A Motorized Switch Operator shall be provided for remote Open/Close operation of the switch.
.7 The complete switch assembly shall have a Rated Ice Breaking Ability to open and close with 20 mm of thick ice.

.3 Insulating Media
.1 All insulating media shall be of an epoxy resin or porcelain system with characteristics and restrictions as follows:
.1 Adequate leakage distance established by test per IEC publication 507, First Edition, 1975.
.2 Adequate strength for short-circuit stress established by test.
.3 Conformance with applicable ANSI standards.

.4 Construction
.1 The overall construction of the 69 kV disconnect switch shall be corrosion resistant.
.2 All inactive components shall be hot-dipped galvanized steel.
.3 All hardware (including fittings, fasteners, etc.), all operating- mechanism parts, and other parts subject to abrasive action from mechanical motion shall be of either nonferrous materials, or hot-dipped galvanized or zinc-nickel- plated materials.
.4 Touch-up materials with complete instructions shall be included for touch-up in the field.
.5 Grounding provisions shall be provided for all non-current-carrying parts of the disconnect assembly.
.6 Switch blades shall be tin- plated copper with silver-plated contact surfaces.

.5 Accessories
.1 Motorized Switch Operator
.1 The Contractor shall provide the motorized switch operator c/w all necessary provisions,

2.1 69 KV DISCONNECT SWITCH (Cont'd)

.5 (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

including pipe, universal joints, bearings, and auxiliary manual operator (lockable), such as to provide a complete operable disconnect assembly.

.1 Motorized switch operator shall have rigid construction sealed and gasketted weatherproof housing c/w thermostatically controlled heater.

.2 The motor shall be high torque 125 VDC motor, totally enclosed type with permanently lubricated bearings.

.3 Cam actuated limit switches shall be used to electrically control the limits of travel required as well as to serve as initiators for signalling devices. The limit switches shall be readily accessible for initial setting as well as for adjustment at any time after installation.

.4 A fast acting disc brake shall prevent overtravel of the switch operating mechanism. The brake shall be spring set and solenoid released.

.5 All electrical controls shall be conveniently located and readily accessible for either side of the housing.

.6 Separate knife switches and protection fuses shall be provided for the control and for the heater. Fuses shall be of the slow blow type.

.7 The motor reversing contactors shall be mechanically interlocked to prevent generation of simultaneous open and close commands.

.8 The gear train shall be of type not requiring routine bearing lubrication.

.9 The motorized switch operator shall be able to operate manually. Motor/Manual selector switch shall be provided on the front of the housing.

.10 The motorized switch operator comprising the manual operator shall have provision for two grounding terminations.

.2 The motorized switch operator and the transmission mechanism shall be mounted on the pre- fabricated galvanized steel support structure. Three (3) support brackets shall be provided for the transmission mechanism. The Vendor shall, in the Quotation Submission, clearly indicate acceptance of this mounting arrangement, and include for any and all adaptor plates required to allow installation to proceed; site drilling and welding of the structure shall not be acceptable.

2.1 69 KV DISCONNECT SWITCH (Cont'd)

.5 (Cont'd)
.1 (Cont'd)
.3 Switch bearings shall be sealed and lubricated corrosion-resistant bearings and shall not require further field lubrication.
.4 The construction of the motorized switch operator and the transmission mechanism shall conform to the requirements of the connected disconnect as defined herein.
.5 The Vendor shall provide provision for installation of a Purchaser-supplied padlock to lock the 69kV disconnect switch in the open and closed positions.

.6 Auxiliary Contacts
.1 The Vendor shall provide a minimum of two (2) Form "a" and two (2) Form "b" contacts directly coupled to the 69kV disconnect switch operator.
.2 Auxiliary contacts shall be wired to a terminal strip contained within a corrosion-resistant enclosure.
.3 Auxiliary contacts shall be operated at 125Vdc nominal.

2.2 34.5 KV DISCONNECT SWITCHES

.1 Ratings
.1 The ratings for the integrated high-voltage disconnect shall be as designated below or greater:
.1 kV, Nominal: 34.5
.2 kV, Maximum: 38
.3 kV, BIL: 200
.4 Amperes, Rated Continuous Current:
.1 Design "A": 1200
.2 Design "B", "C" and "D": 600
.5 Amperes, Short- Circuit Ratings (minimum):
.1 Withstand, RMS Symmetrical (kA): 30
.2 Load Interrupting Rating (transformer size), kVA
.1 Design "A": 33,000
.2 Design "B": 75
.3 Design "C": 1750
.4 Design "D": N/A
.6 Operating Temperature Range: -40°C to 40°C

.2 General
.1 The Design "A" 34.5 kV medium-voltage disconnect switch shall be upright-mounting, rotating blade, vertical- break air disconnect switch, transformer switching class, with the three-poles being manually gang operated.
.1 Consideration will be given to side-break switches where the switches can be installed in the mounting configurations as indicated on design drawings under the requirements of the

2.2 34.5 KV DISCONNECT SWITCHES (Cont'd)

.2 (Cont'd)
.1 (Cont'd)
.1 (Cont'd)
Canadian Electrical Code Parts I & III Table 30 regarding minimum clearances between live parts (460 mm minimum) and live parts to grounded metal support structures (390 mm minimum) note that all switches may be potentially energized from either side.
.2 Design "A" shall be upright- mounting configuration with steel base and handle operability.
.3 Design "B" and "D" shall be vertical-mounting configuration with steel base and handle operability.
.4 Design "C" shall be vertical-mounting configuration with wood-pole and hookstick operability.
.5 The switch gang-operating handle shall be constructed to prevent any incidental contact with the high-voltage source, with provisions for grounding and locking in both the open and closed position.
.6 A counter balance assembly shall provide uniform opening and closing stroke.
.7 The Design "A", "B" and "D" 34.5 kV disconnect switches shall be mounted on the pre-fabricated galvanized steel support structure with two (2) support brackets for the operating handles, as detailed on the Contract Drawings. The Contractor shall clearly indicate acceptance of this mounting arrangement, and include for any and all adaptor plates required to allow installation to proceed; site drilling and welding of the structure shall not be acceptable.
.8 Design "C" 34.5 kV disconnect switches shall be pole-mounted.
.9 The complete switch assembly shall have a Rated Ice Breaking Ability to open and close with 20 mm of thick ice.

.3 Insulating Media
.1 All insulating media shall be of an epoxy resin or porcelain system with characteristics and restrictions as follows:
.1 Adequate leakage distance established by test per IEC publication 507, First Edition, 1975.
.2 Adequate strength for short-circuit stress established by test.
.3 Conformance with applicable ANSI standards.

.4 Construction
.1 The overall construction of the 34.5 kV disconnect switch shall be corrosion resistant.

2.2 34.5 KV DISCONNECT SWITCHES (Cont'd)

.4 (Cont'd)
.2 All inactive components shall be hot-dipped galvanized steel.
.3 All hardware (including fittings, fasteners, etc.), all operating- mechanism parts, and other parts subject to abrasive action from mechanical motion shall be of either nonferrous materials, or hot-dipped galvanized or zinc-nickel-plated materials.
.4 Touch-up materials with complete instructions shall be included for touch-up in the field.
.5 Grounding provisions shall be provided for all non-current-carrying parts of the disconnect assembly.
.6 Switch blades shall be tin-plated copper with silver-plated contact surfaces.

.5 Accessories
.1 Group-Operating Handle (Design "A", "B" and "D" only)
.1 The Contractor shall provide the all necessary operating handle provisions, including pipe, universal joints, bearings, and operator (lockable), such as to provide a complete operable disconnect assembly to be installed (operating handle shall traverse up to 1 m horizontally and 5 m vertically).
.1 Operating Handle shall have provision for two grounding terminations.
.2 Each operating handle shall be mounted on the pre- fabricated galvanized steel support structure with support brackets. The Contractor shall, in the Quotation Submission, clearly indicate acceptance of this mounting arrangement, and include for any and all adaptor plates required to allow installation to proceed; site drilling and welding of the structure shall not be acceptable.
.3 Switch bearings shall be sealed and lubricated corrosion-resistant bearings and shall not require further field lubrication.
.4 The construction of the operating handle shall conform to the requirements of the connected disconnect as defined herein.
.5 The Contractor shall provide provision for installation of a supplied padlock to lock each 34.5kV disconnect switch in the open and closed positions.

.6 Auxiliary Contacts
.1 The Vendor shall provide a minimum of two (2) Form "a" and two (2) Form "b" contacts directly coupled to the Design "A" 34.5kV disconnect switch operator.

2.2 34.5 KV DISCONNECT SWITCHES (Cont'd)

.6 (Cont'd)
.2 Auxiliary contacts shall be wired to a terminal strip contained within a corrosion-resistant enclosure.
.3 Auxiliary contacts shall be operated at 125Vdc nominal.

.7 Hook-stick operators
.1 Two hook-stick operators shall be provided c/w insulated handle, various attachments to 38 kV minimum, 3 m in length. Submit shop drawing for approval.

2.3 EQUIPMENT IDENTIFICATION

.1 General
.1 Each and every device shall be provided with a clearly visible rating plate of weatherproof material, inscribed with the minimum information defined herein.
.2 Each and every device shall be provided with a clearly visible nameplate of weatherproof material, inscribed with the Owner-assigned device number.

.2 Ratings Nameplates
.1 The disconnect assembly shall be provided with an external nameplate secured next to the switch gang- operating handle containing the following information:
.1 Manufacturers Name
.2 Switch Type and Designation Number
.3 Maximum Voltage Rating (kV)
.4 Continuous Current Rating (A)
.5 Fault Current Withstand Ratings (Momentary and Three-Second)
.6 Basic Impulse Level (BIL) (kV)
.7 Frequency Rating (Hz)
.8 CSA or CUL marking as applicable; ANSI Standard Designed and Tested to as a Minimum

.3 Identifying Nameplate
.1 The Disconnect Switch assemblies shall be provided with one (1) nameplate, engraved on 3mm thick plastic lamicoid, with the Owner's numerical designation for the Power Transformer.
.2 The identifying nameplate shall be secured to the Disconnect Switch using permanent adhesive or permanent mechanical connection, suitable for permanent outdoor usage in the given atmospheric conditions.
.3 The identifying nameplate shall be 200mm long x 50mm high, white lettering on a black background. Letters shall be 38mm high, width as required.

2.3 EQUIPMENT IDENTIFICATION (Cont'd)

.3 (Cont'd)
.4 Designation shall be of the form: "xxxV-xxx", where "xxx" shall be provided by the Engineer prior to delivery.

2.4 MATERIALS

.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Contractor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

2.5 WARRANTY

.1 All equipment, including accessories and tools, shall have a minimum two (2) year warranty against manufacturer's defects effective from the earlier date of the following:
.1 Substantial completion of the work.
.2 Six (6) months following delivery to the Place of the Installation.

.2 The Owner, through the Engineer, shall promptly give the Vendor notice in writing of observed defects and deficiencies that occur during the warranty period.

.3 The Contractor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

.4 The Contractor shall administer the warranty claims when indicated by Owner. The Owner shall have the right to assign the warranties to:
.1 The Project Company.
.2 The Purchaser of all or substantially all of the project assets.

.5 The Contractor shall name the Owner as beneficiary of the Warranty.

2.6 FACTORY TESTS

.1 The disconnect switch assembly and all individual components shall be completely tested in accordance with the relevant standards.

.2 Operational and resistivity test shall be conducted on each disconnect switch after fabrication.

.3 Advise the engineer 14 days prior to the tests so that the owner and engineer may witness those tests,

2.6 FACTORY TESTS (Cont'd)

.3 (Cont'd) if they so desire. Submit results for review by Engineer.

.4 All test results are to be included in the Commissioning Report.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install equipment in accordance with manufacturer's instructions and as per design drawings.

3.2 TESTING AND COMMISSIONING

.1 Overview

.1 General

.1 In general, provide electrical services in the testing and commissioning of the Disconnect Switches in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Section 01 91 33 - Commissioning (Cx) Forms.

.2 The scheduling of all work shall be co-ordinated with Owner and Purchaser to ensure that no delays are caused by interference between persons operating on site under different contracts. The Contractor shall allow a minimum of five (5) Working Days for the Testing and Commissioning, weather-permitting.

.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.

.4 Should any test results be deemed unacceptable, whether due to test conditions, Contractor error, or required correction of an equipment deficiency, the Contractor shall be responsible for repeating the applicable test or tests.

.5 The Contractor and the Engineer shall review all tests prior to the testing personnel leaving the site.

.2 Compliance with Standards and Codes

.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

.2 The Contractor shall adhere to the following standards during the process of testing and commissioning:

.1 Nova Scotia Provincial Standards

.2 Nova Scotia Occupational Health and Safety Act

3.2 TESTING AND COMMISSIONING (Cont'd)

.1 (Cont'd)
.2 (Cont'd)
.2 (Cont'd)
.3 Nova Scotia Workers' Compensation Act.
.4 CSA Standards
.1 C22.1-06, Canadian Electrical Code Part I
.2 C22.3, Canadian Electrical Code Part III
.3 Z462-08, Workplace Electrical Safety
.5 ANSI/IEEE Standards
.1 C37.34, Test Code for High-Voltage Air Switches
.2 Std. No. 472, Guide for Surge Withstand Capability (SWC) Tests
.3 Equipment
.1 The Contractor shall be responsible for the supply of all required test equipment.

.2 Test Procedures
.1 General
.1 The Contractor shall test the Disconnect Switches to the satisfaction of the Engineer as defined herein; the Contractor shall indicate and include any additional Vendor-recommended tests.
.2 The Contractor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.
.3 The Contractor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.
.4 All test results shall be provided to the Engineer in written form within 24 hours of completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.
.5 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.
.6 All test reports shall include the following information:
.1 Name of testing firm.
.2 Date of test.
.3 Ambient temperature at time of test.
.4 Relative humidity at time of test.
.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).
.6 Confirmation that test results are acceptable.

3.2 TESTING AND COMMISSIONING (Cont'd)

.2 (Cont'd)
.1 (Cont'd)
.6 (Cont'd)
.7 Initialed by Contractor.

.3 Documentation
.1 Official Test Results
.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Contractor shall provide six (6) copies of final, official test reports, type-written with the Contractor's signature of approval, to the Engineer following the completion of Testing.
.2 The Contractor shall include the results of all on- site testing described herein.
.3 The Contractor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.
.4 The Contractor shall accompany the official test report with written approval that the field test results have been reviewed and the Disconnect Switches and all accessories have been found acceptable for energization and operation.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 11 01 - Unit Substation.

.4 Section 26 28 14 - Fuses - Low Voltage.

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA International).
- .1 CAN/CSA C22.2 No.4-M89, Enclosed Switches.
- .2 CSA C22.2 No.39-M89, Fuseholder Assemblies.

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible, disconnect switch in CSA Enclosure type and size as indicated.

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, to Section 26 28 14 - Fuses - Low Voltage.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

.2 Use 41mm x 41mm galvanized strut channel for support.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Receive, inspect, report, offload and store wind turbines at the place of the installation. Assembly, erection and system start-up of twenty (20) GE 1.5sle, 1.5 MW wind turbine generator assemblies, each complete with tower, nacelle (machine house), rotor blades, accessories, and special tools as defined herein. Special field equipment approval inspection of twenty (20) wind turbines per Nova Scotia Power Bulletin #B-2-024-1.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 22 - Connectors and Terminations

.3 Section 26 05 27 - Grounding - Primary

.4 Section 33 71 20 - Electrical Pole Lines and Hardware

.5 Section 01 91 13 - General Commissioning (Cx) Requirements

.6 Section 01 91 33 - Commissioning (Cx) Forms

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CSA C22.1-09, Canadian electrical code, part I.

.3 Reference Document R1 - GE 1.5SLE Technical Exhibits.

.4 Reference Document R2 - GE Energy Supplementary Erection Details and Information.

.5 ISO Standards
.1 9000: 2000, Quality Management

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION

.1 General

.1 Each and every device shall be provided with a clearly visible rating plate of weatherproof material, inscribed with the minimum information defined herein.

.2 Each and every device shall be provided with a clearly visible nameplate of weatherproof material, inscribed with the Owner-assigned device number.

.2 Rating Nameplates

.1 All devices supplied shall include all information as required by the ruling CSA Standards on an external nameplate.

.3 Identifying Nameplate

.1 Each and every device shall be provided with one (1) nameplate, engraved on 3mm thick plastic lamicoid, with the Owner's numerical designation.

.2 The identifying nameplate shall be secured using permanent adhesive or permanent mechanical connection, suitable for permanent indoor or outdoor usage in the given atmospheric conditions.

.3 The identifying nameplate shall be 200mm long x 50mm high, white lettering on a black background. Letters shall be 38mm high, width as required.

.4 Designation shall be provided by the Engineer.

2.2 MATERIALS

.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Contractor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

PART 3 - EXECUTION

3.1 RECEIVING

.1 The equipment will be transported to the site by the Owner.

.2 Contractor will be responsible to:
.1 Receive equipment per GE documentation in Reference Documents R1 and R2.
.2 Inspect and report on equipment per GE documents in Reference Documents R1 and R2.
.3 If any equipment is damaged before it has been off-loaded, the Contractor is to record and photo damages and make the owner aware before off-loading. If Contractor fails to get Owner direction at this point, they will become responsible for the damages.
.4 Once equipment has been received without damage, the Contractor is responsible to fill out Receiving Reports and Check Out sheets provided in the GE Documentation.
.5 Provide lifting equipment and materials to off-load and stage the equipment and make ready for erection.
.6 Store and stage equipment and provide weather protection where required.
.7 Load shipping containers on Owner-supplied transport company for return to manufacturer by Owner.
.8 Provide assistance onsite to transport company where Access Road slopes are such that transport equipment cannot make the grade under their own power.

3.2 WIND TURBINE ERECTION

.1 Contractor will be responsible to erect the wind turbines as outlined in the GE Documentation found in Reference Documens R1 and R2.

.2 Contractor will be responsible to complete all GE test sheets, GE check out sheets and verification sheets for review during progress meetings.

.3 Contractor will be responsible for the erection, mechanical assembly, electrical connections, electrical terminations, check out and testing of all systems.

.4 Contractor will be responsible to provide temporary power for each turbine to run aviation indication lights until such time that power is available from the wind farm substation.

3.2 WIND TURBINE ERECTION (Cont'd)

.5 Contractor is responsible to coordinate for and pay all costs to have a special field equipment inspection for each turbine per Nova Scotia Power Bulletin B-2-024-1.

3.3 ADDITIONAL WORKS

.1 Overview:

.1 General

.1 In general, provide electrical services in the testing and commissioning of the Wind Turbine Generators in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and Section 01 91 33 - Commissioning (Cx) Forms.

.2 The scheduling of all work shall be co-ordinated with Owner's Representative to ensure that no delays are caused by interference between persons operating on site under different contracts. The Contractor shall allow a minimum of five (5) Working Days per Wind Turbine Generator for the Testing and Commissioning, weather-permitting.

.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.

.4 Should any test results be deemed unacceptable, whether due to test conditions, Contractor error, or required correction of an equipment deficiency, the Contractor shall be responsible for repeating the applicable test or tests.

.5 The Contractor and the Engineer shall review all tests prior to the testing personnel leaving the site.

.2 Compliance with Standards and Codes

.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

.2 The Contractor shall adhere to the following standards during the process of testing and commissioning:

.1 Nova Scotia Provincial Standards

.2 Nova Scotia Occupational Health and Safety Act

.3 Nova Scotia Workers' Compensation Act.

.4 CSA Standards

.1 C22.1-06 Canadian Electrical Code Part I

.2 C22.3 Canadian Electrical Code Part III

.3 Z462-08 Workplace Electrical Safety

3.3 ADDITIONAL WORKS (Cont'd)

.1 Overview:(Cont'd)

.3 Equipment

.1 The Contractor shall be responsible for the supply of all test equipment including but not limited to the following:

.1 Meggar Test Set (or equivalent).
.2 Fluke Meter (or equivalent).
.3 Three-phase generator.
.4 Current meter.
.5 Voltage meter.
.6 Testing cables.
.7 Disconnect switch.
.8 Current transformer tester.

.4 Test Procedures

.1 General

.1 The Contractor shall test the Wind Turbine Generators and all accessories under Vendor's Representative directions to the satisfaction of the Engineer as defined herein; the Contractor shall indicate and include any additional Vendor-recommended tests.

.2 The Contractor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.

.3 The Contractor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.

.4 All test results shall be provided to the Engineer in written form within 24 hours of completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.

.5 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

.6 All test reports shall include the following information:

.1 Name of testing firm.
.2 Date of test.
.3 Ambient temperature at time of test.
.4 Relative humidity at time of test.
.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).
.6 Confirmation that test results are acceptable.

3.3 ADDITIONAL WORKS (Cont'd)

.1 Overview:(Cont'd)
.4 (Cont'd)
.1 (Cont'd)

.7 Initialled by Contractor.

.2 Wind Turbine Generator Testing
.1 The Contractor shall be required to provide all tests specified in the GE Documentation on the Wind Turbine Generator and its auxiliary devices.

.3 Documentation
.1 Official Test Results
.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Contractor shall provide six (6) copies of final, official test reports, type-written with the Contractor's signature of approval, to the Engineer following the completion of Testing.
.2 The Contractor shall include the results of all on-site testing described herein.
.3 The Contractor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.
.4 The Contractor shall accompany the official test report with written approval that the field test results have been reviewed and the Wind Turbine Generators and all accessories have been found acceptable for energization and operation.

.2 Complete any additional work as instructed by Owner's Representative to:
.1 Ensure equipment is safe to operate.
.2 Provide complete and operating system.
.3 Provide assistance to GE Energy to commission the GE Energy scope of supply.

3.4 DEMONSTRATION AND TRAINING

.1 As directed by Owner's Representative and in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements, provide assistance to the Vendor's Representative for demonstration of complete Wind Turbine Generator unit for Project acceptance.

3.4 DEMONSTRATION AND TRAINING (Cont'd)

.2 As directed by Owner's Representative provide assistance to the Vendor's Representative for the familiarization training of operating and maintenance staff.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Purchase, deliver to the Place of the Installation and install one (1) DC Uninterruptible Power Supply System suitable for indoor installation, complete with accessories and special tools as defined herein.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements

.2 Section 26 05 00 - Common Work Results - Electrical

.3 Section 26 05 22 - Connectors and Terminations

.4 Section 01 91 13 - General Commissioning (Cx) Requirements

.5 Section 01 91 33 - Commissioning (Cx) Forms

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 CSA Standards
.1 CSA C22.1, Canadian Electrical Code Part I
.2 CSA C22.2 No 107.2, Battery Chargers

.3 ANSI/IEEE Standards
.1 STD 446, IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Application
.2 STD 450, Recommended Practice for Large Lead Storage Batteries for Generating Stations and. Substations
.3 STD 485, IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications
.4 STD 1188, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve Regulated Lead-Acid Batteries for Stationary Applications
.5 C62.41, IEEE Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits

.4 NEMA Standards
.1 PE 1, Uninterruptible Power Systems
.2 PE 5, Utility Type Battery Chargers

1.3 REFERENCES (Cont'd)

.5 ISO Standards
.1 9000: 2000, Quality Management

.6 Unless otherwise noted, CSA Standards shall be given precedence when and where conflicts arise.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 10 00.

.2 Include:
.1 Outline sketch showing arrangement of cubicles, meters, controls, recommended aisle spaces, battery rack, battery arrangement and dimensions.
.2 Shipping weight
.3 Schematic diagram showing interconnection of rectifier, inverter, battery, bypass switch, meters, controls and indicating lamps.
.4 Description of system operation
.5 Efficiency of system at 25%, 50%, 75% and 100% rated load.
.6 Battery:
.1 Number of cells;
.2 Maximum and minimum voltages;
.3 Type of battery;
.4 Type of plates;
.5 Catalogue data with cell trade name and type;
.6 Size and weight of each cell;
.7 Cell charge and discharge curves of voltage, current, time and capacity;
.8 Derating factor for specified temperature range;
.9 Nominal ampere hour capacity of each cell;
.10 Maximum short circuit current;
.11 Maximum charging current expected for fully discharged condition;
.12 Recommended low voltage limit for fully discharged condition;
.13 Expected life.
.7 Rectifier:
.1 Type and capacity, with catalogue number;
.2 Battery charging sequence;
.3 Current-time data for Silicon Controlled Rectifier (SCR) protective devices;
.4 Guaranteed noise level;
.5 Estimated life;
.6 Metering;
.7 Alarms.
.8 Manufacturer's field experience with UPS of similar ratings including engineering expertise, manufacturing facilities and listing of UPS units manufactured and installed during last 5 years

1.4 SUBMITTALS (Cont'd)

.2 Include:(Cont'd)

.8 (Cont'd)
including model, customer, location and installation dates.

.9 Heat losses at no load, 25%, 50%, 75% and 100% of rated output, in kW.

.10 Cooling air required in m3/s.

.11 List of recommended spare parts, tools and instruments with catalogue numbers and current prices.

.12 Description of factory test facilities.

.13 Manufacturer's maintenance capabilities including:

.1 Willingness to undertake maintenance contract;

.2 Number of trained personnel available;

.3 Location of trained personnel and repair facilities.

.3 Operation and Maintenance Manual to include:

.1 Operation and maintenance instructions concerning design elements, construction features, component functions and maintenance requirements to permit effective operations maintenance and repair.

.2 Technical data:

.1 Approved shop drawings;

.2 Characteristic curves for automatic circuit breakers and protective devices;

.3 Project data;

.4 Technical description of components;

.5 Parts lists with names and addresses of suppliers.

1.5 SHIPPING

.1 General

.1 Responsibility for delivery shall belong to the Contractor, who shall provide for all delivery costs from factory to the Place of Installation, including but not limited to the following:

.1 Complete delivery from the Place of Manufacture to the Place of Installation at Digby County, Nova Scotia.

.2 All necessary permits and regulatory costs involved in the transport of the power transformer, including but not limited to those imposed by the following bodies (such costs and requirements to be based on the size, weight, point of origin, and materials of the final product):

.1 Canada Border Services Agency.

.2 Transport Canada.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal.

1.5 SHIPPING (Cont'd)

.1 (Cont'd)
.1 (Cont'd)
.3 Following delivery to the Place of Installation but prior to off-loading, the Contractor shall be responsible for the following:
.1 Visually inspect the Works to ensure no superficial damage during the transportation process:

.2 Follow-up
.1 The Vendor shall provide to the Engineer one (1) reproducible copy of the following within 24 hours of off- loading at the Place of the Installation:
.1 List of any and all noted visible defects noted prior to off-loading.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 10 00.

.2 Include:
.1 Four sets of each type and size of fuses used;
.2 Four sets indicating lamps;
.3 Spare parts provided.

1.7 SYSTEM START-UP

.1 Arrange with Owner's Representative:
.1 For factory service engineer to supervise start-up of system, checking, adjusting and testing on site;
.2 For instruction of O&M personnel on theory, construction, installation, operation and maintenance of system:
.1 After installation and during site testing;

.2 Advise on:
.1 Expected failure rate of equipment;
.2 Type of expected failures;
.3 Estimated time between major overhauls based on 20 year equipment life;
.4 Estimated cost of major overhaul based on current costs and excluding travelling expenses;
.5 Type and cost of test equipment needed for fault isolating and performing preventive maintenance.

PART 2 - PRODUCTS

2.1 UNINTERRUPTIBLE POWER SYSTEM

.1 General

.1 This specification covers the design, manufacture, testing and delivery of one (1) DC Uninterruptible Power Supply System assembly complete with charger, sealed lead acid batteries, DC panelboard, fused disconnect, accessories, special tools, and provisionals as described herein.

.2 Battery Charger

.1 The Battery Charger shall be a solid state, constant voltage, current limiting, device using Silicon Controlled Rectifiers (SCR), designed to float/equalize batteries complete with protective devices, metering and control equipment as described below.

.2 The Battery Charger shall be sized to supply the full load DC current and recharge the fully discharged battery within 8 hours to a fully charged condition, while supplying the normal load operation.

.3 The design shall be in accordance with the environmental conditions specified in the data sheet. The cabinet enclosure shall be rated NEMA 1, floor or wall mounted, convection cooled.

.4 The Floating Mode and Equalizing Mode shall have separate control points such that the Float Mode and Equalizing Mode can be set independently of the other.

.5 All control, measuring and alarm components shall be located at a maximum of 1800 mm from the floor.

.6 Access to charger shall be through front hinged door(s).

.7 Cable entry shall be from either the cabinet top or bottom.

.8 Remote status monitoring of the charger shall be via RS232/RS485 communication.

.9 The Battery Charger and all individual components shall be CSA certified.

.10 The Battery Charger shall satisfy the following operating conditions:

.1 Input Ratings:

.1 Voltage, VAC: 208

.2 No. of Phases: 3

.3 Voltage Variation, %: +/- 10

.4 Frequency, nominal, Hz: 60

.5 Frequency variation, %: +/- 5

.2 Output Ratings:

.1 Nominal Output DC Voltage (temperature compensated), VDC: 125

.2 Continuous Load Current, A: 30

.3 Momentary Load Current, A: 125

2.1 UNINTERRUPTIBLE POWER SYSTEM (Cont'd)

.2 (Cont'd)
.10 (Cont'd)
.2 Output Ratings:(Cont'd)
.4 Static regulation from 0 to 100 % full load +/- 1 having a +/- 10% input voltage variation and +/- 5% frequency variation, %
.5 Voltage Ripple (loss of AC), %: +/- 2
.6 Maximum total current harmonic distortion 10 (THD) at full load and at nominal input voltage and frequency, %
.7 Adjustable Output Current, % of the rated output, 10 to 100 factory adjusted to 100%)
.8 Sustain input surges without damage the criteria listed in IEEE C62.41.

.11 The Battery Charger shall be provided with a HMI comprising front door mounted LCD Display and LED indicators providing rectifier status and metering functions as follows:
.1 AC "On" Green LED
.2 Fault Red LED
.3 Current Limit (Green LED or HMI Graphic)
.4 Voltage Regulation (Green LED or HMI Graphic)
.5 Equalize (Amber LED or HMI Graphic)
.6 Float (Green LED or HMI Graphic)
.7 DC Charge Discharge Ammeter (HMI Graphic).
.8 DC Voltmeter (HMI Graphic).

.12 Battery Charger Monitoring System shall provide on screen alarm log reporting but not limiting to the following alarms:
.1 AC Low Voltage
.2 AC High Voltage
.3 DC Low Voltage
.4 DC High Voltage
.5 Positive DC Ground Fault
.6 Negative DC Ground Fault
.7 Battery Low Temperature
.8 Battery High Temperature
.9 AC Breaker Open
.10 DC Breaker Open

.13 Each alarm shall have a dedicated one form C contact for remote annunciation. All alarms shall be stored in alarm log for retrieval at any time.

.14 The following charger operation controls shall be user adjustable as minimum:
.1 Float/ Equalize Select
.2 Float Voltage.
.3 Equalize Voltage.
.4 Equalize duration.
.5 Under Voltage Alarm Setpoint.
.6 Over Voltage Alarm Setpoint.
.7 Temperature Compensation Slope.

2.1 UNINTERRUPTIBLE POWER SYSTEM (Cont'd)

.2 (Cont'd)

.15 All alarm and control settings shall be accessible for configuration through a menu on the LCD display.

.16 The Battery Charger protection scheme shall include the following protections:

.1 Two (2) Pole AC Input Circuit Breaker
.2 Two (2) Pole DC Output Circuit Breaker
.3 AC Surge Suppression
.4 DC Surge Suppression
.5 Two (2) Pole, 100 A Fused Battery Maintenance Disconnect Switch
.6 Two (2) Pole, 54 CCT, Circuit Breaker Distribution Panel (Two (2) Pole, 15A Branches) c/w 125A Main Lugs.

.17 All circuit breakers shall be with adequate interrupting capabilities.

.18 All input and output connections shall be screw connection type terminal blocks. All terminal blocks shall be clearly labeled with permanent markings for AC input, DC output, battery, and alarms.

.19 The cabinet shall be baked polyester powder paint finished with 2-3 mils to support salt spray chamber for 1000 hrs per ASTM B-117-97. Color outside and inside color shall be the same grey ANSI 61 or ANSI 70.

.3 Batteries

.1 The batteries shall be completely sealed lead-acid design using pure lead or lead alloy plates, ten (10) years minimum life design with high cycling ability over 800 cycles to eighty (80) percent depth of discharge, complete in all respects, with all required accessories.

.2 The cells provided shall have fire-retardant jars and covers and shall be provided with flame-arrester type vents.

.3 The batteries cells shall be non gassing with completely sealed electrolyte and permanently sealed pressure release safety vent.

.4 All posts and battery terminals shall be shrouded, no live part is to be uncovered.

.5 The individual units shall be 2, 6, or 12 volts connected in series to the required load voltage (nominal 125Vdc).

.6 The batteries shall be capable of operating all breakers after the power outage, supporting the steady load for 8 hours followed by simultaneous 30% of open/close breaker operations.

.7 The battery shall be sized to be capable of supplying 100% load at the time of initial installation and at the end of life, with a steady-state current draw of 30A for minimum 8 hours.

.8 The batteries shall have a minimum discharge life on loss of AC of 250 A*hrs.

2.1 UNINTERRUPTIBLE POWER SYSTEM (Cont'd)

.3 (Cont'd)
.9 Batteries shall be CSA approved.
.10 Use type written, heat shrink sleeve wire markers through out.

.4 Battery Rack
.1 The battery rack shall be two tier. Each to have provision for floor and wall anchoring
.2 Battery rack paint shall be corrosion resistant.
.3 Battery rack shall have 12 mm grounding holes on both ends.
.4 Battery cells shall be isolated with isolating mat from battery rack.
.5 The battery rack shall be installed in a dedicated enclosure.

2.2 EQUIPMENT IDENTIFICATION

.1 General
.1 Each and every unit in the DC Uninterruptible Power Supply System shall be provided with a clearly visible rating plate, inscribed with the required standard information.
.2 Each and every unit in the DC Uninterruptible Power Supply System shall be provided with a clearly visible identifying nameplate of weatherproof material, inscribed with the Owner- assigned device number.

.2 Ratings Nameplates
.1 The DC Uninterruptible Power Supply System equipment rating nameplate shall include but not be limited to the the following information:
.1 Manufacturer's Name
.2 Type
.3 Manufacturer's Serial Number
.4 AC and DC Continuous Voltage and Current Ratings (as applicable)
.5 Momentary and Fault Withstand Ratings (amperes, RMS asymmetrical)
.6 Frequency Rating (Hz)
.7 Battery Discharge Life (Ampere-Hours)
.8 Total Weight
.9 Date of Manufacture (Month and Year)
.10 CSA or cUL classification markings

.3 Identifying Nameplate
.1 The DC Uninterruptible Power Supply System equipment shall be provided with individual nameplates, engraved on 3mm thick plastic lamicoid, with the function of the equipment and Owner's numerical designation.
.2 The identifying nameplate shall be secured to the equipment using permanent adhesive or permanent

2.2 EQUIPMENT IDENTIFICATION (Cont'd)

.3 (Cont'd)
.2 (Cont'd)
mechanical connection, suitable for permanent indoor usage in the given atmospheric conditions.
.3 The equipment identifying nameplates shall be white lettering on a black background. Letters shall be 30 mm high for the charger and the battery rack and 10mm high for the associated components, width as required.
.4 The equipment designation shall be provided by the Engineer after awarding of contract, prior to delivery.

2.3 MATERIALS

.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

2.4 WARRANTY

.1 All equipment, including accessories and tools, shall have a minimum two (2) year warranty against manufacturer's defects effective from the earlier date of the following:
.1 Substantial completion of the work.
.2 Six (6) months following delivery to the Place of the Installation.

.2 The Owner, through the Engineer, shall promptly give the Contractor notice in writing of observed defects and deficiencies that occur during the warranty period.

.3 The Contractor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

.4 The Contractor shall administer the warranty claims when indicated by Owner. The Owner shall have the right to assign the warranties to:
.1 The Project Company.
.2 The Purchaser of all or substantially all of the project assets.

.5 The Contractor shall name the Owner as beneficiary of the Warranty.

2.5 FACTORY TESTS

.1 Complete system including rectifier, controls and battery factory tested in presence of Owner's Representative.

.2 Notify Owner's Representative:
.1 One week in advance of date of factory test;
.2 That system has had preliminary testing and has met design requirements satisfactorily.

.3 Test procedures:
.1 Use standard blank forms and check sheet with spaces for recording data.
.2 Mark check sheet and record test data on forms in duplicate as test proceeds. Attach meter recordings.
.3 Provide Owner's Representative signature on form to indicate concurrence in results reported.
.4 Duplicate given to Owner's Representative at end of test.
.5 Information from original presented as part of O&M Manual.

.4 Test equipment:
.1 Instruments used during test, including indicating meters installed as part of system to have recent calibration certificate.
.2 Dummy load for testing, adjustable to 150 % of system rated output..

.5 Tests:
.1 Visual inspection to determine:
.1 Materials, workmanship, and assembly conform with design requirements;
.2 Parts are new and free of defects;
.3 Battery and components are not damaged;
.4 Battery cells are of identical construction;
.5 Electrolyte in each cell is at manufacturer's recommended full level;
.6 Each battery cell polarity and polarity of connections to inverter are correct;
.7 Proper size fuses are installed;
.8 Metres have suitable range;
.9 Accessories are present;
.10 Portable metres for acceptance tests are suitable and instrument transformers connected correctly.
.2 Demonstrate:
.1 System start-up and shut down;
.2 Operation during mains power failure, recording output during failure and return of mains power, using oscilloscope and camera attachment. Repeat several times;
.3 Adjustable settings;

2.5 FACTORY TESTS (Cont'd)

.5 Tests:(Cont'd)

.2 Demonstrate:(Cont'd)

.4 Record values measured at test points using oscilloscope, digital multimetre and camera attachment;

.5 Protective devices and indications function as designed. Record actual settings, and note operation of remote indications.

.6 Simulate over temperature by applying heat to sensor with hot air blower.

.7 Simulate fuse blowing to test indication response.

.8 Simulate fan failure.

.9 Bypass switch automatic operations. Record with camera/oscilloscope absence of load disturbance during automatic bypass switching.

.1 Over voltage of rectifier dc output.

.3 Transients:

.1 With normal power input, apply full load to system.

.2 Remove one half load.

.3 Reapply one half load instantly.

.4 Record voltages and currents using digital camera.

.4 Steady load:

.1 Switch system onto ac mains and connect dummy load.

.2 Operate system at full rated load for 24 hours and at 125% load for 10 min in ambient temperature of 40 degrees C.

.3 Record data at start of test and at half hour intervals thereafter; including:

.1 Input frequency;

.2 Input voltage (each phase);

.3 Input current (each phase);

.4 Input kW;

.5 Output voltage (phase to phase, phase to neutral);

.6 Output current (each phase);

.7 Output kW;

.8 Temperature of ventilating air-in;

.9 Temperature of ventilating air-out;

.10 Temperature at critical zones;

.11 DC voltage to load;

.12 DC current to load;

.13 Rectifier DC current.

.5 Varying loads:

.1 Take one set of readings as above of no load, 25% load, 50% load, 75% load and 125% load.

.2 Calculate efficiencies of rectifier, inverter, and complete system.

.6 Battery:

2.5 FACTORY TESTS (Cont'd)

.5 Tests:(Cont'd)

.6 Battery:(Cont'd)

.1 Charge battery to ensure cells fully charged. When voltage reaches steady value at end of charge, record:

.1 Ambient temperature;
.2 Temperature of each cell;
.3 Voltage of each cell;
.4 Voltage of battery;
.5 Charging current;
.6 Specific gravity of each cell (lead acid battery only).

.2 Discharge battery by operating uninterruptible power system with ac mains open, at full rated output for duration quoted in design requirements. Record, at 5 min intervals:

.1 Voltage of battery;
.2 Current;
.3 Voltage of 10% random cells;
.4 Ambient temperature;
.5 Battery temperature;
.6 Specific gravity of 10% random cells (lead acid only);

.3 Recharge battery automatically by closing ac mains supply to system for 4 hours period, with dummy load connected. Record at 15 min intervals.

.1 Battery voltage;
.2 Charging current.

.4 At start and finish of charge record ambient and battery temperatures of each cell.

.5 Repeat discharge test and readings to prove battery was at least 95% recharged in 4 hours charge period.

.6 Recharge battery.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate battery charger, battery racks and battery as indicated.

.2 Assemble and interconnect components to provide complete UPS as specified.

.3 Connect ac mains to main input terminal.

.4 Connect UPS output to load.

.5 Start-up UPS and make preliminary tests to ensure satisfactory performance.

3.2 TESTING AND COMMISSIONING

.1 Overview

.1 General

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and CSA-C813.1.

.2 The scheduling of all work shall be co-ordinated with Owner and Purchaser to ensure that no delays are caused by interference between persons operating on site under different contracts. The Contractor shall allow a minimum of five (5) Working Days for the Testing and Commissioning, weather- permitting.

.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.

.4 Should any test results be deemed unacceptable, whether due to test conditions, Contractor error, or required correction of an equipment deficiency, the Contractor shall be responsible for repeating the applicable test or tests.

.5 The Contractor and the Engineer shall review all tests prior to the testing personnel leaving the site.

.2 Compliance with Standards and Codes

.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

.2 The Contractor shall adhere to the following standards during the process of testing and commissioning:

.1 Nova Scotia Provincial Standards

.1 Nova Scotia Occupational Health and Safety Act

.2 Nova Scotia Workers' Compensation Act.

.2 CSA Standards

.1 C22.1-06, Canadian Electrical Code Part I

.2 C22.3, Canadian Electrical Code Part III

.3 Z462-08, Workplace Electrical Safety

.3 ANSI/IEEE Standards

.1 STD 1188, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve Regulated Lead-Acid Batteries for Stationary Applications

.3 Equipment

3.2 TESTING AND COMMISSIONING (Cont'd)

.1 (Cont'd)
.2 (Cont'd)
.3 (Cont'd)
.1 The Contractor shall be responsible for the supply of all test equipment including but not limited to the following:
.1 Meggar Test Set (or equivalent).
.2 Fluke Meter (or equivalent).
.3 Current meter.
.4 Testing cables.
.5 Disconnect switch.
.6 Dummy load adjustable to 150% of system rated output.

.2 Test Procedures
.1 General
.1 The Contractor shall test the DC Uninterruptible Power Supply System and all accessories to the satisfaction of the Engineer as defined herein; the Contractor shall indicate and include any additional Vendor-recommended tests.
.2 The Contractor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.
.3 The Contractor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.
.4 All test results shall be provided to the Engineer in written form within 24 hours of completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.
.5 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.
.6 All test reports shall include the following information:
.1 Name of testing firm.
.2 Date of test.
.3 Ambient temperature at time of test.
.4 Relative humidity at time of test.
.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).
.6 Confirmation that test results are acceptable.
.7 Initialed by Contractor.
.2 DC Uninterruptible Power Supply System Testing
.1 Inspection of control cabinet, battery racks and battery.
.2 Inspection of electrical connections.

3.2 TESTING AND COMMISSIONING (Cont'd)

.2 (Cont'd)

.2 (Cont'd)

.3 Inspection of remote mode indications and alarms.

.4 Demonstration of system start-up and shut-down.

.5 Run UPS for minimum period of 4 hours at full rated load to demonstrate proper operation with AC mains input and no AC input.

.6 Discharge battery by operating UPS with AC mains open for specified duration of full load. Record readings of temperature of each cell.

.7 Recharge battery automatically with full rated load on UPS for 4 hours and record readings of voltage of each cell.

.3 Documentation

.1 Official Test Results

.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Contractor shall provide six (6) copies of final, official test reports, type-written with the Contractor's signature of approval, to the Engineer following the completion of Testing.

.2 The Contractor shall include the results of all on- site testing described herein.

.3 The Contractor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.

.4 The Contractor shall accompany the official test report with written approval that the field test results have been reviewed and the circuit breaker and all accessories have been found acceptable for energization and operation.

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for primary lighting arresters.

1.2 SECTION INCLUDES

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (CX) Requirements.

.3 Section 26 11 01 - Outdoor Substation

.4 Section 33 71 20 - Electrical Pole Lines and Hardware

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
.1 ANSI/IEEE C62.22-1997 IEEE Guide for Application of Metal-Oxide Surge Arresters for Alternating-Current Systems.
.2 ANSI/IEEE C62.11-1987. IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits

.2 Canadian Standards Association (CSA International)
.1 CAN/CSA-C233.1-87(R1999), Gapless Metal Oxide Surge Arresters for Alternating Current Systems.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Arrester component parts: to CAN/CSA-C233.1 and ANSI/IEEE-C62.22.

.2 Collector system arrester characteristics:
.1 Heavy duty distribution arrester.
.2 System highest voltage line to line: 38 kV.
.3 MCOV (maximum continuous operating voltage): 22 kV.
.4 Outdoor type.

2.1 MATERIALS (Cont'd)

.2 (Cont'd)
.5 Radio influence voltage: equal to or less than 10-microvolts above background with an applied voltage of 1.05 times MCOV.
.6 Housing: polymer.

.3 Substation Design A arrester characteristics:
.1 Station arrester.
.2 System highest voltage line to line: 72.5 kV.
.3 MCOV (maximum continuous operating voltage): 48 kV.
.4 Outdoor type.
.5 Radio influence voltage: equal to or less than 10-microvolts above background with an applied voltage of 1.05 times MCOV.
.6 Housing: polymer.

.4 Substation Design B arrester characteristics:
.1 Station arrester.
.2 System highest voltage line to line: 38 kV.
.3 MCOV (maximum continuous operating voltage): 29 kV.
.4 Outdoor type.
.5 Radio influence voltage: equal to or less than 10-microvolts above background with an applied voltage of 1.05 times MCOV.
.6 Housing: polymer.

.5 Substation Design C arrester characteristics:
.1 Intermediate arrester.
.2 System highest voltage line to line: 38 kV.
.3 MCOV (maximum continuous operating voltage): 29 kV.
.4 Outdoor type.
.5 Radio influence voltage: equal to or less than 10-microvolts above background with an applied voltage of 1.05 times MCOV.

.6 Housing: polymer.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Mount collection system arresters on cross arms as indicated by design drawings.

.2 Connect line terminals to phase conductors.

.3 From collector system arrester ground terminal run No.2/0 AWG copper ground wire connected to system ground wire (#336 kcmil AASC).

3.1 INSTALLATION (Cont'd)

.4 From substation arrester ground terminal run No.4/0 AWG copper ground wire connected to substation ground grid.

.5 Mount collector system arresters adjacent to line-side of cable terminations as indicated by design drawings

.6 Mount substation arresters adjacent to primary conductor of protected appartus and connect line terminals to phase conductors. Connect ground terminals to ground grid.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for indoor and outdoor lighting.

1.2 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 American National Standards Institute (ANSI)
- .1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
- .2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
- .1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.4 American Society for Testing and Materials (ASTM)
- .1 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.5 United States of America, Federal Communications Commission (FCC)
- .1 FCC (CFR47) EM and RF Interference Suppression.

1.3 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 05 21 - Wires and Cables (0-1000 V).

.4 Section 26 27 26 - Wiring Devices.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Submit shop drawings for the following:
- .1 Luminaire.
- .2 Lamp for each luminaire type.
- .3 Ballast for each luminaire type.

1.4 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.3 Shop Drawings:
.1 Shop drawings shall clearly indicate the following:
.2 Luminaire ID number as identified in contract documents.
.3 Fixture specification as identified in Part 2.
.4 Lamp specification as identified in Part 2.
.5 Ballast specification as identified in Part 2.
.6 Photometric data for each luminaire type.

.4 Catalogue cuts lacking sufficient detail to indicate compliance with Contract documents will not be acceptable.

.5 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Engineer. Photometric data to include:
.1 VCP Table, spacing criterion;
.2 Total input watts;
.3 Candlepower summary, candela distribution, zonal lumen summary;
.4 Luminaire efficiency, C.I.E. type, coefficient of utilization;
.5 Lamp type;

.6 Lumen ratings; and

.7 Summary in accordance with IES procedures

1.5 ACCEPTABLE PRODUCTS

.1 Luminaires described in the Lighting Fixture Schedule identify quality, performance criteria and other parameters, as indicated for this project. Named fixtures are acceptable with modifications and accessories, as indicated.

.2 Fixtures from other manufacturers may be acceptable provided:
.1 Appearance and lighting performance are similar.
.2 Quality is equal or better.

.3 Lamp and ballast criteria remain the same.

.4 The fixture is provided with modifications and accessories to provide a complete product in keeping with the intent of the project.

.5 Approval in writing is obtained from the Engineer to the Contractor 5 days prior to bid depository tender closing.

PART 2 - PRODUCTS

2.1 GENERAL

.1 All T8 lamps and ballasts shall be high performance type and eligible for Conserve Nova Scotia's point-of-sale incentive program.

2.2 LUMINAIRES

.1 Refer to the Lighting Fixture Schedule on the drawings and the floor plans for detailed requirements of luminaries to be supplied and installed under this contract. The referenced manufacturer is given as a standard of acceptance only. Other manufacturers may be accepted provided they comply with the standard of the noted fixture.

2.3 FINISHES

.1 Baked enamel finish:

.1 Conditioning of metal before painting:

.1 For corrosion resistance conversion coating to ASTM F1137.

.2 For paint base, conversion coating to ASTM F1137.

.2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel polyester powdercoat alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.

.3 Reflector and other inside surfaces finished as follows:

.1 White, minimum reflection factor 85%.

.2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.

.3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.

.4 Gloss not less than 80 units as measured with Gardner 60E gloss meter.

.5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.

.6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

.2 Alzak finish:

.1 Aluminium sheet fabricated from special aluminum alloys and chemically brightened,

2.3 FINISHES (Cont'd)

.2 Alzak finish:(Cont'd)
.1 (Cont'd)
subsequently anodically treated to specifications established by Alcoa, to produce:
.1 Finish for mild commercial service, minimum density of coating 7.8 g/m2, minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.
.2 Finish for regular industrial service, minimum density of coating 14.8 g/m2, minimum reflectivity 82% for specular and 73% for diffuse.
.3 Finish for heavy duty service, minimum density of coating 21.8 g/m2, minimum reflectivity 85% for specular, 65% for diffuse.

2.4 LIGHT CONTROL DEVICES

.1 Photocell Switch: UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 120 Vac, 60 Hz with single pole double-throw contacts for control of mechanically held contactors, rated 1000 W.
.1 Switch shall turn on at or below 32 lux (3 footcandles) and off at 22 to 107 lux (2 to 10 footcandles).
.2 A time delay shall prevent accidental switching from transient light sources.
.3 Provide switch:
.4 Integral to the luminaire. rated 400W minimum. Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.
.5 In a cast weatherproof aluminum housing with adjustable window slide, rated 1800 VA, minimum.

2.5 ACCESSORIES

.1 Labels: Provide labels for the luminaires. Include the following information on each label:
.1 1. All luminaires shall be clearly marked for operation of specific lamps and ballasts and according to proper lamp type in accordance with CSA requirements, as applicable.

.2 2. For maintenance purposes, the following lamp characteristics should be noted, as applicable, in the format "Use Lamps Only":

.3 Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

.4 Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated by design drawings.

3.2 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires from roof structure.

.2 Support luminaires mounted in continuous row once every 2.4 m.

3.3 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.4 SPARE LAMPS

.1 Provide 20% minimum spare lamps for each type of fixture provided for the project.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and Section 01 91 13 - General Commissioning (Cx) Requirements.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 05 21 - Wires and Cables (0-1000 V).

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA)
.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 10 00.

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

.1 For batteries, the ten years warranty period is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EQUPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 12 or 24 V dc.

.4 Operating time: as required by the latest edition of the NBC.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON'.

.10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: micro-tungsten or sealed beam as indicated.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: standard.

.13 Auxiliary equipment:
- .1 Test switch.
- .2 Time delay relay.
- .3 Battery disconnect device.
- .4 AC input and DC output terminal blocks inside cabinet.
- .5 Shelf.
- .6 Cord and single twist-lock plug connection for AC.
- .7 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

2.2 WIRING OF REMOTE HEADS (Cont'd)

.2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V) sized as indicated in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This document, together with attachments and associated design documents prescribes the minimum requirements for the design, installation, termination and testing of the Fiber Optic Cable used for Digby Wind Power Project.

.2 Selection of all accessories, materials and methods of fabrication which are not specifically covered by this specification, but are necessary to complete the fabrication shall be the responsibility of the Contractor and shall be carried out in accordance with the applicable codes, standards and best practices defined in this document.

.3 In case of conflict between this specification and associated design documents or reference drawings, the information represented in the design documents or reference drawings shall prevail. The Contractor shall notify Engineer, in writing, of the discrepancy and the chosen resolution.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 01 91 13 - General Commissioning (CX) Requirements.

.3 Section 33 71 20 - Electrical Pole Lines and Hardware

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA International)
.1 CSA C22.1 Canadian Electrical Code, Part 1 (Sections 10, 54, 56 and 60)
.2 CSA C22.2 No. 230-M1988 (R1999) Tray Cable
.3 CSA C22.2 No. 232-M1988, Optical Fiber Cables
.4 CSA C22.3 No. 1-M87 (R1997): Overhead Systems
.5 CSA C22.3 No. 5.1-93: Recommended Practices for Electrical Protection - Electric Contact between Overhead Supply and Communication lines
.6 CSA C22.3 No. 7-94: Underground Systems
.7 CSA T527-94 Grounding and Bonding for Telecommunications in Commercial Buildings
.8 CSA T529-M91 Installation and Mechanical requirements

1.3 REFERENCES (Cont'd)

.2 (Cont'd)
.9 CSA T530-M90 Building Facilities Design Guidelines for Telecommunications

.3 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
.1 ANSI/TIA/EIA - 455-34 Interconnection Device Insertion Loss Test
.2 ANSI/TIA/EIA - 526-7 Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant
.3 ANSI/TIA/EIA - 568-B Telecommunications Cabling Standard
.4 ANSI/TIA/EIA - 569-A Commercial Building Standard for Telecommunications Pathway and Spaces
.5 ANSI/TIA/EIA - 598 Color Coding of Fiber Optic Cables
.6 ANSI/TIA/EIA - 758-A Customer Owned Outside Plant Telecommunications Cabling Standard

.4 Nova Scotia Provincial Standards
.1 Q OHSA, Occupational Health and Safety Act of Nova Scotia
.2 BICSI Telecommunications Cabling Installation Manual
.3 BICSI Telecommunications Distribution Methods Manual

.5 Manufacturer Installation Guidelines
.1 The following cable manufacturer standard recommended procedures shall be used as guidelines for the fiber optic cable installation:
.1 SRP-005-010 Iss 9 Fiber Optic Cable Placing - Lashed Aerial
.2 SRP-005-011 Iss 7 Fiber Optic Cable Placing - Duct
.3 GE - Fiber Optic Network Design Specifications

1.4 SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 10 00.

.2 Test Results
.1 The Contractor shall submit the cable test results to Engineer for review and signoff. The test results shall be in accordance with the Fiber optic tests identified in Section 3.2 including:
.1 Cable birth certificate,
.2 Test sheet record for cable on reel,
.3 Test sheet record for cable after placement, and,

1.4 SUBMITTALS (Cont'd)

.2 (Cont'd)
.1 (Cont'd)
.4 Test sheet record for cable after termination.
.2 The tester who performed the test shall sign the paper copy of the test results.
.3 The Contractor shall provide one copy of the test results to Engineer in PDF format. The test results shall be delivered on a recordable CDROM.
.4 The Contractor shall provide viewer software with a minimum of one user license for the OTDR or TDR trace file.

.3 As-Builts
.1 The Contractor shall provide one paper copy of as-built drawings to Engineer. The drawings shall be black and white,
.2 The Contractor shall provide as-built drawings to Engineer in electronic format. The drawings shall be delivered on recordable CDROM.

.4 Warranty
.1 The Contractor shall provide a copy of the Corning Lanscape Extended Warranty Program certificate to Engineer. This warranty shall be applicable to all the Landscape Fiber optic cables installed site-wide.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 FIBER OPTIC CABLE

.1 All cables used shall be Corning Cable Systems' LANscape Fiber optic products. Cables shall be fit for installation in specific raceway design, such as:
.1 underground duct,
.2 overhead pole line,
.3 cable tray.

.2 Corning cable part numbers will be identified in bill of materials included in design documents.

.3 Single-mode self-supporting aerial Fiber optic cable shall be used.

.4 All Fiber optic cables shall meet CSA C22.1 Canadian Electrical Code, Part 1, and Section 56.

2.1 FIBER OPTIC CABLE (Cont'd)

.5 For cable tray application, the Fiber optic cable shall meet the tray-rated cable test criteria outlined in CSA C22.2 No. 230-M1988 (R1999), Tray Cable specification, with no impact on the cable performance. The cable Vendor shall submit technical evidence that shows the cable test result.

.6 All outdoor Fiber optic cables shall meet the following temperature requirements:
.1 Storage: -40 deg C to +50 deg C
.2 Operation: -40 deg C to + 50 deg C
.3 Installation: -30 deg C to + 40 deg C

.7 Fiber optic cable outer jacket color shall be black and buffer tube color shall be in accordance with TIA/EIA 598A, Color Coding of Fiber Optic Cables.

.8 Standard of acceptance shall be Corning Altos All-Dielectric Fiber Optic Cables.

2.2 PATCH CORDS

.1 Fiber optic patch cords are generally not included in any outside plant cable installation, unless specified in design documents and installation drawings.

.2 Single-mode Fiber optic patch cords shall be yellow in color.

.3 3.0 mm dual or zipcord (duplex) Fiber patch cords shall be used unless specified otherwise by design drawings.

.4 Unless specified otherwise by design drawings, all Fiber optic patch cords shall be custom built to length to avoid excess slack.

.5 Pre-manufactured patch cords, if used, shall be Corning Cable Systems' product and will be identified in design drawings.

.6 Fiber optic patch cords shall be used only within the same equipment cabinet or the same room. The use of Fiber optic patch cords between equipment rooms or buildings is not permitted.

.7 All Fiber optic patch cords shall be protected in covered raceway designed for Fiber optic patch cables.

.8 The Fiber optic connectors shown in (Table 1) shall be used for all field installed patch cords:

Fiber Type	Connector Type	Corning Part No.
Single-mode	SC	95-200-41

2.2 PATCH CORDS (Cont'd)

.8 (Cont'd)

Table 1 - Fiber Optic Connector Standard

2.3 FIBER DISTRIBUTION (PATCH) PANELS

.1 All Fiber optic terminations shall be housed in Corning's Pretium Connector Housing. The enclosure shall be sized to fit the application and the environmental conditions for outdoor application.

.2 Rack-mounted patch panels to be Corning CCH or similar, and shall be of sufficient size to allow termination of all Fibers from a single cable. Spare connectots or patch panels may be used if indicated by design drawings.

.3 Pole-mounted patch panels to be Corning CCH or similar, and shall be of sufficient size to allow termination of all Fibers from a single cable. Spare connectots or patch panels may be used if indicated by design drawings. The enclosure shall be rated NEMA 4X.

.4 Single-mode Fiber shall be terminated on Corning SC connector single-mode CCH Connector Panel as indicated by design drawings.

.5 All Fiber optic cables shall be fully terminated and unused connectors shall be protected with plastic caps.

2.4 OUTDOOR FIBER SPLICE BOXES

.1 Oudoor Fiber Splice Boxes shall be NEMA 4X rated completed with all accessories required for pole installation. Boxes shall have hinged cover with means to install a padlock.

.2 Oudoor Fiber Splice Boxes to be Corning EDC or similar. and shall be of sufficient size to allow splicing of all Fibers from a single cable with 25% spare.

PART 3 - EXECUTION

3.1 FIBER OPTIC INSTALLATION

.1 General

.1 Installers who are responsible for the Fiber installation shall be Corning certified.

.2 The Contractor who is responsible for the Fiber installation shall be prepared, upon request, to present evidence of training and certification by Corning Cable Systems.

.3 All Fiber installation shall adhere to the following Corning standard documents:

.1 LANscape Solution Design Guide

.2 Corning installation practices shown in Attachment A

.4 The installation shall meet all requirements necessary to qualify for Corning's 20-year LANscape Extended Warranty Program.

.5 All materials shall be new. No recovered or refurbished material may be used.

.6 Cable runs shall be continuous and splicing shall be done only at locations indicated by design drawings drawings. If during construction, splicing is required, the Contractor shall obtain Engineer approval before proceeding.

.7 During and after installation, all Fiber optic cables shall confirm to Corning's specifications for tensile loading, bend radius and vertical rise. During installation, cable guides shall be used to limit cable bend radius. The bend radius shall not be less than the minimum bend radius specified by Corning.

.8 Cable tension shall be monitored when mechanical pulling device is used for Fiber optic cable installation. Monitoring is not required when cable is hand-pulled.

.9 Lubricant compatible with the cable jacket shall be used to facilitate Fiber optic cable pulling to prevent potential damages.

.10 No more than two 90-degree changes of direction can occur in any single Fiber optic cable pull without prior approval by Engineer. Pull boxes shall be used after every second 90-degree bend.

.11 Cables shall not have any residual tension after installation (except where tension is caused by weight of cable as in a vertical rise). Cables shall be strain relieved to prevent any potential damages.

.12 The Contractor shall be responsible for grounding and bonding of all communication equipment as per CSA T527-94 specification and Canadian Electrical Code, Part 1 (Section 10).

.13 When pulling long lengths of cable through duct or conduit, less than 50 percent fill ratio by cross sectional area shall be used.

3.1 FIBER OPTIC INSTALLATION (Cont'd)

.1 (Cont'd)

.14 All cables without Riser/FT4 rating, if used, shall be enclosed in metallic conduit after building entrance. The maximum cable distance between building entry point and the beginning of conduit run shall be less than or equal to 3 m.

.15 Aboveground cable splice enclosure assembly shall meet site environmental conditions and shall be designed for pole mounting.

.16 A minimum of 3 m service loop (slack) shall be left in manholes, pedestals, and inside telecommunication rooms to allow for termination, maintenance and potential cable expansion and contraction due to wide variation in temperature. Service loop can typically be stored in the following locations:

.1 Dedicated enclosure
.2 Cable tray

.17 The service loop shall be installed in a layout that does not impede maintenance work and future expansion of the cable system.

.2 Underground Duct Installation

.1 Underground Duct Installation shall be in accordance with Section 26 05 44 - Installation of Cables in Trenches and in Ducts.

.2 Before pulling cable into ducts and until cables are properly terminated, seal ends with moisture seal tape.

.3 Where cable rises above grade for termination or splicing, it shall be protected from mechanical damage by concrete encased rigid PVC conduit. See for details the design drawings.

.4 A 152 mm wide magnetically detectable warning tape with orange protective polyethylene jacket with

.5 Separation of at least 1,000 mm shall be maintained between underground cables ducts and underground pipelines.

.6 Permanent markers shall be placed beside the cable route immediately after installation to warn against possible future "dig-ups". Where cable changes direction, additional permanent markers shall be installed.

.7 Contractor shall follow Corning Cable Systems SRP-005-011 for duct cable installation procedures.

.3 Riser Cable Installation

.1 A split mesh grip shall be used at the top of the run to support vertical fiber optic cables.

.2 Intermediate cable ties shall be installed every 3,000 mm to prevent lateral movement. The cable shall be allowed to slide through the attachment point due to cable expansion or contraction.

3.1 FIBER OPTIC INSTALLATION (Cont'd)

.4 Installation in Cable Tray

.1 Installation in Cable Tray shall be in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.2 Fiber optic cable shall be installed in dedicated tray, or, in shared tray with

.3 Fiber optic cable shall not run in the same tray as power cables.

.4 For ease of laying cables, tray systems shall be as simple as possible, with minimum number of turns and offsets. Bends shall not be smaller than the minimum-bending radius of any cable in the tray.

.5 Cables shall be fastened to tray every 3,000 mm with UV resistant cable ties.

.6 If cables are placed in warm weather, slacks should be allowed to ensure no cable damage would occur due to cable contraction in winter.

.5 Aerial Installation

.1 Self-supporting aerial Fiber optic cable shall be used as default without mesenger. Messenger wire may be used after Engineering approval.

.2 Installation of aerial Fiber optic cable with pole spans greater than 70 meters requires Engineer approval.

.3 Cable lasher and its accessories shall be pulled with a constant tension to prevent the lashing wire from wrapping the fiber optic cable around the strand.

.4 Aerial Fiber optic cable installations shall not share a messenger wire with other cable types without the approval of Engineer. Generally approval will only be granted where the other cable is Multi Pair telephone cable of 100 pair or less.

.5 Contractor shall follow Corning Cable Systems SRP-005-010 Lashed Aerial installation procedures.

.6 Field Connectorization

.1 A furcation kit shall be used to fan out the individual Fibers from a loose buffer tube. Manufacturer's installation best practice shall be followed.

.2 Connectors shall be UV or heat cured. Connector shall allow original Fiber to pass straight through the connector, and be polished.

.3 Connector tips shall be polished as per manufacturer recommendations.

.4 Completed connectors shall be inspected (under magnification) to ensure that:

.1 connector tip is properly polished, with no damage,

.2 fiber core is centered within manufacturer recommended limits,

.3 no residue is left on the connector.

3.1 FIBER OPTIC INSTALLATION (Cont'd)

.5 (Cont'd)

.6 (Cont'd)

.5 If the connector fails inspection, it shall be cleaned or redone and re-tested until it meets the testing criteria.

.7 Cable Splicing

.1 Only factory connectorized pigtails shall be used.

.2 All Fibers in a buffer tube shall be terminated in a dedicated splice tray.

.3 Fiber slacks shall be allowed inside the splice tray as per manufacturer's installation procedure.

.4 Fiber splices shall be protected with heat shrink tubing or RTV (silicone).

.5 Optical Fibers shall not be exposed except within the splice tray.

.6 Splice trays shall have lids or covers.

.7 Completed splices shall be visually inspected (under magnification) to ensure they are undamaged. Splices that fail inspection shall be broken and re-done.

.8 Heat-shrink, mechanical crimp connectors or silicone sealant shall be used to provide strain-relief and protection of the stripped Fiber splices.

.9 Fusion splicing equipment shall be properly calibrated and shall meet industry standards. Cable preparation and splicing shall be in accordance with accepted industry standards.

3.2 INSPECTION AND TESTING OF FIBER OPTIC CABLE

.1 General

.1 A Corning-certified Contractor shall conduct inspection and testing of all Fiber optic cables.

.2 The Contractor shall be responsible for all labor, test equipment and material required to complete the inspection and test procedure.

.3 Every Fiber optic cable strand shall be tested in the following sequence:

.1 On reel, after cable delivered on site

.2 After cable placement, but before termination

.3 After termination

.4 Only cable attenuation test (Section .3) shall be required for (a) and (b). Full tests shown in Section .3 to .4 shall be conducted for (c).

.5 The Contractor shall also conduct visual inspection of Fiber optic cable in each of the steps shown in Section .3 to identify potential damages due to shipping or placement in raceway.

3.2 INSPECTION AND TESTING OF FIBER OPTIC CABLE (Cont'd)

.1 (Cont'd)

.6 Test sheets submitted shall include, but not be limited to the following information:

.1 Cable tag
.2 Strand number
.3 Date and time of test
.4 Name of tester
.5 Test equipment manufacturer, type, model, serial number and last calibration date
.6 Test wavelengths used
.7 Attenuation (dB)
.8 Splice loss (dB), where applicable
.9 Connector loss (dB), where applicable
.10 Return loss (dB), where applicable
.11 OTDR signature trace, where applicable

.7 All inspection and test results, including cable. The same inspection and test results shall be included in the overall turnover package to Engineer.

.8 Test equipment used for all the tests shall be calibrated no more than 2 months before the date of the tests.

.2 Test Wavelengths

.1 Test wavelengths used for single-mode cable shall be 1310 nm and 1550 nm.

.3 Cable Attenuation Test (Power Meter)

.1 End-to-end Fiber attenuation test shall be conducted and recorded for each cable strand. The test shall be in accordance with TIA/EIA-526-7 for single-mode cable.

.2 Cable acceptance is based on the following table (Table 2):

	@1300nm	@1550nm
Attenuation (dB/km)	<0.40	<0.30

Table 2 - Fiber Optic Cable Attenuation Acceptance Test.

.3 The Contractor shall inform Engineer if any of cables do not meet the attenuation specification defined in Section

.4 Only cable attenuation test is required for field installed patch cords.

.4 Optical Time Domain Reflectometry (OTDR) Test

.1 A 15 second OTDR test run shall be conducted on each Fiber optic strand end-to-end (patch panel to patch panel).

.2 The following Fiber optic data shall be obtained:

.1 Normalized Fiber loss in dB/km
.2 Actual cable length measurement
.3 Splice loss
.4 Connector loss

3.2 INSPECTION AND TESTING OF FIBER OPTIC CABLE (Cont'd)

.4 (Cont'd)

.2 (Cont'd)

.5 Return loss

.6 Signature trace for the entire cable run

.3 Splice, connector loss and return reflectance specifications are shown in the following table (Table 3):

	Single-mode Cable	
	Target	Maximum
Splice Loss (dB)	0.07	0.1
Connector Loss (dB)	0.3	0.5
Return Loss (dB)	>40	-

Table 3 - OTDR Test Criteria

.4 Cables or splices that fail the test specification shall be redone and retested.

.5 If a Fiber optic cable fails a test, Engineer shall be notified immediately. The responsible engineer and Albian Sands will review the situation. A decision will be made on how to proceed and it may include replacement and re-termination of the entire cable. All damaged Fiber strands, if retained, shall be marked as "non-functional" at the patch panels end-to-end.

3.3 CABLE AND EQUIPMENT LABELING

.1 Cable Labeling Format

.1 All communication cables shall be labeled using the following naming format:

Field Description:

System: W=Wind Farm, S=Substation

Media: C=Copper, F=Fiber

Type: 3=Category-3, 5=Category-5, 6=Category-6

Source: xxxxxxxxx - Cable source wind turbine number or junction box number

Destination: xxxxxxxxx - Cable destination wind tubine number or junction box number

Number: xxx - Cable number padded with leading 0s

.2 All outdoor cables shall be tagged at both ends using 19 mm x 76 mm engraved stainless steel tags ty-wrapped to the cables and visible at the proximity of termination. Cable tags shall also be installed at locations where cables penetrate buildings or junction boxes.

3.3 CABLE AND EQUIPMENT LABELING (Cont'd)

.1 (Cont'd)

.3 All indoor cables shall be labeled with permanent machine printed label. The label shall be a tubular, heat-shrinkable, slip-on sleeve.

.2 Optical Link ID

.1 Each permanent end-to-end optical link shall be assigned with a unique 1 - 999 series link ID. The link shall be from patch panel to patch panel with no temporary patch cords in the optical path.

.2 Fiber optic connectors in patch panels shall be labeled with the associated optical link IDs.

.3 Fiber Optic Patch Cord Labeling Format

.1 Fiber optic patch cord between equipment and patch panel shall be tagged with the optical link ID of the connector, to which the equipment is connected.

.2 Fiber optic patch cord shall be tagged at both ends of the cable, using permanent machine printed label. The label shall be a tubular, heat-shrinkable, slip-on sleeve.

.3 In addition to the optical link ID, the label at the equipment end shall include equipment name of the equipment to where the patch cord is connected.

.4 Equipment Labeling Format

.1 Cable termination equipment shall be labeled using the following naming system:
Field Description:

Equipment:	P=Patch panel, S=Surge protection, X=Splice panel
Media:	C=Copper, F=Fiber
Type:	3=Category-3, 5=Category-5, 6=Category-6
Location:	xxxxxxxx - Building name of the equipment location
Number:	xxx - Equipment number padded with leading 0s

.5 Cable termination equipment shall be tagged at the top left corner of the front panel, using 15 mm x 50 mm engraved lamacoid. Tags shall be visible to maintenance personnel while standing in front of the cabinet in which the equipment is mounted.

3.4 SYSTEM QUALITY ASSURANCE (QA)

.1 QA Program

.1 The Contractor shall have a QA program to manage incoming parts, assemblies and final product installations.

.2 The Contractor shall have test procedures in place to ensure the final installed cable system meets all the specifications defined in this document.

.3 Supplied equipment will bear the approved label of the Canadian Standards Association (CSA) or Underwriters Laboratory Canada (ULC).

.2 Electronic Data

.1 All electronic data delivered to Engineer shall be scanned for viruses prior to delivery.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies the requirements for clearing, grubbing and disposing of vegetation on-site at Owner approved locations.

1.2 RELATED WORK

.1 Site grading: Section 31 22 10

1.3 DEFINITIONS

.1 Clearing consists of cutting of all trees, brush, and vegetative growth to not more than 30 mm above ground and disposing of felled trees, previously cut or uprooted trees and stumps, and surface debris within the designated limits.

.2 Grubbing consists of excavation and disposal of stumps, roots, embedded logs, rootmat, humus, organic and other objectionable material, boulders and rock fragments of specified size to not less than a specified depth below existing ground surface.

1.4 STORAGE AND PROTECTION

.1 Prevent damage to snow fence, trees, wetland, natural features, benchmarks, utility lines, site appurtenances, and root systems of trees outside designated limits.
.1 Repair damaged items to approval of Engineer.
.2 Replace trees designated to remain, if damaged, as directed by Engineer.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect site and verify with Engineer, items designated to remain.

.2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.

.3 Notify utility authorities before starting work.

3.2 CLEARING LIMITS

.1 Before beginning clearing operations, review with Engineer, limits set for clearing based on limits indicated on Drawings.

3.3 CLEARING

.1 Begin clearing operations only after limits of clearing have been established, marked by snow fence, and agreed to by the Engineer on site.

.2 Clear as directed by Engineer. Height of stumps left from clearing operations to be not more than 300 above ground surface.

.3 Do not cut down vegetation outside designated limits of clearing with the exception of any tree considered unsafe. Do not cut any such tree unless marked for cutting.

.4 Cut off unsound branches on trees designated to remain.

3.4 GRUBBING

.1 Grub out stumps, roots, embedded logs, humus, organic and other objectionable material to not less than 200 mm below ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m^3.

3.5 REMOVAL AND DISPOSAL

.1 Remove and dispose of cleared materials off site.

.2 Chip and spread brush on site as directed by Engineer.

.3 Remove grubbed material and dispose on site within eachproperty owner's boundaries.

3.6 FINISHED SURFACE

.1 Leave ground surface in condition suitable for immediate grading operations to approval of Engineer.

END

PART 1 - GENERAL

1.1 RELATED WORK

.1 Clearing and grubbing: Section 31 10 00

.2 Earthwork: Section 31 20 00

1.2 PROTECTION

.1 Prevent damage to trees, structures, natural features, bench marks, or surface or underground utility lines which are to remain. Repair damage to original or better condition at no extra cost to the Contract.

.2 Contractor responsible for sedimentation and erosion control. All sedimentation and erosion control devices to be in place before commencing work.

1.3 SITE CONDITIONS

.1 Contours and road profiles present on the drawings are metric. Topographic survey has been done by Terrain Group.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Selected Backfill: as specified in Section 31 20 00.

.2 Granular Material: as specified in Section 31 20 00.

PART 3 - EXECUTION

3.1 EXCAVATING

.1 Before commencing cut and fill operations, agree with Engineer as to ground surface elevations to be cut and filled.

.2 Notify Engineer whenever unsuitable materials are encountered and remove unsuitable materials to depth and extent directed.

.3 Construct roads and ditches to approved profiles.

.4 Excavate in all kinds of material including rock encountered on the site and make own computations of amount and nature of excavation required.

3.1 EXCAVATING (Cont'd)

.5 Perform all excavation within ±50 mm of the lines, grades and dimensions shown on the Drawings or as established by the Engineer. During the progress of the Work, the Engineer may vary the lines, grades and dimensions of the excavations from those specified in this Section.

.6 Proof roll subgrade in completed excavations in presence of geotechnical inspector. Over-excavate any soft spots and backfill with approved granular fill.

.7 Take necessary precautions to preserve the material below and beyond the lines of all excavation in the soundest possible condition.

.8 Do not stockpile excavated site tills except as directed by the Engineer. If material is stockpiled do not endanger personnel and the work, reduce sight lines, obstruct roadways, or become saturated.

.9 Do not obstruct existing drainage ditches and natural watercourses unless indicated on the Drawings.

.10 Reduce steepness of slopes wherever possible, and expose smallest practical area of land for shortest possible time.

.11 During construction direct surface runoff to sediment control facilities installed and maintained to the Requirements of the Nova Scotia Department of the Environment.

3.2 ROCK EXCAVATION

.1 Conduct blasting in accordance with the Construction Safety Regulations of the NS Department of Labour. Blasting will be permitted only after securing written approval of the Engineer and only after appropriate permits have been obtained.

.2 Conduct blasting operations using only certified personnel. Cover rock with effective mats, and provide warning to all persons in vicinity of the work before blasting. Repair damage caused by blasting at no additional cost to the Contract.

.3 Take full responsibility for claims arising from hauling, storing, handling, and use of explosives and for the effects arising from blasting, including vibrations, concussion, flying material, structural damage to adjacent properties, and the like.

.4 Provide seismic monitoring as recommended by the Contractor's insurers.

3.3 EMBANKMENTS

.1 Do not place material which is frozen nor place material on frozen surfaces.

.2 Maintain a sloped surface during construction to ensure ready run-off of surface water.

.3 Place and compact embankment material to full width in uniform layers not exceeding 200 mm loose thickness. Engineer may authorize thicker lifts if specified compaction can be achieved.

.4 Compact material to a density of not less than 95% standard Proctor density, except last 300 mm up to sub-grade elevation. Compact last 300 mm to 98% standard Proctor density.

3.4 FINISHING

.1 Remove soft or other unstable material that will not compact properly and fill resulting depressions with approved material.

.2 Shape and compact entire subgrade to within 25 mm of design elevations but not uniformly high or low.

.3 Do scarifying, blading, compacting or other methods of work as necessary to provide a thoroughly compacted site shaped to grades indicated or directed.

.4 Finish side slopes to a neat condition, true to lines and grades indicated.
.1 Remove boulders encountered and fill resulting cavities.
.2 Hand finish slopes that cannot be finished satisfactorily by use of machine.

3.5 GRANULAR MATERIAL SURFACE

.1 Prior to placing granular material, grade surface to within 35 mm of elevations and cross sections indicated but not uniformly high or low. Compact top 300 mm to 98% Standard Proctor Density.

.2 Do not place granular material until finished subgrade is inspected and approved by Engineer.

.3 Place granular material on clean, unfrozen surface, properly shaped and compacted and free from snow or ice.

.4 Place granular material in uniform layers, maximum 150 mm compacted lifts, using methods which do not lead to segregation or degradation.

3.5 GRANULAR MATERIAL SURFACE (Cont'd)

.5 Shape each layer to smooth contour and compact to 100% Standard Proctor Density before next layer is placed.

.6 Finish surface to be within 12 mm of specified grade, but not uniformly high or low.

.7 Remove and replace that portion of a layer in which material becomes segregated during spreading.

.8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.6 COMPACTION TESTING

.1 Contractor to arrange for and pay for independent compaction testing of all materials used in site grading and finishing.

.2 Compaction testing to be performed by an accredited soils testing company to the approval of the Engineer.

.3 Three copies of all compaction tests results to be provided to Engineer.

3.7 SURPLUS MATERIAL

.1 Dispose of surplus approved embankment material not required for placement in fills and material unsuitable for grading or landscaping on-site at approved locations.

3.8 MAINTENANCE

.1 Maintain finished surfaces in a condition conforming to this section until acceptance.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for providing chain link fence and gates as indicated on the Drawings, and as specified.

1.2 RELATED WORK

.1 Cast-in-place concrete: Section 03 30 00

1.3 REFERENCES

.1 ASTM A53/A53M-04a, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.2 ASTM A90/A90M-01, Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A653/A653M-04a, Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 CAN/CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.5 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CAN/CGSB-138.1-96, Fabric for Chain Link Fence.

.7 CAN/CGSB-138.2-96, Steel Framework for Chain Link Fence.

.8 CAN/CGSB-138.3-96, Installation of Chain Link Fence.

.9 CAN/CGSB-138.4-96, Gates for Chain Link Fence.

.10 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Drawings to indicate: dimensions, size of components, anchorage details.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Concrete mixes and materials: as specified in Section 03 30 00.

.2 Chain-link fence fabric: to CAN/CGSB-138.1.
.1 Type 1, Class A, medium style.
.2 Height of fabric: as indicated.

.3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated.

.4 Bottom tension wire: to CAN/CGSB-138.1, Table 2, single strand, galvanized steel wire, 5 mm diameter.

.5 Tie wire fasteners: to CAN/CGSB-138.1, Table 2 (steel wire), single strand.

.6 Tension bar: to ASTM A653, 5 x 20 mm minimum galvanized steel.

.7 Tension bar bands: 3 mm x 20 mm minimum, galvanized steel.

.8 Gate frames: to ASTM A53, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.
.1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.
.2 Fasten fence fabric to gate with twisted selvedge at top.
.3 Furnish gates with galvanized malleable iron hinges, latch and catch with provision for padlock which can be attached and operated from either side of installed gate.
.4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.

.9 Fittings and hardware: to CAN/CGSB-138.2, cast aluminum alloy, galvanized steel or malleable or ductile cast iron. Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum. Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail. Overhang tops to provide waterproof fit.

.10 Organic zinc rich coating: to CAN/CGSB-1.181.

.11 Barbed wire: to CAN/CGSB-138.2 and as specified on the drawings.

2.2 FINISHES

.1 Galvanizing:
.1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.
.2 For pipe: 550 g/m^2 minimum to ASTM A90.
.3 For barbed wire: to CAN/CGSB-138.2.
.4 For other fittings: to CAN/CSA-G164.

PART 3 - EXECUTION

3.1 GRADING

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.2 ERECTION OF FENCE

.1 Erect fence along lines as indicated accordance with CAN/CGSB-138.3.

.2 Excavate post holes to dimensions indicated by methods approved by Engineer.

.3 Space line posts 3 m apart, measured parallel to ground surface.

.4 Install additional straining posts at relative changes in grade greater than 1V:5H and where directed by Engineer.

.5 Install corner post where change in alignment exceeds 10°.

.6 Install gate posts on both sides of gate openings.

.7 Place concrete in post holes then embed posts into concrete to minimum mm depth. Extend concrete 50 mm above ground level and slope to drain away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.8 Do not install fence fabric until concrete has cured a minimum of 5 days.

.9 Install brace between gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner.

.10 Install overhang tops and post caps.

3.2 ERECTION OF FENCE (Cont'd)

.11 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.12 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.13 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals. Knuckled selvedge at bottom. Twisted selvedge at top.

.14 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals. Give tie wires minimum two twists.

.15 Install barbed wire strands and clip securely to lugs of each projection.

3.3 INSTALLATION OF GATES

.1 Install gates in locations as indicated.

.2 Level ground between gate posts and set gate bottom approximately 40 mm above ground surface.

.3 Determine position of centre gate rest for double gate. Cast gate rest in concrete as directed. Dome concrete above ground level to shed water.

.4 Install gate stops where indicated.

3.4 TOUCH UP

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas. Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.5 CLEANING

.1 Clean and trim areas disturbed by operations. Dispose of surplus material and replace damaged turf with sod as directed by Engineer.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for constructing new transformer passive oil containment system able to contain 110% of the oil of one substation and one STATCOM system connection transformers plus a 25-year storm event.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 31 20 00 - Earthwork.

1.3 REFERECES

.1 The passive oil containment system shall comply to the latest edition of all applicable Canadian and North American Fire Safety and Environmental standards.

1.4 SUBMITTALS

.1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings and information where pertinent.

1.5 SCHEDULING OF WORK

.1 Schedule work to minimize site disturbance during construction.

.2 Submit schedule for approval and adhere to approved schedule.

PART 2 - PRODUCTS

2.1 OIL MAT

.1 The oil mat shall be textile sandwiched polymer interlocked together forming a continuous mat.

.2 The oil mat not subjected to hydrocarbons shall allow water to pass through the system into the subsoil, or a drainage system.

.3 When hydrocarbons come into contact with the oil mat the polymer shall congeal and seal, not permitting any hydrocarbon from leaving the containment area.

2.2 BACKFILL MATERIAL

.1 As indicated by design drawings.

.2 In accordance with Section 31 20 00 - Earthwork.

2.3 ACCEPTABLE MATERIALS

.1 Sorbweb, 85 MOrrow Road, Barrie, ON, L4N 3V7, 1-866-269-8275, www.sorbwebplus.com.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Place bedding and surround material in unfrozen condition.

.2 Do excavation in accordance with Section 31 20 00 - Earthwork and as per design drawings.

.3 Place bedding material in accordance with details as indicated. Compact to 95% maximum dry density to ASTM D698.

.4 Install the oil mat in accordance with manufacturer recommendations.

.5 Place layer of sand as indicated by design drawings.

.6 Fill with fire quenching crushed stone.

.7 Do backfilling in accordance with Section 31 20 00 - Earthwork.

END

PART 1 - GENERAL

1.1 Work Included

.1 This Section specifies requirements for performing all operations necessary to complete the electrical grounding well construction.

1.2 Work Not Included

.1 The work does not include yield determination testing, supply and installaltion of pump.

1.3 Related Sections

.1 General Requirements: Section 01 10 00

.2 Grounding - Secondary: Section 26 05 28

1.4 Standards

.1 The work under this Section to be in accordance with Nova Scotia Environment (NSE) Well Construction Regulations.

1.5 Qualifications

.1 The Contractor shall be a well driller, licensed in the Province of Nova Scotia and experienced in drilling wells in sub-surface conditions existing at the Site.

1.6 Reports

.1 On completion of work, submit to the Owner a report containing:
.1 Log of well drilling;
.2 Record drawing of well;
.3 GPS coordinates of the well.

1.7 Submittals

.1 Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submittals.

1.8 Waste Management and Disposal

.1 Maintain site in tidy condition free from accumulation of waste products and debris.

.2 Upon attaining Substantial Performance of the Work remove surplus products, tools, machinery and equipment.

1.8 Waste Management and Disposal (Cont'd)

.3 Completion of cleanup is required for Substantial Performance of the Work.

1.9 Environmental Protection

.1 Provide measures to ensure that erosion or significant channelization of the embankment does not occur.

.2 Provide environmental protection measures as required to reduce potential for fine particulates entrained in the drill cuttings to enter local waterways.

1.10 Safety

.1 Observe construction safety measures in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 General

.1 Provide all materials, equipment and supplies to drill the electrical ground well.

.2 Use new material only.

.3 103mm nominal inside diameter carbon steel inner well casing with 4.7 mm wall thickness.

.4 Surface well casing to meet standard in 'Schedule A' of Well Construction Regulations, of sufficient casing diameter for placement of grout and packing. Casings will be used as an additional grounding electrode.

.5 Use pipe fittings of same standard as pipe casing.

PART 3 - EXECUTION

3.1 Drilling

.1 Use drilling equipment and methods approved by the NSEL. Drill the hole using a rotary drill rig.

.2 Drill in general location indicated on the drawings.

.3 Drill hole round, plumb and true to line.

.4 Log the hole as drilling proceeds including the following information:
.1 Depth of changes in formation.
.2 Description of formations encountered.
.3 Elevation at which aquifers are encountered, sudden changes in water level, loss of drilling fluid or other indications of permeable strata.

.5 At intervals, as dictated by the observed conditions, perform air lift testing, record the depth, and the yield assessed to determine whether drilling should stop or continue. In addition, measure and record water conductivity on each such bail test. When the indications of yield are favourable, or when the conductivity approaches 1000 mmho/cm, stop drilling, measure and record the (static) water level and carry out a blow test (or electric pump test) for minimum two hours, at a steady rate, without breaking suction. The target yield is to be determined by the Engineer but is expected to be 15 imperial gallons per minute. Measure water level at end of 2 hours while blowing (pumping), then increase rate to exhaust borehole and stop.

.6 Prevent foreign matter from entering bore hole and prevent contaminated water or other objectionable fluids from reaching aquifer through borehole.

.7 Be prepared to control, shut-off and seal hole should flowing artesian water or gas be encountered.

.8 Develop well until acceptable water quality clarity is produced.

.9 Seal abandoned holes by approved methods with concrete, cement bentonite grout.

3.2 Casing, Screens, Packing and Grouting

.1 Joints shall be welded to allow continuous ground electrode.

.2 Provide a minimum 10m of surface casing, or to bedrock, and leave it a minimum of 1m below grade upon completion to allow addition of clear granit stone to assist with step towards potential hazards.

.3 Surround casing with bentonite grout to grade surface not less than 25 mm in thickness to seal annular space between casing and borehole wall/ surface casing.

.4 Place grout from bottom up by approved methods. Place grout in one continuous operation with entire amount of grout placed before initial set occurs.

.5 After grouting is completed, cut off casing squarely and neatly. Cover casing and leave ready for installation of ground conductor.

END

PART 1 - GENERAL

1.1 RELATED WORK

.1 Site grading: Section 31 10 00

.2 Earthwork: Section 31 22 10

1.2 REFERENCES

.1 CAN/CSA-A257 Series-M92 (R2003), Standards for Concrete Pipe.

.2 CAN/CSA A3000-03, Cementitious Materials Compendium.

.3 ASTM C144-04 Standard Specification for Aggregate for Masonry Mortar

1.3 LOAD REQUIREMENTS

.1 Contractor responsible to ensure that all culverts will handle HS20 Loading Conditions.

.2 Any culverts that do not meet HS20 Loading Conditions are to be replaced using new concrete, class 140-D.

PART 2 - PRODUCTS

2.1 CONCRETE PIPE

.1 Reinforced concrete pipe: to CAN/CSA-A257 diameter indicated, strength classification 140-D.

.2 Rubber gaskets for joints: to CAN/CSA-A257.

.3 Cement mortar joint filler:
.1 Portland cement: to CAN/CSA A3000,
.2 Sand: to ASTM C144.
.3 Mortar: one part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

2.2 BEDDING AND BACKFILL

.1 Bedding and backfill: selected backfill material and type 1 gravel as specified and as indicated on the drawings.

2.3 GEOTEXTILE

.1 Geotextile: non-woven, needle-punched synthetic filter fabric composed of minimum 85% by mass of polyester with inhibitors to resist deterioration.
.1 Acceptable products: Terrafix 270R or approved equivalent.

PART 3 - EXECUTION

3.1 TRENCHING

.1 Do trenching work during embankment work.

.2 Obtain Engineer's approval of trench line and depth prior to placing bedding material or pipe.

3.2 BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in the dry. Temporarily divert or contain surface water runoff to facilitate placement of culvert bedding in the dry.

.2 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Engineer, free from sags or high points.

.3 Place bedding in unfrozen condition.

3.3 LAYING CONCRETE PIPE CULVERTS

.1 Begin at downstream end of culvert with female end of first pipe section facing upstream.

.2 Ensure barrel of each pipe is in contact with shaped bed throughout its length.

.3 Do not allow water to flow through pipes during construction except as permitted by Engineer.

3.4 JOINTS: CONCRETE PIPE CULVERTS

.1 Rubber gasket joints:
.1 Install to manufacturer's recommendations.

.2 Ensure that male ends are fully entered into female ends.

3.5 BACKFILLING

.1 Backfill around and over culverts.

.2 Compact each layer to 95% corrected maximum dry density taking special care to obtain required density under haunches.

.3 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

.4 Place backfill in unfrozen condition.

3.6 INLET AND OUTLET STRUCTURES

.1 Provide hand placed stone around all inlets and outlets of culvert structures, as specified in Section 31 20 00.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation of concrete encased duct banks and pull pits.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 03 10 00 - Concrete Forming and Accessories.

.3 Section 03 30 00 - Cast-in-Place Concrete.

.4 Section 26 05 00 - Common Work Results - Electrical.

.5 Section 26 05 44 - Installation of Cables in Trenches and in Ducts.

1.3 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA),
.1 CSA C22.2 No. 211.1, Rigid Types EBI and DB2/ES2 PVC Conduit.
.2 CSA C22.2 No. 211.3, Reinforced Thermosetting Resin Conduit RTRC and Fittings (Bi-national standard, with UL 1684).
.3 CAN/CSA-A3000, Cementitious Materials Compendium. Includes:
.1 CAN/CSA-A5, Portland Cement
.4 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
.5 CAN/CSA G164-M92 Hot Dip Galvanizing of Irregularly Shaped Articles

1.4 SHOP DRAWINGS

.1 Submit shop drawings for precast manholes in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 PVC DUCTS AND FITTINGS

.1 Rigid PVC duct and conduit: to CSA C22.2 No. 211.1, for exterior underground and below interior concrete floor slabs wiring, size as indicated to CSA C22.2, with moulded fittings and minimum wall thickness at any point of 2.8 mm. Nominal length: 3 m plus or minus 12 mm.

.2 Rigid PVC split ducts as required.

.3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.

.4 Rigid PVC 90° and 45° bends.

.5 Rigid PVC 5° angle couplings.

.6 Expansion joints as required.

.7 Preformed, interlocking intermediate duct spacers for duct size as indicated.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC duct joints.

2.3 PULL PITS

.1 Precast Shaw manhole with manhole cover.

2.4 CABLE PULLING EQUIPMENT

.1 Pulling iron: galvanized steel rods, size and shape as indicated.

.2 Pull rope: 6 mm stranded nylon polypropylene, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

2.5 DRAINAGE

.1 Pitch all conduits for drainage as the plans show. If unable to slope PVC conduit for draining, drain by drilling one 6 mm diameter hole in the underside of the conduit at each low point. Then place a drain sump under the drilled drainage hole as the conduit standard detail drawing shows.

2.6 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm, with words: "Cable", "Joint", "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

.2 Provide 150 mm wide, 4 mil, polyethylene marker tape in all trenches. Use red colored tape. Install at depth as per drawings.

2.7 DUCT SPACERS

.1 As required for installation. Horizontal and vertical center-to-center separation as indicated by design drawings.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install underground duct banks and pull pits including formwork in accordance with manufacturer's instructions.

.2 Build duct bank and pull pits on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density.

.3 Open trench completely between manholes to be connected before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.

.4 Prior to laying ducts, construct "mud slab" not less than 75 mm thick.

.5 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.

.6 Install base spacers at maximum intervals of 900 mm levelled to grades indicated for bottom layer of ducts.

.7 Lay ducts with configuration as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 75 mm horizontally and vertically. Stagger joints in adjacent layers at least 150 mm and make joints watertight. Encase duct bank with 75 mm thick concrete cover. Use epoxy coated galvanized steel conduit (i.e. corroguard) for sections extending above finished grade level.

3.1 INSTALLATION GENERAL (Cont'd)

.8 Make transpositions, offsets and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.

.9 Use bell ends at duct terminations in pull pits or buildings.

.10 Use conduit to duct adapters when connecting to conduits.

.11 Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.

.12 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.

.13 Allow concrete to attain 50% of its specified strength before backfilling.

.14 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.

.15 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

.16 Immediately after placing of concrete, pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.17 Install four 3 m lengths of 15M reinforcing rods, one in each corner of duct bank when connecting duct to buildings. Wire rods to 10M dowels at building and support from duct spacers. Protect existing cables and equipment when breaking into existing manholes. Place concrete down sides of duct bank filling space under and around ducts. Rod concrete with flat bar between vertical rows filling voids.

.18 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.2 PULL PITS

.1 Install pull pits at locations and as indicated by design drawings.

.2 Provide identification of the cables within a pull pit.

.3 Build up concrete pull pit neck to bring cover flush with finished grade and provide 2 meters asphalt apron all around.

.4 Install pull pit covers for each pull pit (traffic rated).

3.3 MARKERS

.1 Mark location of duct runs under hard surfaced areas not terminating in manhole with railway spike driven flush in edge of pavement, directly over run. Place concrete duct marker at ends of such duct runs. Construct markers and install flush with grade.

.2 Mark ducts every 150 m along straight runs and changes in direction.

.3 Where markers are removed to permit installation of additional duct, reinstall existing markers.

.4 Lay concrete markers flat and centered over duct with top 25 mm above earth surface.

3.4 INSPECTIONS

.1 Inspection of duct will be carried out by Owner's Representative prior to placing. Placement of concrete and duct cleanout to be done when Owner's Representative present.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for electrical pole lines and hardware.

1.2 RELATED SECTIONS

.1 Section 01 10 00 - General Requirements.

.2 Section 26 05 14 - Power Cable and Overhead Conductors (1001 V).

.3 Section 26 05 22 - Connectors and Terminations.

.4 Section 26 05 27 - Grounding - Primary.

.5 Section 26 13 01 - Isolating Switches.

.6 Section 26 41 01 - Primary Lightning Arrestors.

1.3 REFERENCES

.1 Codes and Standards referenced in this section refer to the latest edition thereof.

.2 Canadian Standards Association (CSA),
.1 CAN/CSA-G12, Zinc-Coated Steel Wire Strand.
.2 CAN/CSA-C83, Communication and Power Line Hardware.
.3 CAN/CSA-O80 Series, Wood Preservation.
.4 CAN/CSA-O15, Wood Utility Poles and Reinforcing Stubs.
.5 CSA O116, Power and Communication Sawn Wood Crossarms.
.6 CSA O124, Specification for the Physical Properties of Power and Communication Wood Insulator Pins.

.3 American National Standards Institute (ANSI)
.1 ANSI C29.5, Wet-Processed Porcelain Insulators, Low and Medium Voltage Pin Type.

.4 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
.1 EEMAC1B-1, Wet Process Porcelain Insulators (Strain Type).
.2 EEMAC2B-1, Wet Process Porcelain Insulators (Spool Type).

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Wood preservation: to CAN/CSA O80 Series.

.2 Power line hardware: to CAN/CSA-C83.

2.2 POLES

.1 Wood utility poles, if not otherwise noted: to CAN/CSA-O15, wood species Red Pine, CCA wood preservative treated.

.2 Wood utility poles located within 15 m of a well or high water tank: to CAN/CSA-O15, wood species Western Red Cedar, untreated.

.3 For both, Class and Height refer to project Schedule B (B.O.M.).

2.3 CROSSARMS

.1 Wood crossarms: to CSA O116, pressure or vacuum treated with CCA preservative.

.2 For details refer to project Schedule A (B.O.M.), items C1, C2b and C3.

2.4 INSULATORS

.1 Primary insulators:
.1 Post type: to ANSI C29.1 for low and medium voltages, nominal rating 34.5 kV, for primary conductors.
.2 Suspension Type: to ANSI C29.13/CSA C411.1, nominal rating 34.5 kV, for primary conductors.

.2 Secondary insulators:
.1 Spool type: to, ANSI C29.3 mounted on secondary racks, for secondary runs.

.3 Guy strain insulators:
.1 Strain type: to ANSI C29.4, nominal rating 34.5 kV, one per guy wire.

2.5 GUYS AND ANCHORS

.1 Guy wire: To CSA G12. Guy wire to be stranded galvanized steel 9.5 mm grade 160. Where guy attaches to pole, provide one guy hook and one performed guying deadend.

.2 Guy clamps, preformed guying, deadend.

.3 Eye bolt: 19 mm thimble, length to suit, four hole guy straps and 16 mm machine bolt with square washer to attach guy wire to pole.

.4 Anchor rod: 19 mm diameter x 2.1 m long, galvanized steel with thimble eye 16 mm HDG.

.5 Anchor plate: To CSA C83. 406 mm x 406 mm with 19 mm hole heavy duty HDG steel plate.

.6 Guy guard: plastic, colored yellow, 2.1 m long.

2.6 PRIMARY CONDUCTORS

.1 In accordance with Section 26 05 14 - Power Cable and Overhead Conductors (1001 V).

2.7 TRANSFORMERS

.1 No pole mounted transformers are associated with this specification.

.2 For Pad Mounted Transformer specification see Section 26 12 19 - Pad Mounted, Liquid Filled, Medium Voltage Transformers.

2.8 ISOLATION SWITCHES

.1 In accordance with Section 26 13 01 - Isolation Switches.

2.9 LIGHTNING ARRESTERS

.1 In accordance with Section 26 41 01 - Primary Lightning Arrestors.

2.10 WIRE CONNECTORS

.1 In accordance with Section 26 05 22 - Connectors and Terminations.

2.11 GROUND RODS, GROUND CONDUCTORS AND GROUND MAT

.1 In accordance with Section 26 05 27 - Grounding - Primary.

2.12 EQUIPMENT IDENTIFICATION

.1 Rustproof number nails with 50 mm high designated number.

2.13 FIBRE OPTIC CABLE SYSTEM

.1 In accordance with Section 27 05 10 - Fibre Optic Cable System.

PART 3 - EXECUTION

3.1 PREPARATION OF POLES

.1 Where poles require shortening, cut piece from top only.

.2 Roof top of poles with single slope bevelled top.

.3 Treat roof top, gains, bored holes with preservative before assembly.

.4 Cut parallel plane crossarm gains in face of pole for single and double arming, spacing as indicated.

.5 Bore hole in center of each gain for crossarm bolt.

.6 Drill crossarms for pins, through bolts, double arm bolts and brace bolts. Pre drill treated crossarms to standard spacing.

.7 Fasten wood insulator pins to crossarms with galvanized steel nails.

.8 Install crossarms and braces.

.9 Install secondary racks.

3.2 INSTALLATION

.1 Install poles at locations indicated by design drawings and in accordance with the installation details.

.2 Pole spans greater than 70 meters require Engineer approval.

.3 Locate and dig pole holes. Make holes large enough to allow space for tamping backfill.

3.2 INSTALLATION (Cont'd)

.4 Set poles.

.5 Align poles with crossarms at right angles to pole line on straight runs.

.6 At change in direction of line, set crossarms to bisect angle formed by change.

.7 Set poles to maintain even grade. Allow for contour of terrain and do not exceed grading of 1.5 m per pole.

.8 Replace backfill in 150 mm layers. Tamp each layer, and apply final layer to drain water away from pole.

.9 For rock mounted poles, install cribs, size as shown on the drawings.

.10 For swampy condition install cribs size as shown on the drawings.

.11 Locate and install guy wires and anchors at dead-ends, corner poles, and start of branch feeders.

.12 Insert anchor at least 1.8 m into ground. Backfill and tamp in 150 mm layers.

.13 Install insulators.

.14 Identify primary circuit on pole showing phasing of each conductor, every 300 m and including origin of primary pole.

.15 Install directional fault indicators as shown on the drawings.

.16 Install Medium Voltage Kits (Stress Cones) for connection to outdoor load break switch and riser poles as specified on drawings. Refer to Section 26 05 22 - Connectors and Terminations.

.17 Install ground conductors, grounding mat and other related pole hardware to constitute system as indicated on drawings.

APPENDIX A1



SKYPOWER CORP

DIGBY WIND POWER PROJECT

COMMISSIONING FORMS

Rev	Description	Date	By	Ckd	Approved
O	ISSUED FOR TENDER	6/30/09	LO'K	RO'C	
A	ISSUED FOR FINAL REVIEW	06/24/09	LO'K	RO'C	

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Date	Office	Title:
06/30/09	Hfx	COMMISSIONING FORMS
Designed	Drawn	
LO'K	LO'K	

Schedule No. APPENDIX A1

DRAWING INDEX

Client:	SKYPOWER CORP
Project No.	090630.00
Project:	DIGBY WIND POWER PROJECT
Schedule No.	
Page No.	

DRAWING NUMBER	TITLE	REVISION
ETR001	Potential Transformer	A
ETR002	Current Transformer	A
ETR003	Instrument Transformer	A
ETR007	LV Distribution Panel	A
ETR008	HV Disconnect Switch	A
ETR010	Battery Charger	A
ETR011	Station Battery	A
ETR012	Station Battery Discharge Curve	A
ETR013	Station Battery Charging Curve	A
ETR014	Station Battery Cell Inspection	A
ETR015	Lightning Arresters	A
ETR017	MV Power Cables	A
ETR018	Overhead Bus	A
ETR019	Structure Inspection	A
ETR020	Grounding System	A
ETR021	Grounding Grid	A
ETR022	Equipment Bushings and Connectors	A
ETR023-1	Power Line	A
ETR024	Switchyard Control And Protection Pre-energization Checks	A
ETR025	Switchyard Apparatus Pre-energization Checks	A
ETR026	Switchyard Control And Protection Post-Energization Checks	A
ETR027	Switchyard Apparatus Post Energization Checks	A
ETR028	Recloser Basic Data	A
ETR029	Recloser Operation Testing	A
ETR030	Power Transformer Basic Information	A
ETR031	Power Transformer Internal Inspection	A
ETR032	Power Transformer External Inspection	A
ETR033	Power Transformer Accessory And Cooling Fluid Testing	A
ETR034	Power Transformer Control Cabinet	A
ETR035	Power Transformer On Load Tap Changer Control	A
ETR036	Power Transformer Turn Ratio Ttr Set	A
ETR037	Power Transformer Turn Ratio Testing (With Applied Voltage)	A
ETR038	Power Transformer Polarity And Phase Relation	A
ETR039	Power Transformer Post Energization	A
ETR040-1	DC Hi-Pot Test	A
ETR040-2	Power Cable Hi-Pot Test	A
ETR041	List of Deficiencies	A
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ETR113	Power Circuit Breaker Spring Operated Mechanism	A
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ETR115	Power Circuit Breaker Inspection After Testing	A
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ETR120	Capacitor Bank Inspection and Testing	A
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ETR130	Insulating Oil or Askarel Prior to Equipment Filling	A
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Rev	Description	Date	By	Ckd	Approved
0	ISSUED FOR TENDER	06/30/09			
A	ISSUED FOR FINAL REVIEW	06/24/09	LO'K	RO'C	

Date	Office	Title:
06/30/09	Hfx	
Designed	Drawn	COMMISSIONING FORMS
LO'K	LO'K	
Schedule No.	**APPENDIX A1**	

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Potential Transformer Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Rated Voltage: _____

Primary Voltage: _____ Secondary Voltage: _____

Accuracy Class: _____ Thermal Rating: _____

Data as per Design? ☐ Yes ☐ No Bulletin No:

GENERAL INSPECTION

	Oil Level	Oil Leaks	Porcelain	Paint	Mounting/ Fastening	Grounding	Nameplate	Conn. Box Weathertight	Oil Test Page No.
Phase A									
Phase B									
Phase C									

Testing	Phase A Serial No: _____	Phase B Serial No:	Phase C Serial No:
_____ V Megger Test	Sec'y to ground: _____	Sec'y to ground: _____	Sec'y to ground: _____
_____ V Megger Test for _____ minutes	Pri to sec'y: _____ Pri to ground: _____	Pri to sec'y: _____ Pri to ground: _____	Pri to sec'y: _____ Pri to ground: _____

Ratio Test Connections		Ratio Test, Pri & Sec'y Volts															
Pri:		Pri															
Sec:		Sec															
Pri:		Pri															
Sec:		Sec															
Pri:		Pri															
Sec:		Sec															
Pri:		Pri															
Sec:		Sec															

Polarity Checks	H: _____ = X: _____ at: _____	H: _____ = X: _____ at: _____	H: _____ = X: _____ at: _____
Magnetizing Current Test	Page No: _____	Page No: _____	Page No: _____
Conn. Box Heaters _____ V, set at _____ ^{0}C	Insulation Test: _____ Operation: _____	Insulation Test: _____ Operation: _____	Insulation Test: _____ Operation: _____
Tank to gnd insulation			

INSPECTION AFTER TESTING

	Pri. Fuses as per Schematics	Primary Fuses Tested	Sec'y Fuses as per Schematics	Secondary Fuses Tested	Wiring Re-Connected and Tight	Secondary Connection Used	Ratio Used	Secondary Ground Replaced At	Primary Re-Connected and Tight
Phase A									
Phase B									
Phase C									

☐ Check that nothing is in contact with heaters ☐ Heaters "ON"

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Current Transformer Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Rated Voltage: _____

Primary Amps: _____ Secondary Amps: _____

Accuracy Class: _____ Burden: _____

Data as per Design? ☐ Yes ☐ No Bulletin No:

GENERAL INSPECTION

	Oil Level	Oil Leaks	Porcelain	Paint	Mounting/ Fastening	Grounding	Name Plate	Conn. Box W.Tight	Oil Test Page No.
Phase A									
Phase B									
Phase C									

Testing	Phase A Serial No:	Phase B Serial No:	Phase C Serial No:
_____ V Megger Test	Sec'y to ground: _____	Sec'y to ground: _____	Sec'y to ground: _____
_____ V Megger Test for _____ minutes	Pri to sec'y: _____ Pri to ground: _____	Pri to sec'y: _____ Pri to ground: _____	Pri to sec'y: _____ Pri to ground: _____

Ratio Test Connections		Ratio Test, Pri & Sec'y Volts																	
Pri:		Pri																	
Sec:		Sec																	
Pri:		Pri																	
Sec:		Sec																	
Pri:		Pri																	
Sec:		Sec																	
Pri:		Pri																	
Sec:		Sec																	

Polarity Checks	H: _____ = X: _____ at: _____	H: _____ = X: _____ at: _____	H: _____ = X: _____ at: _____
Sec'y DC Resist. at _____ ^{0}C			
Magnetizing Current Test	Page No: _____	Page No: _____	Page No: _____
Conn. Box Heaters _____ V, set at _____ ^{0}C	Insulation Test: _____ Operation: _____	Insulation Test: _____ Operation: _____	Insulation Test: _____ Operation: _____
Tank to ground insulation			

INSPECTION AFTER TESTING

	Wiring Re-Connected and Tight	Secondary Connection Used	Ratio Used	Secondary Ground Replaced At	Primary Re-Connected and Tight				
Phase A									
Phase B									
Phase C									

☐ Check that nothing is in contact with heaters ☐ Heaters "ON"

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Instrument Transformer Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Type: Frequency: _____

V.A.: _____ Primary Volts: _____ Secondary Volts: _____ Accuracy: _____

Burden: _____ Primary Amps: _____ Secondary Amps: _____ Accuracy: _____

Data as per Design? ☐ Yes ☐ No Bulletin No:

INSPECTION AND TESTING

Serial No: _____ Ratio Used: _____ Phase: _____

_____ V Megger Test Primary to Secondary: _____ Primary to ground: _____ Secondary to ground: _____

Ratio Testing	Test Connection														
Primary Amps: _____	Secondary Reading														
Magnetizing Current Testing (Full Winding)	Injected Volts														
	Injected Amps														

Polarity Check: H ____ = X ____ at _____ Secondary DC Resistance: _____ at _____ ^{0}C

Serial No: _____ Ratio Used: _____ Phase: _____

_____ V Megger Test Primary to Secondary: _____ Primary to ground: _____ Secondary to ground: _____

Ratio Testing	Test Connection														
Primary Amps: _____	Secondary Reading														
Magnetizing Current Testing (Full Winding)	Injected Volts														
	Injected Amps														

Polarity Check: H ____ = X ____ at _____ Secondary DC Resistance: _____ at _____ ^{0}C

Serial No: _____ Ratio Used: _____ Phase: _____

_____ V Megger Test Primary to Secondary: _____ Primary to ground: _____ Secondary to ground: _____

Ratio Testing	Test Connection														
Primary Amps: _____	Secondary Reading														
Magnetizing Current Testing (Full Winding)	Injected Volts														
	Injected Amps														

Polarity Check: H ____ = X ____ at _____ Secondary DC Resistance: _____ at _____ ^{0}C

INSPECTION AFTER TESTING

	Wiring Re-Connected and Tight	Secondary Connection Used	Ratio Used	Secondary Ground Replaced At	Primary Re-Connected and Tight				
Phase A									
Phase B									
Phase C									

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L.V. Distribution Panel Field Test Report

Client:	Date:	Page
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Type: _____

Voltage: _____ Amps: _____ Phases: _____

Main Breaker Size: _____ Number of Circuits: _____ Panel Enclosure: _____

Data as per Design? ☐ Yes ☐ No

PANEL AND PANEL SUPPLY INSPECTION AND CHECKS

☐ Supply cable, breaker or disconnect switch as per design

☐ Paint ☐ Cleaning ☐ Tightening ☐ Grounding

V Megger Test	Feeder Cable	Panel Neutral Bar	Panel Main Busses						

CIRCUIT TESTS AND CHECKS

1) Lighting Circuits

a) Checks: Conduit and j-box fastening, covers and weatherproofing, cable tagging, special wiring if required.
Lamp locations, type, mounting, orientation, fastening, grounding, weatherproofing, wattage.
Switch locations, type, fastening, grounding, weatherproofing.

b) Tests: Lamps, switches, photocell operation, room illumination, receptacle volts and polarity record, full load current of circuit.

2) Miscellaneous Circuits:

a) Checks: Conduit and j-box fastening, covers and weatherproofing, cable tagging, special wiring if required.
Device location, type, mounting, fastening, grounding, readiness for operation.

b) Tests: Device operation, performance, settings or other pertinent data, full load current of circuit

POST TEST CHECKS ON PANEL

Panel internal heating: _____ V, _____ W, set at: _____ ^{0}C.

Panel internal heating operational: ☐ Yes ☐ No

Panel circuits identified: _____

Panel weathertight and facia reclosed: ☐ Yes ☐ No

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L.V. Distribution Panel Circuits Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

L.V. DISTRIBUTION PANEL CIRCUIT INSPECTION AND TESTING

Circuit	Designation	Breaker size	Checks	_____ V Inst. Test	Tests	Alarm Switch	Circuit Current

Circuits continued on page: _____.

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H.V. Disconnect Switch Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Type: _____

Serial Number: _____ kV Rating: _____

B.I.L: _____ kVA Rating: _____

Operator data: _____ Inturrupting capacity: _____

Bulletin Number: _____ Data as per Design? ☐ Yes ☐ No

SWITCH INSPECTION AND CHECKS

Insulators: _____ ☐ Linkage and mechanism: _____ ☐ Arcing horns: _____ ☐

Manual close: _____ ☐ Overtravel: _____ Manual open: ☐ Overtravel: _____

Main contacts closure: Phase A: ☐ Phase B: ☐ Phase C: ☐ Synchronization: ☐

Main arms clearance to ground: _____ ☐ Opening clearance: _____

Mechanical interlock to ground switch: ☐ Yes ☐ No From ground switch: _____ ☐

Ground switch closure: Phase A: ☐ Phase B: ☐ Phase C: ☐ Synchronization: ☐

Ground switch arms clearance: _____ ☐

Auxilary switch development as per schematics: ☐ Yes ☐ No Linkage and switch operation checks: _____ ☐

Position indicators operation: ☐ Yes ☐ No Operating handle and plateform grounding: _____ ☐

OPERATOR INSPECTION AND TESTING

Mechanism tightness _____ ☐ Lubrication: ☐ All shipping blocks removed: _____ ☐ Grounding: ☐

Other checks carried out as per manufacturer instruction: _____ ☐ Yes ☐ No

Set limit switches on preliminary basis: _____ ☐ All fuses as per schematics: _____ ☐ Yes ☐ No

_____ V Megger Test on wiring: Control: _____ Power: _____ Heating: _____

Control voltage: _____ Polarity: ☐ Power voltage: _____ Polarity: ☐

Motor operation: Close: _____ ☐ Overttavel: _____ Open: ☐ Overtravel: _____

All L. SW. Set As Per Schematics: _____ ☐ Yes ☐ No All switches set, screws tightened: _____ ☐ Yes ☐ No

Volts and amps during opening: _____ Volts and amps during closing: _____

Operating speed, opening _____ Operating speed, closing: _____ Remote control simulation _____ ☐

Cabinet heaters: _____ V, _____ W, set at _____ ^{0}C Operation Test: _____ ☐

Operator mechanical and/or electrical interlock checks: _____ ☐

Minimum operating voltage: Opening: Closing:

POST TEST CHECKS

All local switches reclosed: _____ ☐

All fuses in place: _____ ☐

Selector switch properly selected: _____ ☐

Check that nothing is in contact with heaters: _____ ☐ Heaters "ON": _____ ☐

All wiring reconnected and tight: _____ ☐ Yes ☐ No

Disconnect switch open: ☐ Yes ☐ No

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Battery Charger Field Test Report

Client:	Date:	Page
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Type: _____

Serial Number: _____ Constant: _____ charge

AC Volts: _____ Amps: _____ kW: _____ Frequency: _____ Phase: _____

DC Volts: _____ Amps: _____ kW: _____ Trickle Volts: _____ Equalizing Volts: _____

Voltage Regulation: _____ % at _____

Cooling: _____

Bulletin Number: _____ Data as per Design? ☐ Yes ☐ No

PRELIMINARY INSPECTION

☐ Tightening ☐ Cleaning ☐ Paint ☐ Grounding ☐ All wiring connected

☐ AC and DC breakers or fuses as specified ☐ Meters set to zero

TESTING

_____ V megger test on AC side: _____, on DC external wiring: _____

LV ohmmeter resistance test on internal wiring: _____

Test cooling system: _____ Fans set at: _____ ^{0}C

Energize charger with DC output breaker open, check the following and adjust as required:

DC polarity: _____ Trickle (float) voltage: _____ Equalizing voltage: _____

Manual transfer: _____ auto transfer: _____, equalizing set at _____ hours every _____ days.

AC failure alarm: _____ set at _____ Low DC voltage alarm: _____ set at _____

Ground fault alarm: _____ set at _____ _____ set at _____

_____ set at _____ _____ set at _____

_____ set at _____ _____ set at _____

☐ Local alarm indications

☐ Remote alarm indications

CHECKS AFTER TESTING

☐ All wiring reconnected and tight ☐ All covers reclosed ☐ Charger left on

Cabinet internal temperature _____ ^{0}C after _____ hours running in _____ ^{0}C ambient temperature.

Cabinet internal temperature after first charge.

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Station Battery Field Test Report

Page

Client:	Date:
Project Name:	Prepared By:
Project Number:	Tested By:

Section

BASIC DATA

Manufacturer: _____ Type: _____

Serial Number: _____

Voltage: _____ Volts per cell: _____ Cell type: _____

Recommended initial charge: _____ Recommended trickel charge (float): _____ Equalizing: _____

Fully charged cell voltage: _____ Specific gravity: _____ at _____

INSPECTION AND TESTS PRIOR TO FRESHENING CHARGE

☐ Leveling ☐ Fastening ☐ Assembly ☐ Tightening ☐ Painting

☐ Cells interconnected and tight ☐ Greased ☐ Cells polarity checked

☐ Support grounded Battery grounded at: _____

☐ Cells voltage, electrolyte level, and specific gravity checked (form ETR-XXX)

☐ Battery main disconnect switch or breaker installation ☐ Testing ☐ Grounding

☐ Main cabling connected to charger ☐ Charger operational

Battery voltage prior to charging: _____ Ambient temperature: _____ ^{0}C

Pilot cell number: _____ Voltage: _____ Specific gravity: _____ at _____ ^{o}C

☐ All vents opened or free ☐ Battery room fan operational ☐ No smoking sign

INSPECTION AND TESTS DURING FRESHENING CHARGE

Record battery and pilot cell behavior during the charge on form ETR-XXX, see page: _____

Time and date of freshening charge beginning: _____ Charging rate: _____

Gassing: _____

Connections heating: _____

INSPECTION AND TESTS AFTER FRESHENING CHARGE

Time and date of freshening charge completion: _____

Battery voltage (disconnected from charger) after charging: _____

Pilot cell number: _____ Voltage: _____ Specific gravity: _____ at _____ ^{o}C

Record voltage, electrolyte level, and specific gravity on form ETR-XXX, see page: _____

New pilot cell number: _____ Voltage: _____ Specific gravity: _____ at _____ ^{o}C

☐ All vents reclosed Trickle charge:

Equalizing charge: _____ V, _____ A to start in _____ days

Discharge test (if required): Record on form ETR-XXX, see page

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Station Battery Discharge Curve Field Test Report

Page

Client:	Date:
Project Name:	Prepared By:
Project Number:	Tested By:

Section

STATION BATTERY DISCHARGE CURVE

Fill in the y-axis based on the battery characteristics. The reference values should be positioned such as to ensure thet the respective curves on the graph are separated to ensure legibility.

Hours

after testing: _____

Battery room temperature before testing: _____

Pilot Cell	**Voltage**
	Temp.
Battery Voltage	
Test Discharge Amps	

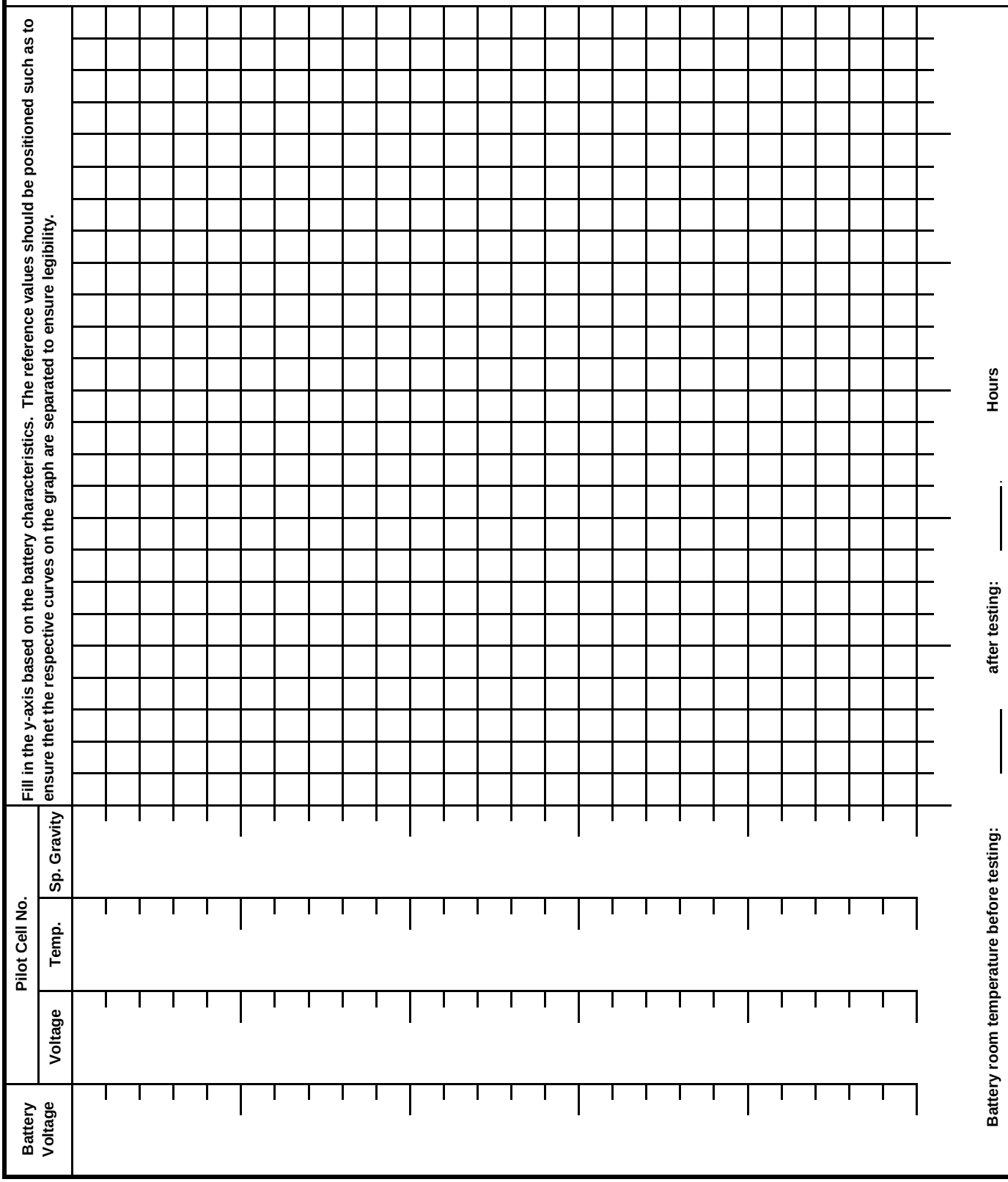
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Station Battery Charging Curve Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

STATION BATTERY CHARGING CURVE



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Station Battery Cell Inspection Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

STATION BATTERY CELL INSPECTION AND TESTING

Date:	Temp.:			Date:	Temp.:			Date:	Temp.:		
Cell Number	Electrolyte		Cell Voltage	Cell Number	Electrolyte		Cell Voltage	Cell Number	Electrolyte		Cell Voltage
	Level	Sp. Gravity			Level	Sp. Gravity			Level	Sp. Gravity	

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Lightning Arrester Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Arrester Manufacturer: _____ Type: _____

Serial Number: _____ Voltage Rating: _____

Operation Counter Manufacturer: _____ Type: _____

Serial Number: _____ Other Data: _____

Bulletin Number: _____ Data as per design: ☐ Yes ☐ No

INSPECTION AND TESTING

	Phase A	Phase B	Phase C
Any sign of damage			
Stack and H.V. jumper electrical clearances adequate			
Arresters and ground cables insulated to the counters			
Check and record insulation			
Ground cabling as short as possible			
Counter operation			
Counter reading after testing			

INSPECTION AFTER TESTING

All cables reconnected and tight: Phase A: _____

Phase B: _____

Phase C:

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MV Power Cable Field Test Report

Client:	Date:	Page
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

PRELIMINARY INSPECTION

Cable size and type as per specifications and/or drawings: ☐ Yes ☐ No

☐ Check phase allocation in ducts and conduit ☐ Tagging and identification

☐ Check cable installation along the route ☐ Spacing ☐ Fastening ☐ Protection

Check potheads or terminations as follows:

Power end: ☐ Proper type ☐ Proper installation and filling ☐ Porcelin ☐ Grounding

Load end: ☐ Proper type ☐ Proper installation and filling ☐ Porcelin ☐ Grounding

Check stress cones as follows:

Power end: ☐ Clearances and dimensions as per manufacturer's instructions

☐ Grounding Ground wire path: _____

Load end: ☐ Clearances and dimensions as per manufacturer's instructions

☐ Grounding Ground wire path: _____

☐ Cable supports at terminations ☐ Cable entry sealed

TESTING

Disconnect shield ground and check shield insulation to ground with a 100 V (maximum) megger test:

Phase A: _____ Phase B: _____ Phase C: _____

☐ Check phasing ☐ Ensure proper cable paralleling ☐ Reconnect shield ground as specified

☐ Ensure that cables are disconnected and carry out Hipot or Dobble test

_____ V megger test for _____ minutes (if Hipot or Dobble tests are not required).

Time	30 seconds	60 seconds	min.	min.	Time	30 seconds	60 seconds	min.	min.
A to ground					A to B				
B to ground					B to C				
C to ground					C to B				

POST TEST CHECKS

☐ Cables reconnected at load end ☐ Cables reconnected at power end

☐ Shield ground reconnected ☐ Clearances adequate

☐ All covers or barriers re-installed

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Overhead Bus Field Inspection Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

The inspection covered by this sheet is very general and is not a substitute for proper checks and inspection during and after the construction.

Bay Number: Bus Section:

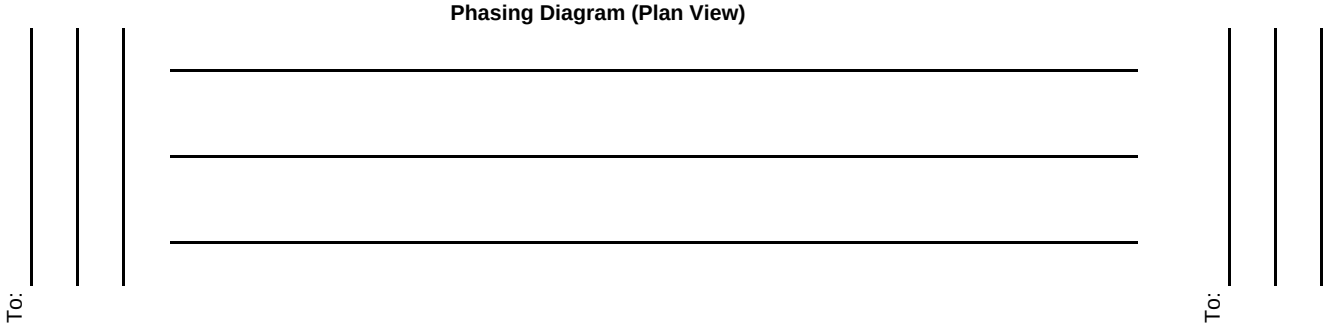
Visual inspection of the following:

☐ Condition of insulators ☐ Condition of conductors ☐ Condition of clamps ☐ Condition of spacers

Expansion joint gaps: _____ Temperature: _____ °C

☐ Conductors supported adequately ☐ Conductor sag appears normal ☐ Electrical clearances adequate

Phasing Diagram (Plan View)



Bay Number: Bus Section:

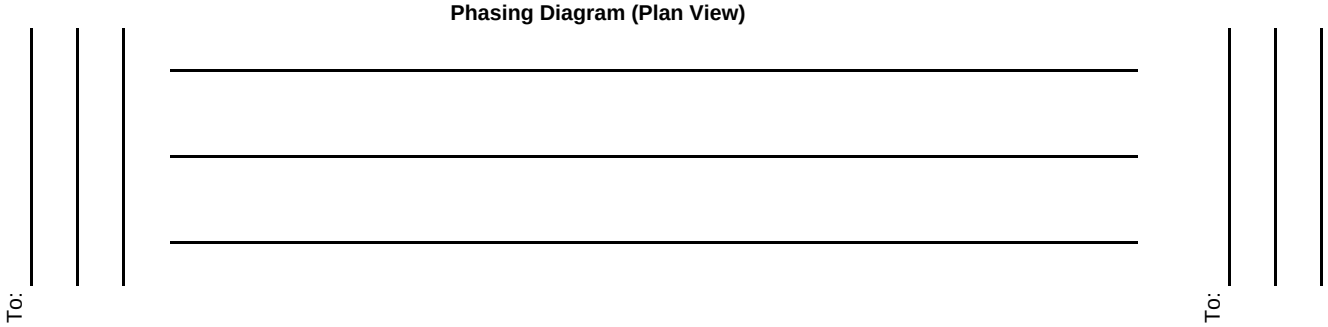
Visual inspection of the following:

☐ Condition of insulators ☐ Condition of conductors ☐ Condition of clamps ☐ Condition of spacers

Expansion joint gaps: _____ Temperature: _____ °C

☐ Conductors supported adequately ☐ Conductor sag appears normal ☐ Electrical clearances adequate

Phasing Diagram (Plan View)



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Structure Inspection Report

Client:	Date:	Page
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

STRUCTURE INSPECTION

Check for damages during transport or setting on site:

Check installation (level, vertical, warping, strains):

Any members missing:

Check bolts wedge washers and tightening:

Torquing:

Check anchoring:

Anchor bolts tight:

Shims properly packed:

Check galvanizing or painting:

All site drilling or cutting touched up:

Check foundations (level, settlement, cracks, finish):

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Grounding System Field Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

GROUNDING SYSTEM INSPECTION

Grounding material as per drawings: _____

Structure grounding as per drawings: _____

Equipment grounding as per drawings: _____

Overhead ground wire as per drawings: _____

Fence grounding as per drawings: _____

Grounding material resistance test, see page number: _____

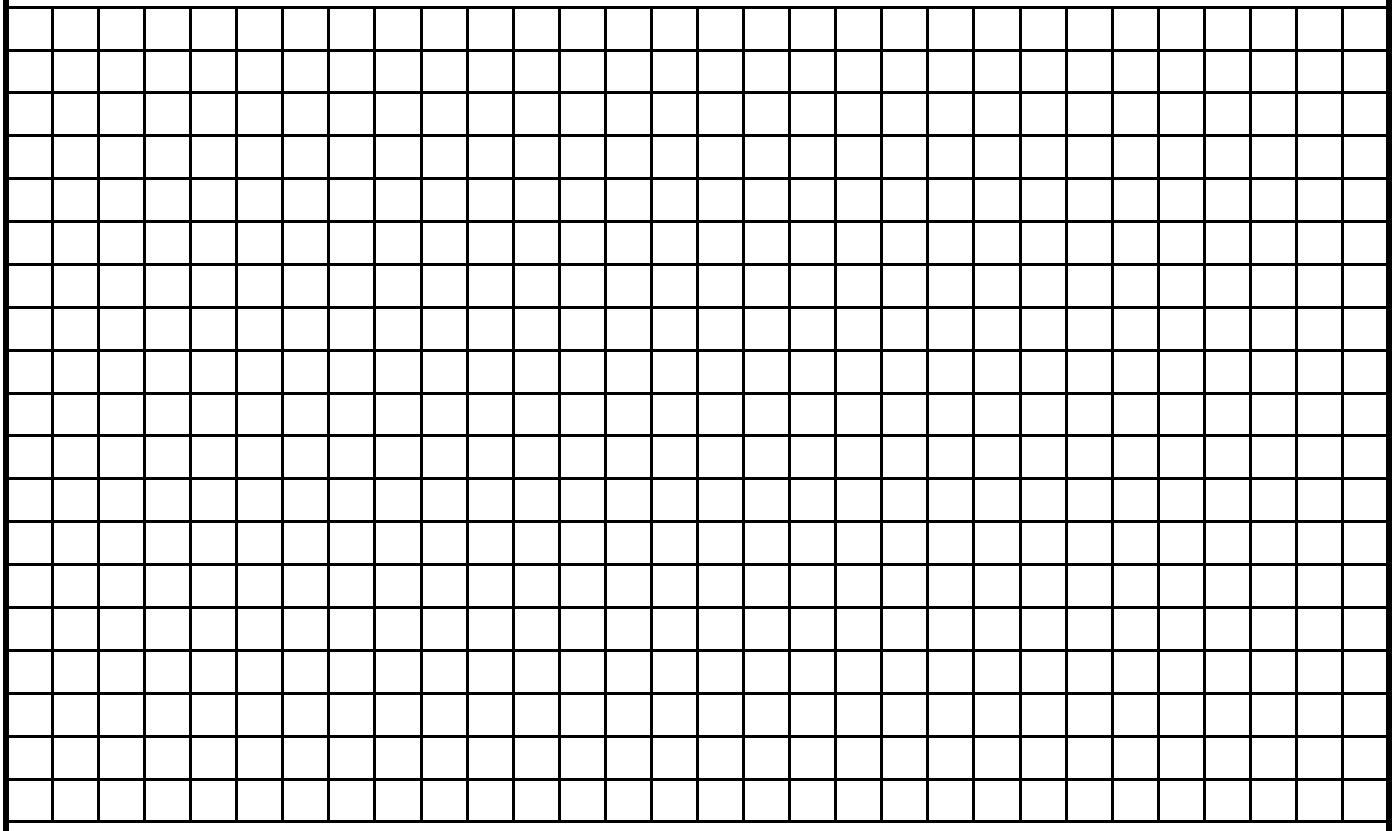
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Grounding Grid Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

TEST CONNECTIONS (SCALE: 1 SQUARE =)



Counterpoise connected: ☐ Yes ☐ No

Temperature and weather: _____

Surrounding ground composition and conditions: _____

Test Description	Distance in _____ between rod and ground under test.							
	Distance							
	Resistance							
	Distance							
	Resistance							
	Distance							
	Resistance							
	Distance							
	Resistance							
	Distance							
	Resistance							

Ground resistance curve: see page number _____

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Grounding Grid Field Test Report

Page

Client:	Date:
Project Name:	Prepared By:
Project Number:	Tested By:

Section

GROUND RESISTANCE CURVE

Ground resistance in ohms

Distance in _____

☐ All ground wires reconnected and retightened

CBCL LIMITED
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Equipment Bushings & Connectors Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

EQUIPMENT BUSHINGS AND CONNECTORS DATA

Check the following during the internal inspection (if possible):

Power Facter												
Current												
Voltage												
Class												
S.O. or Style No.												
Drawing or Cat. No.												
Type												
Serial Number												
Manufacturer												

Connector Manufacturer, H.V.: L.V.: Tertiary:

Connector Cat. No., H.V.: L.V.: Tertiary:

Connector Current Rating, H.V.: L.V.: Tertiary:

CBCL LIMITED
Consulting Engineers

Power Line Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC CHECKS PRIOR TO ENERGIZATION

Note: This page is to be used for the last inspection prior to energization and is not meant as a substitute for proper final inspection after construction.

Final inspection after construction: _____ Date: _____

Line released from construction: _____ Date: _____

Line phased out: _____

_____ Date: _____

_____ V megger test for _____ minutes, date: _____

Phase A: _____ Phase B: _____ Phase C: _____

Final patrol, see page: _____ Date: _____

Condensed results: _____

	Line Connected	Overhead Ground Connected	Line Disconnect Switch Position	Line Ground Switch Position	Other Ground
Remote End					
Supply End					

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Consulting Engineers

Power Line Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

LINE PATROL

Note: This page is to be used for the last inspection prior to energization and is not meant as a substitute for proper final inspection after construction.

Structure or span identification number	Overhead ground and line conductors	Insulators and hardware	Structures and guying	Foundations and grounding	Scrubbing, obstructions and clearances	Temporary grounds or shorts	Observations

Continued on page: _____.

CBCL LIMITED
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Switchyard Control and Protection Pre Energization Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

SWITCHYARD CONTROL AND PROTECTION PRE-ENERGIZATION CHECKS

Description of Checks	Report Page No.	Comments (indicate values)	Check'd by	App'd by
Ensure that main dc system is in service.				
Ensure that air system is in service.				
Ensure that all required control and protection dc supplies are "ON" with proper indication on the boards.				
Ensure that all required protection trip blocking switches are reclosed.				
Ensure that all protection relay flags are reset. Record operation counter readings.				
Temporarily lower the settings of the protection relays.				
Ensure that annunciaors and other supervisory equipment are in service. Check that all points are clear of indication. Record all points "ON".				
Ensure that all synchronization, selectors, or other control switches are in proper position. Check all indicating lights.				

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Switchyard Apparatus Pre Energization Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

SWITCHYARD APPARATUS PRE-ENERGIZATION CHECKS

Description of Checks	Report Page No.	Comments (indicate values)	Check'd by	App'd by
Record lightning arrestor operation counter readings.				
Visually inspect all circuit breakers. Ensure that all local control fuses and switches are properly "ON" or selected.				
Ensure that cabinet heaters are operational.				
Ensure that all valves are open and the air system is in service.				
Visually inspect all transformers. Ensure that all local fuses are "ON".				
Visually ensure that all disconnects are in proper position.				
Visually ensure that all ground (temporary and other) are removed.				
Ensure that all cabinet doors are reclosed and locked.				

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Switchyard Control and Protection Post Energization Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

POST ENERGIZATION CHECKS

Description	Report Page Number	Comments (indicate values)	Check'd by	App'd by
Check volts, amps, watts, vars, power factor, and/or other indications				
- Check phase rotation - Check phasing (for transformer paralleling) - Complete synchronizing tests				
Run transformer tap changer up and down				
Check that new alarms (if any) can be explained				
Confirm CT's secondary current, PT's secondary voltage, and phasing at protection relays of the following: _____ Protection _____ Protection _____ Protection _____ Protection _____ Protection _____ Protection _____ Protection _____ Protection _____ Protection _____				
Complete "on load" check of the directional and/or distance relays				
Check for relay target, unusual noise, sign of overheating, etc.				
Return relays to proper settings (see pre-energization sheets)				

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Switchyard Apparatus Post Energization Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

POST ENERGIZATION CHECKS

Description	Report Page Number	Comments (indicate values)	Check'd by	App'd by
Visual and audible check of all switchyard apparatus and busses for arcing, corona, and/or other unusul conditions				
Record transformer behavior: Transformer number: _____ Transformer number: _____ Transformer number: _____ Transformer number: _____ Transformer number: _____ Transformer number:				

CBCL LIMITED
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Recloser Basic Data Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Type: _____ Serial: _____

Voltage rating: _____ Maximum voltage: _____ Minimum voltage at rated MVA: _____

Continuous current: _____ Momentary current: _____

Inturrupting rating: Three-phase rating: _____ Current at rated voltage: _____ "K" factor: _____

Maximum current: _____ Time in cycles: _____

C.T.'s: _____

Mechanism type (motor, solenoid, air, etc.) _____

Control voltage: _____ V _____

Data as per design: ☐ Yes ☐ No Bulletin number: _____ Oil (gallons): _____

GENERAL INSPECTION

☐ Support level and properly fastened ☐ Foundation ☐ Paint ☐ Supporting structure

☐ Insulators ☐ Grounding ☐ Oil level ☐ Oil leaks ☐ Oil test

ELECTRICAL

Local fuses as per schematics:	☐ Yes	☐ No
Electrical devices free and operational:	☐ Yes	☐ No
Wiring tight:	☐ Yes	☐ No
Control cabinet weathertight:	☐ Yes	☐ No
Clean:	☐ Yes	☐ No
Door and lock operational:	☐ Yes	☐ No
Grounding connected at the head:	☐ Yes	☐ No
All name plates installed:	☐ Yes	☐ No

MECHANICAL

Wait for suitable weather before opening or dropping the tank.

All shipping braces removed: ☐ Yes ☐ No

Any loose parts at the bottom of the tank: ☐ Yes ☐ No

☐ Tightness of mechanism ☐ Lubrication

☐ Dashpots ☐ Bumpers ☐ Arc quenching devices

☐ Insulators ☐ Fixed contacts ☐ Moveable contacts

☐ Mounting of C.T.'s

☐ Drain valve closed and plugged

☐ Other checks as per manufacturer's instructions

After reclosing of the tank and oil filling:

☐ Oil level ☐ Oil leaks ☐ Oil test

Adjustments: _____

CBCL LIMITED
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Recloser Operation Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

CONTROL AND PROTECTION FINAL SETTINGS

Ground Trip			Phase Trip		
Lockout			Timing Plugs		
Phase Trip			Reset Delay Plug		
Reclosing	1		Minimum	G	
Interval	2		Trip	A	
Plugs	3		Resistors	B	
Ground Trip				C	
Timing Plugs			Lamp Test Switch		
Ground Trip Operation Selection			Operating Mode Selection		

OPERATIONAL TESTS

Ensure that the inspection is completed and that the recloser can be safely operated.

_____ V Megger Insulation Test (watch for solid state components): _____.

Quiescent battery drain: _____ at _____.

Manual operation: ☐ Close ☐ Trip

Remarks: _____

_____

Minimum Trip Current Test	Phase A		Trip Time Test	Phase A	
	Phase B			Phase B	
	Phase C			Phase C	
	Ground			Ground	
Reclosing Time Test	First				
	Second				
	Third				

Reset time after successful closure: _____

Operation of non-reclosing switch: _____

Lockout after unsuccessful reclosing: _____

Auxilary switch development as per schematics: ☐ Yes ☐ No

☐ Position indicator operation

☐ Operation counter checks

☐ Re-check that all settings are as noted above

☐ All wiring reconnected

☐ All temporary wiring removed

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Power Transformer Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Type: _____ Frequency: _____

Serial Number: _____ S.O. Number: _____ Built: _____

kVA ONS (ONAN): _____ ONP (ONAF) _____ , _____ : _____

Primary Voltage: _____ B.I.L. _____

Secondary Voltage: _____ B.I.L. _____

Tertiary Voltage: _____ B.I.L. _____

Primary Current: _____ Secondary Current: _____ Tertiary Current: _____

L.T.C. Type: _____ Range: _____ Step Number: _____

Fixed Taps: _____

Z % ONAN:

Temperature Rise: _____ at _____ kVA auxilary power

Cooling:

Weight (core and windings): _____ Instruction Book Number: _____

Weight (tank and fittings): _____ Instruction Book Available: _____

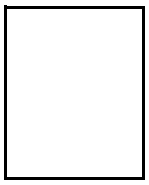
Tank Oil: _____ Data as per design: _____

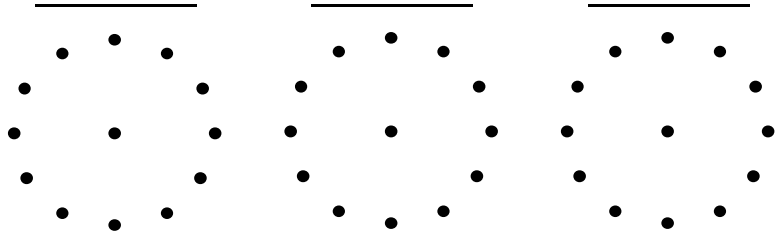
L.T.C. Oil: _____

Total Weight: _____

Connections And Vectors

Top View





Internal Insp., SH. No: _____ External Insp., SH. No: _____ Access'y Tests, SH. No: _____

Auxiliaries Tests SH. No: _____ C.T.'s Tests SH. No: _____

T.T.R./Volt Ratio, SH. No: _____ Vectors Checks SH. No: _____

Hi Pot/Dobble Test, SH. No:

CBCL LIMITED
Consulting Engineers

Power Transformer Internal Inspection Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

INSPECTION

☐ Check core position for evidence of shifting: _____

☐ Check insulation structure for loosening: _____

☐ Check for dirt, foreign material, and moisture: _____

☐ Check bushing draw leads for damages and insulation: _____

☐ Check internal bus connections for strain: _____

☐ Check bolted connections: _____

☐ Record tap (if applicable): _____

☐ Check removal of shipping braces or blocks: _____

☐ Check that all core packets are grounded: _____

☐ Remove ground strap and megger to confirm core grounding through strap only: _____

Record reading: _____ with a _____ V megger.

☐ Check electrical clearances: _____

☐ Check data and pertinent information on bushings and connectors: _____

Record above on page: _____

☐ Check C.T. ratio and polarity: _____

Record above on page: _____

☐ Check load tap changer contact operation:

Other checks: _____

CBCL LIMITED
Consulting Engineers

Power Transformer External Inspection Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

EXTERNAL INSPECTION

Main Tank:
- ☐ Oil leaks _____
- ☐ Drain or fill valves closed and blanked off _____

Radiators:
- ☐ Oil leaks _____
- ☐ Valves to tank open and locked _____
- ☐ Vented _____

Explosion Vent:
- ☐ Diaphragm sound (top) _____
- ☐ Diaphragm sound (bottom) _____
- ☐ Direction of discharge _____
- ☐ Electrical clearance _____
- ☐ Vented _____

Bushings:
- ☐ Porcelin (no chips) _____
- ☐ Leaks _____
- ☐ Oil level _____
- ☐ Pockets vented _____

Conservator Tank:
- ☐ Oil leaks _____
- ☐ Valve to tank open and locked _____
- ☐ Breather type: _____
- ☐ Connecting valves open _____
- ☐ Gel. color: _____

Control Cabinet:
- ☐ Seal and weather tightness _____

Tank insulation: _____ to ground, with _____ V megger.

Painting:
- ☐ Painting _____

FINAL INSPECTION (PRIOR TO ENERGIZING)

- ☐ Electrical clearances
- ☐ Connections flexibility
- ☐ Tightness
- ☐ All valves open
- ☐ Gas detector bled
- ☐ Bushings
- ☐ Hot spot test switch
- ☐ Cabinet heater available
- ☐ Fans available
- ☐ Oil level
- ☐ Oil temperature
- ☐ Winding temperature
- ☐ Ground connections
- ☐ Re-check tank insulation

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Power Transformer Accessory & Cooling Fluid Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

GAS, TEMPERATURE, LEVEL AND DIELECTRIC TESTS

Winding Temperature, Indicator Test (Oil Bath)	Required Setting	As Found		As Left	
		Rise	Drop	Rise	Drop

Indic. At 40ºC: _____ 60ºC: _____ 80ºC: _____ 100ºC: _____ 120ºC: _____ 140ºC: _____ 160ºC: _____

Top Oil Temperature, Indicator Test (Oil Bath)	Required Setting	As Found		As Left	
		Rise	Drop	Rise	Drop

Indic. At 40ºC: _____ 60ºC: _____ 80ºC: _____ 90ºC: _____ 100ºC: _____ 110ºC: _____ 120ºC: _____

Hot Spot Injection Test (If test winding available) _____ Cal. Resistor: _____ Ohms

Inject: _____ Amps For _____ Min.
(See Manuf. Recommendations)

	Local Indication		Remote Indication
	Start	Finish	
Hot Spot Winding Temp.			
Top Oil Temp.			
Temp. Rise:			

Oil Level Gauge Test:

Actual Oil Level: _____ Indic: _____ Alarm At: _____

Coolant Fluid Test: * For Askarel Only	Breakdown K.V	Colour	Neutralizing Number	Interfacial Tension	* Specific Gravity
Sample 1 From:					
Sample 2 From:					
Sample 3 From:					
Sample 4 From:					
Sample 5 From:					
Sample 6 From:					

Gas Detector Test	Tank	L.T.C.	_____
1) Gas Accumulation Alarm	At: _____ %	_____ %	_____ %
2) Gas Trip	At: _____ P.S.I	_____ P.S.I	_____ P.S.I

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Power Transformer Control Cabinet
Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

_____ V Megger Test On Internal Aux. Wiring: _____ ☐ Tightening ☐ Cleaning

Inc. Aux. A.C. Supply Volts: AB: _____ BC: _____ CA: _____ Φ ROT: _____

Inc. Aux. A.C. Supply Volts: AB: _____ BC: _____ CA: _____ Φ ROT: _____

☐ Aux. Supply Transfer Tests Settings: _____

☐ Motor Controls Test (Dry Run) ☐ Motor Mechanical Inspection ☐ Lube

Motor No.	Φ	V	A	HP	RPM	Temp. Rise	0/Load		Insul. Test	DC Resist @____°			Amps			Rotation Facing Shaft
							Amps	%		AB	BC	CA	A	B	C	

☐ Check that 0/Load elements match characteristics of the motors

Auxiliary Systems Full Operation Testing

Fan system, Local: ☐ , Remote: ☐ , Alarms: ☐ , Set At: _____

Oil system, Local: ☐ , Remote: ☐ , Alarms: ☐ , Set At: _____

Water system, Local: ☐ , Remote: ☐ , Alarms: ☐ , Set At: _____

_____ Cabinet Heaters: _____ X _____ W, _____ V, Set At: _____ °

_____ Cabinet Heaters: _____ X _____ W, _____ V, Set At: _____ °

_____ Cabinet Heaters: _____ X _____ W, _____ V, Set At: _____ °

Lighting: ☐ _____ Receptacles: ☐ _____ Cabinet Water Tight? ☐

Ensure That No Wiring is in contact with the heaters ☐

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Power Transformer On Load Tap Changer Control Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC INSPECTION	L.T.C. DRIVE CABINET	L.T.C. CONTROL SUB. PANEL	PARALLELING SUB. PANEL	A.V.R. SUB. PANEL	REMOTE CONT. CABINET
NAMEPLATE					
BULLETIN NO:					
DRAWING NO:					
TIGHTENING & CLEANING					
EQT. FREE & OPERATIONAL?					
N. PLATES & IDENTIFICATION					
DOOR OPERATION & W/T?					
_____ V MEGGER TEST				AVOMETER ONLY ☐	

MOTOR DATA: _____ V, _____ HZ, _____ PH, _____ A, _____ º _____ RISE

MANUAL OPERATION OF THE MECHANISM ☐ UNUSUAL STRESSES? ☐ L. SW. SET? ☐ YES ☐ NO

TAP POSITION INDICATOR OPERATION ☐ CRANK ELECTRICAL INTERLOCK OPERATION ☐

ELECTRICAL OPERATION TEST FROM DRVE MECH. CABINET

- CHECK UPPER LIMIT ☐, LOWER LIMIT ☐, IS OPERATION CONSISTENT? ☐ YES ☐ NO
- CHECK SELECTION OF LIMITS (IF THE CASE) ☐ UNUSUAL NOISES? ☐ YES ☐ NO
- MOTOR AMPS UP: _____, DOWN: _____, VOLTAGE DROP? ☐ Y ☐ N
- O/L HEATER ELEMENTS CAT: _____, SET AT: _____, FOR: _____ AMPS, ADEQUATE? ☐ Y ☐ N

BRAKE ADJUSTED PROPERLY? ☐ YES ☐ NO IF NOT, COMMENTS: _____

CONTROL TESTS AT CONTROL SUB. PNL: ☐ , PARALLELING SUB. PNL: ☐ , A.V.R. SUB. PNL: ☐

REMOTE OPERATION AT: _____ ☐ , INDICATION ☐, TAP POSITION INDIC. ☐

REMOTE OPERATION AT: _____ ☐ , INDICATION ☐, TAP POSITION INDIC. ☐

CONTROL RELAYS & A.V.R. SETTINGS: _____

FOR LIGHTING & HEATING SEE FORM CBCL-ETR-034 PAGE: _____

CBCL LIMITED
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Power Transformer Turn Ratio Ttr Set Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

TAP	Calculated Ratio. H to L	H1 To _____ To	H2 To _____ To	H3 To _____ To	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
Buck 1 ⊕					
TERT WDG ▲	Calculated Ratio. H to T	H1 To _____ To	H2 To _____ To	H3 To _____ To	
1					

⊕ = For voltage regulators or regulating transformers, check ratio for all taps in boost position and one tap in buck.

▲ = For Tertiary WDG, check one tap only.

CBCL LIMITED
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Power Transformer Turn Ratio Testing (With Applied Voltage) Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

- Ensure Vector Relationship If Test On 1 Phase Basis
- Ensure Phase Balance on 3 Phase Test

TAP No.	H.V. WDG Applied Volts			L.V. WDG Volts Read'G			Theoretical Ratio	Actual Ratio
	H1 To ____	H2 To ____	H3 To ____	X1 To ____	X2 To ____	X3 To ____		
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
⊗ BUCK								
⊗ TAP								

▲ TERT	H.V. WDG Applied Volts			T.V. WDG Volts Read'g			Theoretical	Actual
WDG	H1 To ____	H2 To ____	H3 To ____	T1 To ____	T2 To ____	T3 To ____		
1								

⊗ = For voltage regulators or regulating transformers, check ratio for all taps in boost position and one tap in buck.

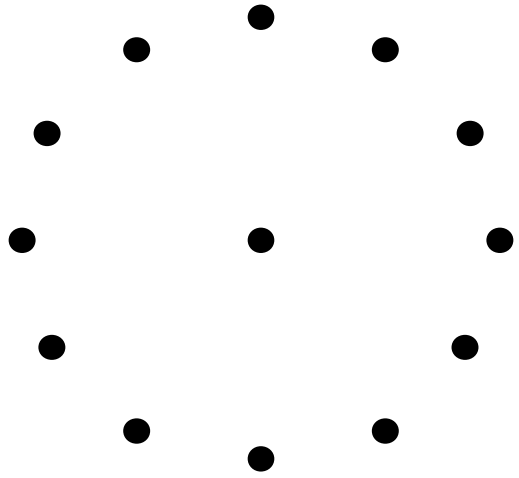
▲ = For Tertiary WDG, check one tap only.

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Power Transformer Polarity and Phase Relation Field Test Report

Client:	Date:	Page
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

TEST CONNECTIONS DIAGRAM

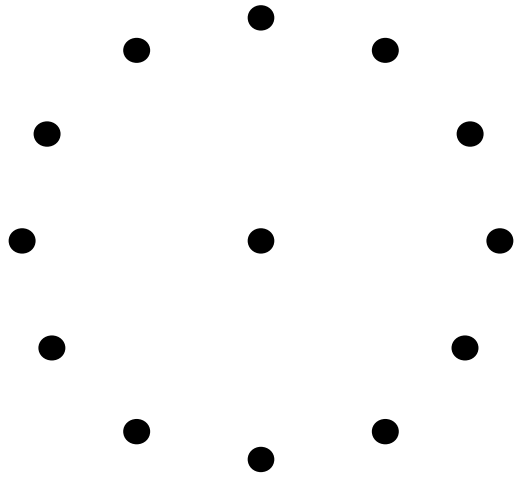


Voltage Applied To _____ WDG: _____

_____ TO _____ WDG Ratio: _____ TO _____

Test Volt Readings						
	1	2	3	1	2	3
1						
2						
3						
1						
2						
3						

TEST CONNECTIONS DIAGRAM



Voltage Applied To _____ WDG: _____

_____ TO _____ WDG Ratio: _____ TO _____

Test Volt Readings						
	1	2	3	1	2	3
1						
2						
3						
1						
2						
3						

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Power Transformer Post Energization Field Test Report

Page

Client:	Date:	Section
Project Name:	Prepared By:	
Project Number:	Tested By:	

AT FIRST ENERGIZATION, AND IMMEDIATELY AFTER

CHECK FOR ARCING AND UNUSUAL NOISE _____ ☐ VISUALLY INSPECT FROM THE GROUND ☐

IF TAP CHANGER IS "ON LOAD" TYPE, RUN TAPS UP & DOWN AND CHECK FOR UNUSUAL NOISE ☐

RECORD LAST TAP POSITION: _____

SOAKING PERIOD RECORDS (BY OPERATION PERSONNEL)

DATE	TIME	OUTSIDE TEMP. ºC	TOP OIL TEMP. ºC	WINDING TEMP. ºC	MAIN OIL LEVEL	T/C OIL LEVEL	GAS DETECTOR		REMARKS
							MAIN	T/C	

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DC Hi-Pot Step Voltage Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

RATING OF THE ITEM UNDER TESTS: _____ KV, FACTORY AC APPLIED TEST: _____ KV

SPECIFIED MAX DC TEST: _____ KV, PROPOSED TEST: _____ % OF MAX.:_____KV

PROPOSED VOLTAGE RISE: _____KV/ _____ MIN. TEST SET DATA:_____

_____

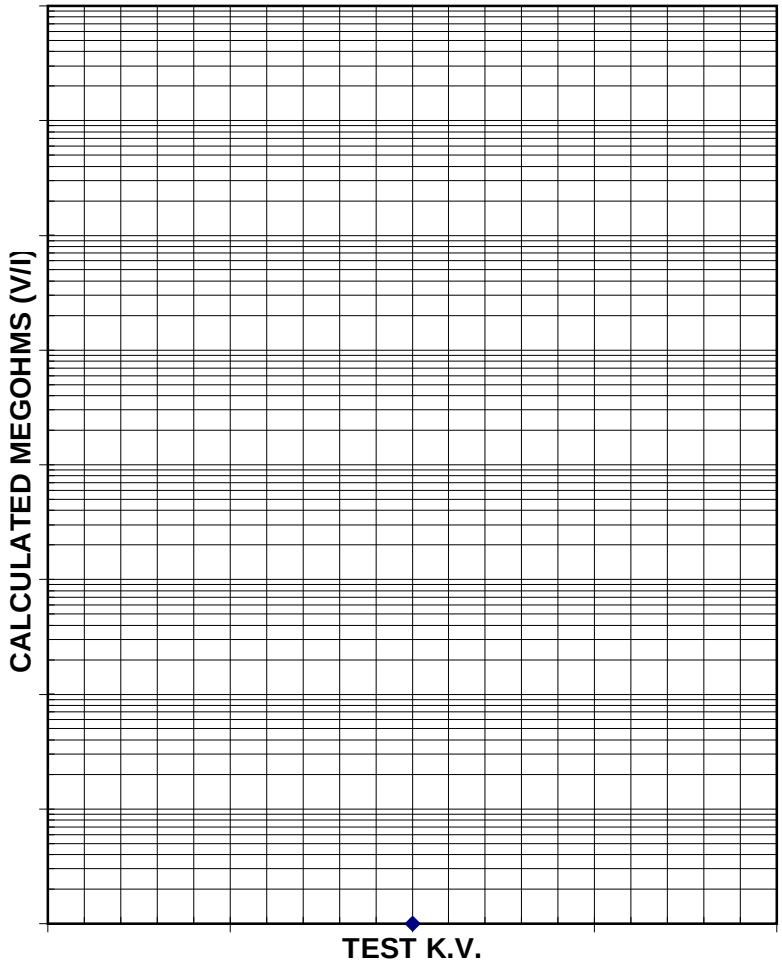
TEST SET HIGH LIMIT SET: _____ AT:_____KV, TEST SET LEAKAGE: _____ AT: _____KV

_____KV MEGGER TEST BEFORE HIPOT: _____

AFTER HIPOT: _____

TEMPERATURE CORRECTION FACTOR: _____

RESULTS BELOW TEMPERATURE CORRECTED? ☐



KV	Phase:____ MICRO AMPS	Phase:____ MICRO AMPS	Phase:____ MICRO AMPS

CBCL LIMITED
Consulting Engineers

Power Cable Hi-Pot Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

CIRCUIT									CIRCUIT LENGTH	AERIAL ☐ DUCT ☐ BURIED ☐				
NUMBER OF CONDUCTORS			CONDUCTOR SIZE			BELTED		SHIELDED						
INSULATING MATERIAL			INSULATION THICKNESS			VOLTAGE RATING			AGE					
POTHEAD OR TERMINAL TYPE									LOCATION	INDOORS ☐		OUTDOORS ☐		
NUMBER AND TYPE OF JOINTS									MFR.					
PART(S) TESTED												TEST MADE	HOURS	AFTER SHUTDOWN
GROUNDIN G TIME												DRY BULB TEMP.		
TEST VOLTAGE												WET-BULB TEMP.		
TEST CONNECTIONS			TO LINE			TO LINE			TO LINE			DEW POINT		
			TO EARTH			TO EARTH			TO EARTH			RELATIVE HUMIDITY		%
			TO GUARD			TO GUARD			TO GUARD			ABSOLUTE HUMIDITY		Gr./lb
	I TEST	R TEST	R 20ºc	I TEST	R TEST	R 20ºc	I TEST	R TEST	R 20ºc	I TEST	R TEST	R 20ºc	EQUIPMENT TEMP.	
													HOW OBTAINED	
													TEST INST. & SERIAL No.	
													RANGE	VOLTAGE

MISCELLANEOUS

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Consulting Engineers

List of Deficiencies Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

DEF'Y NO.	DESCRIPTION (REFER TO REPORT PAGE NO.)	CORRECTIONS		
		CHECKED BY	CHECKED DATE	COMMENTS

CBCL LIMITED
Consulting Engineers

Test Equipment Rental Field Test Form

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

DESCRIPTION	SECO NO.	WITHDRAWL		RETURN		RENTAL TIME	RENTAL RATE	CHARGES
		DATE	BY	DATE	BY			

TOTAL:

RENTAL CHARGES FOR ABOVE EQUIPMENT SHALL BE IN ACCORDANCE WITH THE SCHEDULE OF RENTAL ATTACHED TO SECO PROPOSAL FOR THE SERVICES.

CLIENT SITE REPRESENTATIVE:

DATE:

CBCL LIMITED
Consulting Engineers

Cable Testing Procedures Field Test Form

Client:	Date:	Page
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

CABLE ID: _____ **AGE:** _____

FROM: _____ **TO:** _____

NO. COND./SIZE _____ **LENGTH (m):** _____

RATINGS (VOLTAGE, TEMP., INSULATION CLASS, ETC.)

_____

_____

_____

INSULATION TYPE: _____

ROUTING CONDITIONS (HUMIDITY, TEMP., CONTAMINANTS, ETC. ALONG RACEWAY, DIFFERENT RACEWAYS CONFIGS, ETC.)

_____

_____

_____

_____

_____

_____

CONNECTED ACCESSORIES: _____

HISTORY: _____

_____

_____

_____

_____

_____

CBCL LIMITED
Consulting Engineers

Control Panel Inspection Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

EXTERIOR

NAMEPLATE ATTACHED ☐ PANEL ID: _____

GENERAL CONDITION _____

RUST _____ PAINT _____

CLASPS _____ HANDLE _____

MOUNTING _____

CABLE/CONDUIT CONNECTION _____

PILOT DEVICES _____

REMARKS: _____

INTERIOR

PANEL COMPONENTS PROPERLY SECURED:
- ☐ PLC _____ ☐ POWER SUPPLY _____
- ☐ RELAYS _____ ☐ _____
- ☐ TERMINALS _____

DEVICE IDENTIFICATION IN PLACE:
- ☐ RELAYS ☐ CONDUCTORS
- ☐ TERMINALS ☐ _____

WIRING TESTS COMPLETED:

- ☐ MEGGER TO PANEL GROUND BUS
- ☐ WIRE INSULATION TESTING WITH MULTIMETER (ON OHMS SCALE) TO PANEL GROUND BUS

CAUTION: DO NOT MEGGER SENSITIVE ELECTRONIC EQUIPMENT INCLUDING PLC OR ANY EQUIPMENT OPERATING AT 50Vac OR 50Vdc OR LESS.

GENERAL WIRING CONDITION _____

GENERAL ENCLOSURE CONDITION _____

C.E.C. CODE COMPLIANCE ISSUES _____

REMARKS: _____

CBCL LIMITED
Consulting Engineers

Splitter Basic Information & Inspection

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

SPLITTER BASIC DATA

PRESENT SPLITTER ID: _____

MANUFACTURER: _____ TYPE: _____

VOLTAGE: _____ AMPERE RATING _____ YEAR MANUF.: _____

PHASE/WIRE: _____ / _____ ENCLOSURE _____

NUMBER OF LUGS: _____ MANUFACTURER: _____

GROUNDING: _____

CANADIAN ELECTRICAL CODE PART 1 (CSA STANDARD C22.1) COMPLIANCE ISSUES

GENERAL COMMENTS

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Disconnect Switch Basic Information & Inspection

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

DISCONNECT SWITCH BASIC DATA

PRESENT SPLITTER ID: _____

MANUFACTURER: _____ TYPE: _____

VOLTAGE: _____ AMPERE RATING _____ YEAR MANUF.: _____

PHASE/WIRE: _____ / _____ ENCLOSURE _____

NUMBER OF LUGS: _____ MANUFACTURER: _____

GROUNDING: _____

CANADIAN ELECTRICAL CODE PART 1 (CSA STANDARD C22.1) COMPLIANCE ISSUES

GENERAL COMMENTS

Lighting Systems Basic Information Inspection & Testing

Page

Client:	Date:
Project Name:	Prepared By:
Project Number:	Tested By:

Section

BASIC INFORMATION

FIXTURE DESIGNATION: _____ MANUFACTURER: _____

CATALOG No.: _____ DESCRIPTION: _____

REFLECTOR MODEL No.: _____ LAMP: _____ WATTAGE: _____

FIXTURE VOLTAGE: _____ SUPPLY CABLE TYPE: _____

MOUNTING HEIGHT _____ TOTAL NUMBER OF FIXTURES _____

INSPECTION

REFERENCE DRAWING No.: _____ INSTALLATION COMPLETE: _____

INSTALLATION PER DESIGN: _____ OPERATION OF FIXTURES _____

CANADIAN ELECTRICAL CODE PART 1 (CSA STANDARD C22.1) COMPLIANCE ISSUES: _____

TESTING: LUX HI-TESTER RESULTS

AREA DESCRIPTION: _____ REQUIRED LIGHTING LEVEL _____

SAMPLE POINT No.	LIGHT LEVEL READING (Lx)	
	(0" AFL)	(30" AFL)

REMARKS: _____

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Panel Testing
Secondary Wiring Injection (Panel Basis)

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

☐ Panel Released for testing?

Drawing No.: _____

Overall _____ V megger test on wiring: _____

Overall _____ (Volts) (Amps) injected at panel: _____ on all (PT) (CT) Circuits

TEST RESULTS AND COMMENTS

	Note: Record panel meter readings during the test
Circuit: _____ _____ V Megger Test _____ _____ (Volts) (Amps) at: _____	
Circuit: _____ _____ V Megger Test _____ _____ (Volts) (Amps) at: _____	
Circuit: _____ _____ V Megger Test _____ _____ (Volts) (Amps) at: _____	
Circuit: _____ _____ V Megger Test _____ _____ (Volts) (Amps) at: _____	
Circuit: _____ _____ V Megger Test _____ _____ (Volts) (Amps) at: _____	
Circuit: _____ _____ V Megger Test _____ _____ (Volts) (Amps) at: _____	
Circuit: _____ _____ V Megger Test _____ _____ (Volts) (Amps) at: _____	

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Points Internal Calibration

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

INJECT AT INPUT TERMINALS WITH EXTERNAL WIRING DISCONNECTED

Calibration Checks

Point Number	Location	Test Number 1	2	3	4	5	6	Date
	Injection Value							
	Calculated Primary Value							
☐ Zero	Indication							
	Injection Value							
	Calculated Primary Value							
☐ Zero	Indication							
	Injection Value							
	Calculated Primary Value							
☐ Zero	Indication							
	Injection Value							
	Calculated Primary Value							
☐ Zero	Indication							
	Injection Value							
	Calculated Primary Value							
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	Calculated Primary Value							
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	Injection Value							
	Calculated Primary Value							
☐ Zero	Indication							
	Injection Value							
	Calculated Primary Value							
☐ Zero	Indication							
	Injection Value							
	Calculated Primary Value							
☐ Zero	Indication							
	Injection Value							
	Calculated Primary Value							
☐ Zero	Indication							

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Transducers (Circuit Basis) Testing & Calibration

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Primary Ratio: P.T.S. _____ C.T.S. _____

Device Data, Function and Test Description	Test Results			
	Input and Power Factor	Output	Calculated Primary Value	Indication
Test				
Test				
Test				
Test				
Test				
Test				

☐ All wiring reconnected?

Note: Zero output should be adjusted and confirmed for each tranducer

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Main Panel Bus Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

MAIN BUSES

Equipment Released for Testing? _____

Bus Assembly _____ Tightening _____ Insulators _____ Cleaning _____

Insulation Test with a _____ V Megger: _____

R-N _____ S-N _____ T-N _____

Phasing (Facing Rear):

BREAKERS AND DISCONNECTS

Identification						
Breakers	Manufacturer					
	Type					
	Voltage Rating					
	Nominal Amps					
	Maximum Amps					
	Interrupting Capacity					
	General Tightening					
	Cleaning					
	Operation					
	O/C Test (If Possible)					
	_____ V Meger Test					
Disconnects	Manufacturer					
	Type					
	Voltage Rating					
	Nominal Amps					
	General Tightening					
	Cleaning					
	Operation					
	_____ V Meger Test					
Cable	Size & Type					
	Phasing & Identification					
	_____ V Meger Insulation Test	R-S	R-N			
		S-T	S-N			
		T-R	T-N			

All Wiring Reconnected? _____

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Power Line Grounding Field Test Report

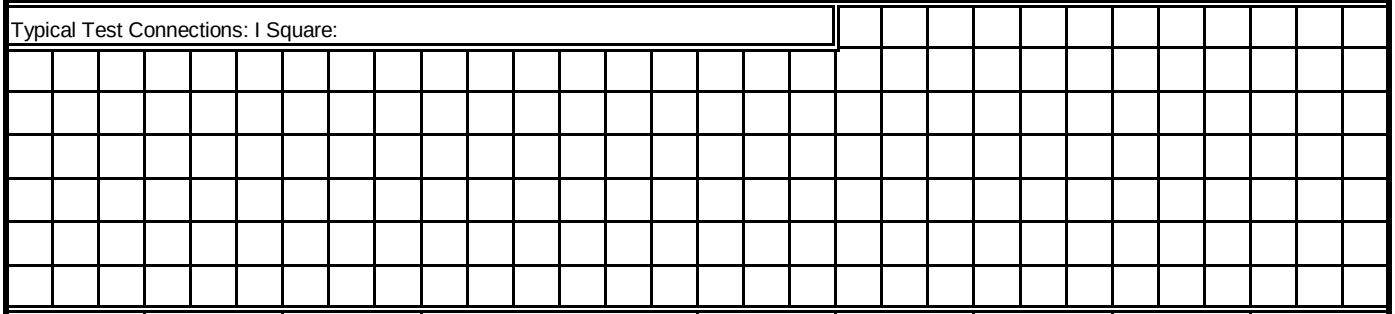
Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

TEST RESULTS

Test Instrument Data: _____

Typical Test Connections: I Square:



Structure Number	Date Of Test	Temperature And Weather	Surrounding Ground Composition And Conditions	Test #1	Test #2	Test #3	Test #4	Gnd Wire Re-connected

CBCL LIMITED
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Reactor Basic Information Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Basic Data

Manufacturer: _____ Type: _____

Serial Number: _____ S.O. Number: _____ Built: _____

kVA Rating: _____ Primary kV Rating: _____ Frequency: _____

Primary B.I.L.: _____ Neutral B.I.L.: _____

Z: _____ at _____ °C, temperature rise: _____ °C, at: _____

Auxilary Power: _____ V _____ Phase

Mode of Cooling: _____

_____

_____

Weight: Core and Windings: _____

Tank and Fittings: _____

Tank Oil: _____, _____ Litres

_____ _____, _____ Litres

Total: _____, _____ Litres

Manufacturer's Bulletin Number: _____ Available? _____ Data As Per Design? _____

Other Data: _____

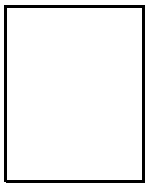
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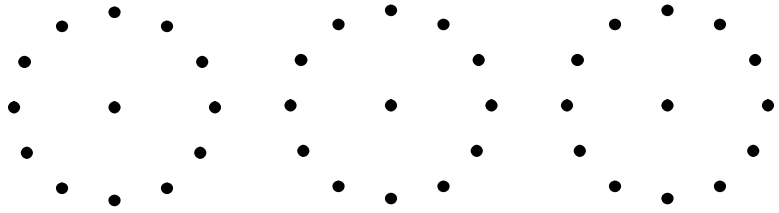
_____

_____

Connections And Vectors

Top View





Internal Insp. SH. No: _____ External Insp. SH. No: _____ Access'y Tests, SH. No: _____

Auxiliaries Tests SH. No: _____ Bushing Data SH. No: _____ Hi Pot/Dobble Test SH. No:

T.T.R./Volt Ratio SH. No: _____ Vectors Checks SH. No: _____

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POWER CIRCUIT BREAKER SPRING OPERATED MECHANISM

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

BASIC DATA

Manufacturer: _____ Type: _____ Serial: _____

Motor: _____

_____

Manufacturer Bulletin No: _____ Available? ☐

PRELIMINARY INSPECTION EQUIPMENT RELEASED FOR TESTING? ☐

Mechanical
- ☐ Mounting
- ☐ General Tightening
- ☐ Painting
- ☐ Lubrication
- ☐ Equipment Free & Operational?

Electrical
- ☐ Wiring as per Schematics
- ☐ Properly Sized
- ☐ Connected
- ☐ Tightened
- ☐ All Electrical Equipment Free & Operational?
- Circuit Fuses Size: _____ ☐ Adequate?

MECHANISM TESTING

☐ Ensure That Breaker Can Be Safely Operated

_____ V Megger Test on Internal Wiring: _____ Voltage: _____ V _____ Polarity ☐

		Ø	Ø	Ø
Manual Charging		☐	☐	☐
Slow Close		☐	☐	☐
Slow Trip		☐	☐	☐
Electrical Charging	Duration			
	Volts/Amps	/	/	/
Motor DC Resistance @ °				

☐ Unusual Vibrations or Noise?

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Circuit Breaker Pre-Comissioning Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Inspection and Test on Arrival

☐ Check Impact Recorder: _____

☐ Check for Evidences of Shifting: _____

☐ Check Shipping Blocks: _____

☐ Check for Exterior Damages: _____

☐ Check for Leaks: _____

☐ Check Nitrogen Pressure: _____ P.S.I./kg/cm^2 at _____ °

Inspection and Tests During Erection

Erection by: _____ Manufacturer Bulletin Number _____ Available? ☐

☐ Internal Inspection By: _____

☐ Adjustments & Clearances By: _____ See Page No. _____

☐ Oil Test (if the case) By: _____ See T.C. 869, Page No. _____

Inspection and Tests after Installation

☐ External Inspection By: _____ See Page No. _____

☐ H.V. Connections Tightening ☐ Flexibility ☐ Clearances

☐ Internal Control Wiring Tightening _____ V Megger Test: _____

☐ External Control Wiring Tightening _____ V Megger Test: _____

☐ General Cleaning ☐ Paint Touch Up

☐ Hipot or Doble Test See Page No. _____

Notes: _____

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Power Circuit Breaker Inspection After Testing Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Disregard Checks Not Applicble to Type of Breaker Considered

		Phase A	Phase B	Phase C
Check connections for tightness	Primary (Bus Side)			
	Primary (Load Side)			
	Ground			
	Control			
Check that nothing is in contact with the heaters				
Heaters "On"?				
All fuses in place?				
All local switches reclosed?				
Selector switch properly selected?				
All valves open?				
Gauges indication and operation satisfactory?				
Mechanism fully operational?				
Oil level, air or SF6 press. Correct?				
Any leaks?				
Air bleed devices operational?				
Pressure regulator set properly?				
Operation counters reading after the tests				
High voltage clearances adequate?				
All temporary wiring removed?				
CT's properly connected and earthed?				
Boxes secure and reclosed?				

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SF6 Power Circuit Breaker Basic Data & Inspection

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Basic Data

Manufacturer: _____ Type: _____ Frequency: _____

Serial number: A: _____ B: _____ C: _____

Voltage rating: _____ Maximum: _____ Minimum: _____

Continuous current rating: _____ Momentary: _____

Inturrupting rating: Three phase rating: _____ MVA Current at rated voltage: _____ kA

Maximum current: _____ kA Time (in cycles): _____

Number of inturrupts per phase: _____ Resistors: _____ Capacitors: _____

Mechanism Type (Motor, Air, Hydraulic, Etc.): _____

Maximum operating pressure (air or hydraulic type only): _____ Minimum: _____ Nominal: _____

Control voltage: _____ Auxilaries voltage: _____

Data as per design? ☐ Y ☐ N Manufacturer's bulletin number: _____ Available? ☐ Y ☐ N

General Inspection

Breaker leval and properly fastened: ☐ ☐ ☐ Structures: ☐ ☐ ☐ Foundations: ☐ ☐ ☐

Paint: ☐ ☐ ☐ Resistors: ☐ ☐ ☐ Insulators: ☐ ☐ ☐ Grounding: ☐ ☐ ☐

SF6 Pressure: _____ Pole A: _____ Pole B: _____ Pole C: _____

Electrical

Local fuses as per schematics?	☐ ☐ ☐
Electrical devices free and operational?	☐ ☐ ☐
Wiring Tight?	☐ ☐ ☐
Control cabinet weather tight?	☐ ☐ ☐
Clean?	☐ ☐ ☐
Door and lock operational?	☐ ☐ ☐
All name plates installed?	☐ ☐ ☐

High Voltage Phasing and Connections:

Mechanical

All shipping blocks and braces removed?	☐ ☐ ☐
Mechanism tight?	☐ ☐ ☐
Lubrication?	☐ ☐ ☐
Other checks as per manufacturer's instructions?	☐ ☐ ☐

Notes: _____

Notes: _____

CBCL LIMITED
Consulting Engineers

SF6 Power Circuit Breaker Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Operational Tests

☐ Ensure that the inspection sheet is completed and that the breaker can be operated safely

☐ Ensure that the preliminary testing of the cell is completed

☐ Ensure that the mechanism air, hydraulic, or motor system is operational

_____ V Megger Test on internal wiring: _____ Control voltage: _____ Polarity: _____

			Phase A	Phase B	Phase C
Local control and operation					
Trip free					
Anti pumping					
Phase Discrepancy Test		Fault at A			
		Fault at B			
		Fault at C			
Voltage/Current		Closing			
		Tripping			
Minimum operating voltage		Closing			
		Tripping			
DC Resistance	Closing Coils	1			
		2			
	Tripping Coils	1			
		2			
		3			
	Main Contacts	1			
		2			
		3			
		4			
SF6	Pressure at: °C				
	Relief valve operation				
	Gas "Low Pressure" alarm				
Auxilary switch development as per schematics?					
Position indicators operation checks					
Linkage and switches operation checks					
Operation counter operation checks					
Auxilaries voltages					
Control cabinet heaters operational?					
Lighting and receptacles operational?					

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Power Circuit Breaker Internal Air System Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Preliminary Inspection And Testing

Piping: Configuration as per drawings? ☐ Y ☐ N ☐ Mounting and fastening ☐ Connections and coupling tight

Guages and pressure switches bench tested? ☐ Y ☐ N

Safety valve: Free and operational? ☐ Y ☐ N Bench tested? ☐ Y ☐ N Settings: _____

☐ Check isolating valve operation ☐ Inspect and test local air compressor

☐ Blow system clean ☐ Pressurize and check for leaks

Guages reading normal? ☐ Y ☐ N

Air System Basic Testing

Pressure	Regul. or Compr.		Safety Valve					
Control Settings	Ref.	App.	Ref.	Valve	Ref.		Ref.	
Operate								
Reset								
Pressure Switch								
Settings	Ref.	P. Sw.	Ref.	P. Sw.	Ref.	P. Sw.	Ref.	P. Sw.
Rise								
Drop								
Pressure Switch								
Settings	Ref.	P. Sw.	Ref.	P. Sw.	Ref.	P. Sw.	Ref.	P. Sw.
Rise								
Drop								
Pressure Switch								
Settings	Ref.	P. Sw.	Ref.	P. Sw.	Ref.	P. Sw.	Ref.	P. Sw.
Rise								
Drop								

Pressure Guage Accuracy Test

Ref.	Guage	Ref.	Guage	Ref.	Guage	Ref.	Guage	Ref.	Guage	Ref.	Guage

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Power Circuit Breaker Air Compressor Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Basic Data

Manufacturer: _____ Type: _____ Serial: _____

Motor: _____

_____

Compressor: _____

_____

Manufacturer's Bulletin Number: _____ Available: _____ Data As Per Design: _____

Preliminary Inspection

Mechanical: ☐ Mounting ☐ Vibration pads ☐ Belt tightening ☐ General tightening
☐ Lubrication ☐ Paint ☐ Alignment

Reservoir inspection (if applicable)? ☐ Y ☐ N Reclosed? ☐ Y ☐ N All connections tight? ☐ Y ☐ N

Local safety valve free? ☐ Y ☐ N Properly rated? ☐ Y ☐ N Set at: _____

Equipment free and operational? ☐ Y ☐ N Pressure switches bench tested? ☐ Y ☐ N

Other checks as per manufacturer's instructions: _____

Electrical: Wiring as per schematics? ☐ Y ☐ N Properly sized? ☐ Y ☐ N Connected? ☐ Y ☐ N Tightened? ☐ Y ☐ N

All electrical equipment free and operational? ☐ Y ☐ N

Breaker and starter data: _____

_____

_____

Compressor Testing

☐ Ensure isolation of the compressor from the breaker air system

_____ V Megger Test on power wiring: _____ _____ V Megger Test on control wiring: _____

Supply voltage: _____ Phase rotation: _____

☐ "Dry run" control checks

Motor rotation check: ☐ CW ☐ CCW Off load current: _____ On load current: _____

Unusual vibrations? ☐ Y ☐ N Noise? ☐ Y ☐ N Air leaks? ☐ Y ☐ N

Time to load reservoir (if applicable): _____ Off loading pressure: _____ Loading: _____

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Capacitor Bank Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Basic Data

Manufacturer: _____ Type: _____ Serial: _____

Voltage: _____ Rated (maximum): _____ kVARs: _____ Ultimate capacity (kVAR): _____

Dielectric: _____ Unit size (kVAR/mF): _____ B.I.L.: _____ Frequency: _____

Number of units: _____ Series: _____ Parallel: _____

Fusing type: _____ Rating: _____

Three phase connection: _____ Grounded: _____ Cooling: _____

Ground switch: _____ Reactor: _____

Interlocks: From: _____ To: _____

☐ Fence ☐ Ground switch ☐ Enclosure doors

Manufacturer's Bulletin Number: _____ Available? ☐ Y ☐ N As Per Design? ☐ Y ☐ N

Pre Energization Inspection and Tests

Structure and/or Cubicle: ☐ Levelling ☐ Anchoring ☐ Painting ☐ Grounding

Cooling: ☐ Air filters inspection ☐ Forced ventilation tested and operational ☐ Sheet Number

Insulators and bars: ☐ Configuration as per drawings? ☐ Tightening ☐ Cleaning ☐ Damages?

Fuses: ☐ Y ☐ N As Per Design? ☐ Tested? ☐ Can leaks? ☐ Damage?

Neutral insulation: _____ with a _____ V megger

Doors: ☐ Operation ☐ Locking

Ground switch: ☐ Operation ☐ Locking

Post Energization Checks and Operational Tests

☐ Fuse indicators? ☐ Unbalance alarm? ☐ Noise?

Bus voltage before energization: _____ V After _____ V

Bank current: Phase A: _____ Phase B: _____ Phase C: _____

C.T. current: Phase A: _____ Phase B: _____ Phase C: _____

Neutral unbalance: _____

Relay settings: Alarm: _____ Trip: _____

Unbalance alarm test: _____ Cans: _____

Relays target reset and cover replaced? ☐ Y ☐ N Doors locked? ☐ Y ☐ N Ventilation on? ☐ Y ☐ N

CBCL LIMITED
Consulting Engineers

kWh/kVARh Meter Field Test Report

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Basic Data

Manufacturer: _____ Type: _____ Serial: _____

Voltage: _____ Current: _____ Frequency: _____

Khg: _____ Khp: _____ _____

C.T. ratio: _____ P.T. ratio: _____ Reading multiplier: _____

Data as per design? ☐ Y ☐ N Manufacturer's Bulletin Number: _____ Available? ☐ Y ☐ N

Preliminary Inspection

Actual primary ratios: P.T.'s: _____ C.T.'s: _____ As required? ☐ Y ☐ N

All shipping blocks removed? ☐ Y ☐ N Disk free? ☐ Y ☐ N Air gap clean? ☐ Y ☐ N

Disk ratchet? ☐ Y ☐ N General tightness? ☐ Y ☐ N

Testing

kWh Meter Calibration Test Description	Injection Data (Note: Ensure that the proper polarity is respected for the temporary connections)				Test Results (Note: minimum 10 revolutions)		Theoretical Rev/Hrs For Power Injected W. Injected	Theoretical Sec/Rev For Power Injected 3600	Remarks
	Voltage	Current	P.F.	Power	Sec.	Rev.	Kh	Rev/hrs	

Potential lamps operational? ☐ Y ☐ N

Auxilary revolution counter operational? ☐ Y ☐ N _____ impulses every _____ revolutions.

Post Test Inspection

Air gap clean? ☐ Y ☐ N All wiring reconnected and tight? ☐ Y ☐ N Cover reclosed? ☐ Y ☐ N

Meter reading after test: _____

CBCL LIMITED
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Insulating Oil or Askarel Testing Prior to Equipment Filling

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Note: Refer to T.C.869-1 for test procedures and minimum or maximum acceptable values, specified by the equipment manufacturer.

Identification and origin of the Sample to be Tested	Number	Number	Number	Number
Dielectric Strength				
Tan ___ at: ____				
Neutralizing Value or Acidity Contents				
Corrosive Sulphur				
Oxydation Stability or Saponification Number				
Interfacial Tension				
Specific Gravity				
Viscosity at: ____ ^{o}				
Lowest Flow Temperature				
Flash Point				
Colour Number				
Percent of Sediment				

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Insulating Oil or Askarel
Tests During and After Equipment Filling

Page

Client:	Date:	
Project Name:	Prepared By:	Section
Project Number:	Tested By:	

Note: Refer to T.C.869-1 for test procedures and minimum or maximum acceptable values specified by the equipment manufacturer

Equipment Identification	Identification and Origin of the Sample to be Tested	Field Tests		Laboratory Tests	
		Dielectric Strength	Visual Examination	Neutralizing Value	Interfacial Tension
	No:				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				
	No.				

APPENDIX A2



SKYPOWER CORP

DIGBY WIND POWER PROJECT

COLLECTION SYSTEM STANDARDS

Rev	Description	Date	By	Ckd	Approved
O	ISSUED FOR TENDER	6/30/09	LO'K	RO'C	
A	ISSUED FOR FINAL REVIEW	06/24/09	LO'K	RO'C	

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Date	Office	Title:
06/30/09	Hfx	COLLECTION SYSTEM STANDARDS
Designed	Drawn	
LO'K	LO'K	

Schedule No. **SCHEDULE-C**

DRAWING INDEX

Client: SKYPOWER CORP
Project: DIGBY WIND POWER PROJECT
Project No.: 090630.00
Schedule No.: A
Page No.: 1 of 1

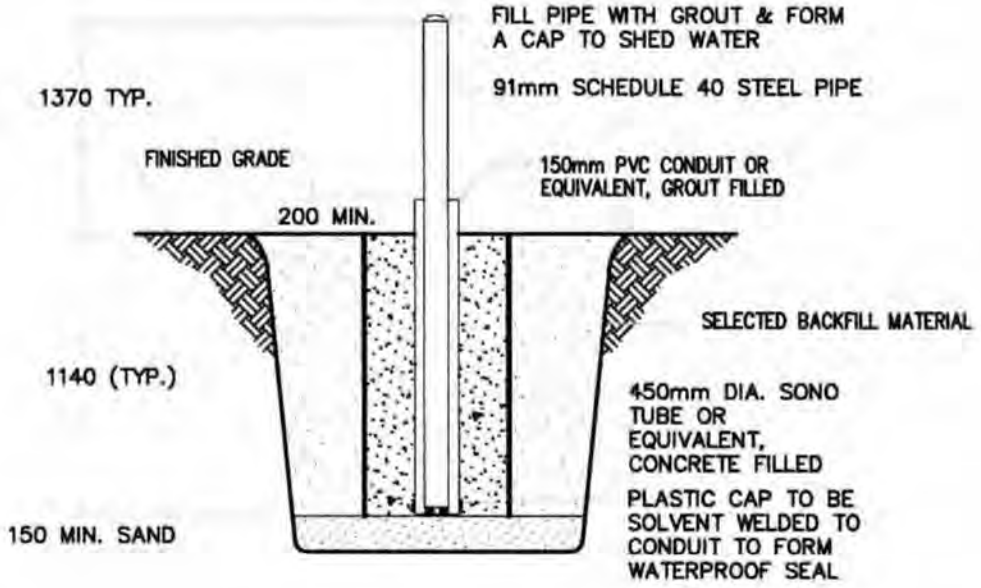
DRAWING NUMBER	TITLE	REVISION
E9004	Protective Bollard	0
E9006	Pole Setting Details, Sheet 1 of 2	0
E9006	Pole Setting Details, Sheet 2 of 2	0
E9007	25kV, 3-Phase, WTG Overhead-to-Underground Concrete Transition Structure	0
E9008	Guy Assembly Details, Sheet 1 of 2	0
E9008	Guy Assembly Details, Sheet 2 of 2	0
E9009	25kV, 3-Phase, Road Crossing Overhead-to-Underground Concrete Transition Structure	0
E9201	34.5kV, 3-Phase Wind Turbine Generator Riser Pole, Sheet 1 of 2	0
E9201	34.5kV, 3-Phase Wind Turbine Generator Riser Pole, Sheet 2 of 2	0
E9202	34.5kV, 3-Phase Overhead-to-Underground Transition Pole, Sheet 1 of 2	0
E9202	34.5kV, 3-Phase Overhead-to-Underground Transition Pole, Sheet 2 of 2	0
E9203	Dead-End Termination Detail	0
E9204	34.5kv, 3-Phase, Vertical Single Take-Off Pole Polymer Insulators, Sheet 1 of 2	0
E9204	34.5kv, 3-Phase, Vertical Single Take-Off Pole Polymer Insulators, Sheet 2 of 2	0
E9205	34.5kv, 3-Phase, Vertical Double Take-Off Pole Polymer Insulators, Sheet 1 of 2	0
E9205	34.5kv, 3-Phase, Vertical Double Take-Off Pole Polymer Insulators, Sheet 2 of 2	0
E9211	34.5kV, 3-Phase Tangent Pole, Polymer Post Insulators, Sheet 1 of 2	0
E9211	34.5kV, 3-Phase Tangent Pole, Polymer Post Insulators, Sheet 2 of 2	0
E9212	34.5kV, 3-Phase, 1'-5' Angle Pole Polymer Post Insulators, Sheet 1 of 2	0
E9212	34.5kV, 3-Phase, 1'-5' Angle Pole Polymer Post Insulators, Sheet 2 of 2	0
E9213	34.5kV, 3-Phase, 6'-20' Angle Pole Polymer Post Insulators, Sheet 1 of 2	0
E9213	34.5kV, 3-Phase, 6'-20' Angle Pole Polymer Post Insulators, Sheet 2 of 2	0
E9214	34.5kV, 3-Phase, 21'-60' Vertical Corner Pole Polymer Insulators, Sheet 1 of 2	0
E9214	34.5kV, 3-Phase, 21'-60' Vertical Corner Pole Polymer Insulators, Sheet 2 of 2	0
E9215	34.5kV, 3-Phase Dead-End Pole Polymer Insulators, Sheet 1 of 2	0
E9215	34.5kV, 3-Phase Dead-End Pole Polymer Insulators, Sheet 2 of 2	0
E9216	34.5kV, 3-Phase Double Dead-End Pole Polymer Insulator, Sheet 1 of 2	0
E9216	34.5kV, 3-Phase Double Dead-End Pole Polymer Insulator, Sheet 2 of 2	0
E9217	34.5kV, 3-Phase 61'-90' Vertical Corner Pole Polymer Insulators, Sheet 1 of 2	0
E9217	34.5kV, 3-Phase 61'-90' Vertical Corner Pole Polymer Insulators, Sheet 2 of 2	0
E9218	34.5kV, 3-Phase 0'-20' Vertical Dead-End Pole Polymer Insulator, Sheet 1 of 2	0
E9218	34.5kV, 3-Phase 0'-20' Vertical Dead-End Pole Polymer Insulator, Sheet 2 of 2	0
E9219	34.5kV, 3-Phase Added Leakage Pole, Polymer Post Insulators, Sheet 1 of 2	0
E9219	34.5kV, 3-Phase Added Leakage Pole, Polymer Post Insulators, Sheet 2 of 2	0
E9301	Wye-Wye Padmounted Transformer Terminations	0
E9401	Joint-Use Pole, Self-Supported Fibre-Optic Cable, High Tension	0
E9402	Fibre-Optic Cable, Joint-Use Pole, Light Angle, Short Span	0
E9501	3-Phase, 750-2500kVA Padmounted Transformer Concrete Pad Deep Well, Sheet 1 of 2	0
E9501	3-Phase, 750-2500kVA Padmounted Transformer Concrete Pad Deep Well, Sheet 2 of 2	0
E9901	34.5kV Standard Crossarms	0
E9902	Wedge-Tap Clamp Detail	0
E9903	Fused Cutout & Lightning Arrester Mounting Details, Sheet 1 of 2	0
E9903	Fused Cutout & Lightning Arrester Mounting Details, Sheet 2 of 2	0
E9905	Anchor Installation Details, Sheet 1 of 2	0
E9905	Anchor Installation Details, Sheet 2 of 2	0

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Office: Hfx
Drawn: LO'K
Title: COLLECTION SYSTEM STANDARDS
Schedule No.: **SCHEDULE-C**

Drawing File: E9004.dwg Date: 6/29/2009 8:18 PM



NOTES:

A. LOCATE BOLLARDS BETWEEN ROADWAYS/PARKING AND THE CONCRETE PAD. BOLLARDS SHALL BE SEPARATED FROM EACH OTHER BY NO MORE THAN 1300mm, AND FROM THE EDGE OF THE SWITCHGEAR PAD BY NO LESS THAN 600mm, EXCEPT IN FRONT OF THE SWITCHGEAR DOORS WHERE THE BOLLARDS SHALL BE AT LEAST 1000mm FROM THE EDGE OF THE PAD (ALL MEASUREMENTS TAKEN RELATIVE TO THE CENTRE OF THE BOLLARD).

B. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE INDICATED.

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ELECTRICAL STANDARD DETAIL

PROTECTIVE BOLLARD

SHEET 1 OF 1

Rev	Description	Date
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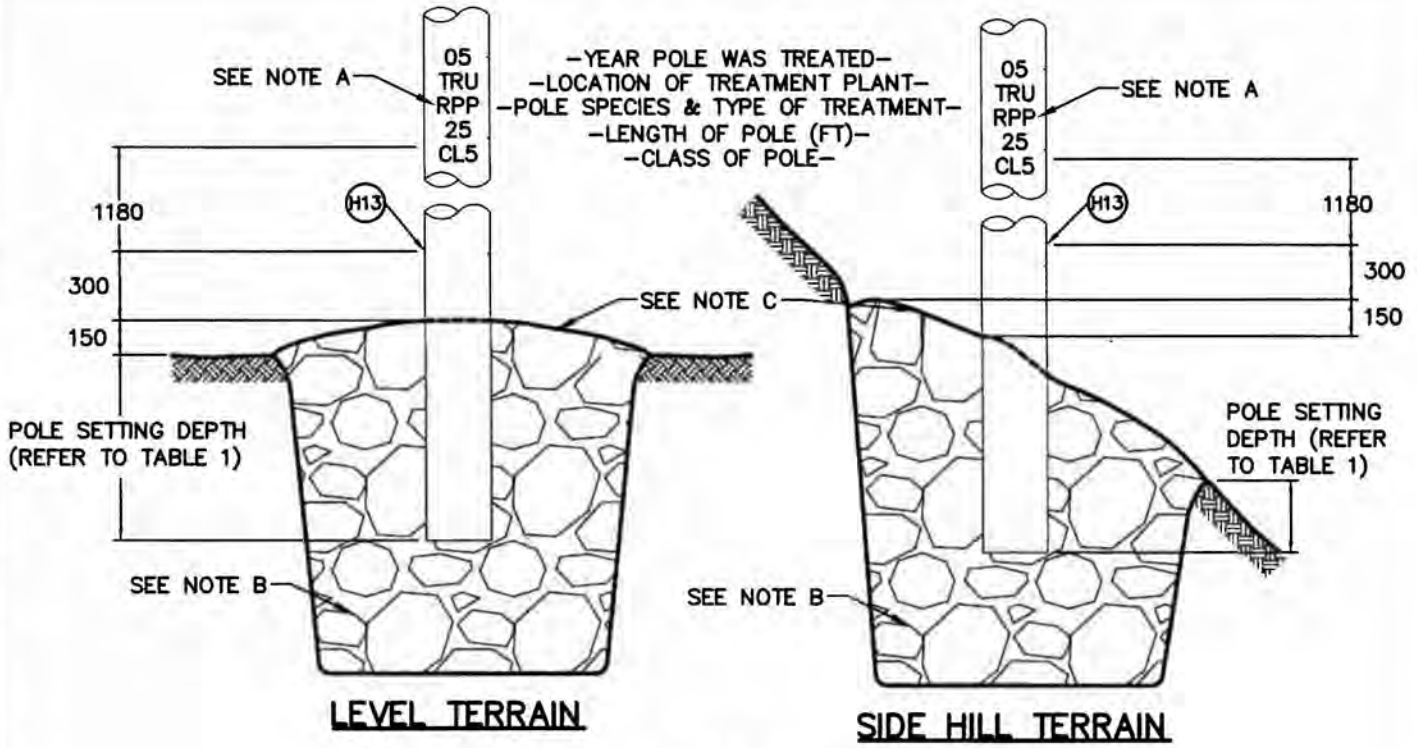
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Contract No: 090630.00

Drawing No: E9004

Revision: 0

Drawing File: E9006.dwg Date: 6/29/2009 8:19 PM



1/– DETAIL– POLE SETTING DETAILS

N.T.S.

MINIMUM POLE SETTING DEPTH (TABLE E9006-1)

POLE LENGTH IN METRES (FEET)	SETTING DEPTH IN SOIL IN METRES (FEET)	SETTING DEPTH IN ROCK IN METRES (FEET)
7.6 (25)	1.37 (4–½)	1.07 (3–½)
9.1 (30)	1.52 (5)	1.22 (4)
10.7 (35)	1.68 (5–½)	1.37 (4–½)
12.2 (40)	1.83 (6)	1.37 (4–½)
13.7 (45)	1.98 (6–½)	1.52 (5)
15.2 (50)	2.13 (7)	1.52 (5)

REFER TO DETAIL 2 FOR POLE SETTING IN SWAMP OR BOG

BILL OF MATERIALS (TABLE E9006-2)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H13	1	POLE DATING NAIL, HOT-DIPPED GALVANIZED	
H44	1	CORRUGATED STEEL POLE CRIBBING, HOT-DIPPED GALVANIZED, 2100mm DIA. x 1200mm LONG (MIN.)	
H45	4	POLE BEARING PLATE, HOT-DIPPED GALVANIZED	

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ELECTRICAL STANDARD DETAIL

POLE SETTING DETAILS

SHEET 1 OF 2

Rev	Description	Date
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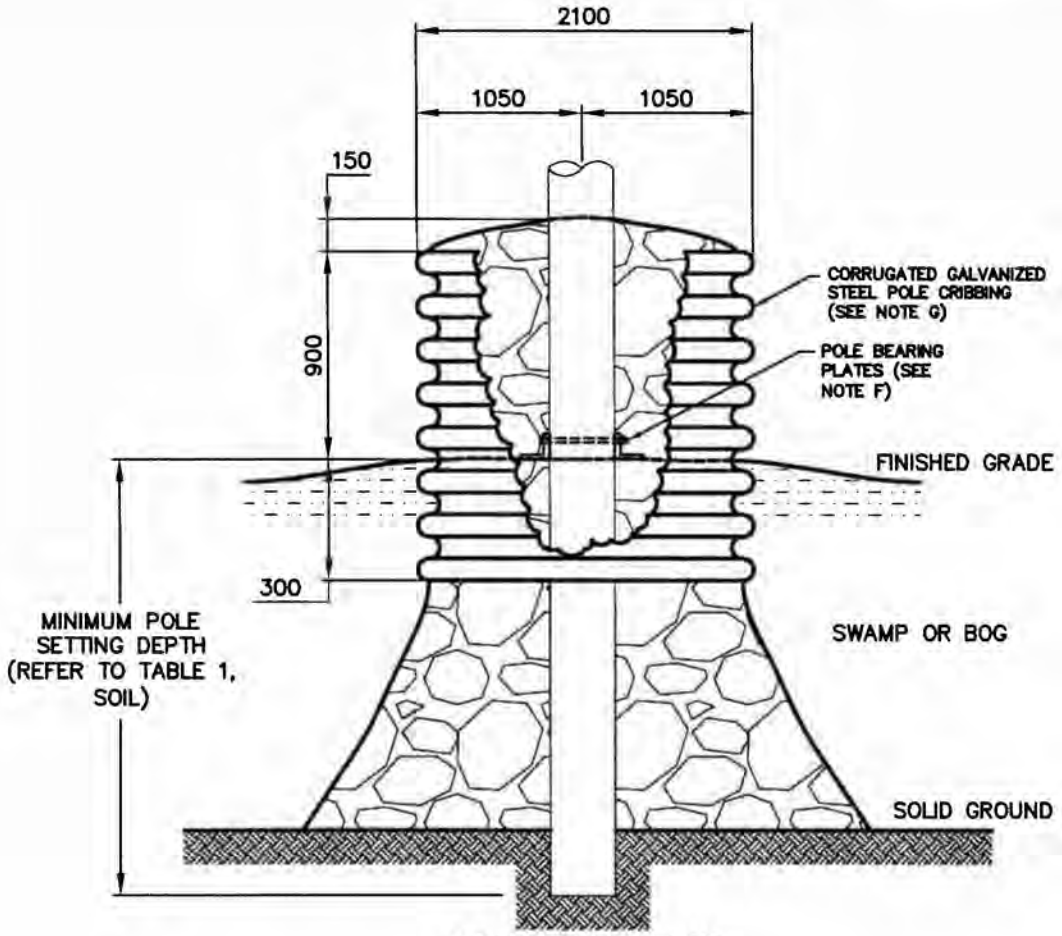
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Contract No: 090630.00

Drawing No: E9006

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SWAMP OR BOG

2 / – DETAIL – POLE SETTING IN SWAMP OR BOG

N.T.S. SEE NOTE E

NOTES:

A. POLE MARKING TO BE MARKED BEFORE TREATMENT WITH 20mm HIGH LETTERING.
B. EARTH SHALL BE TAMPED IN 250mm LAYERS.
C. PLACE AT LEAST 150mm OF EXCESS FILL AROUND POLE TO COMPENSATE FOR SETTLING.
D. HYDRAULIC TAMPING IS RECOMMENDED.
E. EXCAVATE BOG TO SOLID GROUND AND ENSURE THAT THE POLE IS IN SOIL (SWAMP/BOG AND/OR SOLID GROUND) TO THE FULL RECOMMENDED POLE SETTING DEPTH. IF SOLID EARTH IS NOT REACHED WITHIN THE POLE SETTING DEPTH, THEN PLACE A MINIMUM OF 600mm OF ROCK BACKFILL UNDER THE POLE PRIOR TO BACKFILLING.
F. SET POLE IN THE CENTRE OF THE CRIBBING, WITH POLE BEARING PLATES SECURED TO POLE AT THE APPROXIMATE FINISHED GRADE LEVEL.
G. PLACE POLE IN THE HOLE AND BACKFILL WITH ROCK TO 300mm BELOW FINISHED GRADE. INSTALL CRIBBING AND THEN COMPLETE BACKFILLING AS INDICATED.
H. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.

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ELECTRICAL STANDARD DETAIL

POLE SETTING DETAILS

SHEET 2 OF 2

Rev	Description	Date
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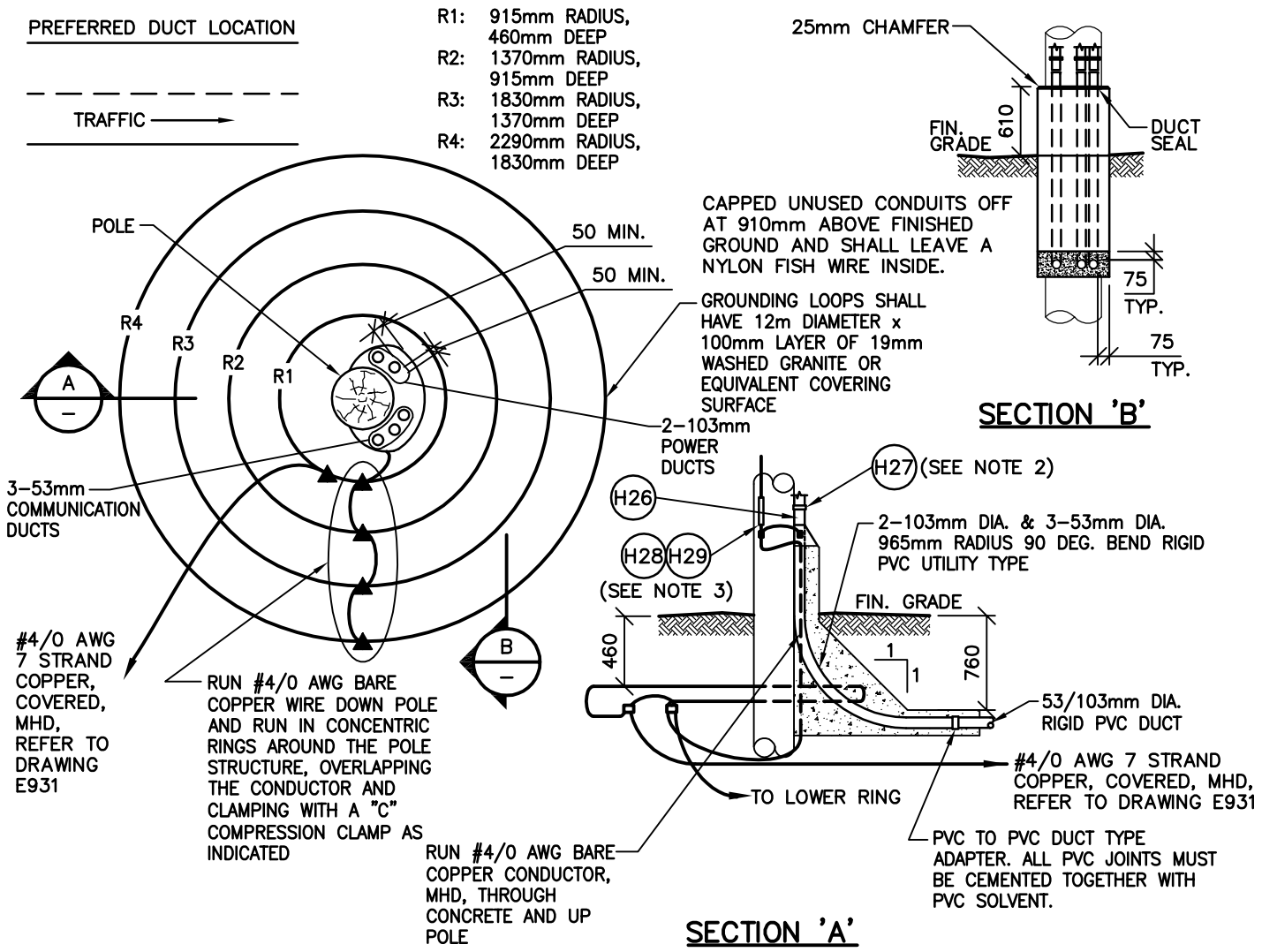
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Revision: 0

Drawing File: E9007.dwg Date: 6/29/2009 9:37 PM



NOTES:

1. MIN. BENDING RADIUS FOR CABLE TO BE TWELVE TIMES DIA. OF CABLE.
2. CONTRACTOR SHALL SECURE CABLE GUARD (B.O.M. #H26) USING ALUMINUM STRAPS (B.O.M. #H27) AT 1200mm INTERVALS, OVER ALL THREE UNDERGROUND POWER CABLES AND CONNECT TO THE GROUND WIRE.
3. STAPLE GROUND WIRE MOULDING TO POLE AT 600mm INTERVALS.
4. REFER TO DRAWING Exxx FOR DETAILS OF OVERHEAD CONSTRUCTION.

BILL OF MATERIALS (TABLE E9007–1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H26	1	2400mm x 130mm STRAIGHT ALUMINUM CABLE GUARD c/w FLARED BASE	ALMAT A48–14–A
H27	as req'd	ALUMINUM POLE STRAP	ALMAT A48–26A
H28	1	TREATED WOODEN MOULDING FOR GROUND WIRE, 22mm DIA. x 2440mm	
H29	as req'd	GALVANIZED STEEL WOOD STAPLES, 4mm DIA. x 50mm x 16mm	
G3	5	COMPRESSION "C" GROUND CONNECTOR	BURNDY

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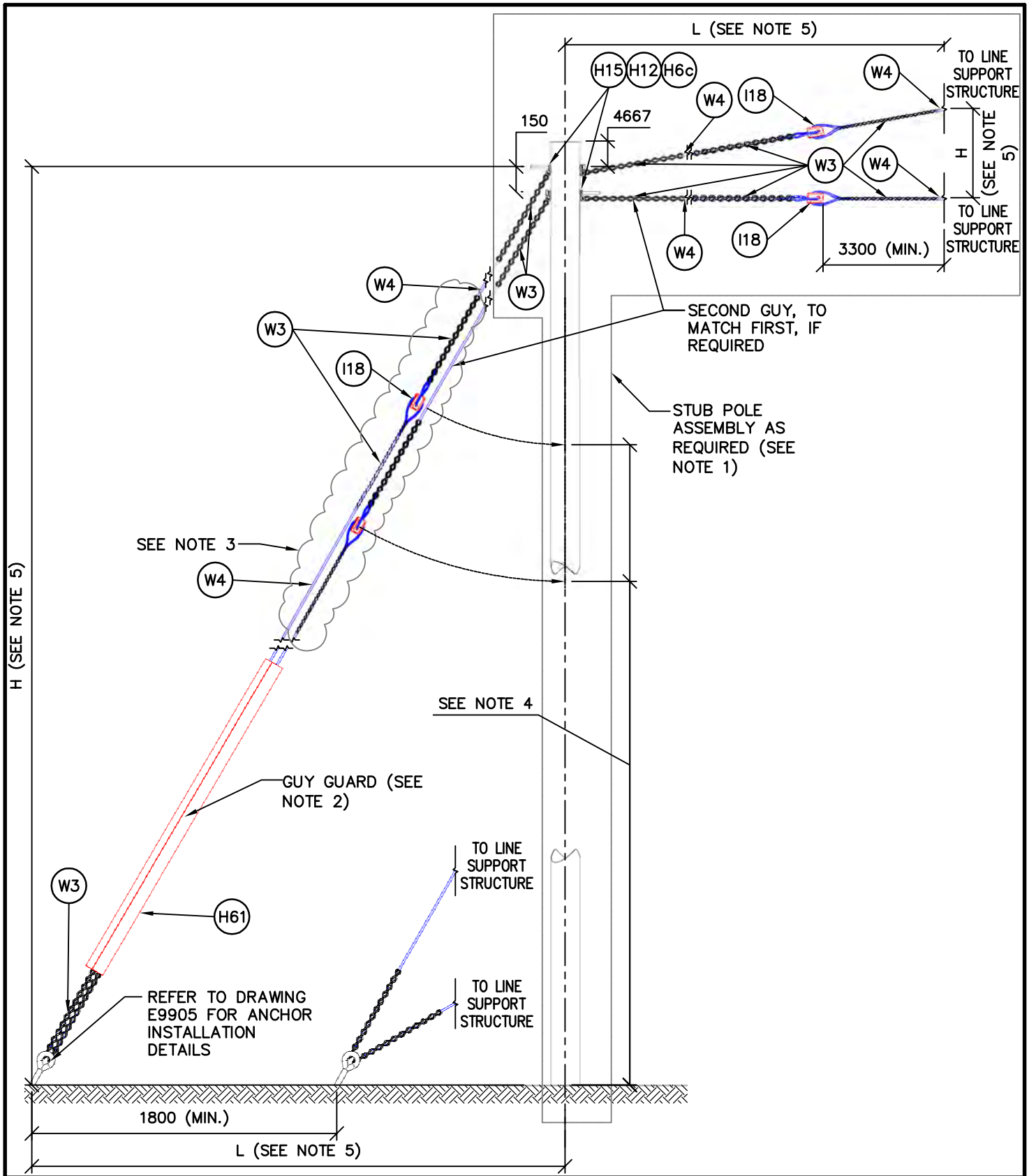
ELECTRICAL STANDARD DETAIL
25kV, 3–PHASE, WTG
OVERHEAD–TO–UNDERGROUND
CONCRETE TRANSITION STRUCTURE
SHEET 1 OF 1

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Revision: 0



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ELECTRICAL STANDARD DETAIL

GUY ASSEMBLY DETAILS

SHEET 1 OF 2

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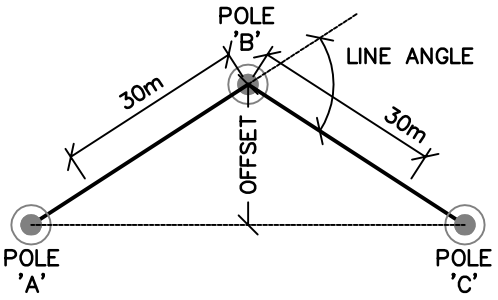
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Contract No: 090630.00

Drawing No: E9008

Revision: 0

Drawing File: E9008.dwg Date: 6/30/2009 10:19 AM



(TABLE E9008-1)

LINE ANGLE BASED ON OFFSET MEASUREMENT (APPROX.)			
OFFSET	LINE ANGLE	OFFSET	LINE ANGLE
1.3 m	5°	9.0 m	35°
2.6 m	10°	10.3 m	40°
3.9 m	15°	11.5 m	45°
5.2 m	20°	12.7 m	50°
6.5 m	25°	13.9 m	55°
7.8 m	30°	15.0 m	60°

MEASUREMENT PROCEDURE:

1. MEASURE A DISTANCE OF 30m FROM POLE 'B' TOWARDS POLE 'A' AND PLACE A MARK/STAKE.
2. MEASURE A DISTANCE OF 30m FROM POLE 'B' TOWARDS POLE 'C' AND PLACE A MARK/STAKE.
3. MEASURE THE OFFSET, i.e. THE SHORTEST DISTANCE FROM POLE 'B' TO THE STRAIGHT LINE CONNECTING THE TWO MARKS/STAKES LOCATED IN STEPS 1 & 2.
4. USE THE OFFET TO DETERMINE THE APPROXIMATE LINE ANGLE FROM TABLE E9008-1.

1 — DETAIL — OFFSET METHOD OF MEASURING LINE ANGLES
N.T.S.

NOTES:

1. INSTALL STUB POLE PER STANDARD POLE SETTINGS DETAILS ON DRAWING E9006.
2. INSTALL GUY GUARD AT ALL LOCATIONS WHERE THE GUY CROSSES A NORMALLY TRAVELLED AREA – INCLUDING ANY VISIBLE PEDESTRIAN, SKIER, ALL-TERRAIN VEHICLE, SNOWMOBILE, OR ANIMAL PATHS – AT LESS THAN 2.5m ABOVE THE GROUND. WHERE TWO GUY WIRES ARE INSTALLED ON A SINGLE ANCHOR, AND ONE GUARD CANNOT FIT EASILY OVER BOTH WIRES, INSTALL THE GUY GUARD ON ONLY THE UPPER WIRE.
3. WHERE A STUB POLE IS INSTALLED WITH A STRAIN INSULATOR IN THE HORIZONTAL GUY WIRE SEGMENT, THE STRAIN INSULATOR SHOWN IN THE DIAGONAL GUY WIRE SEGMENT (AND ASSOCIATED PREFORMED CONNECTORS) MAY BE OMITTED.
4. INSTALL ALL INSULATORS SUCH THAT THE POSITION OF THE INSULATOR IN THE SLACK POSITION IS AT LEAST 2500mm ABOVE GRADE.
5. GUY LEAD L SHOULD, UNLESS IMPRACTICABLE DUE TO SITE CONDITIONS, NOT BE LESS THAN HALF THE GUY HEIGHT H. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF SUCH AN OCCURENCE.
6. GUY WIRES SHALL BE RUN PARALLEL TO THE TENSIONED CONDUCTORS (i.e. STRAIGHT BACK FROM THE CONDUCTOR). IF SITE CONDITIONS RENDER THIS IMPRACTICABLE, TWO GUY WIRES SHALL BE INSTALLED FROM THE SAME GUY HOOK SUCH THAT THE TENSIONED CONDUCTORS BISECT THE ANGLE BETWEEN THE GUY WIRES.

BILL OF MATERIALS (TABLE E9008-2)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H6c	as req'd	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H12	as req'd	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H15	as req'd	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A", No. 1	HYDEL 34GH
I18	as req'd	GUY STRAIN INSULATOR, PORCELAIN, ASA CLASS 54-4, MUNSELL GREY COLOUR, 89kN MIN. TENSILE STRENGTH, 76mm LEAKAGE DISTANCE, 40/23kV DRY/WET FLASHOVER	NGK HCP-194
W3	3	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108
W4	as req'd	WIRE, GUY, GALVANIZED STEEL, 7 STRAND 8mm DIAMETER, GRADE 1300, MINIMUM BREAKING STRENGTH OF 53kN IN ACCORDANCE WITH CSA Std. CAN3-G12	WIRE ROPE PERFORMANCE SERIES 100

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ELECTRICAL STANDARD DETAIL
GUY ASSEMBLY DETAILS
SHEET 2 OF 2

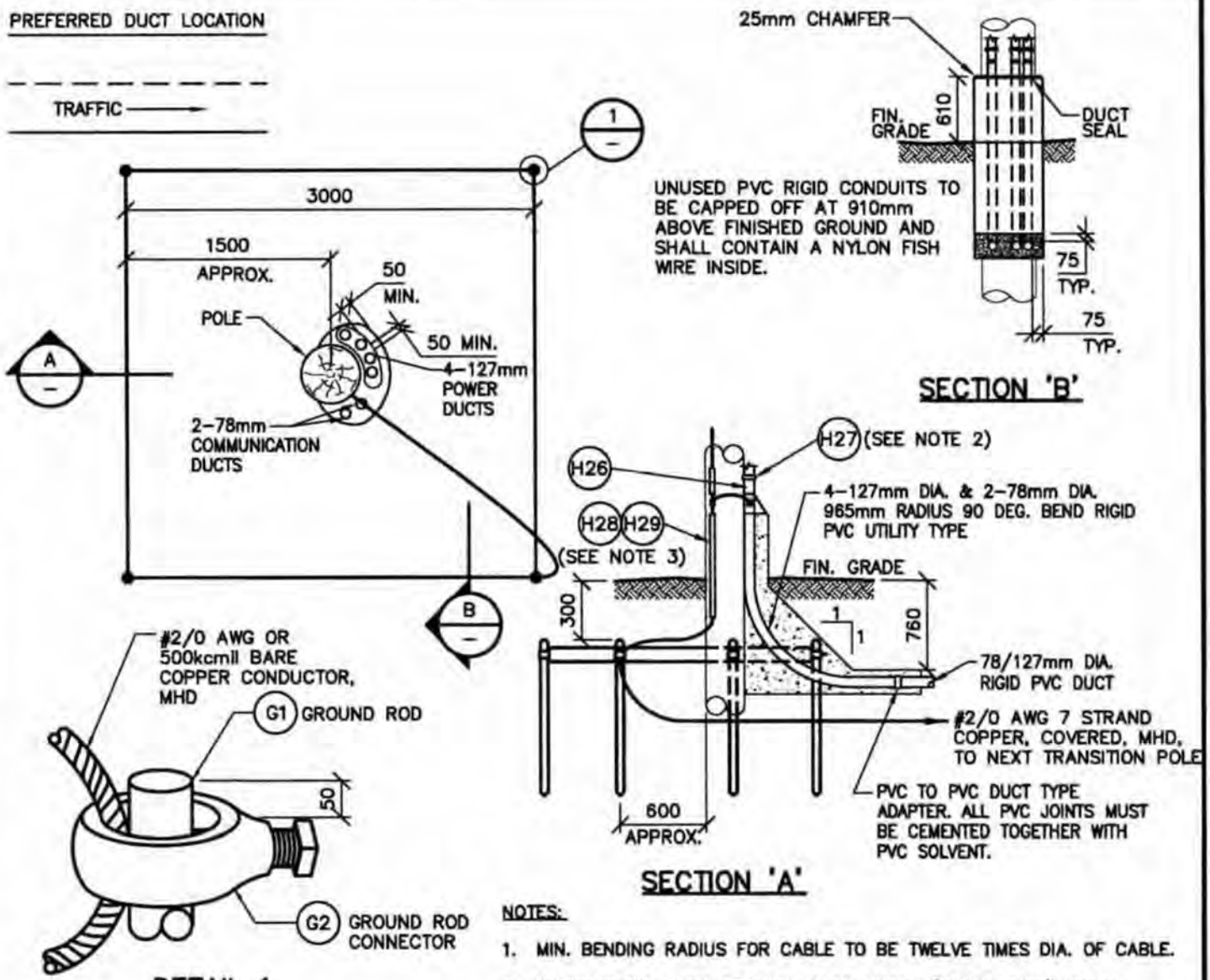
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Revision: 0

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NOTES:

1. MIN. BENDING RADIUS FOR CABLE TO BE TWELVE TIMES DIA. OF CABLE.
2. CONTRACTOR SHALL SECURE CABLE GUARD (B.O.M. #H26) USING ALUMINUM STRAPS (B.O.M. #H27) AT 1200mm INTERVALS, OVER ALL THREE UNDERGROUND POWER CABLES AND CONNECT TO THE GROUND WIRE.
3. STAPLE GROUND WIRE MOULDING TO POLE AT 600mm INTERVALS.
4. REFER TO DRAWING Exxx FOR DETAILS OF OVERHEAD CONSTRUCTION.

BILL OF MATERIALS (TABLE E9009-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H26	1	2400mm x 130mm STRAIGHT ALUMINUM CABLE GUARD c/w FLARED BASE	ALMAT A48-14-A
H27	as req'd	ALUMINUM POLE STRAP	ALMAT A48-26A
H28	1	TREATED WOODEN MOULDING FOR GROUND WIRE, 22mm DIA. x 2440mm	
H29	as req'd	GALVANIZED STEEL WOOD STAPLES, 4mm DIA. x 50mm x 16mm	
G1	3	COPPER-CLAD STEEL GROUND ROD, 19mm DIA. x 3000mm	
G2	3	BRONZE GROUND ROD CONNECTOR	

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ELECTRICAL STANDARD DETAIL
25kV, 3-PHASE, ROAD CROSSING
OVERHEAD-TO-UNDERGROUND
CONCRETE TRANSITION STRUCTURE

SHEET 1 OF 1

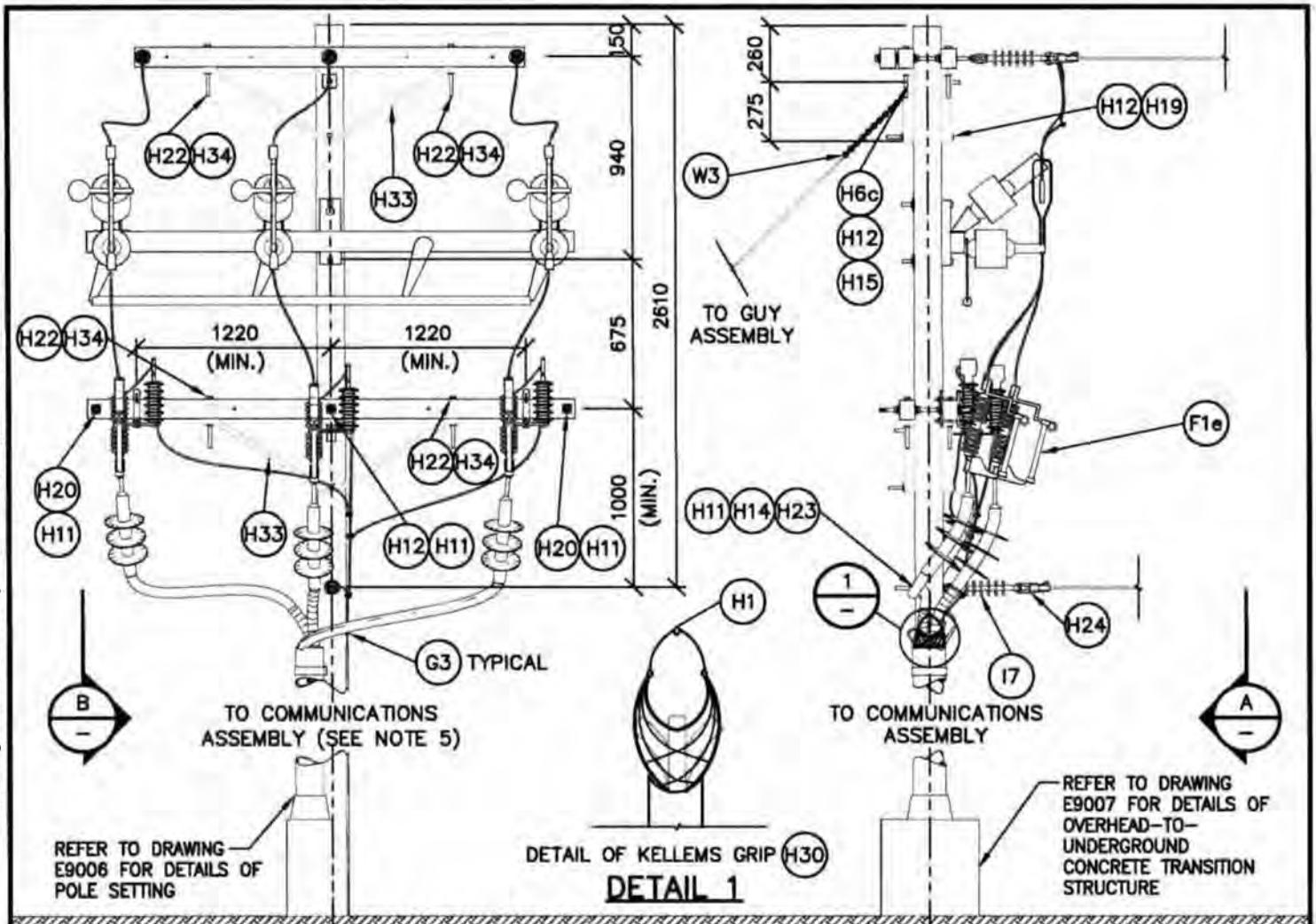
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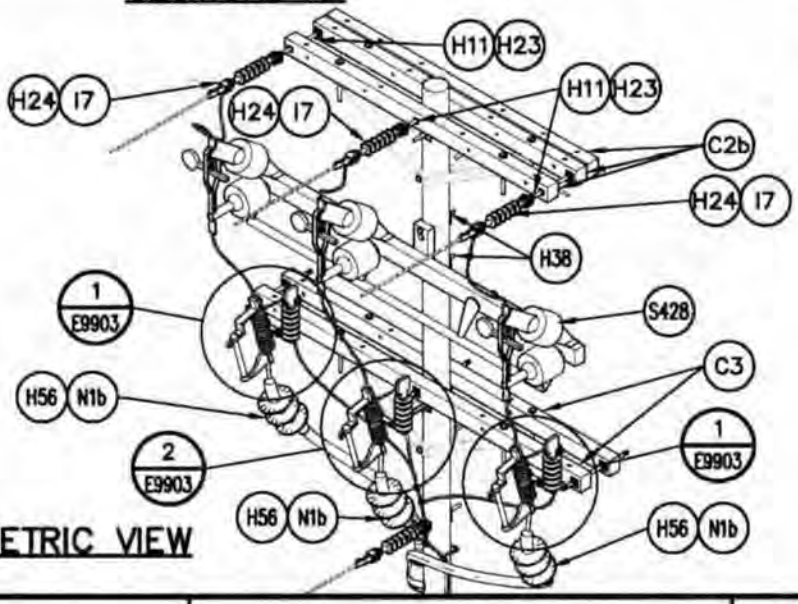
Contract No: 090630.00
Drawing No: E9009
Revision: 0

Drawing File: E9201.dwg Date: 6/29/2009 8:49 PM



SECTION "A"

SECTION "B"



ISOMETRIC VIEW

NOTES:

1. MIN. BENDING RADIUS FOR CABLE TO BE TWELVE TIMES DIA. OF CABLE.
2. FASTEN CABLES TO POLE WITH KELLEMS GRIP.
3. STRAP CABLE TO POLE AT 3000mm INTERVALS USING SYLVANIA 1516 50mm CABLE STRAPS OR APPROVED EQUIVALENT.
4. BOND U/G CABLE COPPER TAPE SHIELD TO GROUND AT POLE.
5. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

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ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE WIND TURBINE GENERATOR RISER POLE

SHEET 1 OF 2

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Drawing No: E9201

Revision: 0

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BILL OF MATERIALS (TABLE E9201-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
C2b	3	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT c/w HOLES FOR 1550mm LONG CROSSARM BRACKET (REFER TO DRAWING E9901); NOTE THAT CROSSARM MATCHES NSPI STANDARD SIX-PIN CROSSARM WITH THE EXCEPTION OF THE NOTED BRACKET HOLES	STELLA-JONES
C3	2	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 4 PIN, 95mm x 120mm x 3050mm, DRILLED BEFORE TREATMENT (REFER TO DRAWING E9901)	STELLA-JONES
F1a	3	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, "T" SPEED, AMPACITY AS NOTED ON SINGLE-LINE DIAGRAM Exxx	S&C 279xxx SERIES
H1	1	BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)	CHANCE 508754
H6c	2	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	as req'd	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	4	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H14	1	WASHER, HOT-DIPPED GALVANIZED, CURVED, 83mm x 83mm x 8mm, 17mm DIA. HOLE	HYDEL 1434CW11
H15	4	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A", No. 1	HYDEL 34GH
H20	2	BOLT, DOUBLE-ARMING FULL THREAD, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA Std. C83 1970, ITEM B-2 FULL THREAD; "xx" = LENGTH IN INCHES + 50) c/w FOUR (4) SQUARE NUTS	CHANCE B874
H21	2	GALVANIZED STEEL EYE-NUT, 16mm DIA, EYE, ACCEPTING 16mm DIA. THREADED BOLT	HYDEL 58EN
H22	8	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 13mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H23	8	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H24	8	CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)	BURNDY CUW series
H25a	1	COMPRESSION CONNECTOR; 'CRIMPIT'; SUITABLE FOR ALUMINUM, COPPER, OR ACSR (FOR CONDUCTOR SIZES UP TO #2/0 AWG ACSR/AASC) ; CSA CERTIFIED	BURNDY YC-A
H25b	3	WEDGE-TYPE CONNECTOR, SUITABLE FOR ALUMINUM OR ACSR (FOR CONDUCTOR SIZES LARGER THAN #2/0 AWG ACSR/AASC), CSA CERTIFIED	BURNDY WCA (WEJTAP) series
H30	1	WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING	HUBBELL 022030xx SERIES
H33	4	BRACE, ANGLE CROSSARM, SINGLE PIECE "V", HOT-DIPPED GALVANIZED STEEL (AS PER CSA STD. C83.20M), 1525mm LONG, NEMA STANDARD	CHANCE 6953
H34	8	WASHER, HOT-DIPPED GALVANIZED, ROUND, 14mm DIA. HOLE	HYDEL138RW
H38	2	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 19mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 8.34kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 89xx
H56	3	TIN-PLATED COPPER COMPRESSION TERMINAL PLUG, FOR CONNECTION TO ALUMINUM OR ACSR CONDUCTOR (CSA approved)	BURNDY YE-R, YE-W
Q3	as req'd	'CRIMPIT' OR 'SQUEEZON' COMPRESSION CONNECTOR FOR COPPER CONDUCTORS UP TO SIZE #2/0 AWG	BURNDY YC-C
I7	8	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
N1b	3	SINGLE CONDUCTOR POLYMERIC CABLE TERMINATION KIT, INDOOR/OUTDOOR (c/w SHEDS), 35kV, RATED TO IEEE-48-1996 CLASS 1, FOR UP TO 500kcmil CONDUCTOR	TFT-353R-SG
S42B	1	38kV, THREE-POLE GROUP-OPERATED DISCONNECT, DESIGN PER TECHNICAL SPECIFICATION DOCUMENT AS NOTED	REFER TO SPECIFICATION DOCUMENT xxxxxx.xx-SP-Exx
W3	2	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE
WIND TURBINE GENERATOR RISER POLE
SHEET 2 OF 2

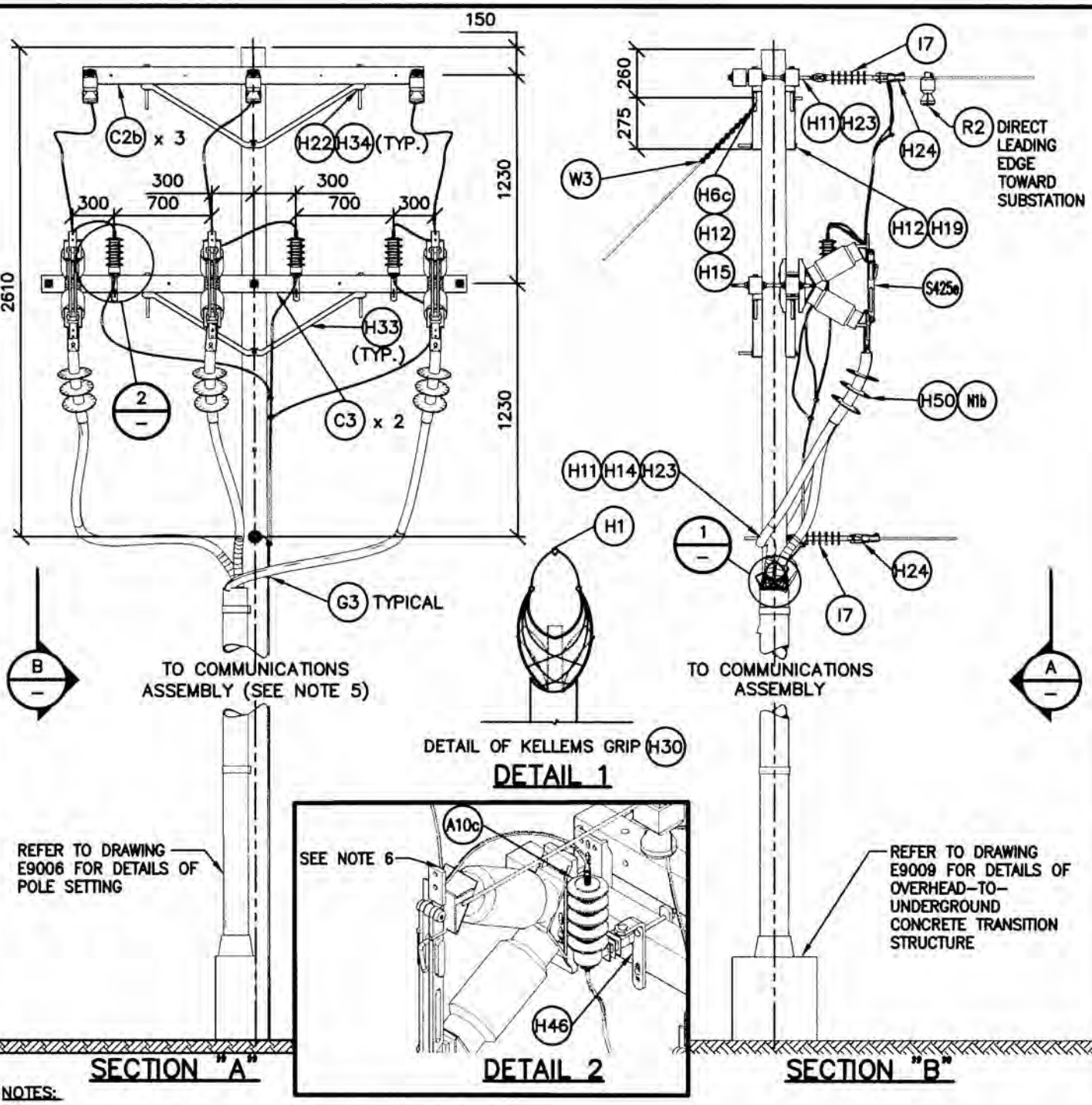
Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

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5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
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Revision: 0

Drawing File: E9202.dwg Date: 6/29/2009 8:51 PM



NOTES:

1. MIN. BENDING RADIUS FOR CABLE TO BE TWELVE TIMES DIA. OF CABLE.
2. FASTEN CABLES TO POLE WITH KELLEMS GRIP.
3. STRAP CABLE TO POLE AT 3000mm INTERVALS USING SYLVANIA 1516 50mm CABLE STRAPS OR APPROVED EQUIVALENT.
4. BOND U/G CABLE COPPER TAPE SHIELD TO GROUND AT POLE.
5. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.
6. RUN CONDUCTOR CONTINUOUSLY THROUGH THE SWITCH EYEBOLT CONNECTOR AND TERMINATE AT ARRESTER.

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE OVERHEAD-TO-UNDERGROUND TRANSITION POLE

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
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Contract No: 090630.00

Drawing No: E9202

Revision: 0

Drawing File: E9202.dwg Date: 6/29/2009 8:53 PM

BILL OF MATERIALS (TABLE E9202-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
A10c	3	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 22.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS	OHIO BRASS 218622
C2b	3	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT c/w HOLES FOR 1550mm LONG CROSSARM BRACKET (REFER TO DRAWING E9901); NOTE THAT CROSSARM MATCHES NSPI STANDARD SIX-PIN CROSSARM WITH THE EXCEPTION OF THE NOTED BRACKET HOLES	STELLA-JONES
C3	2	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 4 PIN, 95mm x 120mm x 3050mm, DRILLED BEFORE TREATMENT (REFER TO DRAWING E9901)	STELLA-JONES
H1	1	BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)	CHANCE 508754
H6c	2	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	as req'd	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	4	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H14	1	WASHER, HOT-DIPPED GALVANIZED, CURVED, 83mm x 83mm x 6mm, 17mm DIA. HOLE	HYDEL 1434CW11
H15	4	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A', No. 1	HYDEL 34GH
H20	2	BOLT, DOUBLE-ARMING FULL THREAD, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA Std. C83 1970, ITEM B-2 FULL THREAD; "xx" = LENGTH IN INCHES + 50) c/w FOUR (4) SQUARE NUTS	CHANCE 8874
H22	8	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 13mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H23	8	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H24	8	CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)	BURNDY CUW series
H30	1	WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING	HUBBELL 022030xx SERIES
H33	4	BRACE, ANGLE CROSSARM, SINGLE PIECE "V", HOT-DIPPED GALVANIZED STEEL (AS PER CSA STD. C83.20M), 1525mm LONG, NEMA STANDARD	CHANCE 6953
H34	8	WASHER, HOT-DIPPED GALVANIZED, ROUND, 14mm DIA. HOLE	HYDEL138RW
H46		SINGLE-PHASE CUTOUT CROSSARM-MOUNTING BRACKET, GALVANIZED, 5 1/4" CLEARANCE	
H50		ALUMINUM COMPRESSION TERMINAL (LUG), 556.4kcmil AASC CONDUCTOR TO FLAT NEMA 1-HOLE PAD (CSA)	BLACKBURN ATL
G3	as req'd	'CRIMPIT' OR 'SQUEEZON' COMPRESSION CONNECTOR FOR COPPER CONDUCTORS UP TO SIZE #2/0 AWG	BURNDY YC-C
I7	8	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
N1b	3	SINGLE CONDUCTOR POLYMERIC CABLE TERMINATION KIT, INDOOR/OUTDOOR (c/w SHEDS), 35kV, RATED TO IEEE-48-1996 CLASS 1, FOR UP TO 500kcmil CONDUCTOR	TFT-353R-SG
R2	3	DIRECTIONAL FAULT INDICATOR FOR OVERHEAD LINE INSTALLATION, 200A PICKUP, 10A RESET, RED/GREEN LED INDICATOR, 4 HOUR AUTO RESET, LITHIUM OXIDE BATTERY, 25kA SYMMETRICAL RMS WITHSTAND FOR 170ms, 8 TO 40.6mm DIAMETER CONDUCTOR INSTALLATION, OPERATIONAL FROM -40 TO +85OC, +/-10% ACCURACY AT 20OC, UV STABLE POLYCARBONATE CASING, 38kV MIN., MEETS ANSI/IEEE Std. 495	PDP 40-3108-001-200A4H
S425e	1	38kV, THREE-POLE GROUP-OPERATED DISCONNECT, DESIGN PER TECHNICAL SPECIFICATION DOCUMENT AS NOTED	REFER TO SPECIFICATION DOCUMENT xxxxxx.xx-SP-Exx
W3	2	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE OVERHEAD-TO-UNDERGROUND TRANSITION POLE
SHEET 2 OF 2

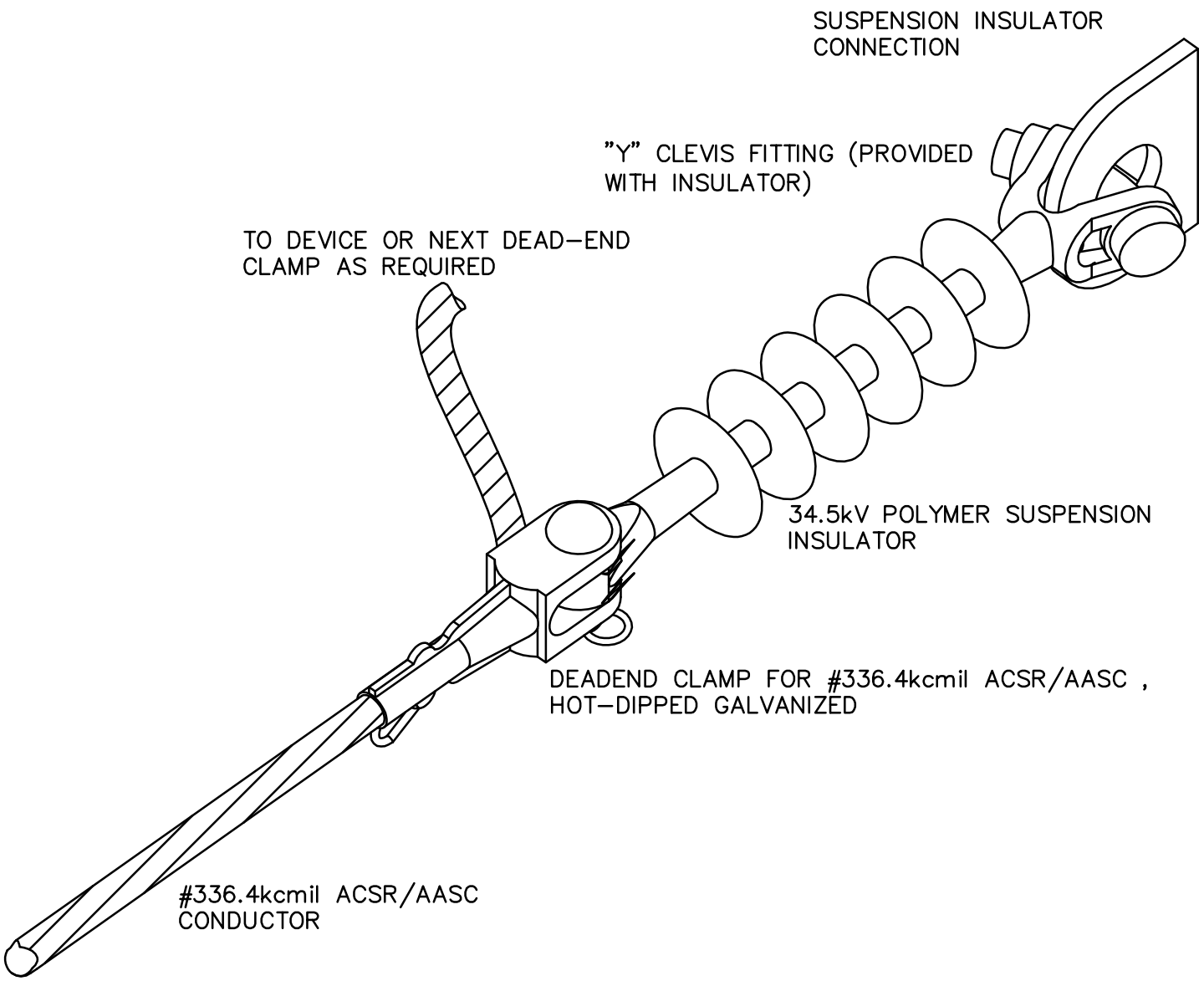
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5/28/2009	LO'K	LO'K
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DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

DEAD-END TERMINATION DETAIL

SHEET 1 OF 1

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
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Date:	Drawn	Designed
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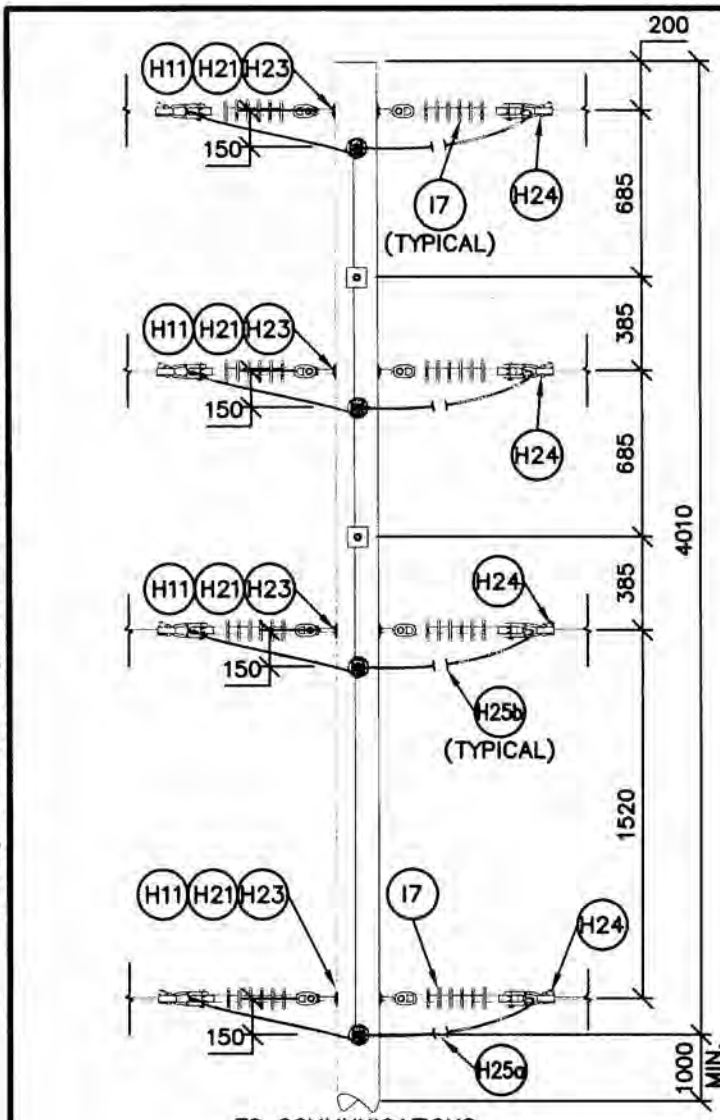
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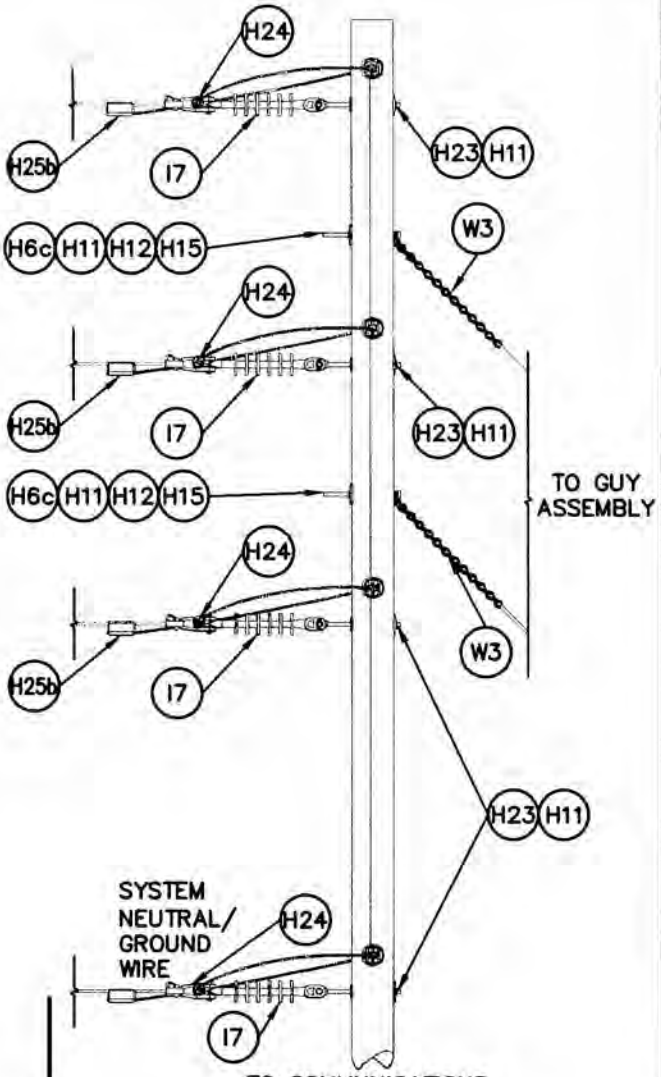
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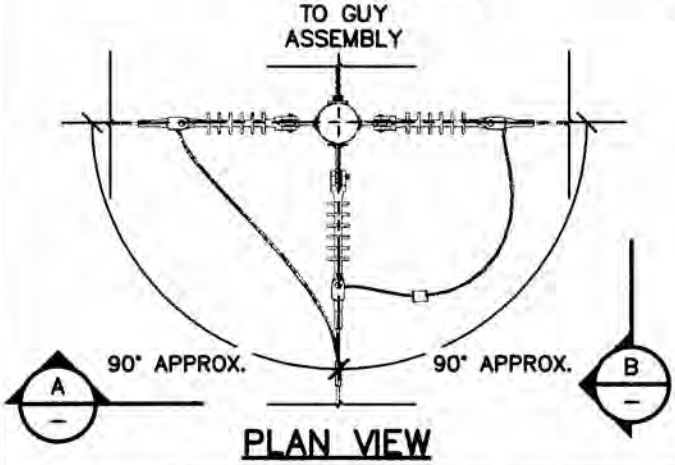
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SECTION "A"



SECTION "B"



PLAN VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
2. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE, VERTICAL
SINGLE TAKE-OFF POLE
POLYMER INSULATORS

SHEET 1 OF 2

Rev	Description	Date
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Contract No: 090630.00
Drawing No: E9204
Revision: 0

BILL OF MATERIALS (TABLE E9204-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H6c	2	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	14	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	3	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H18	2	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A', No. 1	HYDEL 34GH
H21	4	GALVANIZED STEEL EYE-NUT, 16mm DIA, EYE, ACCEPTING 16mm DIA. THREADED BOLT	HYDEL 58EN
H23	8	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H24	12	CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)	BURNDY CUW series
H25a	2	COMPRESSION CONNECTOR; 'CRIMPIT'; SUITABLE FOR ALUMINUM, COPPER, OR ACSR (FOR CONDUCTOR SIZES UP TO #2/0 AWG ACSR/AASC) ; CSA CERTIFIED	BURNDY YC-A
H25b	6	WEDGE-TYPE CONNECTOR, SUITABLE FOR ALUMINUM OR ACSR (FOR CONDUCTOR SIZES LARGER THAN #2/0 AWG ACSR/AASC), CSA CERTIFIED	BURNDY WCA (WEJTAP) series
I7	12	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
W3	2	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

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SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE, VERTICAL
SINGLE TAKE-OFF POLE
POLYMER INSULATORS
SHEET 2 OF 2

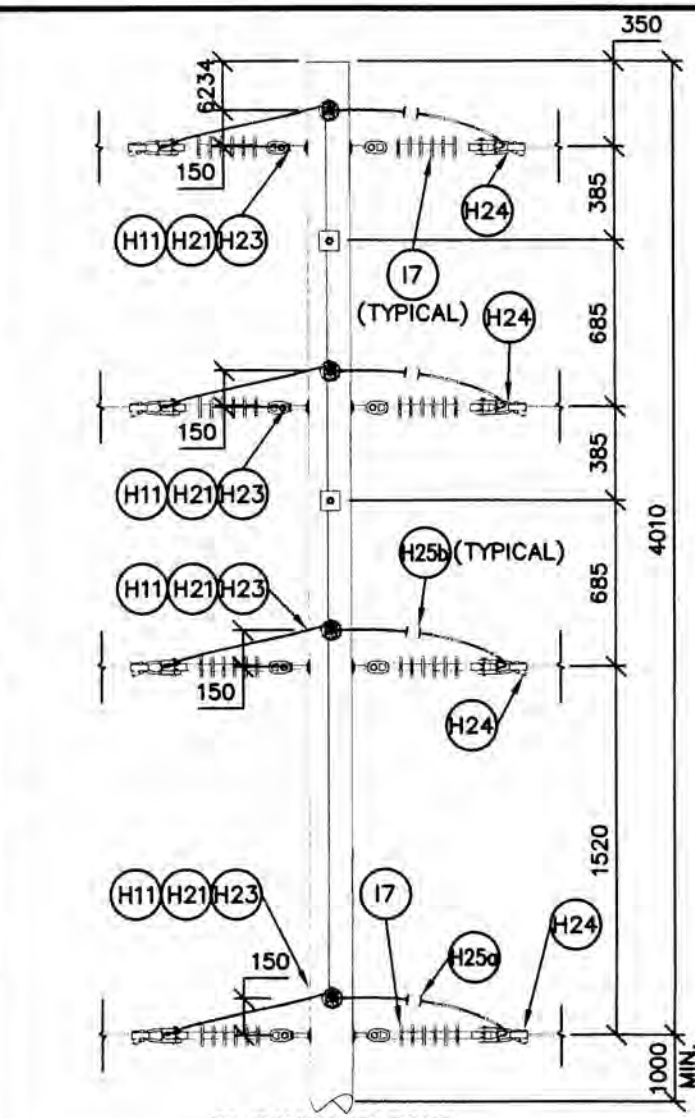
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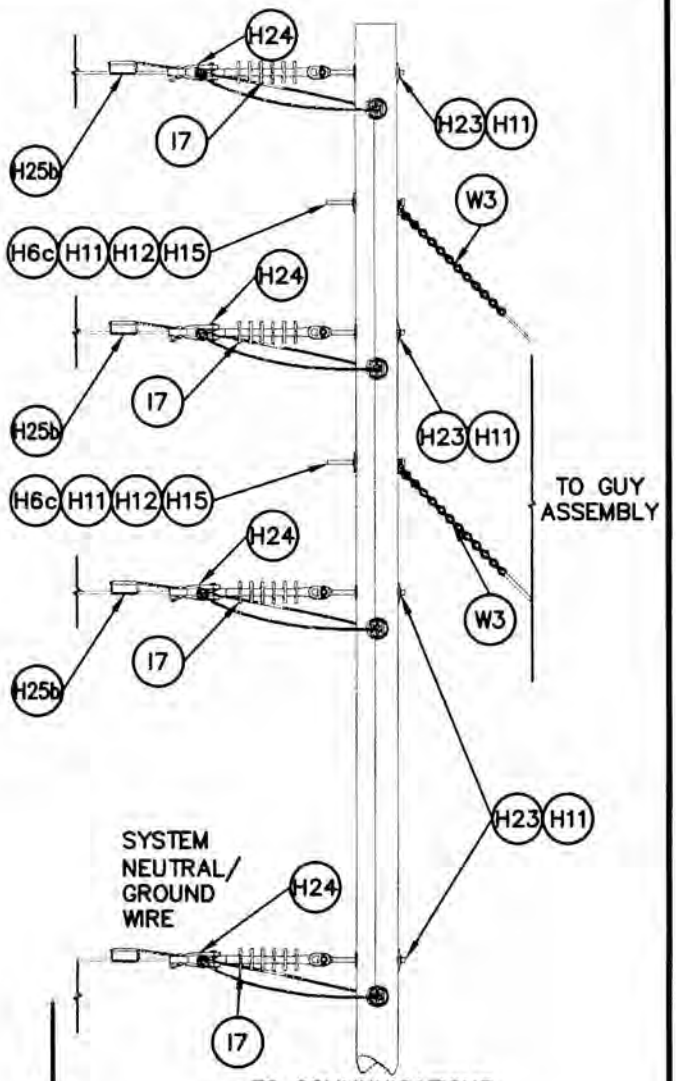
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Revision: 0

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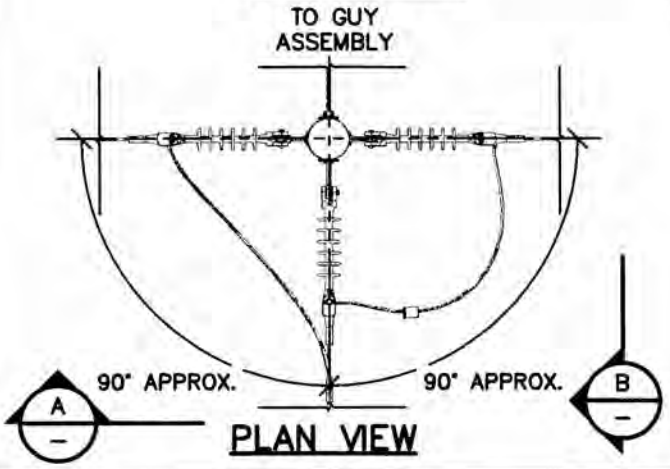
TO COMMUNICATIONS ASSEMBLY (SEE NOTE 2)

SECTION "A"



TO COMMUNICATIONS ASSEMBLY

SECTION "B"



PLAN VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
2. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE, VERTICAL DOUBLE TAKE-OFF POLE POLYMER INSULATORS

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
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Drawing No: E9205
Revision: 0

Drawing File: E9205.dwg Date: 6/29/2009 9:00 PM

BILL OF MATERIALS (TABLE E9205-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H6c	2	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	14	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	3	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H15	2	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A', No. 1	HYDEL 34GH
H21	4	GALVANIZED STEEL EYE-NUT, 16mm DIA, EYE, ACCEPTING 16mm DIA. THREADED BOLT	HYDEL 58EN
H23	8	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H24	12	CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)	BURNDY CUW series
H25a	2	COMPRESSION CONNECTOR; 'CRIMPIT'; SUITABLE FOR ALUMINUM, COPPER, OR ACSR (FOR CONDUCTOR SIZES UP TO #2/0 AWG ACSR/AASC) ; CSA CERTIFIED	BURNDY YC-A
H25b	6	WEDGE-TYPE CONNECTOR, SUITABLE FOR ALUMINUM OR ACSR (FOR CONDUCTOR SIZES LARGER THAN #2/0 AWG ACSR/AASC), CSA CERTIFIED	BURNDY WCA (WEJTAP) series
I7	12	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
W3	2	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE, VERTICAL DOUBLE TAKE-OFF POLE POLYMER INSULATORS

SHEET 2 OF 2

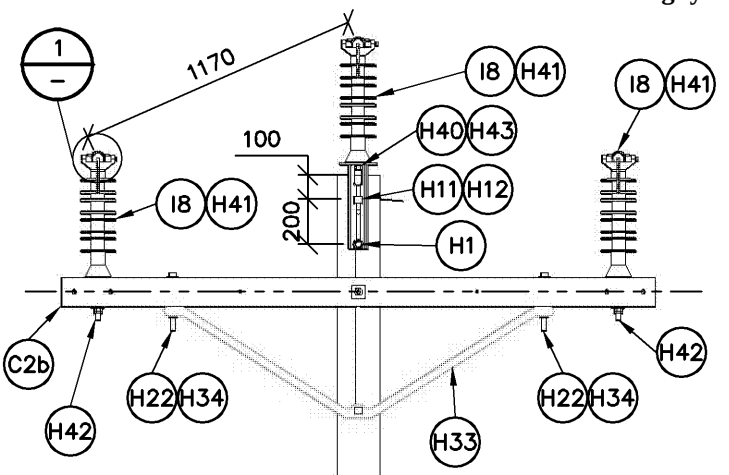
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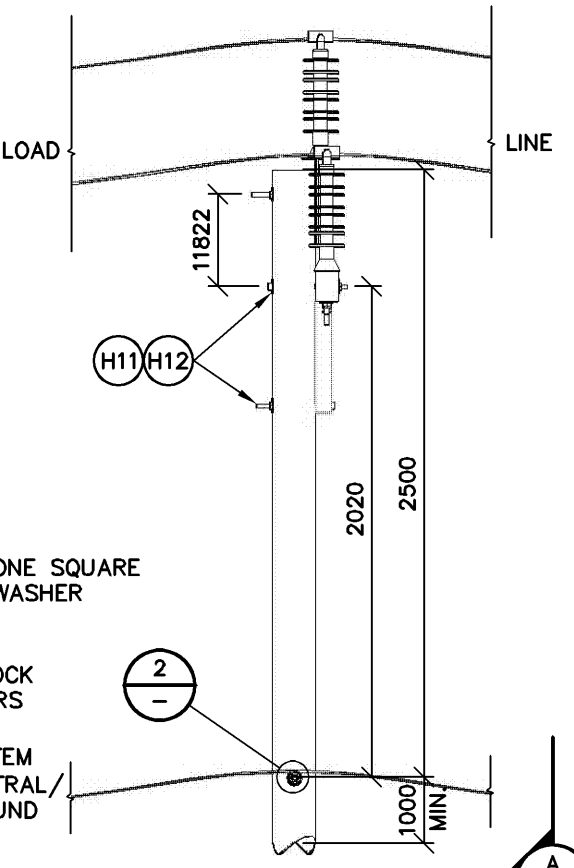
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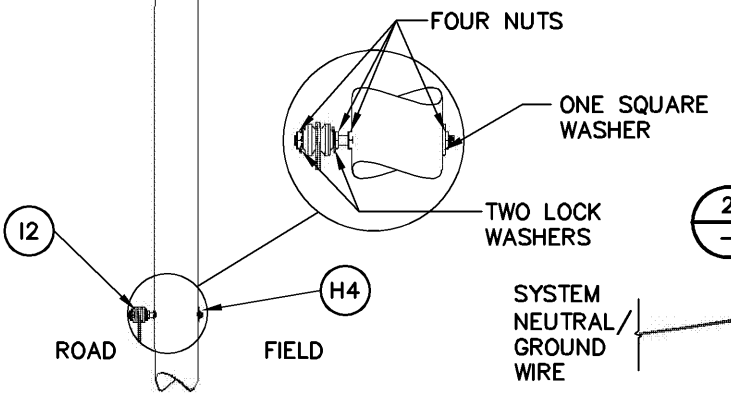
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Drawing No: E9205 | Revision: 0







B

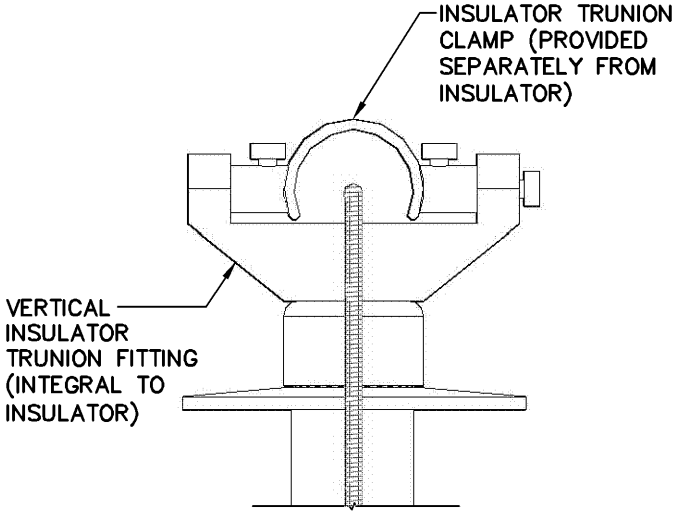
TO COMMUNICATIONS ASSEMBLY (SEE NOTE 5)

SECTION "A"

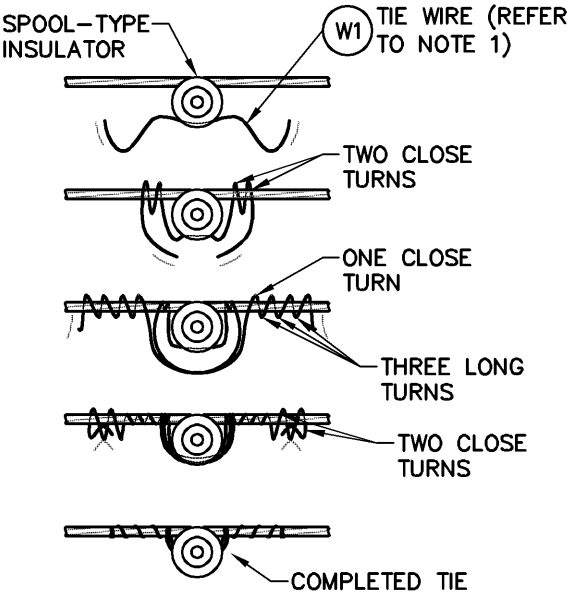
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TO COMMUNICATIONS ASSEMBLY

SECTION "B"



DETAIL 1–VERTICAL TRUNNION



DETAIL 2–SPOOL TIE

(SEE NOTE 2)

Drawing File: E9211.dwg Date: 6/29/2009 7:09 PM

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3–PHASE TANGENT POLE, POLYMER POST INSULATORS

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

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Contract No: 090630.00

Drawing No: E9211

Revision: 0

Drawing File: E9211.dwg Date: 6/29/2009 7:09 PM

NOTES:

1. TIE WIRE SHALL BE 1220mm IN LENGTH FOR NEUTRAL CONDUCTOR UP TO AND INCLUDING #1/0 AWG ACSR, 1270mm FOR NEUTRAL CONDUCTOR ABOVE #1/0 AWG ACSR UP TO AND INCLUDING #2/0 AWG ACSR, 1320mm FOR NEUTRAL CONDUCTOR LARGER THAN #2/0 AWG ACSR UP TO AND INCLUDING #4/0 AWG ACSR, AND 1420mm FOR NEUTRAL CONDUCTOR LARGER THAN #4/0 AWG ACSR.
2. ALL TURNS SHALL BE TIGHT ONCE COMPLETED. PLIERS SHALL NOT BE USED WITH THE EXCEPTION OF THE TWISTING OF THE TIE ENDS.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
4. THIS DRAWING IS APPLICABLE ONLY FOR OVERHEAD LINE CONSTRUCTION WITH A TURN OF LESS THAN 1° FROM A STRAIGHT LINE.
5. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

BILL OF MATERIALS (TABLE E9211-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
C2b	1	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT c/w HOLES FOR 1550mm LONG CROSSARM BRACKET (REFER TO DRAWING E9901); NOTE THAT CROSSARM MATCHES NSPI STANDARD SIX-PIN CROSSARM WITH THE EXCEPTION OF THE NOTED BRACKET HOLES	STELLA-JONES
H1	1	BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)	CHANCE 508754
H4	1	BOLT, SPOOL, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x 300mm SECTION BETWEEN SHOULDERS SHALL BE HEXAGONAL OR FLAT (AS PER CSA STD. C83.25M, TYPE 2, No. 3, EXCEPT THREADS AND NUTS IN IMPERIAL) c/w TWO (2) LOCK WASHERS; FOUR (4) NUTS; AND, ALTERNATELY, ONE (1) SQUARE WASHER SUPPLIED LOOSE OR ONE (1) WASHER FIXED IN POSITION TO THE BOLT SHANK	CHANCE 7744
H11	4	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	2	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H22	2	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 13mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H33	1	BRACE, ANGLE CROSSARM, SINGLE PIECE "V", HOT-DIPPED GALVANIZED STEEL (AS PER CSA STD. C83.20M), 1525mm LONG, NEMA STANDARD	CHANCE 87xx SERIES
H34	2	WASHER, HOT-DIPPED GALVANIZED, ROUND, 14mm DIA. HOLE	HYDEL 138RW
H40	1	POST-TYPE INSULATOR POLE-TOP MOUNTING BRACKET FOR UP TO 35kV INSTALLATION, DUCTILE IRON, 13/16" STUD OPENING, TWO BOLT OPENINGS SPACED AT APPROXIMATELY 8" SEPARATION	MACLEAN BPT-58G
H41	3	CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM	MACLEAN ACTS SERIES
H42	2	INSULATOR STUD, LONG SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 7-1/2" LONG SHANK c/w CAPTURED HARDWARE	MACLEAN J25250.1
H43	1	INSULATOR STUD, SHORT SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 1-3/4" LONG SHANK c/w CAPTURED HARDWARE	MACLEAN J25249.1
I2	1	INSULATOR, SECONDARY SPOOL TYPE, ASA CLASS 53-2, MUNSELL GREY COLOUR	ENERSCAN 99001 53-2 design
I8	3	INSULATOR, 35kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, VERTICAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE	MACLEAN NPVN10XB006S0
W1	1	#4/0 AWG SOLID ALUMINUM TIE WIRE, LENGTH AS INDICATED	ALCAN

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DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE TANGENT POLE, POLYMER POST INSULATORS
SHEET 2 OF 2

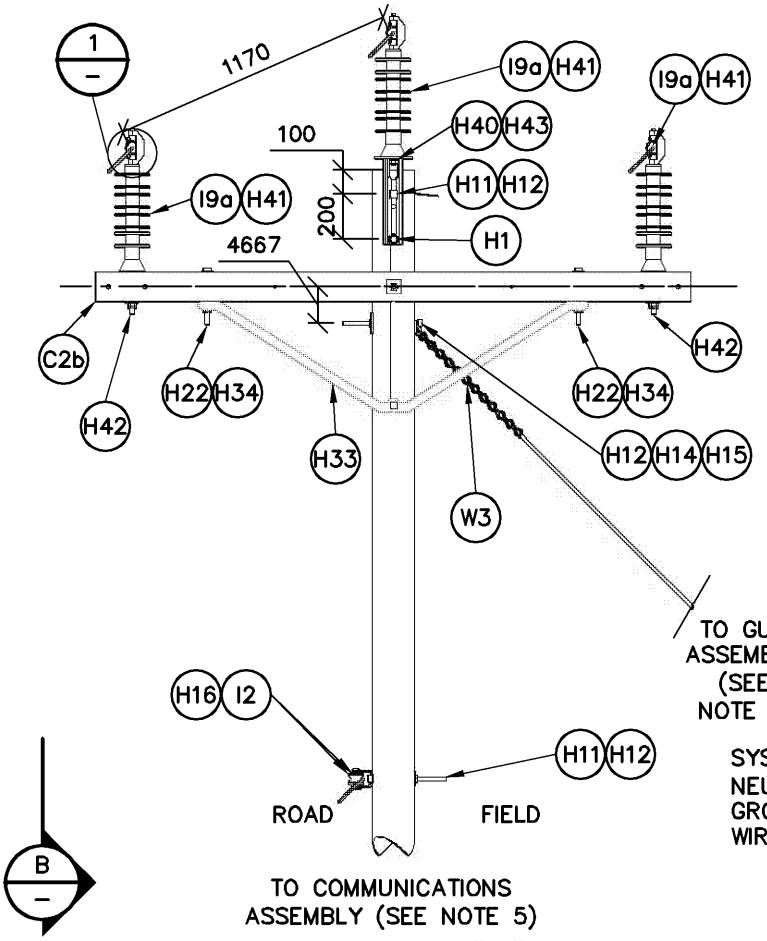
Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

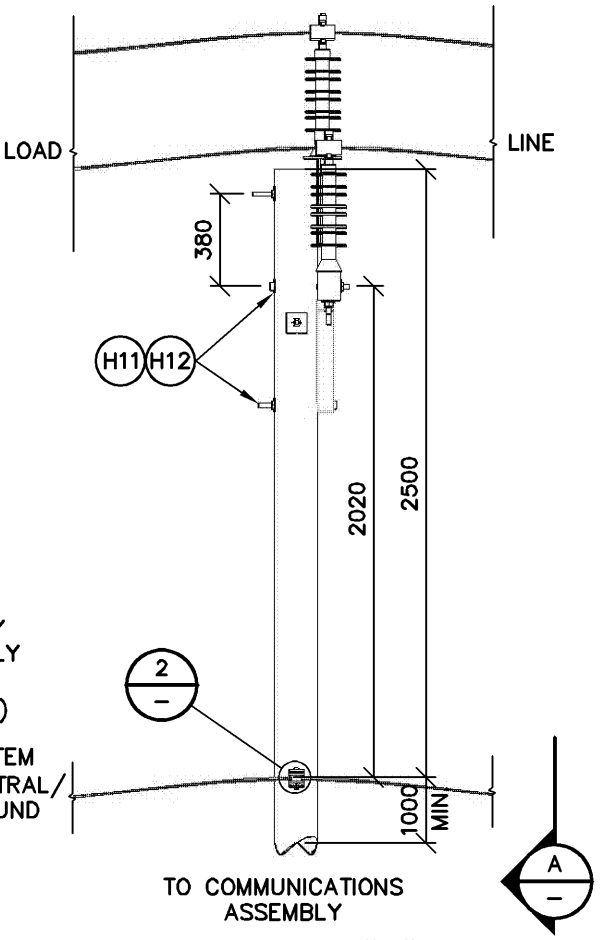
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Contract No: 090630.00
Drawing No: E9211
Revision: 0

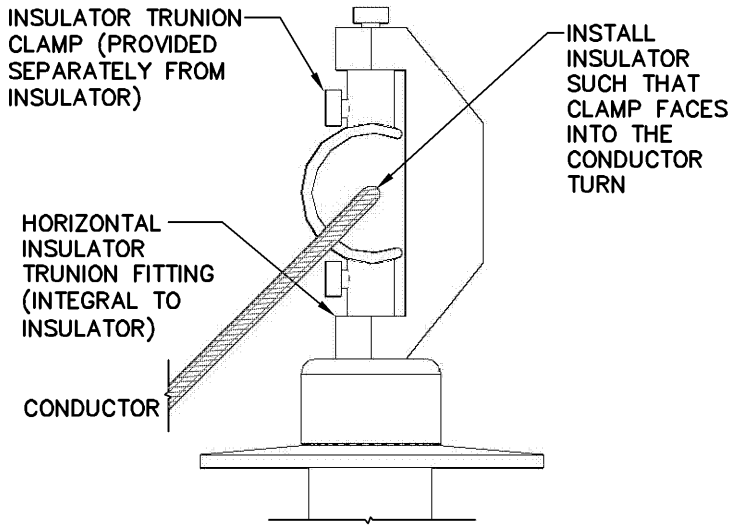
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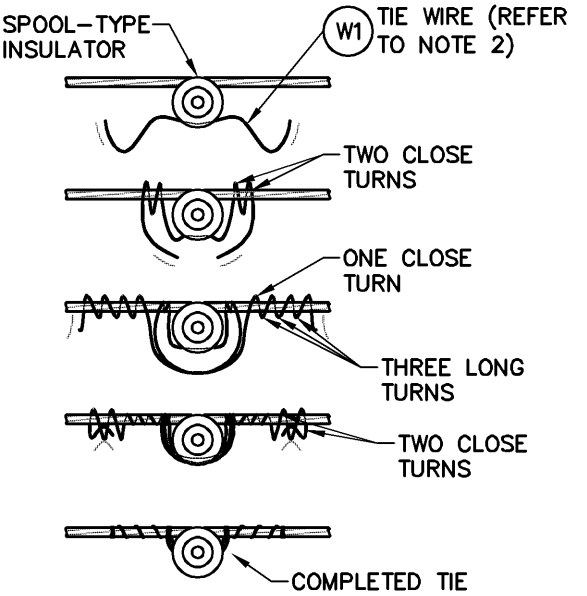
SECTION "A"



SECTION "B"



DETAIL 1–HORIZONTAL TRUNNION



DETAIL 2–SPOOL TIE
(SEE NOTE 3)

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE, 1'-5' ANGLE POLE
POLYMER POST INSULATORS
SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

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Contract No: 090630.00
Drawing No: E9212
Revision: 0

Drawing File: E9212.dwg Date: 6/29/2009 7:09 PM

NOTES:

1. LOCATE THE GUY ASSEMBLY ON THE OUTSIDE OF THE TURNING ANGLE AS REQUIRED (EITHER ROAD OR FIELD).
2. TIE WIRE SHALL BE 1220mm IN LENGTH FOR NEUTRAL CONDUCTOR UP TO AND INCLUDING #1/0 AWG ACSR, 1270mm FOR NEUTRAL CONDUCTOR ABOVE #1/0 AWG ACSR UP TO AND INCLUDING #2/0 AWG ACSR, 1320mm FOR NEUTRAL CONDUCTOR LARGER THAN #2/0 AWG ACSR UP TO AND INCLUDING #4/0 AWG ACSR, AND 1420mm FOR NEUTRAL CONDUCTOR LARGER THAN #4/0 AWG ACSR.
3. ALL TURNS SHALL BE TIGHT ONCE COMPLETED. PLIERS SHALL NOT BE USED WITH THE EXCEPTION OF THE TWISTING OF THE TIE ENDS.
4. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
5. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

BILL OF MATERIALS (TABLE E9212-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
C2b	1	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT c/w HOLES FOR 1550mm LONG CROSSARM BRACKET (REFER TO DRAWING E9901); NOTE THAT CROSSARM MATCHES NSPI STANDARD SIX-PIN CROSSARM WITH THE EXCEPTION OF THE NOTED BRACKET HOLES	STELLA-JONES
H1	1	BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)	CHANCE 508754
H11	5	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	4	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H14	1	WASHER, HOT-DIPPED GALVANIZED, CURVED, 83mm x 83mm x 6mm, 17mm DIA. HOLE	HYDEL 1434CW11
H15	1	HOOK, GUY, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A', No. 1	HYDEL 34GH
H16	1	CLEVIS, INSULATED, HOT-DIPPED GALVANIZED, CHANNEL TYPE, AS PER CSA STD. C83.70-M, CLEVIS No. 1	HYDEL 314CLU
H22	2	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 13mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H33	1	BRACE, ANGLE CROSSARM, SINGLE PIECE "V", HOT-DIPPED GALVANIZED STEEL (AS PER CSA STD. C83.20M), 1525mm LONG, NEMA STANDARD	CHANCE 87xx SERIES
H34	2	WASHER, HOT-DIPPED GALVANIZED, ROUND, 14mm DIA. HOLE	HYDEL 138RW
H40	1	POST-TYPE INSULATOR POLE-TOP MOUNTING BRACKET FOR UP TO 35kV INSTALLATION, DUCTILE IRON, 13/16" STUD OPENING, TWO BOLT OPENINGS SPACED AT APPROXIMATELY 8" SEPARATION	MACLEAN BPT-58G
H41	3	CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM	MACLEAN ACTS SERIES
H42	2	INSULATOR STUD, LONG SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 7-1/2" LONG SHANK c/w CAPTURED HARDWARE	MACLEAN J25250.1
H43	1	INSULATOR STUD, SHORT SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 1-3/4" LONG SHANK c/w CAPTURED HARDWARE	MACLEAN J25249.1
I2	1	INSULATOR, SECONDARY SPOOL TYPE, ASA CLASS 53-2, MUNSELL GREY COLOUR	ENERSCAN 99001 53-2 design
I9a	3	INSULATOR, 35kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE	MACLEAN NPKN10XB006S0
W1	1	#4/0 AWG SOLID ALUMINUM TIE WIRE, LENGTH AS INDICATED	ALCAN
W3	1	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

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SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE, 1'-5' ANGLE POLE
POLYMER POST INSULATORS
SHEET 2 OF 2

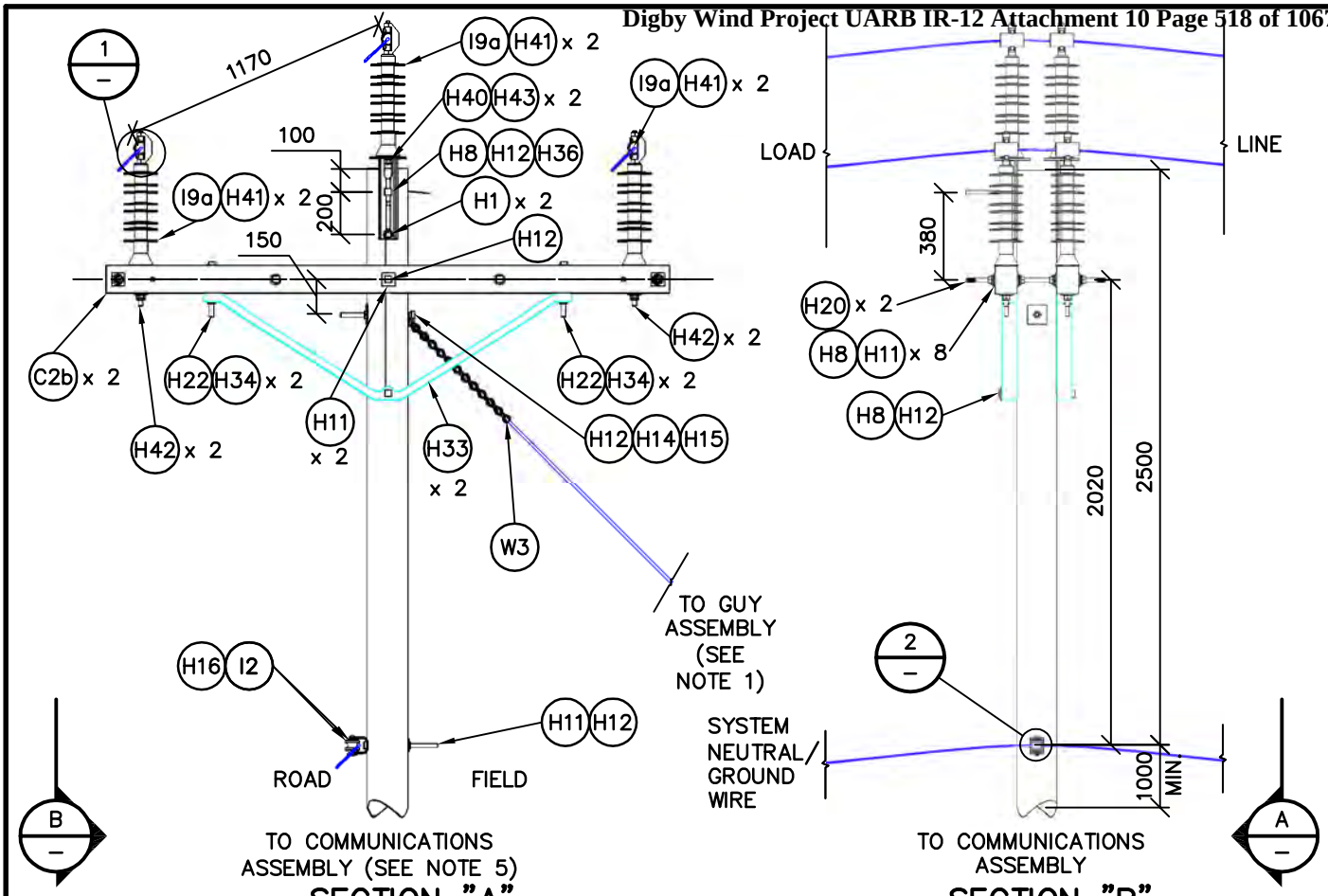
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A	ISSUED FOR FINAL REVIEW	06/15/2009

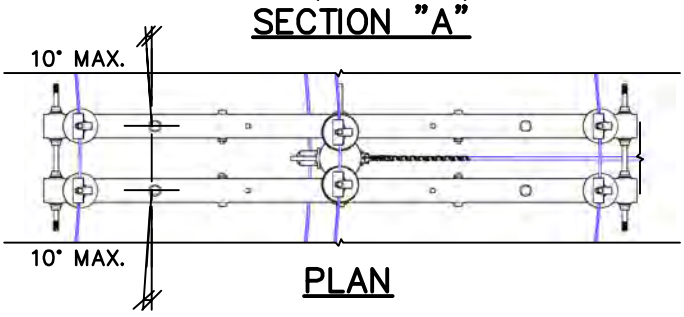
Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

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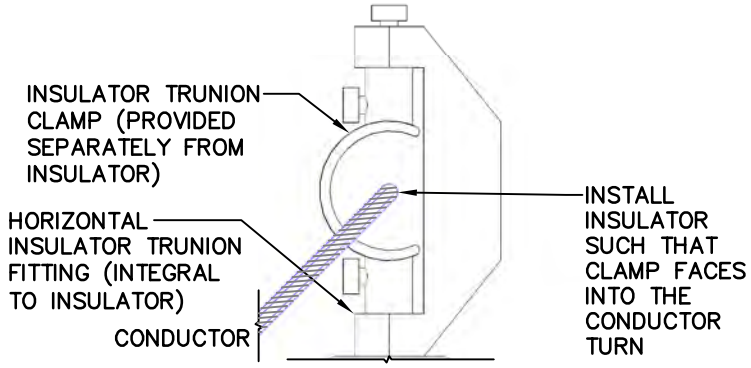
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Drawing No: E9212
Revision: 0

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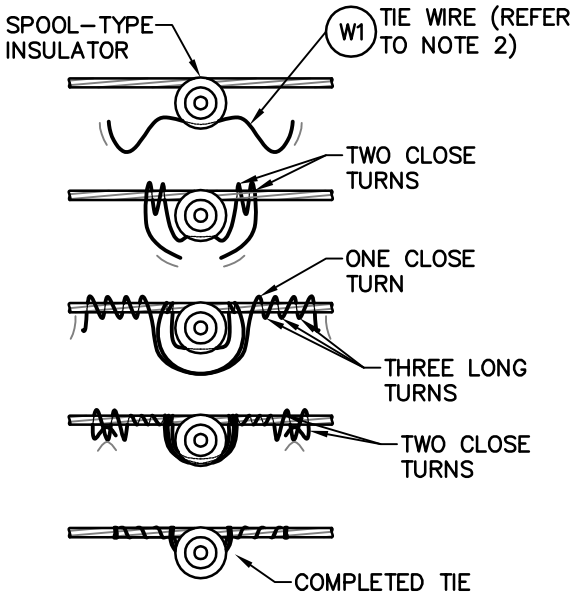




PLAN



DETAIL 1–HORIZONTAL TRUNNION



DETAIL 2–SPOOL TIE
(SEE NOTE 3)

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3–PHASE, 6°–20° ANGLE POLE
POLYMER POST INSULATORS

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/09

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

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Contract No: 090630.00
Drawing No: E9213
Revision: 0

NOTES:

1. LOCATE THE GUY ASSEMBLY ON THE OUTSIDE OF THE TURNING ANGLE AS REQUIRED (EITHER ROAD OR FIELD).
2. TIE WIRE SHALL BE 1220mm IN LENGTH FOR NEUTRAL CONDUCTOR UP TO AND INCLUDING #1/0 AWG ACSR, 1270mm FOR NEUTRAL CONDUCTOR ABOVE #1/0 AWG ACSR UP TO AND INCLUDING #2/0 AWG ACSR, 1320mm FOR NEUTRAL CONDUCTOR LARGER THAN #2/0 AWG ACSR UP TO AND INCLUDING #4/0 AWG ACSR, AND 1420mm FOR NEUTRAL CONDUCTOR LARGER THAN #4/0 AWG ACSR.
3. ALL TURNS SHALL BE TIGHT ONCE COMPLETED. PLIERS SHALL NOT BE USED WITH THE EXCEPTION OF THE TWISTING OF THE TIE ENDS.
4. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
5. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

BILL OF MATERIALS (TABLE E9213-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
C2b	2	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT c/w HOLES FOR 1550mm LONG CROSSARM BRACKET (REFER TO DRAWING E9901); NOTE THAT CROSSARM MATCHES NSPI STANDARD SIX-PIN CROSSARM WITH THE EXCEPTION OF THE NOTED BRACKET HOLES	STELLA-JONES
H1	2	BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)	CHANCE 508754
H8	2	WASHER, HOT-DIPPED GALVANIZED, LOCK, 19mm DIA. HOLE (AS PER CSA STD. C83 1970, ITEM W5)	MACLEAN J140
H11	3	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	5	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H14	1	WASHER, HOT-DIPPED GALVANIZED, CURVED, 83mm x 83mm x 6mm, 17mm DIA. HOLE	HYDEL 1434CW11
H15	1	HOOK, GUY, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A', No. 1	HYDEL 34GH
H16	1	CLEVIS, INSULATED, HOT-DIPPED GALVANIZED, CHANNEL TYPE, AS PER CSA STD. C83.70-M, CLEVIS No. 1	HYDEL 314CLU
H20	2	BOLT, DOUBLE-ARMING FULL THREAD, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA Std. C83 1970, ITEM B-2 FULL THREAD; "xx" = LENGTH IN INCHES + 50) c/w FOUR (4) SQUARE NUTS	CHANCE 8874
H22	4	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 13mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H33	2	BRACE, ANGLE CROSSARM, SINGLE PIECE "V", HOT-DIPPED GALVANIZED STEEL (AS PER CSA STD. C83.20M), 1525mm LONG, NEMA STANDARD	CHANCE 87xx SERIES
H34	4	WASHER, HOT-DIPPED GALVANIZED, ROUND, 14mm DIA. HOLE	HYDEL 138RW
H40	2	POST-TYPE INSULATOR POLE-TOP MOUNTING BRACKET FOR UP TO 35kV INSTALLATION, DUCTILE IRON, 13/16" STUD OPENING, TWO BOLT OPENINGS SPACED AT APPROXIMATELY 8" SEPARATION	MACLEAN BPT-58G
H41	6	CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM	MACLEAN ACTS SERIES
H42	4	INSULATOR STUD, LONG SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 7-1/2" LONG SHANK c/w CAPTURED HARDWARE	MACLEAN J25250.1
H43	2	INSULATOR STUD, SHORT SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 1-3/4" LONG SHANK c/w CAPTURED HARDWARE	MACLEAN J25249.1
I2	1	INSULATOR, SECONDARY SPOOL TYPE, ASA CLASS 53-2, MUNSELL GREY COLOUR	ENERSCAN 99001 53-2 design
I9a	6	INSULATOR, 35kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE	MACLEAN NPKN10XB006S0
W1	1	#4/0 AWG SOLID ALUMINUM TIE WIRE, LENGTH AS INDICATED	ALCAN
W3	2	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE, 6°-20° ANGLE POLE
POLYMER POST INSULATORS
SHEET 2 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/09

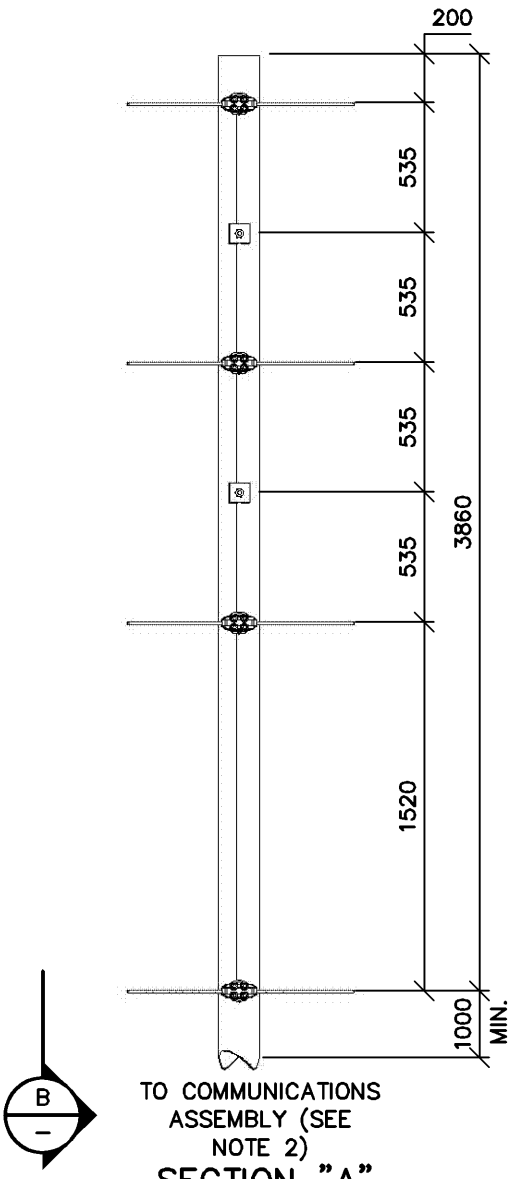
Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
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N.T.S.	RO'C	

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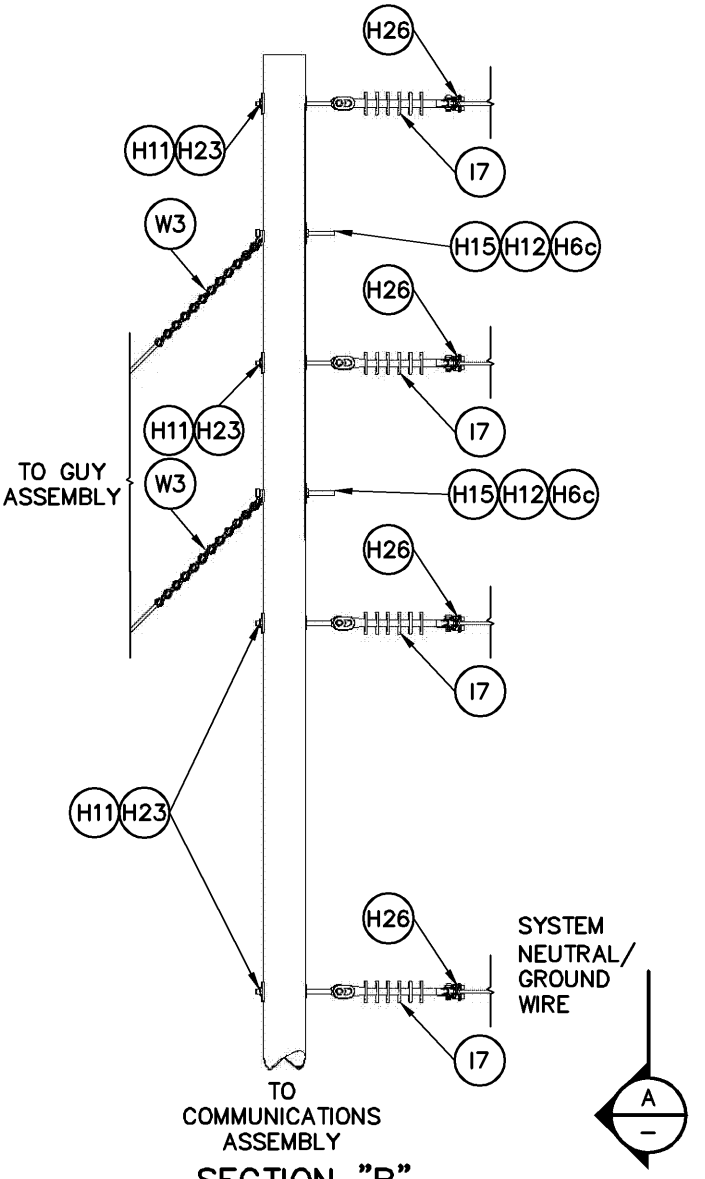
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Drawing No: E9213
Revision: 0

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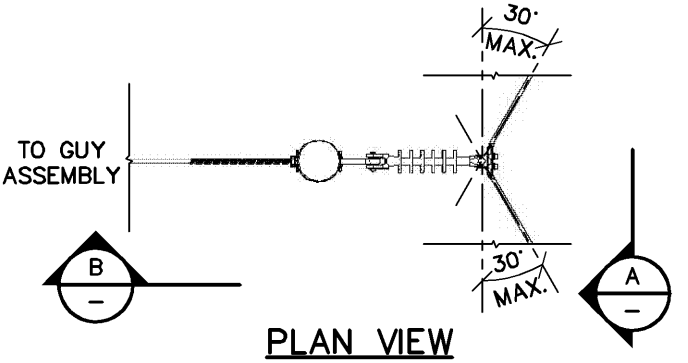
SECTION "A"



SECTION "B"

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
2. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.



PLAN VIEW

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE, 21'-60' VERTICAL CORNER POLE POLYMER INSULATORS
SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

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Contract No: 090630.00
Drawing No: E9214
Revision: 0

BILL OF MATERIALS (TABLE E9214-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H6c	2	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	4	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	2	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H15	1	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A", No. 1	HYDEL 34GH
H23	2	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H26	4	CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 600 LINE ANGLE c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)	MACLEAN TYPE GW, LS, and ASC
I7	4	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
W3	2	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

Drawing File: E9214.dwg Date: 6/29/2009 7:11 PM

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE, 21°-60°
VERTICAL CORNER POLE
POLYMER INSULATORS
SHEET 2 OF 2

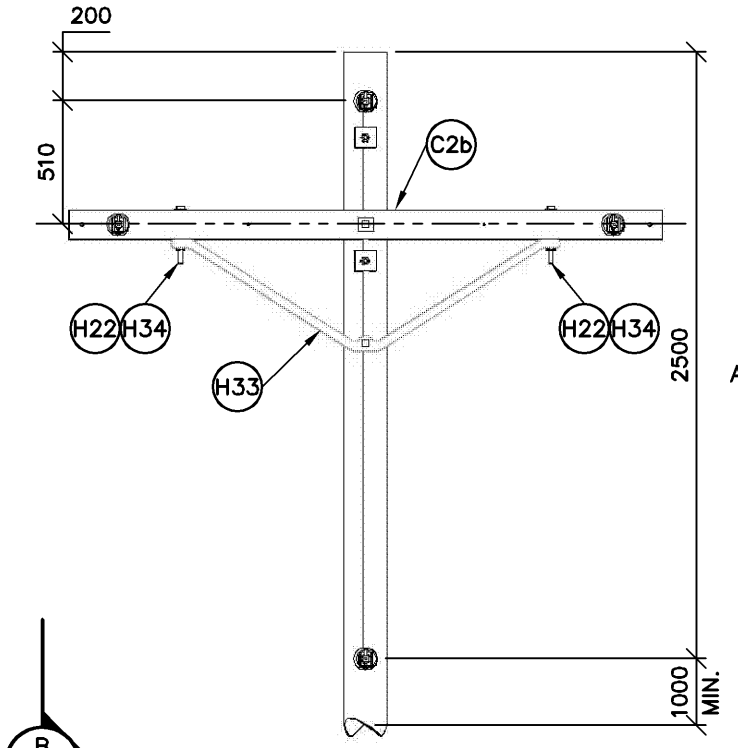
Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
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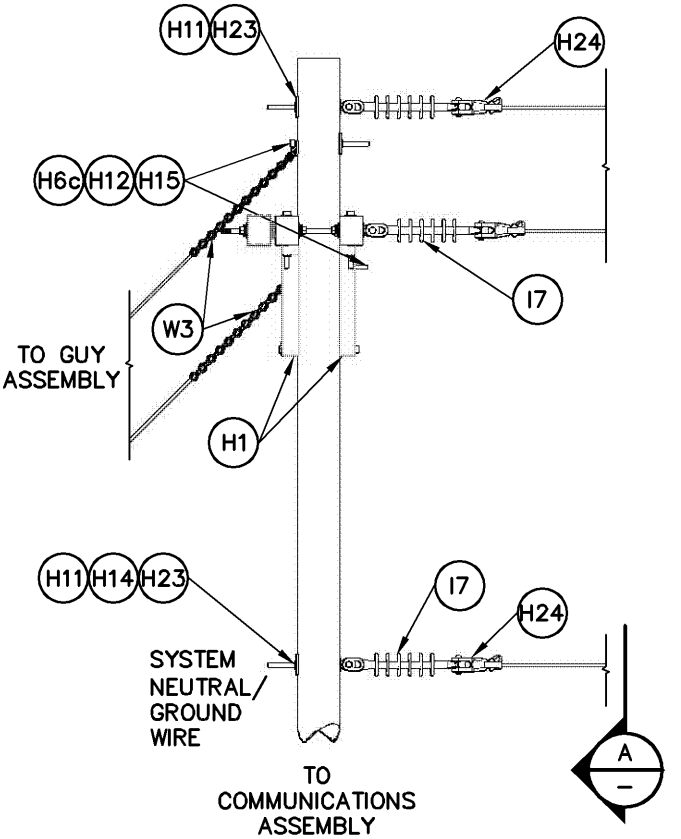
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Contract No: 090630.00
Drawing No: E9214
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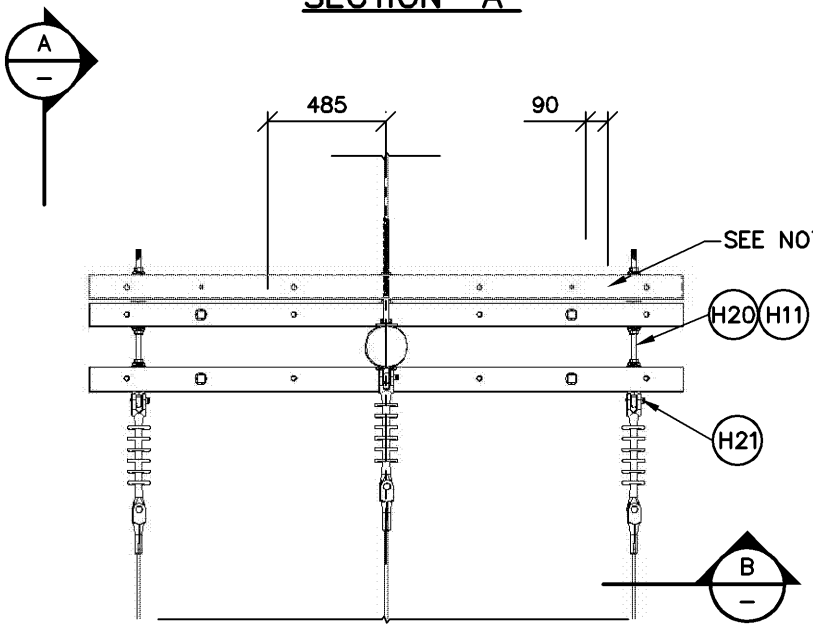
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SECTION "A"



SECTION "B"



PLAN VIEW

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE DEAD-END POLE POLYMER INSULATORS

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

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Contract No: 090630.00

Drawing No: E9215

Revision: 0

NOTES:

1. INSTALL DOUBLE CROSSARMS ON THE SIDE OF POLE OPPOSITE THE PHASE CONDUCTORS IF THE PHASE CONDUCTORS ARE #4/0 ACSR/AASC OR LARGER. MAINTAIN SPACE BETWEEN THE TWO CROSSARMS USING MULTIPLE WASHERS (B.O.M. ITEM No. H10).
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
3. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

Drawing File: E9215.dwg Date: 6/29/2009 7:12 PM

BILL OF MATERIALS (TABLE E9215-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
C2b	3	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT c/w HOLES FOR 1550mm LONG CROSSARM BRACKET (REFER TO DRAWING E9901); NOTE THAT CROSSARM MATCHES NSPI STANDARD SIX-PIN CROSSARM WITH THE EXCEPTION OF THE NOTED BRACKET HOLES	STELLA-JONES
H1	2	BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)	CHANCE 508754
H6c	2	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	as req'd	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	4	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H14	1	WASHER, HOT-DIPPED GALVANIZED, CURVED, 83mm x 83mm x 6mm, 17mm DIA. HOLE	HYDEL 1434CW11
H15	4	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A", No. 1	HYDEL 34GH
H20	2	BOLT, DOUBLE-ARMING FULL THREAD, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA Std. C83 1970, ITEM B-2 FULL THREAD; "xx" = LENGTH IN INCHES + 50) c/w FOUR (4) SQUARE NUTS	CHANCE 8874
H21	2	GALVANIZED STEEL EYE-NUT, 16mm DIA, EYE, ACCEPTING 16mm DIA. THREADED BOLT	HYDEL 58EN
H23	8	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H24	8	CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)	BURNDY CUW series
H25a	1	COMPRESSION CONNECTOR; 'CRIMPIT'; SUITABLE FOR ALUMINUM, COPPER, OR ACSR (FOR CONDUCTOR SIZES UP TO #2/0 AWG ACSR/AASC) ; CSA CERTIFIED	BURNDY YC-A
H25b	3	WEDGE-TYPE CONNECTOR, SUITABLE FOR ALUMINUM OR ACSR (FOR CONDUCTOR SIZES LARGER THAN #2/0 AWG ACSR/AASC), CSA CERTIFIED	BURNDY WCA (WEJTAP) series
I7	8	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
W3	2	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE
DEAD-END POLE
POLYMER INSULATORS
SHEET 2 OF 2

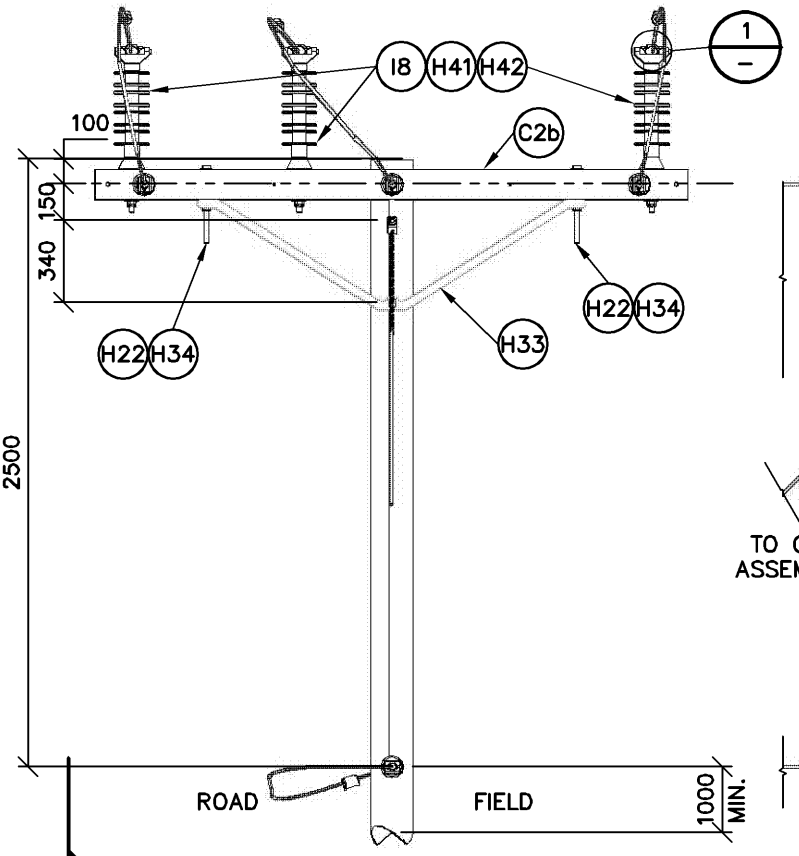
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N.T.S.	RO'C	

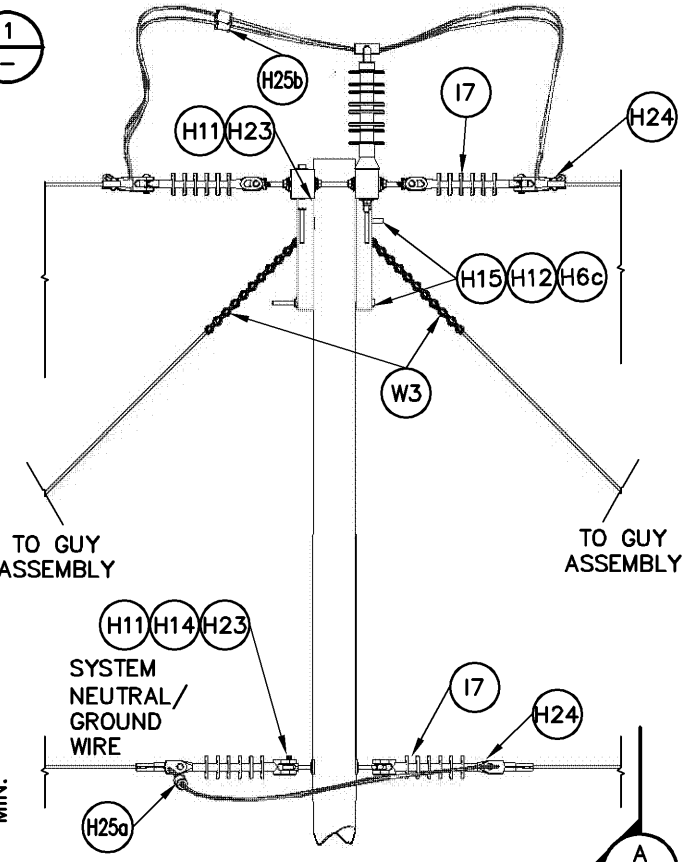
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Contract No: 090630.00
Drawing No: E9215
Revision: 0

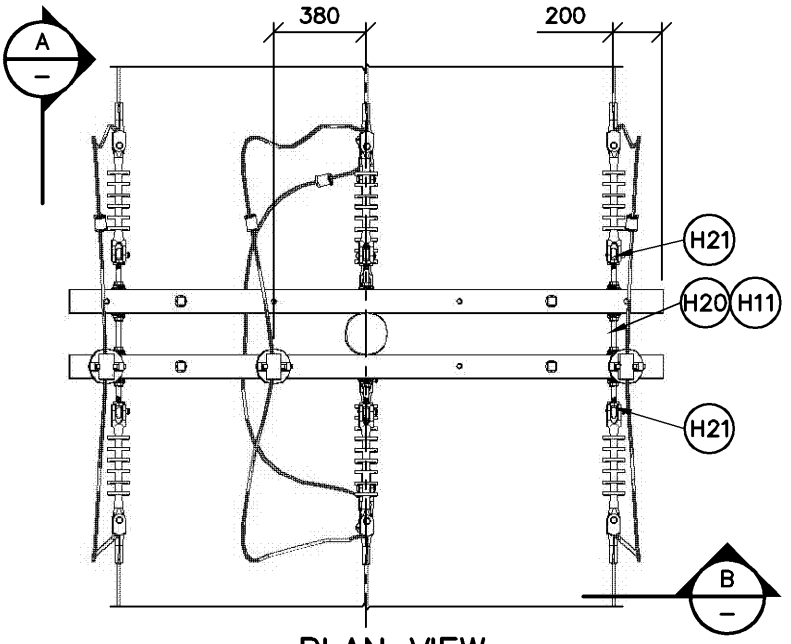
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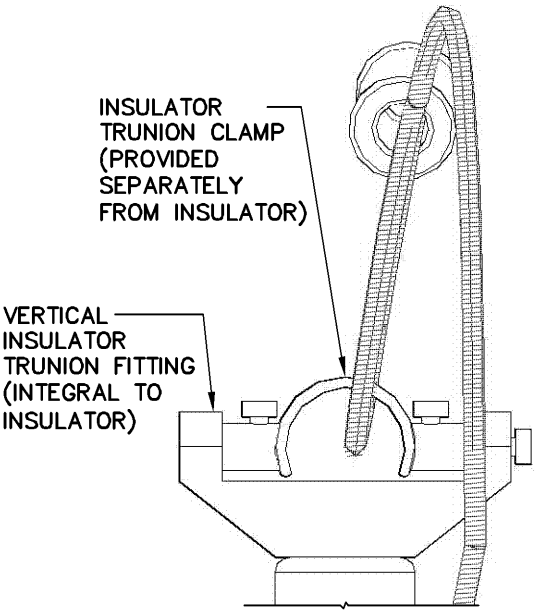
SECTION "A"



SECTION "B"



PLAN VIEW



DETAIL 1–VERTICAL TRUNNION

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3–PHASE
DOUBLE–DEAD–END POLE
POLYMER INSULATORS
SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

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Contract No: 090630.00
Drawing No: E9216
Revision: 0

NOTES:

1. TIE WIRE SHALL BE 1070mm IN LENGTH FOR LINE CONDUCTOR UP TO AND INCLUDING #1/0 AWG ACSR, 1220mm FOR LINE CONDUCTOR ABOVE #1/0 AWG ACSR UP TO AND INCLUDING #4/0 AWG ACSR, AND 1270mm FOR LINE CONDUCTOR LARGER THAN #4/0 AWG ACSR.
2. ALL TURNS SHALL BE TIGHT ONCE COMPLETED. PLIERS SHALL NOT BE USED WITH THE EXCEPTION OF THE TWISTING OF THE TIE ENDS.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
4. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

BILL OF MATERIALS (TABLE E9216-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
C2b	3	CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT c/w HOLES FOR 1550mm LONG CROSSARM BRACKET (REFER TO DRAWING E9901); NOTE THAT CROSSARM MATCHES NSPI STANDARD SIX-PIN CROSSARM WITH THE EXCEPTION OF THE NOTED BRACKET HOLES	STELLA-JONES
H6c	2	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	as req'd	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	4	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H14	1	WASHER, HOT-DIPPED GALVANIZED, CURVED, 83mm x 83mm x 6mm, 17mm DIA. HOLE	HYDEL 1434CW11
H15	4	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A", No. 1	HYDEL 34GH
H20	2	BOLT, DOUBLE-ARMING FULL THREAD, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA Std. C83 1970, ITEM B-2 FULL THREAD; "xx" = LENGTH IN INCHES + 50) c/w FOUR (4) SQUARE NUTS	CHANCE 8874
H21	2	GALVANIZED STEEL EYE-NUT, 16mm DIA, EYE, ACCEPTING 16mm DIA. THREADED BOLT	HYDEL 58EN
H23	8	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H24	8	CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)	BURNDY CUW series
H25a	1	COMPRESSION CONNECTOR; 'CRIMPIT'; SUITABLE FOR ALUMINUM, COPPER, OR ACSR (FOR CONDUCTOR SIZES UP TO #2/0 AWG ACSR/AASC) ; CSA CERTIFIED	BURNDY YC-A
H25b	3	WEDGE-TYPE CONNECTOR, SUITABLE FOR ALUMINUM OR ACSR (FOR CONDUCTOR SIZES LARGER THAN #2/0 AWG ACSR/AASC), CSA CERTIFIED	BURNDY WCA (WEJTAP) series
H41	3	CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM	MACLEAN ACTS SERIES
H42	3	INSULATOR STUD, LONG SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 7-1/2" LONG SHANK c/w CAPTURED HARDWARE	MACLEAN J25250.1
I7	8	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
I8	3	INSULATOR, 35kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, VERTICAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE	MACLEAN NPVN10XB006S0
W3	2	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE
DOUBLE-DEAD-END POLE
POLYMER INSULATORS
SHEET 2 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

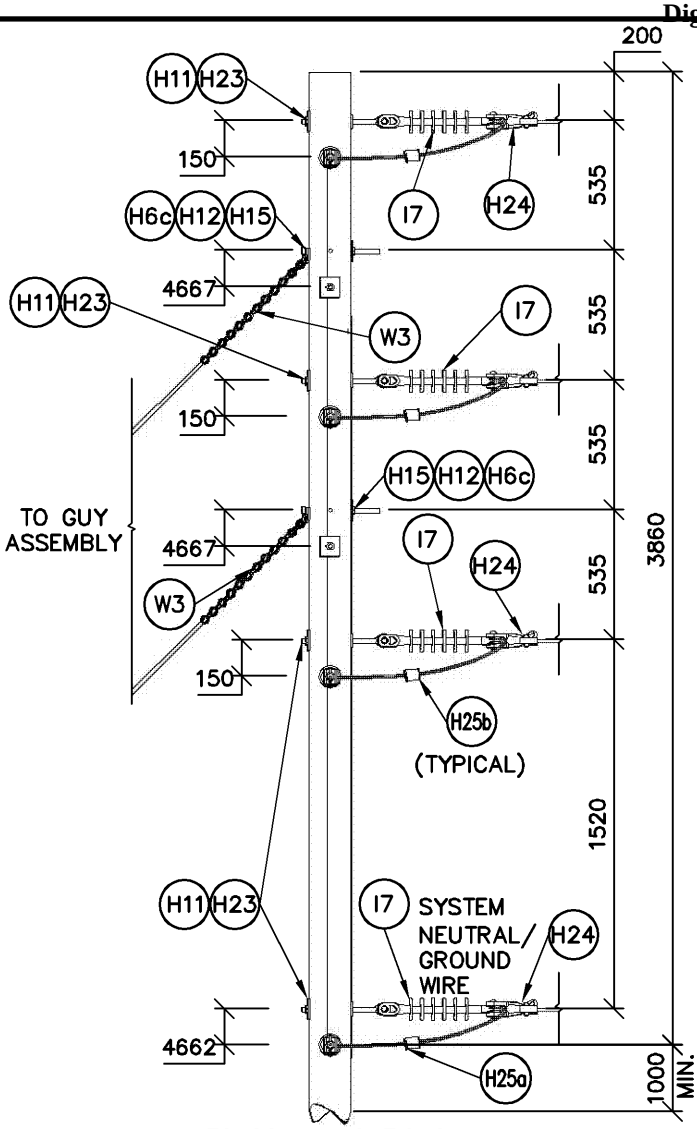
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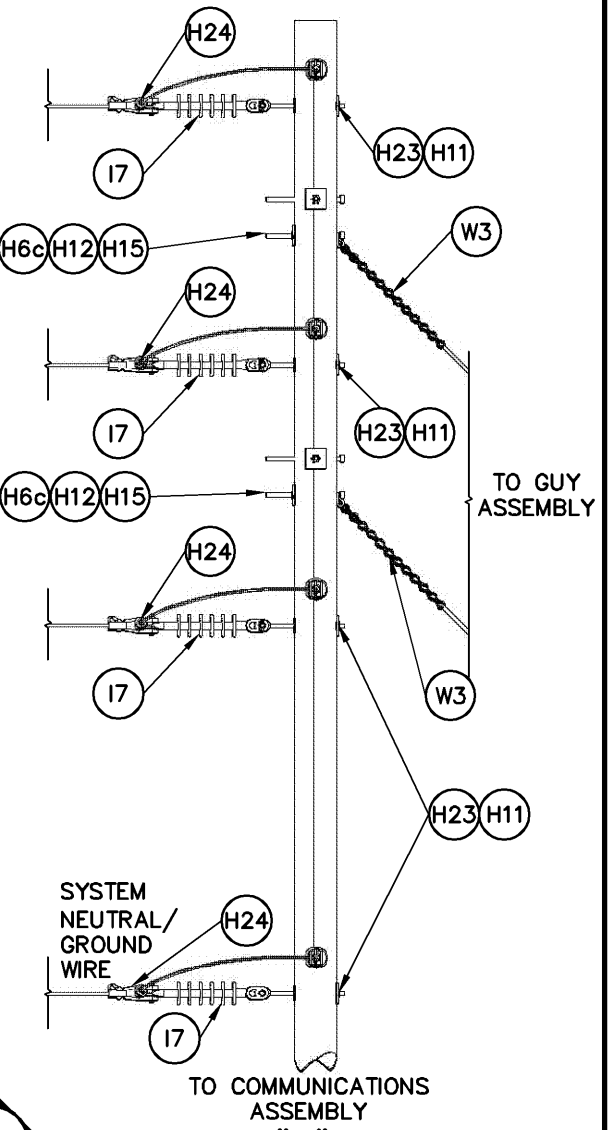
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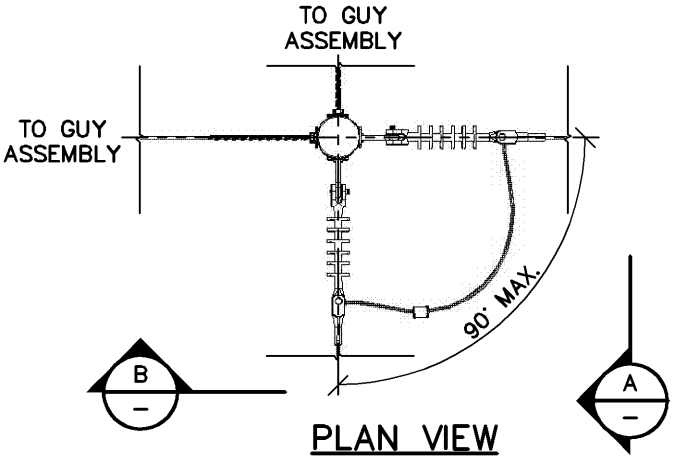
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SECTION "A"



SECTION "B"



PLAN VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
2. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE, 61'-90' VERTICAL CORNER POLE POLYMER INSULATORS

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	L'OK
Scale:	Checked	Approved
N.T.S.	RO'C	

CBCL LIMITED
Consulting Engineers
ISO 9001 CERTIFIED

Contract No: 090630.00

Drawing No: E9217

Revision: 0

BILL OF MATERIALS (TABLE E9217-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H6c	2	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	8	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	4	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H15	4	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A", No. 1	HYDEL 34GH
H23	8	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H24	8	CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)	BURNDY CUW series
H25a	1	COMPRESSION CONNECTOR; 'CRIMPIT'; SUITABLE FOR ALUMINUM, COPPER, OR ACSR (FOR CONDUCTOR SIZES UP TO #2/0 AWG ACSR/AASC) ; CSA CERTIFIED	BURNDY YC-A
H25b	3	WEDGE-TYPE CONNECTOR, SUITABLE FOR ALUMINUM OR ACSR (FOR CONDUCTOR SIZES LARGER THAN #2/0 AWG ACSR/AASC), CSA CERTIFIED	BURNDY WCA (WEJTAP) series
I7	8	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
W3	4	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

Drawing File: E9217.dwg Date: 6/29/2009 7:13 PM

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE, 61°-90°
VERTICAL CORNER POLE
POLYMER INSULATORS
SHEET 2 OF 2

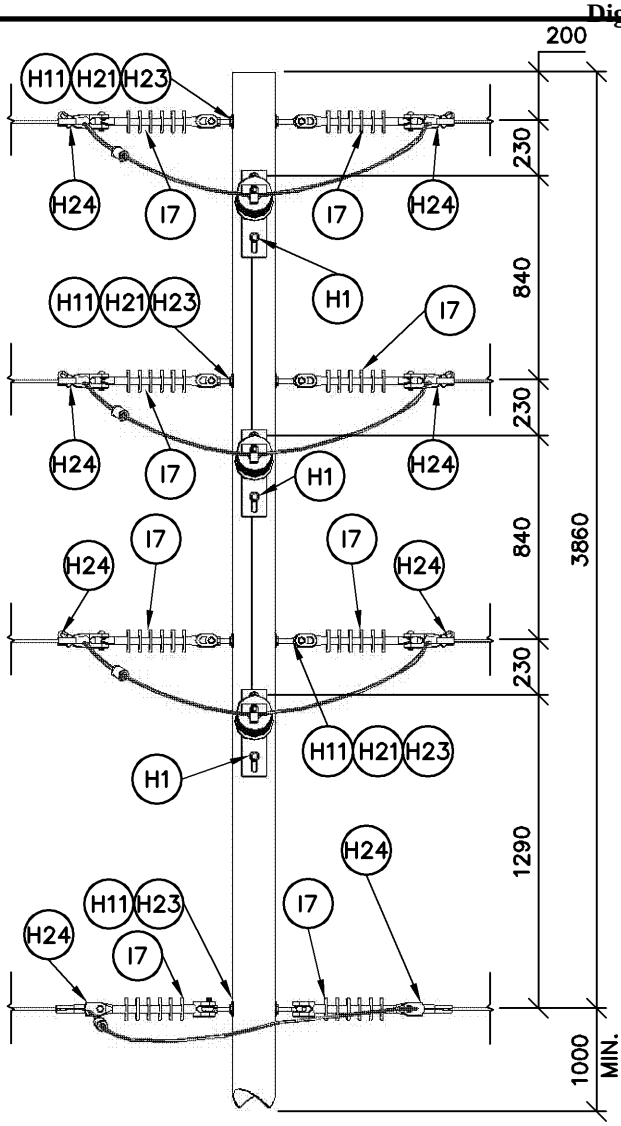
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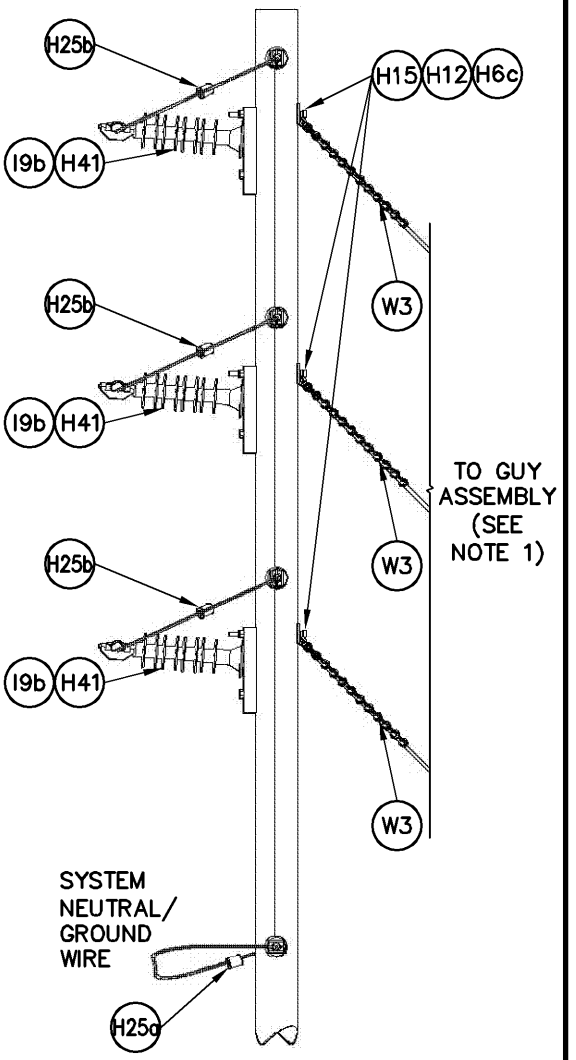
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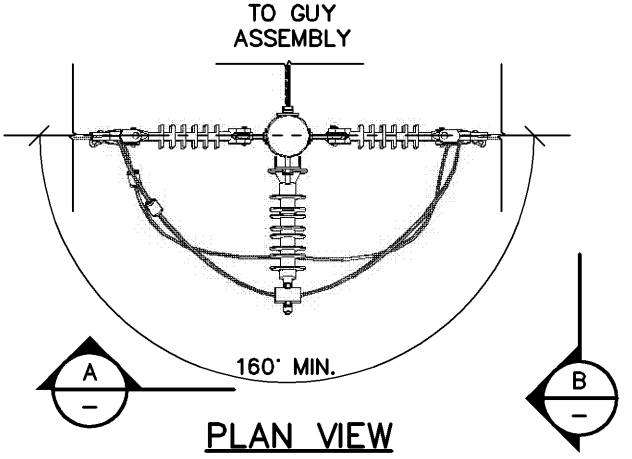
TO COMMUNICATIONS ASSEMBLY (SEE NOTE 3)

SECTION "A"



TO COMMUNICATIONS ASSEMBLY

SECTION "B"



PLAN VIEW

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE, 0°-20° VERTICAL DEAD-END POLE POLYMER INSULATORS

SHEET 1 OF 2

Rev	Description	Date
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Contract No: 090630.00

Drawing No: E9218 | Revision: 0

NOTES:

1. GUY ASSEMBLY REQUIRED FOR LINE ANGLES GREATER THAN 1°.
2. INCLUDE ONE (1) GUY HOOK (B.O.M. ITEM No. 15) WHERE GUY ASSEMBLY IS REQUIRED (NOT REQUIRED FOR LINE ANGLES LESS THAN 1°).
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
4. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.
5. INSTALL CRIMPIT OR AMPACT CONNECTORS ONLY AS REQUIRED; CONDUCTOR SHALL PREFERABLY BE CONTINUOUS UNLESS INDICATED OTHERWISE.

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BILL OF MATERIALS (TABLE E9218-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H1	3	BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)	CHANCE 508754
H6c	3	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H11	8	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	3	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H15	3	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A", No. 1	HYDEL 34GH
H21	4	GALVANIZED STEEL EYE-NUT, 16mm DIA, EYE, ACCEPTING 16mm DIA. THREADED BOLT	HYDEL 58EN
H23	4	BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT	CHANCE 299xx SERIES
H24	8	CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)	BURNDY CUW series
H25a	as req'd	COMPRESSION CONNECTOR; 'CRIMPIT'; SUITABLE FOR ALUMINUM, COPPER, OR ACSR (FOR CONDUCTOR SIZES UP TO #2/0 AWG ACSR/AASC) ; CSA CERTIFIED (SEE NOTE 5)	BURNDY YC-A
H25b	as req'd	WEDGE-TYPE CONNECTOR, SUITABLE FOR ALUMINUM OR ACSR (FOR CONDUCTOR SIZES LARGER THAN #2/0 AWG ACSR/AASC), CSA CERTIFIED (SEE NOTE 5)	BURNDY WCA (WEJTAP) series
H41	3	CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM	MACLEAN ACTS SERIES
I7	8	INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS	MACLEAN DS-35M
I9b	3	INSULATOR, 35kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE c/w 50 GAIN BASE, HOT-DIPPED GALVANIZED	MACLEAN NPKG10XB006S0
W3	3	GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M	PLP GDE-1108

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE, 0°-20°
VERTICAL DEAD-END POLE
POLYMER INSULATORS
SHEET 2 OF 2

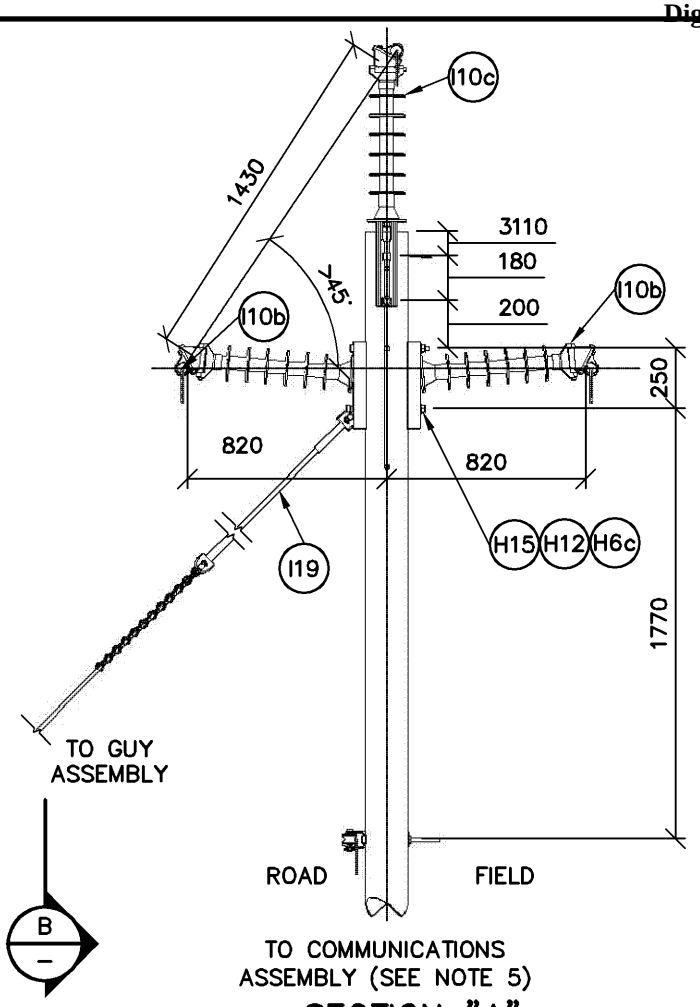
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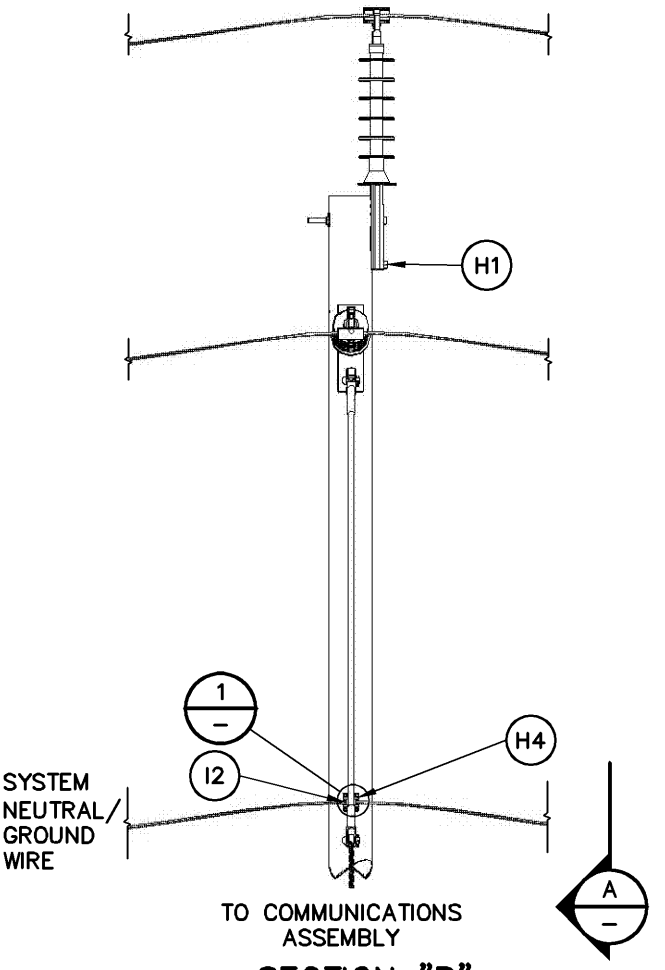
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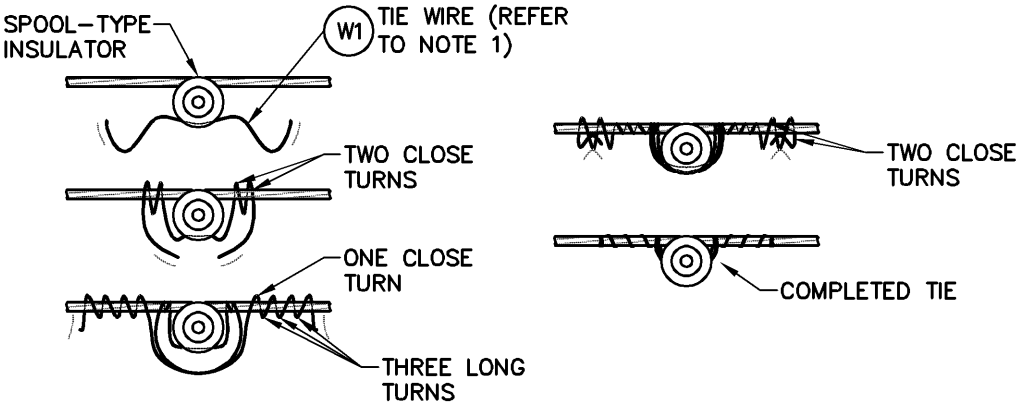
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SECTION "A"



SECTION "B"



DETAIL 1-SPOOL TIE
(SEE NOTE 2)

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DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

34.5kV, 3-PHASE ADDED LEAKAGE POLE, POLYMER POST INSULATORS

SHEET 1 OF 2

Rev	Description	Date
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NOTES:

1. TIE WIRE SHALL BE 1220mm IN LENGTH FOR NEUTRAL CONDUCTOR UP TO AND INCLUDING #1/0 AWG ACSR, 1270mm FOR NEUTRAL CONDUCTOR ABOVE #1/0 AWG ACSR UP TO AND INCLUDING #2/0 AWG ACSR, 1320mm FOR NEUTRAL CONDUCTOR LARGER THAN #2/0 AWG ACSR UP TO AND INCLUDING #4/0 AWG ACSR, AND 1420mm FOR NEUTRAL CONDUCTOR LARGER THAN #4/0 AWG ACSR.
2. ALL TURNS SHALL BE TIGHT ONCE COMPLETED. PLIERS SHALL NOT BE USED WITH THE EXCEPTION OF THE TWISTING OF THE TIE ENDS.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS INDICATED OTHERWISE.
4. THIS DRAWING IS APPLICABLE ONLY FOR OVERHEAD LINE CONSTRUCTION WITH A TURN OF LESS THAN 20° FROM A STRAIGHT LINE.
5. COMMUNICATIONS WIRING SHALL BE SECURED TO THE POLE AT 1m BELOW THE SYSTEM NEUTRAL/GROUND WIRE.

BILL OF MATERIALS (TABLE E9219-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H1	1	BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)	CHANCE 508754
H4	1	BOLT, SPOOL, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x 300mm SECTION BETWEEN SHOULDERS SHALL BE HEXAGONAL OR FLAT (AS PER CSA STD. C83.25M, TYPE 2, No. 3, EXCEPT THREADS AND NUTS IN IMPERIAL) c/w TWO (2) LOCK WASHERS; FOUR (4) NUTS; AND, ALTERNATELY, ONE (1) SQUARE WASHER SUPPLIED LOOSE OR ONE (1) WASHER FIXED IN POSITION TO THE BOLT SHANK	CHANCE 7744
H6c	as req'd	LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT	CHANCE 3532
H12	2	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT	CHANCE 88xx SERIES
H15	as req'd	GUY HOOK, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A", No. 1	HYDEL 34GH
H34	as req'd	WASHER, HOT-DIPPED GALVANIZED, ROUND, 14mm DIA. HOLE	HYDEL 138RW
I2	1	INSULATOR, SECONDARY SPOOL TYPE, ASA CLASS 53-2, MUNSELL GREY COLOUR	ENERSCAN 99001 53-2 design
I10b	2	INSULATOR, 46kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE c/w UNIVERSAL TRUNNION CLAMP SUITABLE FOR 0° - 45° LINE ANGLE, HORIZONTAL GAIN BASE (HOT-DIPPED GALVANIZED)	MACLEAN NPVV20XG13S0-U
I10c	1	INSULATOR, 46kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE c/w UNIVERSAL TRUNNION CLAMP SUITABLE FOR 0° - 45° LINE ANGLE, VERTICAL GAIN BASE (HOT-DIPPED GALVANIZED)	MACLEAN NPVG20XG13S0-U
I19	1	GUY STRAIN INSULATOR, FIBREGLASS, CLEVIS-CLEVIS, 243.8cm LONG x 19mm DIA., TWO (2) ROLLERS, MUNSELL GREY COLOUR, 93.4kN MIN. TENSILE STRENGTH, 970/500kV DRY/WET FLASHOVER	CHANCE GS21096CC2
W1	1	#4/0 AWG SOLID ALUMINUM TIE WIRE, LENGTH AS INDICATED	ALCAN

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SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
34.5kV, 3-PHASE
ADDED LEAKAGE POLE, POLYMER POST INSULATORS
SHEET 2 OF 2

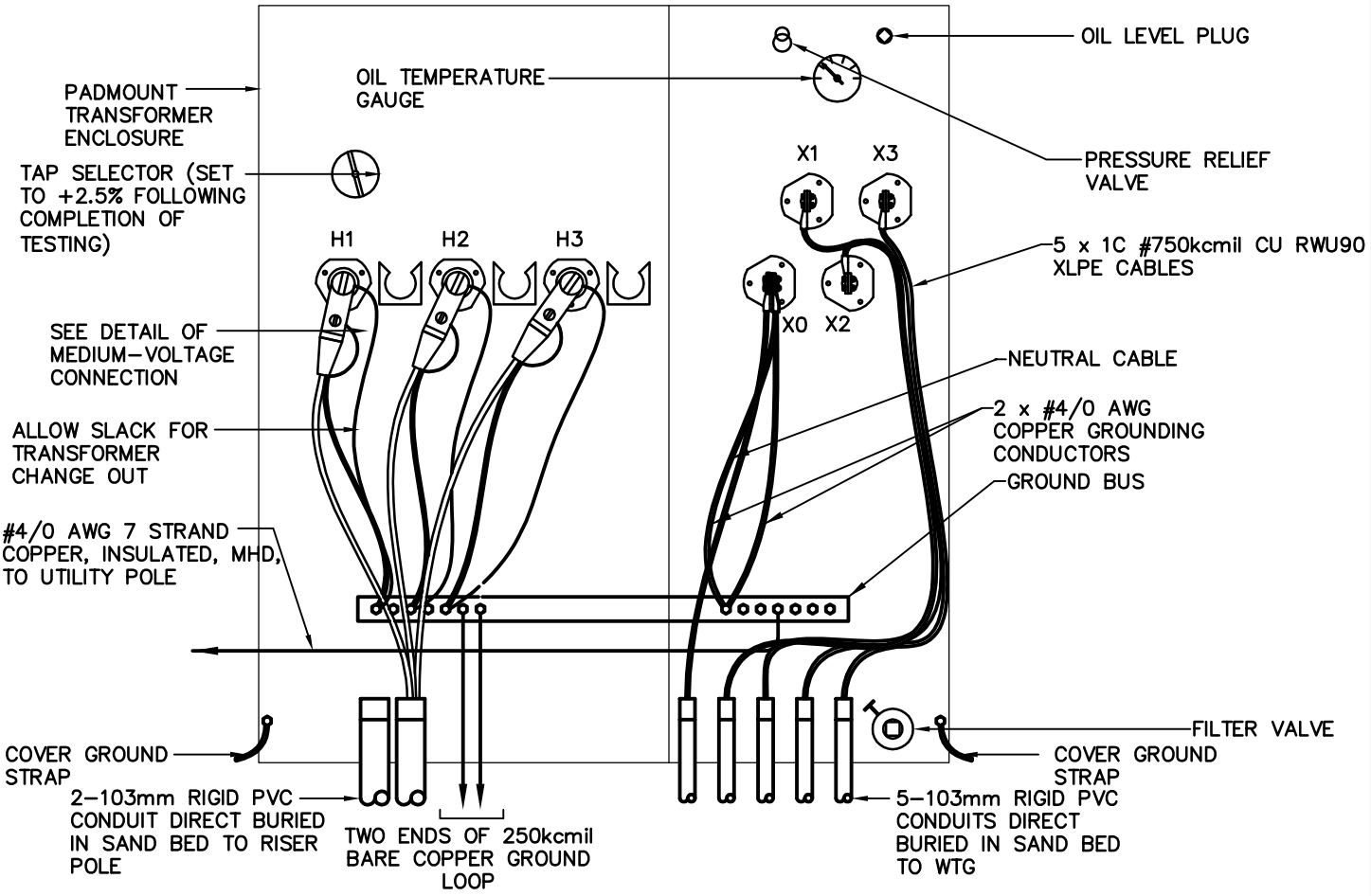
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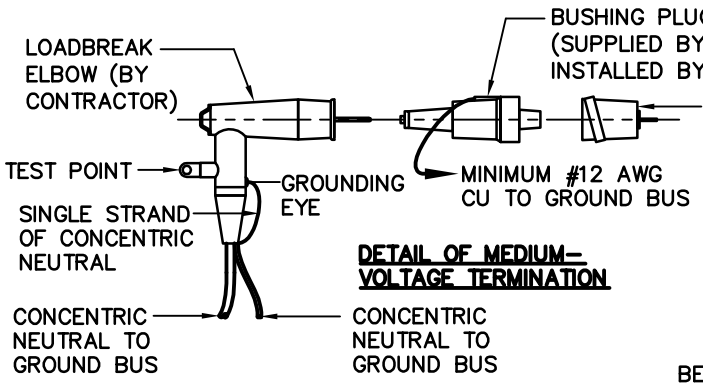
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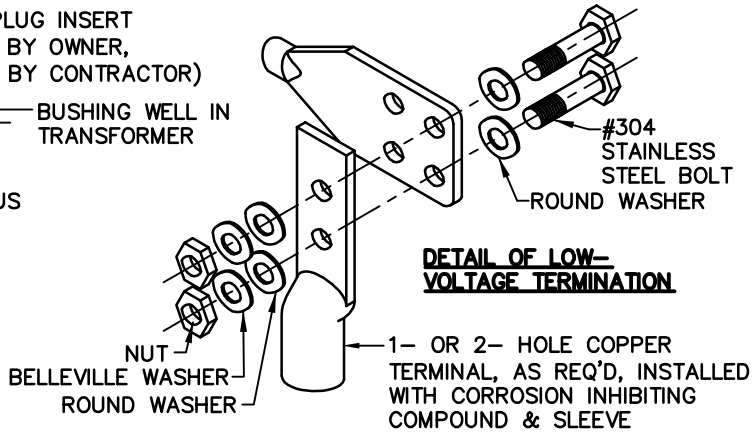
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SKYPOWER

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DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

WYE-WYE PADMOUNTED TRANSFORMER TERMINATIONS

SHEET 1 OF 1

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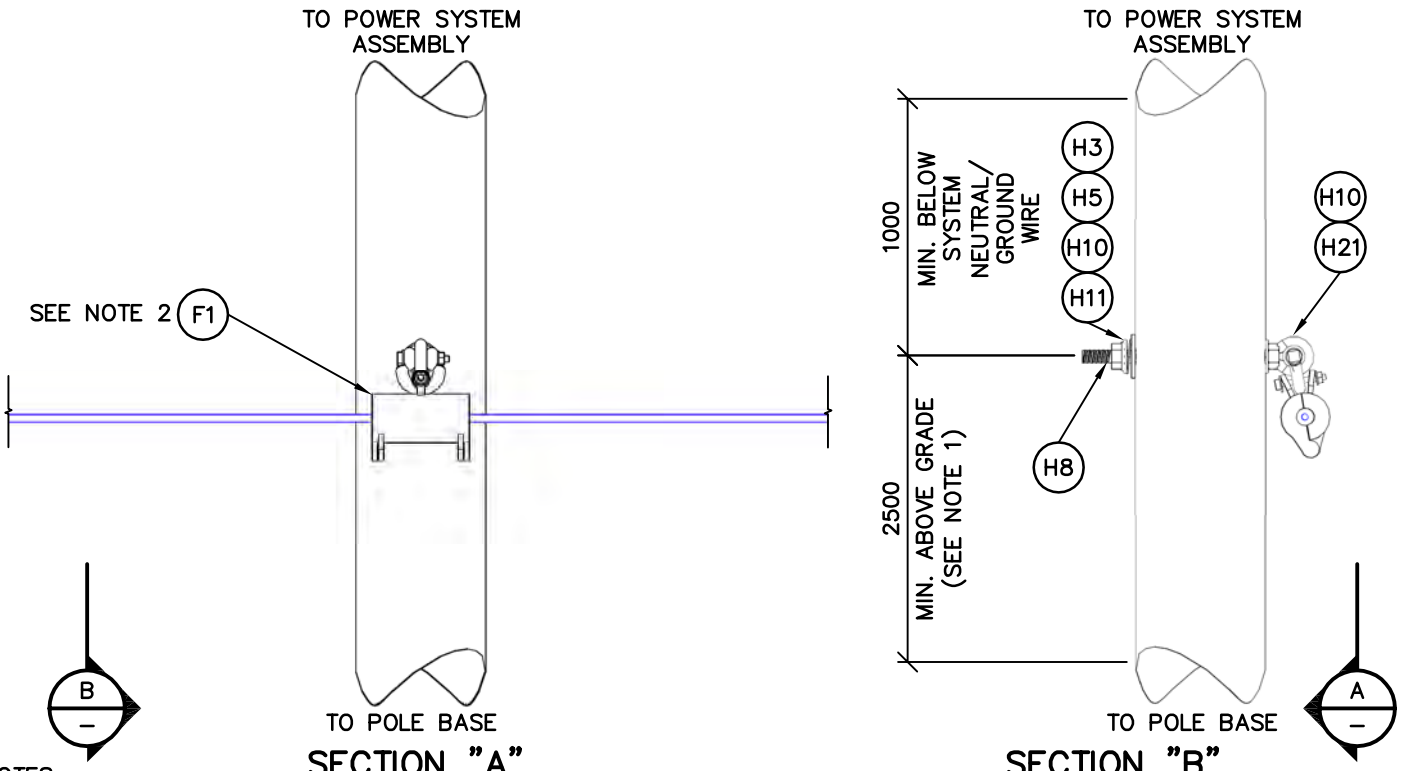
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SECTION "A" SECTION "B"

NOTES:

1. THE POINT OF CONNECTION OF THE COMMUNICATION WIRE TO THE POLE SHALL BE DICTATED BY THE LOCATION OF THE SYSTEM NEUTRAL OR GROUND WIRE, BUT SHALL AT NO TIME BE CONNECTED AT ANY LESS THAN 2500mm ABOVE FINISHED GRADE.

2. FOR SPANS EXCEEDING 183m, INSTALL A GALVANIZED STEEL REINFORCING ROD (B.O.M. ITEM #H19) ON THE FIBRE-OPTIC CABLE PRIOR TO SECURING INSIDE TRUNION ASSEMBLY. INSTALL TRUNION ASSEMBLY ON THE ROAD-SIDE OF THE POLE FOR LINE ANGLES UP TO AND INCLUDING 5°, AND ON THE SIDE OF THE POLE OPPOSITE THE GUY ASSEMBLY FOR LINE ANGLES 6° OR GREATER.

3. THE CONFIGURATION SHOWN IS APPLICABLE FOR INSTALLATIONS WITH A LINE ANGLE UP TO 20° AND SPAN LENGTHS UP TO 366m.

BILL OF MATERIALS (TABLE E9401-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
F1	1	ALUMINUM SUSPENSION CLAMP FOR ADSS FIBRE-OPTIC CABLE c/w KEEPER, CUSHION INSERTS (WITHOUT GRIT), CAPTURED BOLT AND WASHER, LOCKNUT, AND ANCHOR SHACKLE WITH EYE-NUT	
H3	1	WASHER, HOT-DIPPED GALVANIZED, LOCK, 27mm DIA. HOLE (AS PER CSA STD. C83 ITEM W5)	
H5	1	NUT, HOT-DIPPED GALVANIZED, THREAD DIA. TO MATCH ASSOCIATED BOLT AS REQUIRED	
H8	1	BOLT, SPOOL, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x 250mm, SECTION BETWEEN SHOULDERS SHALL BE HEXAGONAL OR FLAT (AS PER CSA STD. C83.25M, TYPE 2, No. 3, EXCEPT THREADS IN IMPERIAL)	
H10	2	WASHER, HOT-DIPPED GALVANIZED, ROUND, 11mm DIA. HOLE	
H11	1	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	
H19	1	GALVANIZED STEEL REINFORCING ROD SUITABLE FOR USE WITH, AND SUPPLIED BY THE SAME MANUFACTURER AS, B.O.M. ITEM F1	
H21	1	GALVANIZED STEEL EYE-NUT, 16mm DIA. EYE, ACCEPTINING 16mm DIA. THREADED BOLT	

SKYPOWER

SKYPOWER CORP
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POWER PROJECT

ELECTRICAL STANDARD DETAIL

JOINT-USE POLE, SELF-SUPPORTED FIBRE-OPTIC CABLE, HIGH TENSION

SHEET 1 OF 1

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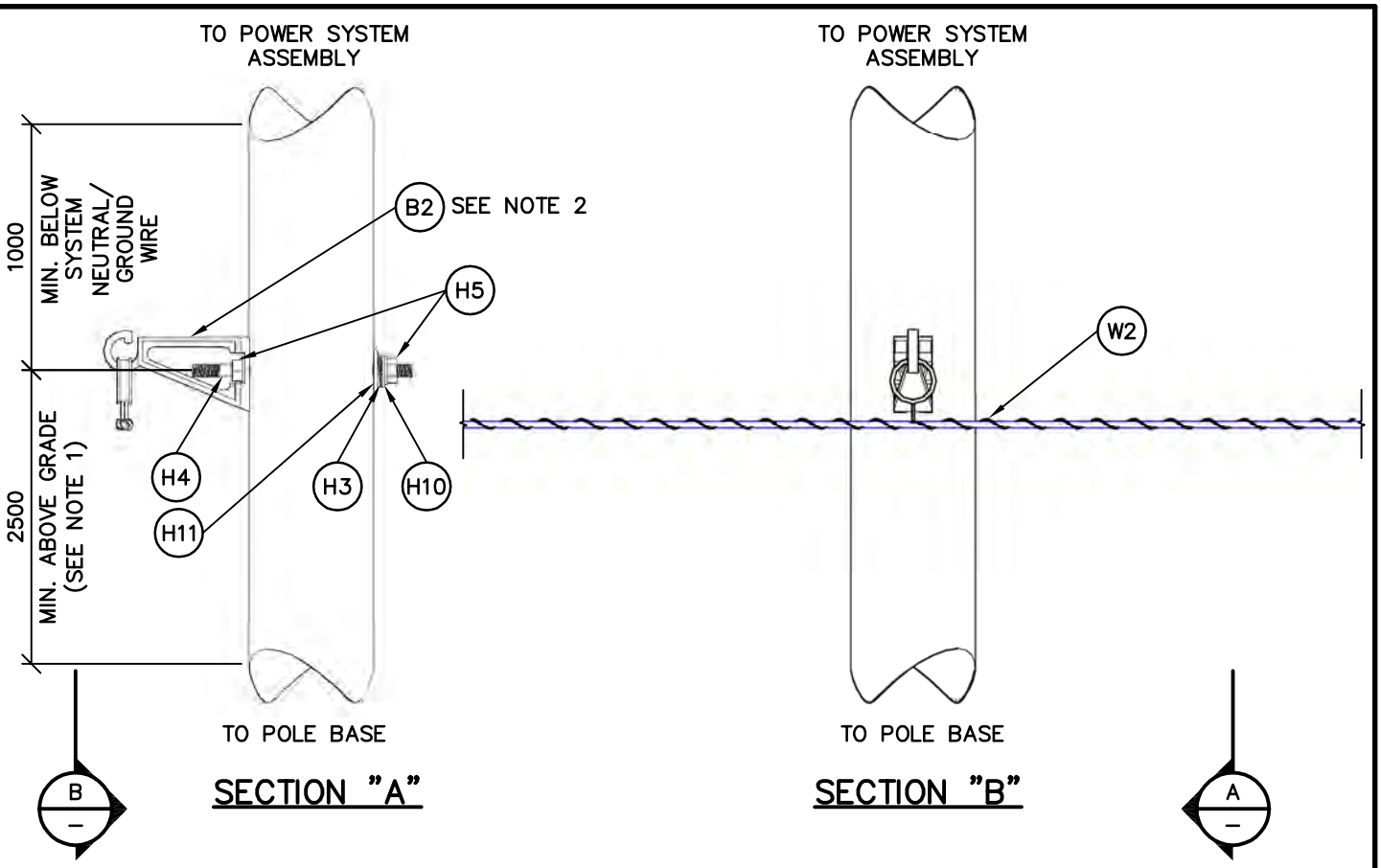
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NOTES:

1. THE POINT OF CONNECTION OF THE COMMUNICATION WIRE TO THE POLE SHALL BE DICTATED BY THE LOCATION OF THE SYSTEM NEUTRAL OR GROUND WIRE, BUT SHALL AT NO TIME BE CONNECTED AT ANY LESS THAN 2500mm ABOVE FINISHED GRADE.

2. FOR LINE ANGLES UP TO AND INCLUDING 5°, MOUNT BRACKET ON THE ROAD SIDE OF THE POLE; FOR ANGLES 6° OR GREATER, MOUNT BRACKET ON THE OPPOSITE SIDE OF THE POLE RELATIVE TO THE GUY ATTACHMENT.

BILL OF MATERIALS (TABLE E9402-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
B2	1	BRACKET, "J-HOOK", ALUMINUM, SUITABLE FOR USE WITH A 16M MACHINE OR SPOOL BOLT	
H3	2	WASHER, HOT-DIPPED GALVANIZED, LOCK, 27mm DIA. HOLE (AS PER CSA STD. C83 ITEM W5)	
H4	1	BOLT, SPOOL, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x 300mm, SECTION BETWEEN SHOULDERS SHALL BE HEXAGONAL OR FLAT (AS PER CSA STD. C83.25M, TYPE 2, No. 3, EXCEPT THREADS IN IMPERIAL)	
H5	2	NUT, HOT-DIPPED GALVANIZED, THREAD DIA. TO MATCH ASSOCIATED BOLT AS REQUIRED	
H10	1	WASHER, HOT-DIPPED GALVANIZED, ROUND, 11mm DIA. HOLE	
H11	1	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	
W2	1	FORMED WIRE SUPPORT, GALVANIZED STEEL, HOT-DIPPED GAVANIZED SUPPORT THIMBLE CLEVIS 22mm IN DIA. MINIMUM, SUITABLE FOR USE WITH ADSS CABLE SPANS UP TO 75m AND MAXIMUM LINE ANGLE OF 30 DEGREES, RELIVED ENDS TO PREVENT CABLE DAMAGE	

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL

FIBRE-OPTIC CABLE JOINT-USE POLE, LIGHT ANGLE, SHORT SPAN

SHEET 1 OF 1

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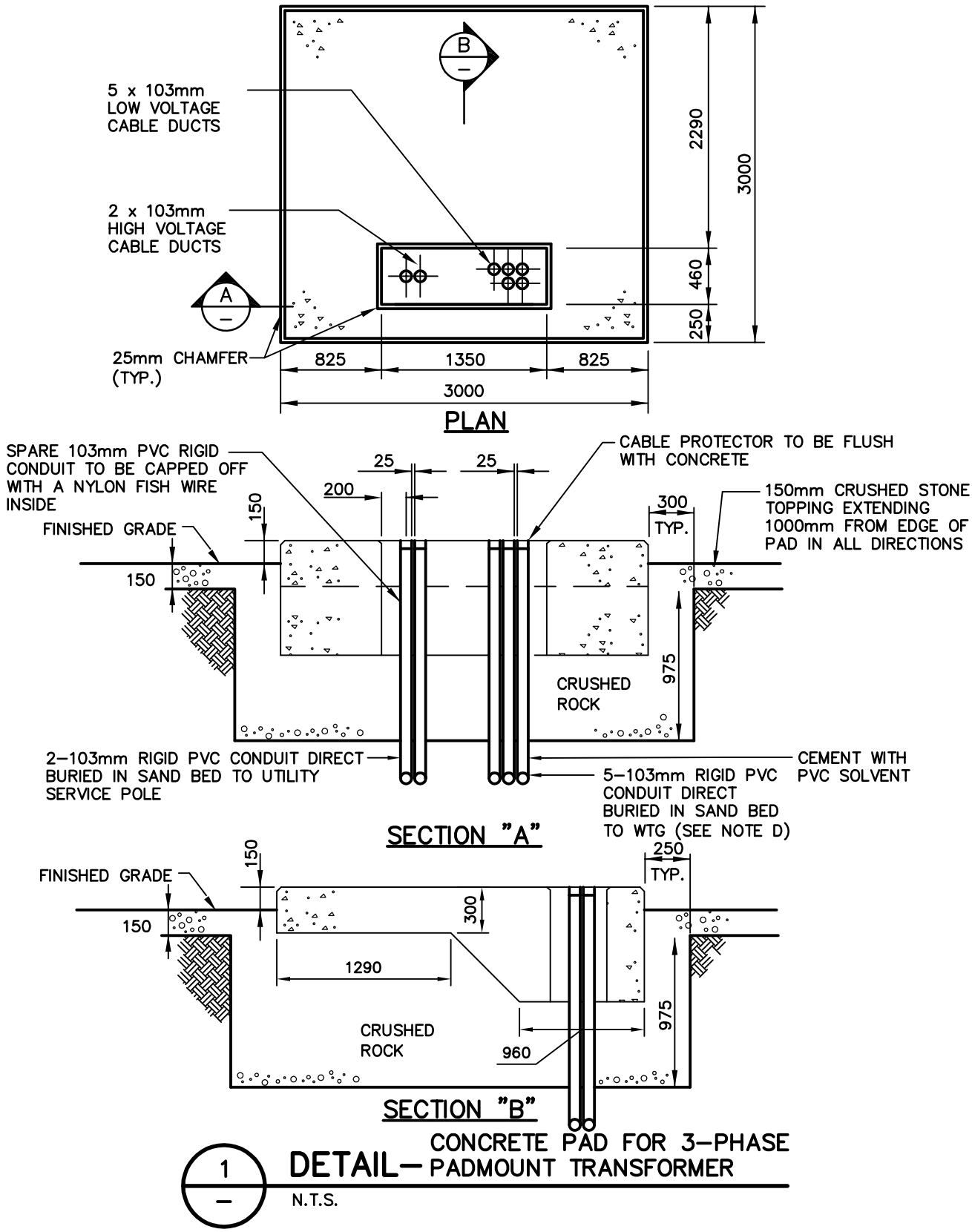
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DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL

3-PHASE, 750-2500kVA
PADMOUNTED TRANSFORMER
CONCRETE PAD, DEEP WELL

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
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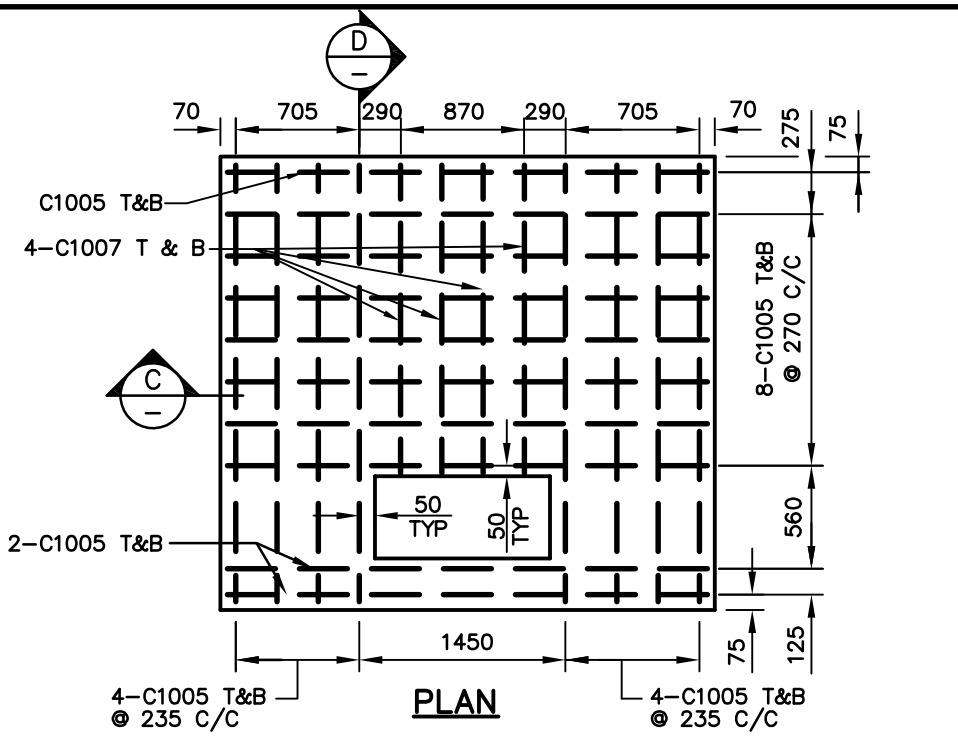
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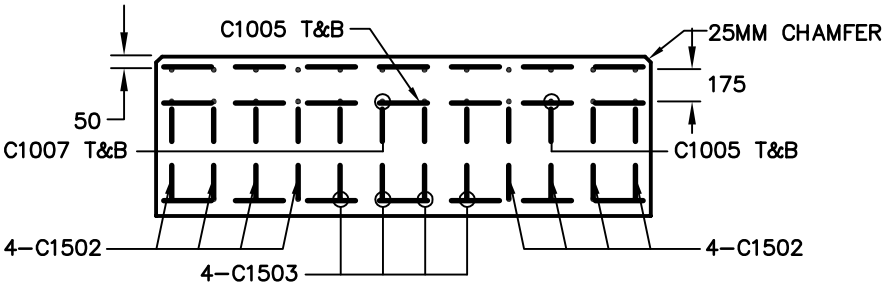
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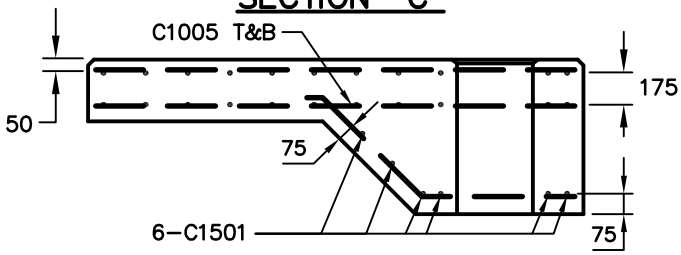
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PLAN



SECTION "C"



SECTION "D"

REBAR SCHEDULE

C1005–#10M BAR x 2900mm LG – 38 REQ'D
C1007–#10M BAR x 2190mm LG – 8 REQ'D
C1501–#15M BAR x 2900mm LG – 6 REQ'D
C1502–#15M BAR x 1700mm LG – 8 REQ'D
C1503–#15M BAR x 990mm LG – 4 REQ'D

2 — DETAIL– REINFORCING CONCRETE PAD FOR 3ø PADMOUNT TRANSFORMER

N.T.S.

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL
3-PHASE, 750-2500kVA
PADMOUNTED TRANSFORMER
CONCRETE PAD, DEEP WELL
SHEET 2 OF 2

Rev	Description	Date
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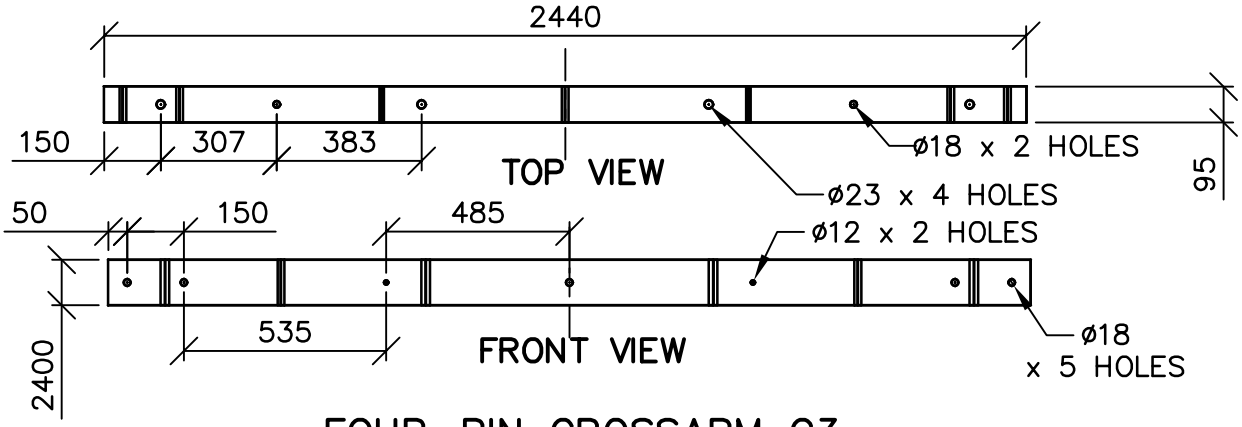
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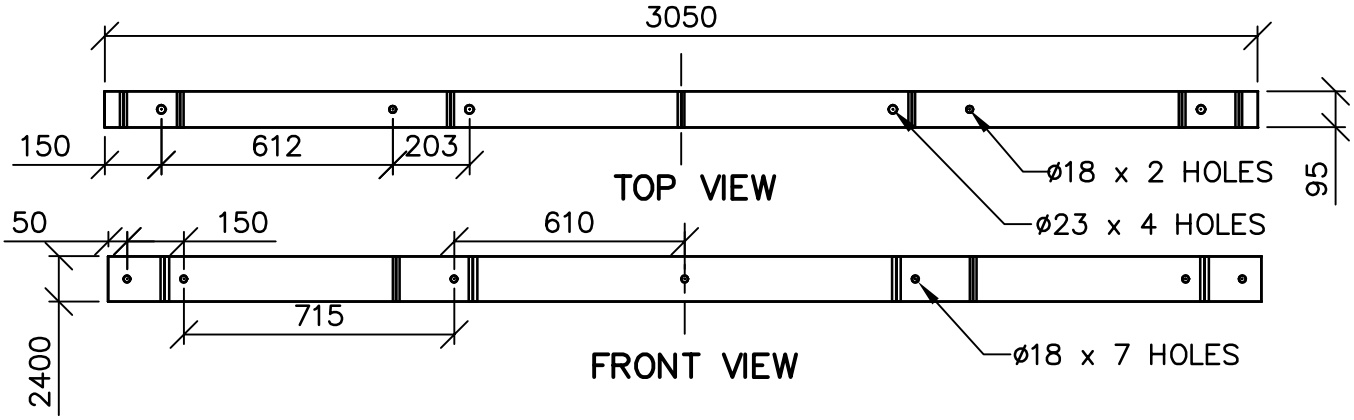
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SIX–PIN CROSSARM C2b



FOUR–PIN CROSSARM C3



NOTES:

1. CROSSARMS SHALL BE AS PER CSA STD. 0116, CLASS '1' PENTACHLOROPHENOL–TREATED DOUGLAS FIR IN ACCORDANCE WITH THE LATEST REVISION OF CSA STD. 080. ALL HOLES SHALL BE DRILLED BEFORE TREATMENT.
2. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE NOTED, AND ARE SYMMETRICAL ABOUT THE CENTRE LINE.

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ELECTRICAL STANDARD DETAIL

34.5kV STANDARD CROSSARMS

SHEET 1 OF 1

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Scale:	Checked	Approved
N.T.S.	RO'C	

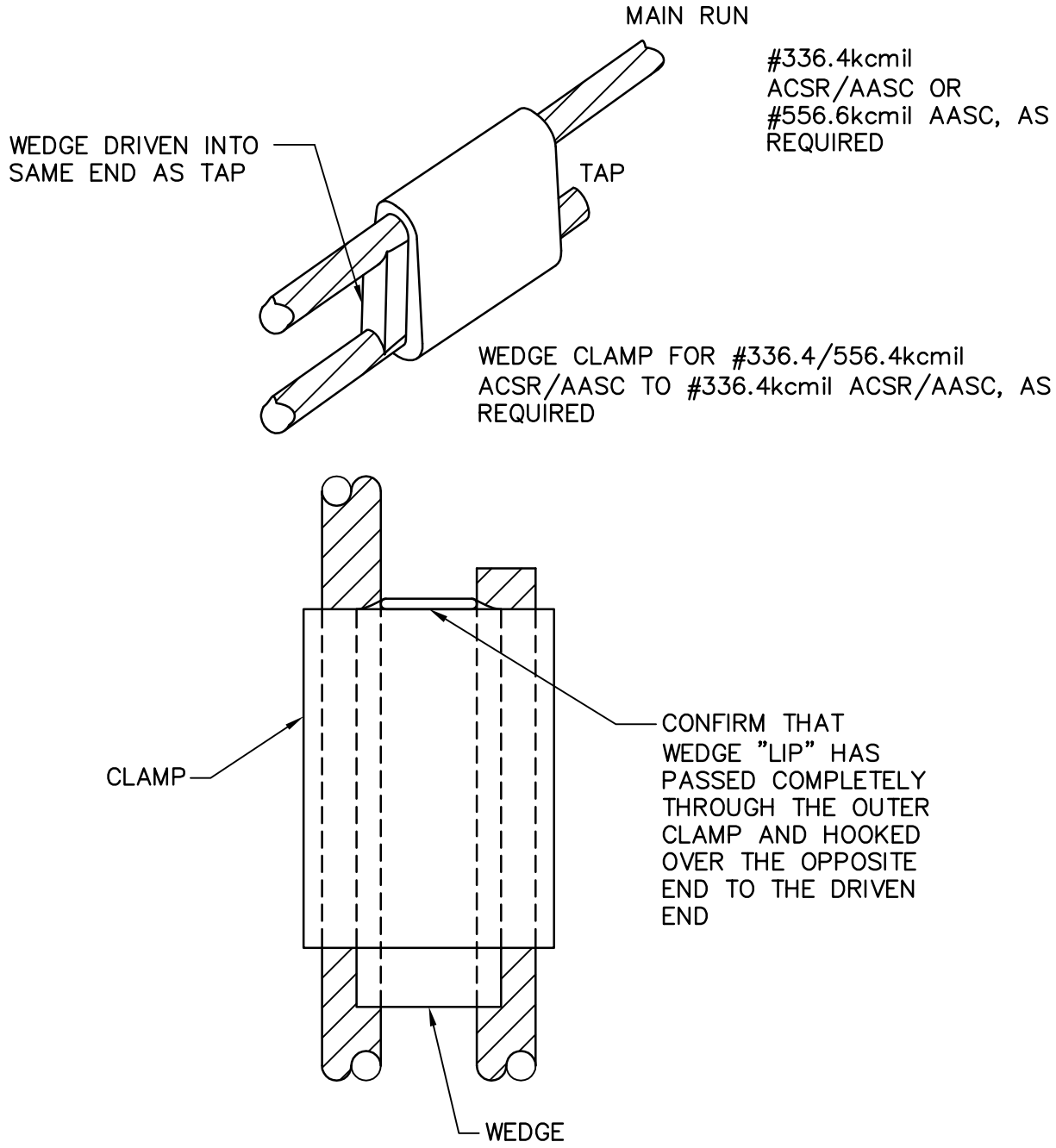
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Contract No: 090630.00

Drawing No: E9901

Revision: 0

Drawing File: E9902.dwg Date: 6/29/2009 9:32 PM



SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

WEDGE–TAP CLAMP DETAIL

SHEET 1 OF 1

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

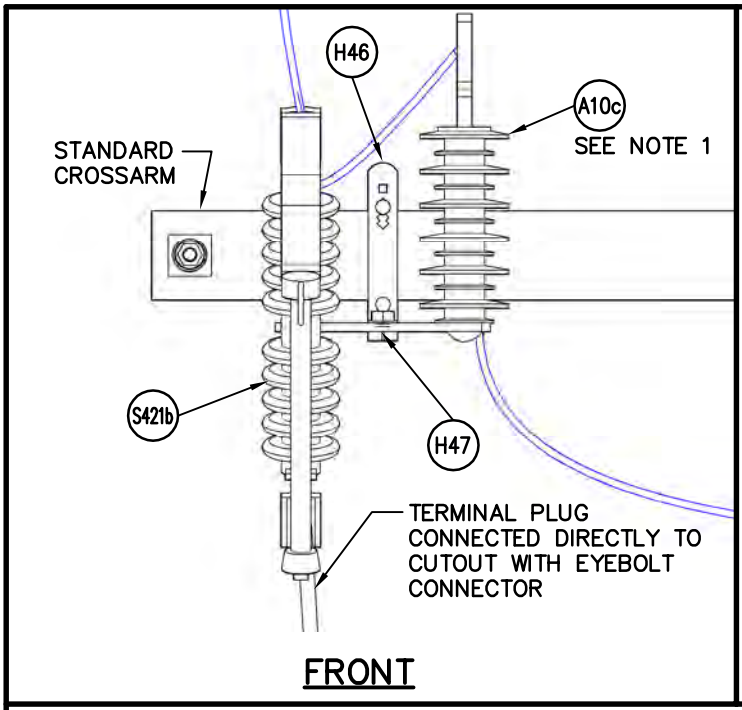
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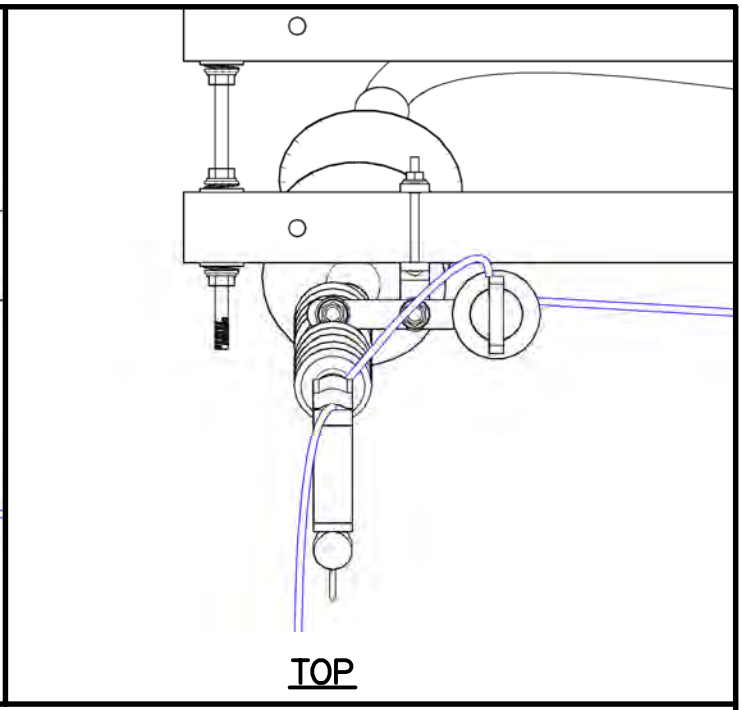
Contract No: 090630.00

Drawing No: E9902

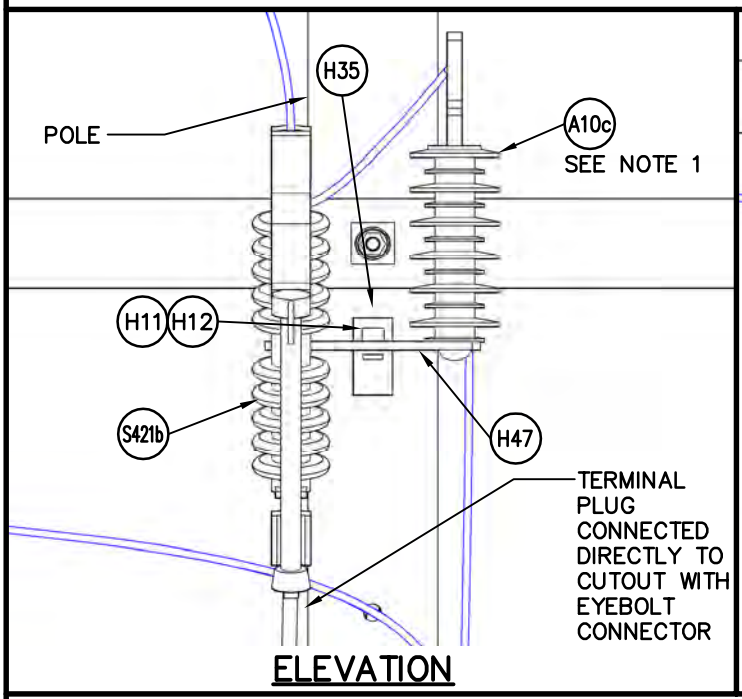
Revision: 0

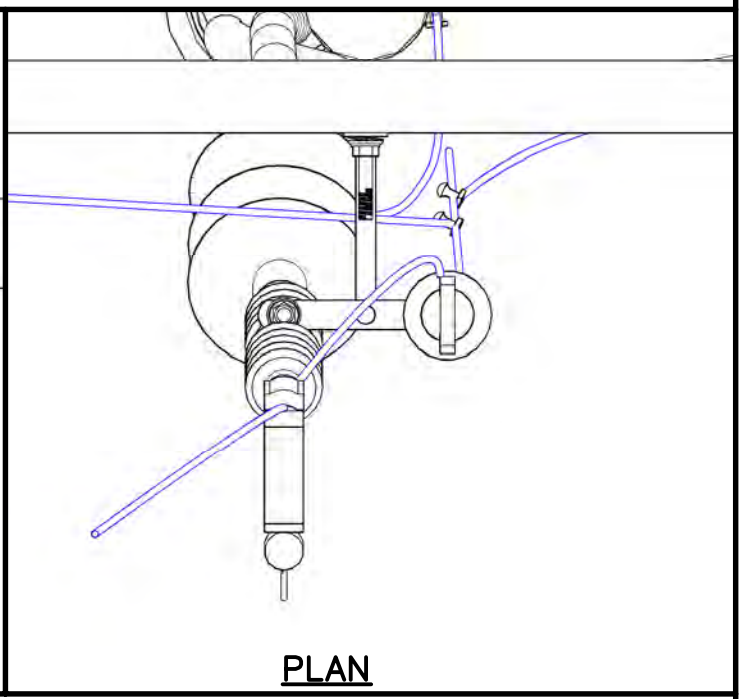
Drawing File: E9903.dwg Date: 6/29/2009 9:28 PM





1 DETAIL— CUTOUT & ARRESTER CROSSARM MOUNTING
N.T.S.





2 DETAIL— CUTOUT & ARRESTER POLE MOUNTING

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

FUSED CUTOUT & LIGHTNING ARRESTER MOUNTING DETAILS

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

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Contract No: 090630.00

Drawing No: E9903

Revision: 0

Drawing File: E9903.dwg Date: 6/29/2009 9:29 PM

NOTES:

1. RUN PRIMARY OVERHEAD CONDUCTOR THROUGH THE UPPER CUTOUT EYEBOLT CONNECTOR AND TERMINATE ON THE PRIMARY TERMINAL OF THE ARRESTER. CONNECT THE ARRESTER TO THE POLE GROUND WIRE WITH AS SHORT A RUN OF #2/0 AWG COPPER CONDUCTOR (MIN.) AS PRACTICABLE.

BILL OF MATERIALS (TABLE E9903-1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
A10c	3	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 22.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS	
H11	as req'd	WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE	HYDEL 3624SW11
H12	4	BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT	CHANCE 88xx SERIES
H35		SINGLE-PHASE CUTOUT POLE-MOUNTING BRACKET, GALVANIZED	
H46		SINGLE-PHASE CUTOUT CROSSARM-MOUNTING BRACKET, GALVANIZED, 5 1/4" CLEARANCE	
H47		CROSS STRAP FOR MOUNTING TWO UNITS OF APPARATUS, GALVANIZED, 8 1/2" CENTRE-TO-CENTRE	
S421b		38kV, 100A CUTOUT C/W LOAD-BREAK ATTACHMENT	

SKYPOWER

SKYPOWER CORP
DIGBY WIND
POWER PROJECT

ELECTRICAL STANDARD DETAIL

FUSED CUTOUT & LIGHTNING ARRESTER MOUNTING DETAILS

SHEET 2 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
AS INDICATED	RO'C	

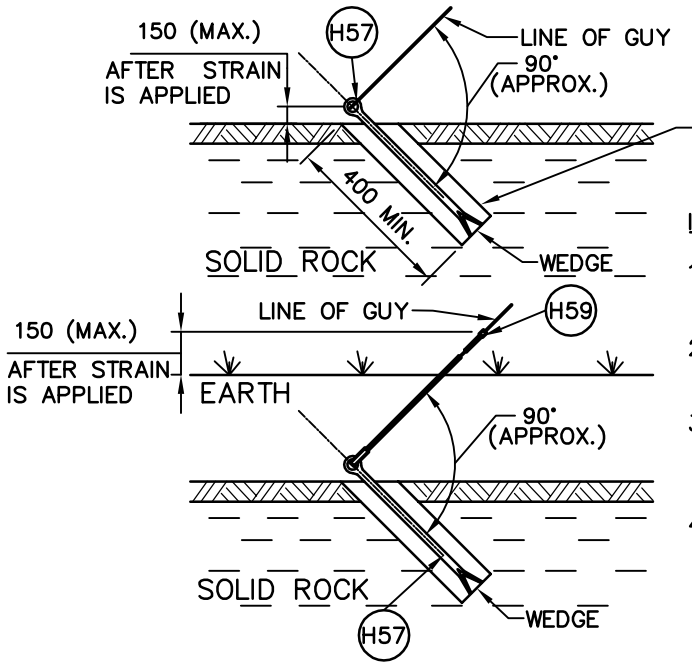
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Contract No: 090630.00

Drawing No: E9903

Revision: 0

Drawing File: E9905.dwg Date: 6/29/2009 9:30 PM

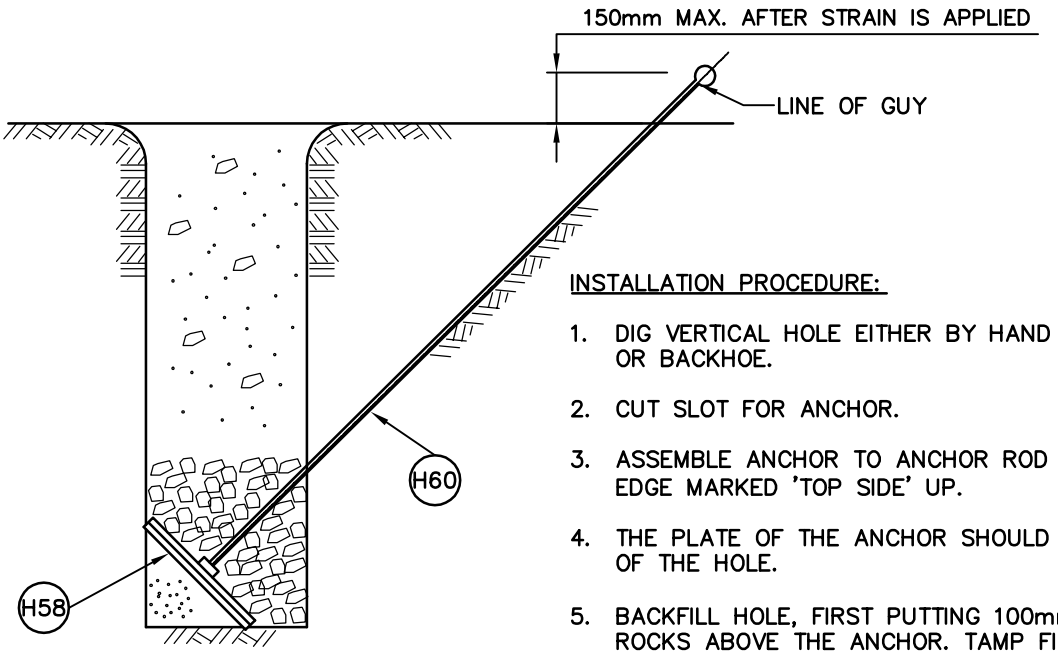


INSTALLATION PROCEDURE:

1. DRILL A HOLE AT 90° TO THE GUY. THE SIZE OF THE HOLE SHALL BE APPROX. 30mm IN DIAMETER.
2. PLACE THE WEDGE IN THE ANCHOR SLOT AND DROP THE ANCHOR TO THE BOTTOM OF THE HOLE.
3. HIT THE DRIVING FACE REPEATLY WITH A HEAVY HAMMER UNTIL THE ANCHOR IS EXPANDED AGAINST THE SIDE OF THE HOLE.
4. TO PREVENT FROST ACTION THE HOLE SHOULD BE SEALED WITH CEMENT GROUT OR SULPHUR.

1 — **DETAIL— ROCK ANCHOR INSTALLATION**

N.T.S.



INSTALLATION PROCEDURE:

1. DIG VERTICAL HOLE EITHER BY HAND OR BY USING POWER AUGER OR BACKHOE.
2. CUT SLOT FOR ANCHOR.
3. ASSEMBLE ANCHOR TO ANCHOR ROD AND LOWER INTO HOLE WITH EDGE MARKED 'TOP SIDE' UP.
4. THE PLATE OF THE ANCHOR SHOULD BE HARD AGAINST THE EDGE OF THE HOLE.
5. BACKFILL HOLE, FIRST PUTTING 100mm–150mm (APPROX. SIZE) ROCKS ABOVE THE ANCHOR. TAMP FIRMLY, PREFERABLY USING A HYDRAULIC TAMPER.

2 — **DETAIL— PLATE ANCHOR INSTALLATION**

N.T.S.

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

ANCHOR INSTALLATION DETAILS

SHEET 1 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

CBCL LIMITED
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ISO 9001 CERTIFIED

Contract No: 090630.00

Drawing No: E9905

Revision: 0

NOTES:

1. CONTRACTOR SHALL CHOOSE THE ANCHOR METHOD DEPENDANT ON FIELD CONDITIONS. ALTERNATE ANCHORING (i.e. LOG, ROCK, OR SCREW) MAY BE USED DEPENDANT ON FIELD CONDITIONS IN CONSULTATION WITH THE ENGINEER.
2. INSTALL A MAXIMUM OF TWO GUYS PER ANCHOR.

Drawing File: E9905.dwg Date: 6/29/2009 9:31 PM

BILL OF MATERIALS (TABLE E9905–1)

ITEM	QTY.	DESCRIPTION	STD. OF ACCEPTANCE
H57	1	ANCHOR, ROCK, HOT–DIPPED GALVANIZED, DOUBLE THIMBLE SIDE EYE (PER CSA Std. C83.24M, No. 2)	CHANCE R315
H58	1	ANCHOR, PLATE STEEL, HOT–DIPPED GALVANIZED OR PAINTED BLACK (PER CSA Std. C83.72M, ANCHOR No. 20)	HYDEL 250SAP
H59	1	EXTENSION, ROCK ANCHOR, HOT–DIPPED GALVANIZED, 1200mm LONG, DOUBLE THIMBLE EYE (PER CSA Std. C83.114M ROD No. 2)	CHANCE 12696
H60	1	ROD, ANCHOR, DOUBLE THIMBLE EYE (PER CSA Std. C83.75M ROD No. 20 x 2130)	CHANCE 5357

SKYPOWER

SKYPOWER CORP
DIGBY WIND POWER PROJECT

ELECTRICAL STANDARD DETAIL

ANCHOR INSTALLATION DETAILS

SHEET 2 OF 2

Rev	Description	Date
0	ISSUED FOR TENDER	06/30/09
A	ISSUED FOR FINAL REVIEW	06/15/2009

Date:	Drawn	Designed
5/28/2009	LO'K	LO'K
Scale:	Checked	Approved
N.T.S.	RO'C	

CBCL LIMITED
Consulting Engineers
ISO 9001 CERTIFIED

Contract No: 090630.00
Drawing No: E9905
Revision: 0

Appendix A3

SKYPOWER CORP

DIGBY WIND POWER PROJECT

COLLECTION SYSTEM POLE SCHEDULE

Rev	Description	Date	By	Ckd	Approved
O	ISSUED FOR TENDER	6/30/09	LO'K	RO'C	
A	ISSUED FOR FINAL REVIEW	06/24/09	#REF!	#REF!	#REF!

CBCL LIMITED
Consulting Engineers

Date	Office	Title:
6/30/2009	Hfx	COLLECTION SYSTEM POLE SCHEDULE
Designed	Drawn	
LO'K	LO'K	

Schedule No. **SCHEDULE-B**

COLLECTION SYSTEM POLE SCHEDULE	Client: SKYPOWER CORP	Project No. 090630.00
	Project: DIGBY WIND POWER PROJECT	Schedule No. B / Page No. 1 of 4

POLE No.	HEIGHT	CLASS	WOOD/PRESERVATIVE	POLE INSTALLATION & FRAMING DETAILS			NOTE
				POLE SETTING	POWER	COMMUNICATION	
P100	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P101	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P102	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P103	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P104	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P105	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P106	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P107	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P108	40'	1	Red Pine, CCA	E9006	E9202	E9401	1
P109	40'	1	Red Pine, CCA	E9006		E9401	1,3
P110	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P111	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P112	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P113	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P114	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P115	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P116	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P117	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P118	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P200	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P201	40'	1	Red Pine, CCA	E9006		E9401	1, 3
P202	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P203	40'	1	Red Pine, CCA	E9006	E9202 (u/b)/E9214 (o/b)	E9401	1, 2
P204	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P205	40'	1	Red Pine, CCA	E9006	E9220	E9401	1, 3
P206	40'	1	Red Pine, CCA	E9006	E9220	E9401	1, 3
P207	40'	1	Red Pine, CCA	E9006	E9220	E9401	1, 3
P208	40'	1	Western Red Cedar, Untreated	E9006	E9220	E9401	1, 3
P209	40'	1	Red Pine, CCA	E9006	E9220	E9401	1, 3
P210	40'	1	Red Pine, CCA	E9006	E9205 (u/b)/E9219 (o/b)	E9401	1, 2
P211	40'	1	Red Pine, CCA	E9006	E9205	E9401	1
P212	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P213	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P214	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P215	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P216	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P217	40'	1	Western Red Cedar, Untreated	E9006	E9219	E9401	1
P218	40'	1	Western Red Cedar, Untreated	E9006	E9219	E9401	1
P219	40'	1	Western Red Cedar, Untreated	E9006	E9219	E9401	1
P220	40'	1	Western Red Cedar, Untreated	E9006	E9214	E9401	1
P221	40'	1	Western Red Cedar, Untreated	E9006	E9214	E9401	1
P222	40'	1	Western Red Cedar, Untreated	E9006	E9219	E9401	1
P223	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P224	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P225	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P300	40'	1	Red Pine, CCA	E9006	E9202	E9401	1
P301	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P302	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P303	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P304	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P305	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P306	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P307	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P308	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P309	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P310	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P311	40'	1	Red Pine, CCA	E9006	E9219	E9401	1

COLLECTION SYSTEM POLE SCHEDULE	Client: SKYPOWER CORP	Project No. 090630.00
	Project: DIGBY WIND POWER PROJECT	Schedule No. B / Page No. 2 of 4

POLE No.	HEIGHT	CLASS	WOOD/PRESERVATIVE	POLE INSTALLATION & FRAMING DETAILS			NOTE
				POLE SETTING	POWER	COMMUNICATION	
P312	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P400	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P401	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P402	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P403	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P404	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P405	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P406	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P407	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P408	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P409	40'	1	Western Red Cedar, Untreated	E9006	E9220	E9401	1
P410	40'	1	Western Red Cedar, Untreated	E9006	E9220	E9401	1
P411	40'	1	Western Red Cedar, Untreated	E9006	E9220	E9401	1
P412	40'	1	Western Red Cedar, Untreated	E9006	E9220	E9401	1
P413	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P414	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P415	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P416	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P417	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P418	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P419	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P420	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P421	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P422	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P423	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P424	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P425	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P426	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P427	40'	1	Red Pine, CCA	E9006	E9217 (u/b)/E9217 (o/b)	E9401	1, 2
P428	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P429	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P430	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P431	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P432	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P433	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P434	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P435	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P436	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P437	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P438	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P439	40'	1	Western Red Cedar, Untreated	E9006	E9220	E9401	1
P440	40'	1	Western Red Cedar, Untreated	E9006	E9202 (u/b)/E9219 (o/b)	E9401	1, 2
P441	40'	1	Red Pine, CCA	E9006	E9202	E9401	1
P500	40'	1	Red Pine, CCA	E9006	E9202	E9401	1
P501	40'	1	Red Pine, CCA	E9006	E9202 (u/b)/E9219 (o/b)	E9401	1, 2
P502	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P503	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P504	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P505	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P506	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P507	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P508	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P509	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P510	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P511	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P512	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P513	40'	1	Red Pine, CCA	E9006	E9220	E9401	1

COLLECTION SYSTEM POLE SCHEDULE

Client: SKYPOWER CORP
Project No: 090630.00
Project: DIGBY WIND POWER PROJECT
Schedule No.: B

POLE No.	HEIGHT	CLASS	WOOD/PRESERVATIVE	POLE INSTALLATION & FRAMING DETAILS			NOTE
				POLE SETTING	POWER	COMMUNICATION	
P514	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P515	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P516	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P517	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P518	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P519	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P520	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P521	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P522	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P523	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P524	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P525	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P526	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P527	40'	1	Red Pine, CCA	E9006	E9202 (u/b)/E9219 (o/b)	E9401	1, 2
P528	40'	1	Red Pine, CCA	E9006	E9202	E9401	1
P600	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P601	40'	1	Red Pine, CCA	E9006	E9202	E9401	
P602	40'	1	Red Pine, CCA	E9006	E9202 (u/b)/E9219 (o/b)	E9401	1, 2
P603	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P604	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P605	40'	1	Western Red Cedar, Untreated	E9006	E9220	E9401	1
P606	40'	1	Western Red Cedar, Untreated	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P607	40'	1	Red Pine, CCA	E9006	E9201 (u/b)/E9219(o/b)	E9401	1, 2
P608	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P609	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P610	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P611	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P612	40'	1	Red Pine, CCA	E9006	E9201 (u/b)/E9219(o/b)	E9401	1, 2
P613	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P614	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P615	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P616	40'	1	Red Pine, CCA	E9006	E9214 (u/b)/E9214 (o/b)	E9401	1, 2
P617	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P618	40'	1	Red Pine, CCA	E9006	E9201 (u/b)/E9219(o/b)	E9401	1, 2
P619	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P620	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P621	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P622	40'	1	Red Pine, CCA	E9006	E9201 (u/b)/E9219(o/b)	E9401	1, 2
P623	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P624	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P625	40'	1	Red Pine, CCA	E9006	E9220	E9401	1
P626	40'	1	Red Pine, CCA	E9006	E9201 (u/b)/E9219(o/b)	E9401	1, 2
P627	40'	1	Red Pine, CCA	E9006	E9202 (u/b)/E9219 (o/b)	E9401	1, 2
P628	40'	1	Red Pine, CCA	E9006		E9401	1, 3
P629	40'	1	Red Pine, CCA	E9006	E9202	E9401	1
P630	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P631	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P632	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P633	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P634	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P635	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P636	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P637	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P638	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P639	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P640	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P641	40'	1	Western Red Cedar, Untreated	E9006	E9202	E9401	1

COLLECTION SYSTEM POLE SCHEDULE	Client: SKYPOWER CORP	Project No. 090630.00
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POLE No.	HEIGHT	CLASS	WOOD/PRESERVATIVE	POLE INSTALLATION & FRAMING DETAILS			NOTE
				POLE SETTING	POWER	COMMUNICATION	
P642	40'	1	Western Red Cedar, Untreated	E9006		E9401	1, 3
P643	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P644	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P645	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P700	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P701	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P702	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P703	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P704	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P705	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P706	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P707	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P708	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P709	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P710	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P711	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P712	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P713	40'	1	Red Pine, CCA	E9006	E9202	E9401	1
P714	40'	1	Red Pine, CCA	E9006	E9217	E9401	1
P715	40'	1	Red Pine, CCA	E9006	E9202	E9401	1
P716	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P800	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P801	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P802	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P803	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P804	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P805	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P806	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P807	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P808	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P809	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P810	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P811	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P812	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P813	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P814	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P815	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P816	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P817	40'	1	Red Pine, CCA	E9006	E9201	E9401	1
P900	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P901	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P902	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P903	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P904	40'	1	Red Pine, CCA	E9006	E9214	E9401	1
P905	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P906	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P907	40'	1	Red Pine, CCA	E9006	E9219	E9401	1
P908	40'	1	Red Pine, CCA	E9006	E9201	E9401	1

CBCL LIMITED
Consulting Engineers

Rev	Description	Date	By	Ckd	Approved
O	ISSUED FOR TENDER	6/30/2009	LO'K	RO'C	

Date	Office	Title:
6/30/2009	Hfx	COLLECTION SYSTEM POLE SCHEDULE
Designed	Drawn	
LO'K	LO'K	
Schedule No.	SCHEDULE-B	

Appendix A4



SKYPOWER CORP

DIGBY WIND POWER PROJECT

BILL OF MATERIALS

CBCL LIMITED
Consulting Engineers

Rev	Description	Date	By	Ckd	Approved
O	ISSUED FOR TENDER	6/30/09	LO'K	RO'C	
A	ISSUED FOR FINAL REVIEW	06/15/09	LO'K	RO'C	

Date	Office	Title:
06/15/09	Hfx	BILL OF MATERIALS
Designed	Drawn	
LO'K	LO'K	

Schedule No. **SCHEDULE-A**

BILL OF MATERIALS

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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
A1a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 2.55kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217253	OHIO BRASS (HUBBELL)	
A2a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 5.1kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217255	OHIO BRASS (HUBBELL)	
A3a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 7.65kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217258	OHIO BRASS (HUBBELL)	
A4a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 8.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217259	OHIO BRASS (HUBBELL)	
A5a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 10.2kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217260	OHIO BRASS (HUBBELL)	
A6a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 12.7kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217263	OHIO BRASS (HUBBELL)	
A7a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 15.3kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217265	OHIO BRASS (HUBBELL)	
A8a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 17.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217267	OHIO BRASS (HUBBELL)	
A9a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 19.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217270	OHIO BRASS (HUBBELL)	
A10a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 22.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217272	OHIO BRASS (HUBBELL)	

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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
A11a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 24.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217274	OHIO BRASS (HUBBELL)	
A12a		each	NORMAL DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 29.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217279	OHIO BRASS (HUBBELL)	
A1b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 2.55kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217603	OHIO BRASS (HUBBELL)	
A2b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 5.1kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217605	OHIO BRASS (HUBBELL)	
A3b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 7.65kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217608	OHIO BRASS (HUBBELL)	
A4b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 8.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217609	OHIO BRASS (HUBBELL)	
A5b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 10.2kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217610	OHIO BRASS (HUBBELL)	
A6b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 12.7kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217613	OHIO BRASS (HUBBELL)	
A7b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 15.3kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217615	OHIO BRASS (HUBBELL)	
A8b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 17.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217617	OHIO BRASS (HUBBELL)	

BILL OF MATERIALS

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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
A9b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 19.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217620	OHIO BRASS (HUBBELL)	
A10b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 22.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217622	OHIO BRASS (HUBBELL)	
A11b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 24.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217624	OHIO BRASS (HUBBELL)	
A12b		each	HEAVY-DUTY GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 29.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		217629	OHIO BRASS (HUBBELL)	
A1c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 2.55kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218603	OHIO BRASS (HUBBELL)	
A2c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 5.1kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218605	OHIO BRASS (HUBBELL)	
A3c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 7.65kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218608	OHIO BRASS (HUBBELL)	
A4c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 8.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218609	OHIO BRASS (HUBBELL)	
A5c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 10.2kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218610	OHIO BRASS (HUBBELL)	
A6c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 12.7kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218613	OHIO BRASS (HUBBELL)	

BILL OF MATERIALS	Client: SKYPOWER CORP	Volume: 090630.00	
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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
A7c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 15.3kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218615	OHIO BRASS (HUBBELL)	
A8c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 17.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218617	OHIO BRASS (HUBBELL)	
A9c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 19.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218620	OHIO BRASS (HUBBELL)	
A10c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 22.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218622	OHIO BRASS (HUBBELL)	
A11c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 24.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218624	OHIO BRASS (HUBBELL)	
A12c		each	RISER POLE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 29.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		218629	OHIO BRASS (HUBBELL)	
A1d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 2.55kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300703	OHIO BRASS (HUBBELL)	
A2d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 5.1kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300705	OHIO BRASS (HUBBELL)	
A3d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 7.65kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300708	OHIO BRASS (HUBBELL)	
A4d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 8.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300709	OHIO BRASS (HUBBELL)	

BILL OF MATERIALS

Client: SKYPOWER CORP | Nobility: 090630.00

Project: DIGBY WIND POWER PROJECT | Schedule No.: A |

B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
A5d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 10.2kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300710	OHIO BRASS (HUBBELL)	
A6d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 12.7kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300713	OHIO BRASS (HUBBELL)	
A7d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 15.3kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300715	OHIO BRASS (HUBBELL)	
A8d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 17.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300717	OHIO BRASS (HUBBELL)	
A9d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 19.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300720	OHIO BRASS (HUBBELL)	
A10d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 22.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300722	OHIO BRASS (HUBBELL)	
A11d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 24.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300724	OHIO BRASS (HUBBELL)	
A12d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 29.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300729	OHIO BRASS (HUBBELL)	
A1e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 2.55kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*003	OHIO BRASS (HUBBELL)	
A2e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 5.1kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*005	OHIO BRASS (HUBBELL)	

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A3e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 7.65kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*008	OHIO BRASS (HUBBELL)	
A4e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 8.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*009	OHIO BRASS (HUBBELL)	
A5e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 10.2kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*010	OHIO BRASS (HUBBELL)	
A6e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 12.7kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*013	OHIO BRASS (HUBBELL)	
A7e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 15.3kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*015	OHIO BRASS (HUBBELL)	
A8e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 17.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*017	OHIO BRASS (HUBBELL)	
A9e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 19.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*020	OHIO BRASS (HUBBELL)	
A10e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 22.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*022	OHIO BRASS (HUBBELL)	
A11e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 24.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*024	OHIO BRASS (HUBBELL)	
A12e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 29.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*029	OHIO BRASS (HUBBELL)	

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A13d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 31.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300731	OHIO BRASS (HUBBELL)	
A14d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 36.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300736	OHIO BRASS (HUBBELL)	
A15d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 39.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300739	OHIO BRASS (HUBBELL)	
A16d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 42.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300742	OHIO BRASS (HUBBELL)	
A17d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 48.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300748	OHIO BRASS (HUBBELL)	
A18d		each	INTERMEDIATE-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 57.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		300757	OHIO BRASS (HUBBELL)	
A13e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 31.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*031	OHIO BRASS (HUBBELL)	
A14e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 36.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*036	OHIO BRASS (HUBBELL)	
A15e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 39.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*039	OHIO BRASS (HUBBELL)	
A16e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 42.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*042	OHIO BRASS (HUBBELL)	

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A17e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 48.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*048	OHIO BRASS (HUBBELL)	
A18e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 57.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*057	OHIO BRASS (HUBBELL)	
A19e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 70.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*070	OHIO BRASS (HUBBELL)	
A20e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 76.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*076	OHIO BRASS (HUBBELL)	
A21e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 84.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*084	OHIO BRASS (HUBBELL)	
A22e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 88.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*088	OHIO BRASS (HUBBELL)	
A23e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 98.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*098	OHIO BRASS (HUBBELL)	
A24e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 106.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*106	OHIO BRASS (HUBBELL)	
A25e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 115.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*115	OHIO BRASS (HUBBELL)	
A26e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 131.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*131	OHIO BRASS (HUBBELL)	

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A27e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 140.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*140	OHIO BRASS (HUBBELL)	
A28e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 144.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*144	OHIO BRASS (HUBBELL)	
A29e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 152.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*152	OHIO BRASS (HUBBELL)	
A30e		each	STATION-CLASS, POLYMER-HOUSED, GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 180.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, 675N-m CANTILEVER STRENGTH (MIN.), TINNED COPPER EYEBOLT TERMINALS		31*180	OHIO BRASS (HUBBELL)	
A1f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 2.55kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611503	HUBBELL	
A2f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 5.1kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611505	HUBBELL	
A3f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 7.65kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611508	HUBBELL	
A4f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 8.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611509	HUBBELL	
A5f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 10.2kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611510	HUBBELL	
A6f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 12.7kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611513	HUBBELL	

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A7f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 15.3kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611515	HUBBELL	
A8f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 17.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611517	HUBBELL	
A9f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 19.5kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611520	HUBBELL	
A10f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 22.0kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611522	HUBBELL	
A11f		each	NORMAL DUTY ELBOW-TYPE GAPLESS METAL-OXIDE VARISTER DISTRIBUTION-CLASS SURGE ARRESTER, 24.4kV MCOV, DESIGNED TO IEEE Std. C62.22, TESTED TO IEEE Std. C62.11, NON-FRAGMENTING, MOLDED EPDM SHIELD TO IEEE 592, FOR USE WITH 200A LOADBREAK BUSHINGS c/w OPERATING EYE		611524	HUBBELL	
B41	2	each	34.5kV RECLOSER FOR PROTECTION OF OVERHEAD COLLECTION CIRCUITS				4
B42	1	each	34.5kV CIRCUIT BREAKER FOR PROTECTION OF POWER FACTOR CORRECTION EQUIPMENT				4
B43	1	each	34.5kV CIRCUIT SWITCHER SUITABLE FOR DISCONNECTION AND ISOLATION OF CAPACITOR	090630.00-SP-E06			2
B51	1	each	69kV CIRCUIT BREAKER FOR POWER TRANSFORMER PROTECTION	090630.00-SP-E01			2
C1			CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 2 PIN, 95mm x 120mm x 1830mm, DRILLED BEFORE TREATMENT (REFER TO DRAWING Exxx)		--	STELLA-JONES	

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C2a			CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT (REFER TO DRAWING Exxx)		--	STELLA-JONES	
C2b			CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 6 PIN, 95mm x 120mm x 2440mm, DRILLED BEFORE TREATMENT c/w HOLES FOR 1550mm LONG CROSSARM BRACKET (REFER TO DRAWING Exxx); NOTE THAT CROSSARM MATCHES NSPI STANDARD SIX-PIN CROSSARM WITH THE EXCEPTION OF THE NOTED BRACKET HOLES		--	STELLA-JONES	
C3			CROSSARM, DOUGLAS FIR, CLASS '1' AS PER CSA STD. 0116, 4 PIN, 95mm x 120mm x 3050mm, DRILLED BEFORE TREATMENT (REFER TO DRAWING Exxx)		--	STELLA-JONES	
C4			CROSSARM, FIBREGLASS, HEAVY-DUTY DEADEND, TO MATCH CLASS '1' AS PER CSA STD. 0116, 10 PRE-DRILLED HOLES, 102mm x 152mm x 3658mm c/w ALL POLE-MOUNTING HARDWARE		PY12SD349-2E-SM	MACLEAN POWER SYSTEMS	
F1a		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, STANDARD SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 100A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		64xxx	S&C	
F1b		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, STANDARD SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR OVER 100A AND UP TO 200A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		64xxxR1	S&C	
F1c		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, "K" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 100A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		265xxx	S&C	3
F1d		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, "K" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR OVER 100A AND UP TO 200A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		265xxxR1	S&C	3
F1e		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, "T" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 200A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		279xxx	S&C	
F1f		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, "N" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 200A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		267xxxR3	S&C	

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F1g		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, "QR"/"QA" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 100A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		338xxx	S&C	
F1h		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, "QR"/"QA" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR OVER 100A AND UP TO 200A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		355xxx	S&C	
F1i		each	FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 34.5kV RATED, "DR"/"D" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 100A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		345xxx	S&C	
F2a		each	HIGH-PERFORMANCE FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 27kV RATED, STANDARD SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 100A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		334xxx	S&C	
F2b		each	HIGH-PERFORMANCE FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 27kV RATED, "K" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 200A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		335xxx	S&C	3
F2c		each	HIGH-PERFORMANCE FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 27kV RATED, "T" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 200A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		336xxx	S&C	
F2d		each	HIGH-PERFORMANCE FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 27kV RATED, "QR"/"QA" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 100A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		337xxx	S&C	
F2e		each	HIGH-PERFORMANCE FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 27kV RATED, "QR"/"QA" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR OVER 100A AND UP TO 200A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		356xxx	S&C	
F2f		each	HIGH-PERFORMANCE FUSELINK SUITABLE FOR FUSE CUTOUT UP TO 27kV RATED, "DR"/"D" SPEED, AMPACITY AS NOTED ("xxx" = AMPACITY), SUITABLE FOR INSTALLATION IN CUTOUT RATED FOR UP TO 100A CONTINUOUS, ACCEPTABLE FOR MULTIPLE TRANSFORMER INRUSH CURRENTS DUE TO AUTOMATIC RECLOSING FOLLOWING TEMPORARY FAULT CONDITIONS		346xxx	S&C	
F3a		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, "K" SPEED, AMPACITY AND VOLTAGE AS NOTED ("aaa" = AMPACITY, "v" = 2,3,4 WHERE 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SMD-20 OR COMPATIBLE FUSE HOLDER		70vaaa	S&C	

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F3b		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, STANDARD "E" SPEED, AMPACITY AND VOLTAGE AS NOTED ("aaa" = AMPACITY, "v" = 2,3,4 WHERE 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SMD-20 OR COMPATIBLE FUSE HOLDER		61vaaa	S&C	
F3c		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, SLOW "E" SPEED, AMPACITY AND VOLTAGE AS NOTED ("aaa" = AMPACITY, "v" = 2,3,4 WHERE 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SMD-20 OR COMPATIBLE FUSE HOLDER		71vaaa	S&C	
F3d		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, VERY SLOW "E" SPEED, AMPACITY AND VOLTAGE AS NOTED ("aaa" = AMPACITY, "v" = 2,3,4 WHERE 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SMD-20 OR COMPATIBLE FUSE HOLDER		60vaaa	S&C	
F4a		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, STANDARD "E" SPEED, AMPACITY AND VOLTAGE AS NOTED ("aaa" = AMPACITY, "v" = 0,2,3 WHERE 0 = 5.5kVmax, 2 = 17kVmax, AND 3 = 29kVmax), FOR USE WITH S&C SMD-40 OR COMPATIBLE FUSE HOLDER		82vaaa	S&C	
F4b		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, SLOW "E" SPEED, AMPACITY AND VOLTAGE AS NOTED ("aaa" = AMPACITY, "v" = 0,2,3 WHERE 0 = 5.5kVmax, 2 = 17kVmax, AND 3 = 29kVmax), FOR USE WITH S&C SMD-40 OR COMPATIBLE FUSE HOLDER		83vaaa	S&C	
F5a		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, STANDARD SPEED, AMPACITY AND VOLTAGE AS NOTED ("aaa" = AMPACITY, "v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12vaaaR4	S&C	
F5b		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "3E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v005R4	S&C	
F5c		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "5E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v007R4	S&C	
F5d		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "7E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v010R4	S&C	
F5e		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "10E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v015R4	S&C	

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F5f		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "13E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v020R4	S&C	
F5g		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "15E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v025R4	S&C	
F5h		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "20E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v030R4	S&C	
F5i		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "25E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v040R4	S&C	
F5j		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "30E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v050R4	S&C	
F5k		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "40E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v060R4	S&C	
F5l		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "50E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v075R4	S&C	
F5m		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "65E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v100R4	S&C	
F5n		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "80E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v125R4	S&C	
F5o		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "100E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v150R4	S&C	

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F5p		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "125E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v200R4	S&C	
F5q		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "150E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v250R4	S&C	
F5r		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "175E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v275R4	S&C	
F5s		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "200E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		12v300R4	S&C	
F6a		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "15E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v025R4	S&C	
F6b		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "20E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v030R4	S&C	
F6c		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "25E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v040R4	S&C	
F6d		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "30E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v050R4	S&C	
F6e		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "40E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v060R4	S&C	
F6f		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "50E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v075R4	S&C	

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F6g		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "65E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v100R4	S&C	
F6h		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "80E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v125R4	S&C	
F6i		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "100E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v150R4	S&C	
F6j		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "125E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v200R4	S&C	
F6k		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "150E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v250R4	S&C	
F6l		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "175E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v275R4	S&C	
F6m		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "200E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 1,2,3,4 WHERE 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		25v300R4	S&C	
F7		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED 210A CONTINUOUS, COORDINATING SPEED, 17kV VOLTAGE (MAX.), FOR USE WITH S&C SM-4 OR COMPATIBLE FUSE HOLDER		382210R4	S&C	
F8a		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, STANDARD SPEED, AMPACITY AND VOLTAGE AS NOTED ("aaa" = AMPACITY, "v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13vaaaR4	S&C	
F8b		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "3E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v005R4	S&C	

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F8c		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "5E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v007R4	S&C	
F8d		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "7E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v010R4	S&C	
F8e		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "10E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v015R4	S&C	
F8f		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "13E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v020R4	S&C	
F8g		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "15E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v025R4	S&C	
F8h		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "20E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v030R4	S&C	
F8i		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "25E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v040R4	S&C	
F8j		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "30E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v050R4	S&C	
F8k		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "40E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v060R4	S&C	
F8l		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "50E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v075R4	S&C	

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F8m		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "65E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v100R4	S&C	
F8n		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "80E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v125R4	S&C	
F8o		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "100E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v150R4	S&C	
F8p		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "125E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v200R4	S&C	
F8q		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "150E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v250R4	S&C	
F8r		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "175E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v275R4	S&C	
F8s		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "200E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v300R4	S&C	
F8t		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "250E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v400R4	S&C	
F8u		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "300E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v500R4	S&C	
F8v		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "400E", STANDARD SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		13v600R4	S&C	

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F9a		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "15E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v025R4	S&C	
F9b		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "20E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v030R4	S&C	
F9c		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "25E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v040R4	S&C	
F9d		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "30E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v050R4	S&C	
F9e		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "40E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v060R4	S&C	
F9f		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "50E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v075R4	S&C	
F9g		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "65E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v100R4	S&C	
F9h		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "80E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v125R4	S&C	
F9i		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "100E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v150R4	S&C	
F9j		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "125E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v200R4	S&C	

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F9k		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "150E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v250R4	S&C	
F9l		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "175E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v275R4	S&C	
F9m		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "200E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v300R4	S&C	
F9n		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "250E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v400R4	S&C	
F9o		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "300E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v500R4	S&C	
F9p		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED "400E", SLOW SPEED, VOLTAGE AS NOTED ("v" = 0,1,2,3,4 WHERE 0 = 4.76kVmax, 1 = 8.3kVmax, 2 = 17kVmax, 3 = 27kVmax, AND 4 = 38kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		26v600R4	S&C	
F10a		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED 410A CONTINUOUS, COORDINATING SPEED, VOLTAGE AS NOTED ("v" = 1,2 WHERE 1 = 8.3kVmax AND 2 = 17kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		38v410R4	S&C	
F10b		each	OUTDOOR DISTRIBUTION FUSE UNIT UP TO 34.5kV, RATED 420A CONTINUOUS, COORDINATING SPEED, VOLTAGE AS NOTED ("v" = 1,2 WHERE 1 = 8.3kVmax AND 2 = 17kVmax), FOR USE WITH S&C SM-5 OR COMPATIBLE FUSE HOLDER		38v420R4	S&C	
F11a		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV, RATED 1A CONTINUOUS, STANDARD SPEED, VOLTAGE AS NOTED ("v" = 4,5,6 WHERE 4 = 34.5kVnom, 5 = 46kVnom, AND 6 = 69kVnom), FOR USE WITH S&C SMD-1A OR COMPATIBLE FUSE HOLDER		44v001R1	S&C	
F11b		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV, RATED STANDARD "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("v" = 4,5,6 WHERE 4 = 34.5kVnom, 5 = 46kVnom, AND 6 = 69kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-1A OR COMPATIBLE FUSE HOLDER		44vaaaR1	S&C	

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F11c		each	OUTDOOR TRANSMISSION FUSE UNIT 115/138kV, RATED STANDARD "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("aaa" = AMPACITY), FOR USE WITH S&C SMD-1A OR COMPATIBLE FUSE HOLDER		529aaaR1	S&C	
F12a		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV, RATED SLOW "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("v" = 4,5,6 WHERE 4 = 34.5kVnom, 5 = 46kVnom, AND 6 = 69kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-1A OR COMPATIBLE FUSE HOLDER		45vaaaR1	S&C	
F12b		each	OUTDOOR TRANSMISSION FUSE UNIT 115/138kV, RATED SLOW "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("aaa" = AMPACITY), FOR USE WITH S&C SMD-1A OR COMPATIBLE FUSE HOLDER		539aaaR1	S&C	
F13		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV, RATED VERY SLOW "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("v" = 4,5,6 WHERE 4 = 34.5kVnom, 5 = 46kVnom, AND 6 = 69kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-1A OR COMPATIBLE FUSE HOLDER		56vaaaR1	S&C	
F14a		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 46kV, RATED 1A CONTINUOUS, STANDARD SPEED, VOLTAGE AS NOTED ("v" = 4,5 WHERE 4 = 34.5kVnom AND 5 = 46kVnom), FOR USE WITH S&C SMD-2C OR COMPATIBLE FUSE HOLDER		46v001R3	S&C	
F14b		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 46kV, RATED STANDARD "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("v" = 4,5 WHERE 4 = 34.5kVnom AND 5 = 46kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-2C OR COMPATIBLE FUSE HOLDER		46vaaaR3	S&C	
F15		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 46kV, RATED SLOW "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("v" = 4,5 WHERE 4 = 34.5kVnom AND 5 = 46kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-2C OR COMPATIBLE FUSE HOLDER		48vaaaR3	S&C	
F16		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 46kV, RATED VERY SLOW "E" SLOW, VOLTAGE AND AMPACITY AS NOTED ("v" = 4,5 WHERE 4 = 34.5kVnom AND 5 = 46kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-2C OR COMPATIBLE FUSE HOLDER		57vaaaR3	S&C	
F17a		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 115kV, RATED 1A CONTINUOUS, STANDARD SPEED, VOLTAGE AS NOTED ("v" = 6,8 WHERE 6 = 69kVnom AND 8 = 115kVnom), FOR USE WITH S&C SMD-2B OR COMPATIBLE FUSE HOLDER		46v001R4	S&C	
F17b		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 138kV NOMINAL, RATED 1A CONTINUOUS, STANDARD SPEED, FOR USE WITH S&C SMD-2B OR COMPATIBLE FUSE HOLDER		469001R5	S&C	

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F17c		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 115kV, RATED STANDARD "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("v" = 6,8,9 WHERE 6 = 69kVnom AND 8 = 115kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-2B OR COMPATIBLE FUSE HOLDER		46vaaaR4	S&C	
F17d		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 138kV NOMINAL, RATED STANDARD "E" SPEED, AMPACITY AS NOTED ("aaa" = AMPACITY), FOR USE WITH S&C SMD-2B OR COMPATIBLE FUSE HOLDER		469aaaR5	S&C	
F18a		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 115kV, RATED SLOW "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("v" = 6,8 WHERE 6 = 69kVnom AND 8 = 115kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-2B OR COMPATIBLE FUSE HOLDER		48vaaaR4	S&C	
F18b		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 138kV NOMINAL, RATED SLOW "E" SPEED, AMPACITY AS NOTED ("aaa" = AMPACITY), FOR USE WITH S&C SMD-2B OR COMPATIBLE FUSE HOLDER		489aaaR5	S&C	
F19		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 115kV, RATED VERY SLOW "E" SPEED, VOLTAGE AND AMPACITY AS NOTED ("v" = 6,8 WHERE 6 = 69kVnom AND 8 = 115kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-2B OR COMPATIBLE FUSE HOLDER		57vaaaR4	S&C	
F20a		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV NOMINAL, RATED 1A CONTINUOUS, STANDARD SPEED, FOR USE WITH S&C SMD-3 OR COMPATIBLE FUSE HOLDER		676001	S&C	
F20b		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV NOMINAL, RATED STANDARD "E" SPEED, AMPACITY AS NOTED ("aaa" = AMPACITY), FOR USE WITH S&C SMD-3 OR COMPATIBLE FUSE HOLDER		676aaa	S&C	
F21		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV NOMINAL, RATED SLOW "E" SPEED, AMPACITY AS NOTED ("aaa" = AMPACITY), FOR USE WITH S&C SMD-3 OR COMPATIBLE FUSE HOLDER		686aaa	S&C	
F22		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV NOMINAL, RATED VERY SLOW "E" SPEED, AMPACITY AS NOTED ("aaa" = AMPACITY), FOR USE WITH S&C SMD-3 OR COMPATIBLE FUSE HOLDER		696aaa	S&C	
F23		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV NOMINAL, RATED STANDARD "E" SPEED, VOLTAGE & AMPACITY AS NOTED ("v" = 4,5,6 WHERE 4 = 34.5kVnom, 5 = 46kVnom, AND 6 = 69kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-50 OR COMPATIBLE FUSE HOLDER		47vaaa	S&C	

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F24		each	OUTDOOR TRANSMISSION FUSE UNIT UP TO 69kV NOMINAL, RATED SLOW "E" SPEED, VOLTAGE & AMPACITY AS NOTED ("v" = 4,5,6 WHERE 4 = 34.5kVnom, 5 = 46kVnom, AND 6 = 69kVnom; "aaa" = AMPACITY), FOR USE WITH S&C SMD-50 OR COMPATIBLE FUSE HOLDER		49vaaa	S&C	
F25		each	INDOOR FUSISTOR UNIT, "E" SPEED, INDICATING STYLE FOR CLIP MOUNTING TO 15.5kV, VOLTAGE & AMPACITY AS NOTED ("v" = 0,1,2 WHERE 0 = 5.5kVmax, 1 = 8.3kVmax, AND 2 = 15.5kVmax; "aaa" = AMPACITY WHERE 000 = 1/2A)		27vaaa		
F26a		each	BAY-O-NET STYLE CURRENT SENSING FUSE, 6A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000353C04	COOPER	
F26b		each	BAY-O-NET STYLE CURRENT SENSING FUSE, 10A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000353C06	COOPER	
F26c		each	BAY-O-NET STYLE CURRENT SENSING FUSE, 15A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000353C08	COOPER	
F26d		each	BAY-O-NET STYLE CURRENT SENSING FUSE, 25A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000353C10	COOPER	
F26e		each	BAY-O-NET STYLE CURRENT SENSING FUSE, 40A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000353C12	COOPER	
F26f		each	BAY-O-NET STYLE CURRENT SENSING FUSE, 65A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000353C14	COOPER	
F26g		each	BAY-O-NET STYLE CURRENT SENSING FUSE, 100A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000353C16	COOPER	
F26h		each	BAY-O-NET STYLE CURRENT SENSING FUSE, 140A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000353C17	COOPER	

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F27a		each	BAY-O-NET STYLE DUAL SENSING FUSE, 3A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000358C03	COOPER	
F27b		each	BAY-O-NET STYLE DUAL SENSING FUSE, 8A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000358C05	COOPER	
F27c		each	BAY-O-NET STYLE DUAL SENSING FUSE, 15A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000358C08	COOPER	
F27d		each	BAY-O-NET STYLE DUAL SENSING FUSE, 25A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000358C10	COOPER	
F27e		each	BAY-O-NET STYLE DUAL SENSING FUSE, 50A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000358C12	COOPER	
F27f		each	BAY-O-NET STYLE DUAL SENSING FUSE, 65A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000358C14	COOPER	
F27g		each	BAY-O-NET STYLE DUAL SENSING FUSE, 100A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000358C16CB	COOPER	
F27h		each	BAY-O-NET STYLE DUAL SENSING FUSE, 140A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4000358C18CB	COOPER	
F28a		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 5A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C03	COOPER	
F28b		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 6A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C04	COOPER	

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F28c		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 8A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C05	COOPER	
F28d		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 12A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C06	COOPER	
F28e		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 15A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C07	COOPER	
F28f		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 25A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C09	COOPER	
F28g		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 40A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C11	COOPER	
F28h		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 50A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C12	COOPER	
F28i		each	BAY-O-NET STYLE DUAL ELEMENT FUSE, 65A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038108C14	COOPER	
F29a		each	BAY-O-NET STYLE HIGH AMPERE OVERLOAD FUSE, 65A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038361C03CB	COOPER	
F29b		each	BAY-O-NET STYLE HIGH AMPERE OVERLOAD FUSE, 100A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038361C04CB	COOPER	
F29c		each	BAY-O-NET STYLE HIGH AMPERE OVERLOAD FUSE, 125A CONTINUOUS CURRENT, FOR PROTECTION OF AND INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038361C05CB	COOPER	

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F29d		each	BAY-O-NET STYLE HIGH AMPERE OVERLOAD FUSE, SOLID LINK SHORTING BAR, FOR INSTALLATION IN TRANSFORMERS PER THE MANUFACTURER'S RECOMMENDATIONS ONLY		4038361C10CB	COOPER	
F30		each	UNDER-OIL BACK-UP CURRENT-LIMITING FUSE, FOR INSTALLATION IN TRANSFORMER IN CONJUNCTION WITH BAY-O-NET FUSES, 50kAICrms,sym, SUITABLE FOR INSTALLATION IN PARALLEL, AMPACITY ("aa") AND VOLTAGE ("v" = 3, 4, 5 FOR 8.3, 15.5, 23kV RESPECTIVELY) AS NOTED UP TO AND INCLUDING 40A & 23kV AND 50A & 15.5kV (PARALLEL FUSES REQUIRED ABOVE THESE RATINGS)		356v0aaM11M	COOPER	
F31a		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 7.8kV AND 40A EXPULSION FUSE		C70L-20KBG0	CHANCE (HUBBELL)	3
F31b		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 15kV AND 12A EXPULSION FUSE		C70L-11KBG0	CHANCE (HUBBELL)	3
F31c		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 15kV AND 25A EXPULSION FUSE		C70L-31KBG0	CHANCE (HUBBELL)	3
F31d		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 15kV AND 40A EXPULSION FUSE		C70L-21KBG0	CHANCE (HUBBELL)	3
F31e		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 25kV AND 12A EXPULSION FUSE		C70L-12KBG0	CHANCE (HUBBELL)	3
F31f		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 25kV AND 25A EXPULSION FUSE		C70L-32KBG0	CHANCE (HUBBELL)	3
F31g		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 25kV AND 40A EXPULSION FUSE		C70L-22KBG0	CHANCE (HUBBELL)	3
F31h		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 35kV AND 12A EXPULSION FUSE		C70L-13KBG0	CHANCE (HUBBELL)	3

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F31i		each	CURRENT LIMITING BACKUP FUSE FOR INSTALLATION ON CUTOUT ASSEMBLY, 50kAICsym, SPADE-SPADE FERRULES, TWO TINNED P.G. CLAMP TERMINALS, FOR 35kV AND 25A EXPULSION FUSE		C70L-33KBG0	CHANCE (HUBBELL)	3
G1			ONE WIRE GROUND CONNECTOR FOR SUBSTATION FENCE GROUNDING, 3" IPS PIPE TO #2/0 SOL.- #250KCMIL ALUMINUM		GAR 2029W	BURNDY	
G2			TWO WIRE GROUND CONNECTOR FOR SUBSTATION FENCE GROUNDING, 1 1/4" IPS PIPE TO #2/0- #250kcmil ALUMINUM		GP-1629W	BURNDY	
G3			CRIMPIT' OR 'SQUEEZON' COMPRESSION CONNECTOR FOR COPPER CONDUCTORS UP TO SIZE 250kcmil		TYPE YC-C	BURNDY	
G4			'CRIMPIT' OR 'SQUEEZON' COMPRESSION CONNECTOR FOR ALUMINUM CONDUCTORS UP TO SIZE #2/0 AWG		TYPE YP-U	BURNDY	
G5			'SERVIT' CONNECTOR, SUBSTATION FENCE GROUNDING (#2 TO #2/0)		KSU-23	BURNDY	
G6			ONE WIRE GROUND CONNECTOR FOR SUBSTATION FENCE GROUNDING, 1 1/4" IPS PIPE TO #2 SOL.- #250kcmil ALUMINUM		GAR 1629W	BURNDY	
G7			'OKLIP' CONNECTOR FOR SUBSTATION FENCE MESH CONNECTORS		KVS-28A	BURNDY	
G8			COMPRESSION SLEEVE CONNECTOR, #4/0 ACSR/AASC TO #2/0 AWG COPPER, FOR SUBSTATION FENCE GROUNDING		YSD28R26R	BURNDY	
G9		each	1800mm X 1200mm GROUND MAT C/W #6 AWG CU GROUND CONNECTOR		6466GCM1	ERICO/ CADWELD	

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G10		each	3m x 13mm (MIN.) DIA. COPPER-CLAD (10mil) STEEL GROUND ROD, POINTED, UL LISTED		611300	ERICO/ CADWELD	
G12		each	GROUND ROD TO GRID CONNECTOR, COMPRESSION		YGLR-C	BURNDY	
G13			GROUND GRID CROSS CONNECTOR, COMPRESSION		YGL-C	BURNDY	
G14			450MM FLEXIBLE BRAIDED GROUND STRAP, TINNED COPPER ALLOY, FERRULES CURVED TO SUIT 34mm (APPROX.) OUTER DIAMETER PIPE		BF18-CG7	BURNDY	
G15			'SERVIT' CONNECTOR, MECHANICAL GROUNDING (#4/0 TO FLAT)		KC28	BURNDY	
G16		each	19mm DIAMETER X 2130mm LONG COPPER LIGHTING MAST c/w TWO (2) BASES FOR POLE MOUNTING		LPC427	ERICO/CADWELD	
G17		each	13mm DIAMETER X 300mm LONG COPPER LIGHTNING POINT c/w UNIVERSAL MOUNTING BASE FOR SECURING TO ROOF		LPC262	ERICO/CADWELD	
G18		each	6mm x 254mm x 406mm CSA-APPROVED GROUNDING PLATE ELECTRODE, HOT-DIPPED GALVANIZED, ACCEPTABLE FOR INSTALLATION IN ATLANTIC CANADA		1016.GPG	HYDEL	
G19			450MM FLEXIBLE BRAIDED GROUND STRAP, TINNED COPPER ALLOY, FLAT FERRULES WITH SINGLE 11mm DIA, (MIN.) BOLT HOLE IN EACH, 250kcmil CROSS-SECTIONAL AREA (MIN.) TO CSA C22.2 No. 41		FB3XD18-1	BLACKBURN	
G20			#2/0 AWG BARE COPPER CONDUCTOR, 7 STRAND MHD				

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					CAT. NO.	MANUFACTURER	
H1			BOLT, LAG, HOT-DIPPED GALVANIZED, FETTER DRIVE WITH PILOT POINT, 13mm THREAD x 100mm LONG (AS PER CSA STD. C83 1970, ITEM S-1)		508754	CHANCE (HUBBELL)	
H2			BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 10mm THREAD x 114mm LONG (AS PER CSA STD. C83 1970, ITEM B-3) c/w MATCHING NUT		8604 1/2	CHANCE (HUBBELL)	
H3			WASHER, HOT-DIPPED GALVANIZED, LOCK, 11mm DIA. HOLE (AS PER CSA STD. C83 1970, ITEM W5)		J134	MACLEAN	
H4			BOLT, SPOOL, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x 300mm SECTION BETWEEN SHOULDERS SHALL BE HEXAGONAL OR FLAT (AS PER CSA STD. C83.25M, TYPE 2, No. 3, EXCEPT THREADS AND NUTS IN IMPERIAL) c/w TWO (2) LOCK WASHERS; FOUR (4) NUTS; AND, ALTERNATELY, ONE (1) SQUARE WASHER SUPPLIED LOOSE OR ONE (1) WASHER FIXED IN POSITION TO THE BOLT SHANK		7744	CHANCE (HUBBELL)	
H5			NUT, HOT-DIPPED GALVANIZED, THREAD DIA. TO MATCH ASSOCIATED BOLT AS REQUIRED				
H6a			LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 3/8" THREAD DIA. TO MATCH ASSOCIATED BOLT		3530	CHANCE (HUBBELL)	
H6b			LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 1/2" THREAD DIA. TO MATCH ASSOCIATED BOLT		3531	CHANCE (HUBBELL)	
H6c			LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 5/8" THREAD DIA. TO MATCH ASSOCIATED BOLT		3532	CHANCE (HUBBELL)	
H6d			LOCKNUT (PALNUT), HOT-DIPPED GALVANIZED, 3/4" THREAD DIA. TO MATCH ASSOCIATED BOLT		3533	CHANCE (HUBBELL)	
H7			PIN, POLE TOP, HOT-DIPPED GALVANIZED, 25mm LEAD THREAD LENGTH, 5kN STRENGTH MINIMUM (AS PER CSA STD. C83.90M, PIN No. 1), EXCEPT WITH EXTRA 14mm DIA. HOLE 160mm DOWN FROM TOP HOLE AND 44mm UP FROM BOTTOM SLOT		2415PT	HYDEL	

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H8			WASHER, HOT-DIPPED GALVANIZED, LOCK, 19mm DIA. HOLE (AS PER CSA STD. C83 1970, ITEM W5)		J140	MACLEAN	
H9			PIN, CROSSARM, LONG SHANK, HOT-DIPPED GALVANIZED, 25mm LEAD THREAD LENGTH, 10kN STRENGTH MINIMUM (AS PER CSA STD. C83.88M, PIN No. 4; LEAD THREAD AS PER CSA STD. C83.92M, TYPE Y)				
H10			WASHER, HOT-DIPPED GALVANIZED, ROUND, 11mm DIA. HOLE		100RW	HYDEL	
H11			WASHER, HOT-DIPPED GALVANIZED, SQUARE, 57mm x 57mm x 5mm, 17mm DIA. HOLE		3624SW11	HYDEL	
H12			BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 5.6kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT		88xx	CHANCE (HUBBELL)	
H13			POLE DATING NAIL, HOT-DIPPED GALVANIZED, 5/8" DIA. HEAD ("year" = YEAR OF INSTALLATION)		C205-year	CHANCE (HUBBELL)	
H14			WASHER, HOT-DIPPED GALVANIZED, CURVED, 83mm x 83mm x 6mm, 17mm DIA. HOLE		1434CW11	HYDEL	
H15			HOOK, GUY, HOT-DIPPED GALVANIZED, AS PER CSA STD. C83.100-M, TYPE 'A', No. 1		34GH	HYDEL	
H16			CLEVIS, INSULATED, HOT-DIPPED GALVANIZED, CHANNEL TYPE, AS PER CSA STD. C83.70-M, CLEVIS No. 1		314CLU	HYDEL	
H17			PIN, CROSSARM, LONG SHANK, 10° DEFLECTION (ANGLE-TYPE), HOT-DIPPED GALVANIZED, 25mm LEAD THREAD LENGTH, 10kN STRENGTH MINIMUM (AS PER CSA STD. C83.91M, PIN No. 2, EXCEPT THAT THE PIN SHALL BE 150mm, MINIMUM, FROM THE BASE) c/w ALUMINUM BASE		334ANP	HYDEL	

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H18			PIN, POLE TOP, 10° DEFLECTION (ANGLE-TYPE), HOT-DIPPED GALVANIZED, 25mm LEAD THREAD LENGTH, 10kN STRENGTH MINIMUM (AS PER CSA STD. C83.89M)		64AT	HYDEL	
H19			WASHER, HOT-DIPPED GALVANIZED, ROUND, 21mm DIA. HOLE		200RW	HYDEL	
H20			BOLT, DOUBLE-ARMING FULL THREAD, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA Std. C83 1970, ITEM B-2 FULL THREAD; "xx" = LENGTH IN INCHES + 50) c/w FOUR (4) SQUARE NUTS		88xx	CHANCE (HUBBELL)	
H21			GALVANIZED STEEL EYE-NUT, 16mm DIA, EYE, ACCEPTING 16mm DIA. THREADED BOLT		58EN	HYDEL	
H22			BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 13mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3; "xx" = LENGTH IN INCHES) c/w MATCHING NUT		87xx	CHANCE (HUBBELL)	
H23			BOLT, OVAL-EYE, HOT-DIPPED GALVANIZED, 16mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-24; "xx" = LENGTH IN INCHES + 50) c/w MATCHING NUT		299xx	CHANCE (HUBBELL)	
H24a			CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM, FOR UP TO #2/0 AWG ACSR/AAC c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)		CUW26RE-1	BURNDY	
H24b			CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM, FOR UP TO 300kcmil AAC/266.8kcmil (18/1) ACSR c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)		CUW30A-E	BURNDY	
H24c			CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM, FOR UP TO 350kcmil AAC/336.4kcmil (26/7) ACSR c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)		CUW32R-E	BURNDY	
H24d			CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM, FOR UP TO 500kcmil AAC/477kcmil (18/1) ACSR c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)		CUW361R-E	BURNDY	

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H24e			CLAMP, DEAD-END, STRAIGHT-LINE, ALUMINUM, FOR UP TO 795kcmil AAC/636kcmil (26/7) ACSR c/w HOT-STICK EYE (AS PER CSA STD. C83.71M)		CUW391R-E	BURNDY	
H25a			COMPRESSION CONNECTOR; 'CRIMPIT'; SUITABLE FOR ALUMINUM, COPPER, OR ACSR (FOR CONDUCTOR SIZES UP TO #2/0 AWG ACSR/AASC) ; CSA CERTIFIED		YC-A	BURNDY	
H25b			WEDGE-TYPE CONNECTOR, SUITABLE FOR ALUMINUM OR ACSR (FOR CONDUCTOR SIZES LARGER THAN #2/0 AWG ACSR/AASC), CSA CERTIFIED		WCA (WEJTAP)	BURNDY	
H26a			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO .6" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		GW-1-C	MACLEAN	
H26b			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO .7" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-0-C	MACLEAN	
H26c			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO .87" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-1-C	MACLEAN	
H26d			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 1.05" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-2-C	MACLEAN	
H26e			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 1.19" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-3-C	MACLEAN	
H26f			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 1.37" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-4-C	MACLEAN	
H26g			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 1.49" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-6-C	MACLEAN	

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H26h			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 1.77" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-7-C	MACLEAN	
H26i			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 1.92" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-8-C	MACLEAN	
H26j			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 2.18" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		LS-9-C	MACLEAN	
H26k			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 2.33" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		ASC-10-C	MACLEAN	
H26l			CLAMP, CLEVIS-TYPE, ANGLE SUSPENSION, ALUMINUM, SUITABLE FOR UP TO 60° LINE ANGLE, FOR CONDUCTOR UP TO 2.55" DIA. c/w CLEVIS PIN, HOT-DIPPED GALVANIZED HARDWARE (CONDUCTOR SHALL NOT CONTACT ANY MATERIAL EXCEPT ALUMINUM)		ASC-11-C	MACLEAN	
H27			ALUMINUM POLE STRAP, 130mm DIA.		A48-26A	ALMAT	
H28			TREATED WOODEN MOULDING FOR GROUND WIRE, 22mm DIA. x 2440mm		701W	HYDEL	
H29			GALVANIZED STEEL WOOD STAPLES, 4mm DIA. x 50mm x 16mm		703	HYDEL	
H30a			WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING, FOR CABLE DIAMETERS 25.4mm TO 31.5mm, 7.161kN BREAKING STRENGTH		02203017	HUBBELL	
H30b			WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING, FOR CABLE DIAMETERS 31.7mm TO 37.8mm, 7.161kN BREAKING STRENGTH		02203018	HUBBELL	

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H30c			WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING, FOR CABLE DIAMETERS 38.1mm TO 44.2mm, 7.161kN BREAKING STRENGTH		02203019	HUBBELL	
H30d			WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING, FOR CABLE DIAMETERS 44.4mm TO 50.5mm, 9.563kN BREAKING STRENGTH		02203020	HUBBELL	
H30e			WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING, FOR CABLE DIAMETERS 50.8mm TO 63.2mm, 14.5kN BREAKING STRENGTH		02203021	HUBBELL	
H30f			WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING, FOR CABLE DIAMETERS 63.5mm TO 75.9mm, 14.5kN BREAKING STRENGTH		02203022	HUBBELL	
H30h			WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING, FOR CABLE DIAMETERS 76.2mm TO 88.6mm, 25.576kN BREAKING STRENGTH		02203023	HUBBELL	
H30i			WIRE MESH SUPPORT GRIP, SINGLE EYE, SPLIT MESH, ROD CLOSING, FOR CABLE DIAMETERS 88.9mm TO 101.3mm, 25.576kN BREAKING STRENGTH		02203024	HUBBELL	
H31a			CLAMP, DEAD-END, STRAIGHT-LINE STRAIN BUS, ALUMINUM, FOR UP TO #4/0 AWG ACSR/AAC c/w PULLING EYE (AS PER CSA STD. C83.71M)		DUW28A-E	BURNDY	
H31b			CLAMP, DEAD-END, STRAIGHT-LINE STRAIN BUS, ALUMINUM, FOR UP TO 350kcmil AAC/336.4kcmil (18/1) ACSR c/w PULLING EYE (AS PER CSA STD. C83.71M)		DUW31A-E	BURNDY	
H31c			CLAMP, DEAD-END, STRAIGHT-LINE STRAIN BUS, ALUMINUM, FOR UP TO 1000kcmil AAC/900kcmil (54/7) ACSR c/w PULLING EYE (AS PER CSA STD. C83.71M)		DUW44A-E	BURNDY	
H32			BRACE, CROSSARM, FLAT, HOT-DIPPED GALVANIZED STEEL (AS PER CSA STD. C83.21M, BRACE No. 3), 711mm LONG		28CAB	HYDEL	

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H33			BRACE, ANGLE CROSSARM, SINGLE PIECE "V", HOT-DIPPED GALVANIZED STEEL (AS PER CSA STD. C83.20M), 1525mm LONG, NEMA STANDARD		6953	CHANCE (HUBBELL)	
H34			WASHER, HOT-DIPPED GALVANIZED, ROUND, 14mm DIA. HOLE		138RW	HYDEL	
H35		each	SINGLE-PHASE CUTOUT POLE-MOUNTING BRACKET, GALVANIZED		IAC-18-5	MACLEAN	
H36			WASHER, GALVANIZED, ROUND, 17mm DIA. HOLE		J1084	JOSLYN	
H37			2400mm x 130mm STRAIGHT ALUMINUM CABLE GUARD c/w FLARED BASE		A48-14-A	ALMAT	
H38			BOLT, MACHINE, HOT-DIPPED GALVANIZED, SQUARE HEAD, 19mm THREAD x LENGTH AS REQUIRED (AS PER CSA STD. C83 1970, ITEM B-3, "xx" = LENGTH IN INCHES), 8.34kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT		89xx	CHANCE (HUBBELL)	
H39a			CLAMP TOP LINE POST INSULATOR ANGLE TRUNION CLAMP TO 30°, ALUMINUM, FOR #4 AWG - #4/0 AWG ACSR/AAC		ACP-057	MACLEAN	
H39b			CLAMP TOP LINE POST INSULATOR ANGLE TRUNION CLAMP TO 30°, ALUMINUM, FOR #1 AWG - 477kcmil (18/1) ACSR OR #1/0 AWG - 477kcmil AAC		ACP-084	MACLEAN	
H39c			CLAMP TOP LINE POST INSULATOR ANGLE TRUNION CLAMP TO 30°, ALUMINUM, FOR #3/0 AWG - 715.5kcmil (26/7) ACSR OR #4/0 AWG - 795kcmil AAC		ACP-106	MACLEAN	
H39d			CLAMP TOP LINE POST INSULATOR ANGLE TRUNION CLAMP TO 30°, ALUMINUM, FOR 556.5kcmil (30/7) - 1510.5kcmil (45/7) ACSR OR 715.5kcmil - 1590kcmil AAC		ACP-150	MACLEAN	

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H39e			CLAMP TOP LINE POST INSULATOR ANGLE TRUNION CLAMP TO 30°, ALUMINUM, FOR 605kcmil (30/19) - 1113kcmil (45/7) ACSR OR 795kcmil - 1192.5kcmil AAC		ACP-200	MACLEAN	
H40			POST-TYPE INSULATOR POLE-TOP MOUNTING BRACKET FOR UP TO 35kV INSTALLATION, DUCTILE IRON, 13/16" STUD OPENING, TWO BOLT OPENINGS SPACED AT APPROXIMATELY 8" SEPARATION		BPT-58G	MACLEAN	
H41a			CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM, FOR #4 AWG - #4/0 AWG ACSR/AAC		ACTS-057	MACLEAN	
H41b			CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM, FOR #1 AWG - 477kcmil (18/1) ACSR OR #1/0 AWG - 477kcmil AAC		ACTS-084	MACLEAN	
H41c			CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM, FOR #3/0 AWG - 715.5kcmil (26/7) ACSR OR #4/0 AWG - 795kcmil AAC		ACTS-106	MACLEAN	
H41d			CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM, FOR 556.5kcmil (30/7) - 1510.5kcmil (45/7) ACSR OR 715.5kcmil - 1590kcmil AAC		ACTS-150	MACLEAN	
H41e			CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM, FOR 605kcmil (30/19) - 1113kcmil (45/7) ACSR OR 795kcmil - 1192.5kcmil AAC		ACTS-200	MACLEAN	
H41f			CLAMP TOP LINE POST INSULATOR TRUNION CLAMP, ALUMINUM, FOR 1033.5kcmil (45/7) - 1431kcmil (45/7) ACSR OR 1192.5kcmil - 1510.5kcmil AAC		ACTS-230	MACLEAN	
H42			INSULATOR STUD, LONG SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 7-1/2" LONG SHANK c/w CAPTURED HARDWARE		J25250.1	MACLEAN	
H43			INSULATOR STUD, SHORT SHANK, HOT-DIPPED GALVANIZED, 3/4" DIA. STUD x 3/4" DIA. X 1-3/4" LONG SHANK c/w CAPTURED HARDWARE		J25249.1	MACLEAN	

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H44			CORRUGATED (ANNULAR) STEEL POLE CRIBBING, HOT-DIPPED GALVANIZED, 2100mm DIA. x 1200mm LONG (MINIMUM)		--	ARMTEC	
H45			POLE BEARING PLATE, HOT-DIPPED GALVANIZED, 6.35mm x 100mm x 100mm BENT ANGLE, CENTRAL OPENING FOR 19mm DIA. MACHINE BOLT AND FOUR (4) ADDITIONAL OPENINGS FOR 16mm DIA. LAG BOLTS		16PBP	HYDEL	
H46		each	SINGLE-PHASE CUTOUT CROSSARM-MOUNTING BRACKET, GALVANIZED, 5 $^{1}/_{4}$" CLEARANCE		C206-028	CHANCE (HUBBELL)	
H47		each	CROSS STRAP FOR MOUNTING TWO UNITS OF APPARATUS, GALVANIZED, 8 $^{1}/_{2}$" CENTRE-TO-CENTRE		C206-0190	CHANCE (HUBBELL)	
H48			DEADEND STRAIGHT LINE CLAMP, ALUMINUM, C/W HOT STICK EYE; #4/0 AWG TO 556.4kcmil AASC		GD-965A	FARGO	
H49			ALUMINUM COMPRESSION TERMINAL (LUG), 266.8kcmil AASC CONDUCTOR TO FLAT NEMA 1-HOLE PAD (CSA)		ATL	BLACKBURN	
H50			ALUMINUM COMPRESSION TERMINAL (LUG), 556.4kcmil AASC CONDUCTOR TO FLAT NEMA 2-HOLE PAD (CSA certified)		ATL	BLACKBURN	
H51			COPPER COMPRESSION TERMINAL (LUG), #4/0 AWG Cu CONDUCTOR TO FLAT NEMA 2-HOLE PAD (CSA)		YGHA	BURNDY	
H52			MACHINE BOLT, GALVANIZED, SQUARE HEAD, 3/4", LENGTH AS REQUIRED ("xx" = LENGTH IN INCHES), 8.34kN TENSILE STRENGTH (MIN.) c/w MATCHING NUT		89xx	CHANCE (HUBBELL)	
H53			ALUMINUM BOLTED TERMINAL (LUG), 266.8kcmil AASC CONDUCTOR TO FLAT NEMA 2-HOLE PAD (CSA)		A7M	HOMAC	

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H54			AMPACT TAP CONNECTOR FOR #266.8/556.4kcmil ACSR/AASC CONDUCTOR		STIRRUPS	AMPACT	
H55		each	66kV FUSE HOLDER CONNECTORS, ALUMINUM-ALLOY BODY, TIN-PLATED, GALVANIZED STEEL HARDWARE, SUITABLE FOR USE WITH ITEM 23		4741R2	S&C	
H56			TIN-PLATED COPPER COMPRESSION TERMINAL PLUG, FOR CONNECTION TO ALUMINUM OR ACSR CONDUCTOR (CSA approved)		YE-R, YE-W	BURNDY	
H57			ANCHOR, ROCK, HOT-DIPPED GALVANIZED, DOUBLE THIMBLE SIDE EYE (PER CSA Std. C83.24M, No. 2)		R315	CHANCE (HUBBELL)	
H58			ANCHOR, PLATE STEEL, HOT-DIPPED GALVANIZED OR PAINTED BLACK (PER CSA Std. C83.72M, ANCHOR No. 20)		250SAP	HYDEL	
H59			EXTENSION, ROCK ANCHOR, HOT-DIPPED GALVANIZED, 1200mm LONG, DOUBLE THIMBLE EYE (PER CSA Std. C83.114M ROD No. 2)		12696	CHANCE (HUBBELL)	
H60			ROD, ANCHOR, DOUBLE THIMBLE EYE (PER CSA Std. C83.75M ROD No. 20 x 2130)		5357	CHANCE (HUBBELL)	
H61			ULTRA-VIOLET STABILIZED RIGID PVC SERVICE ENTRANCE/WEATHERHEAD FITTING, 53mm		077286	IPEX	
H62			BOLTED BUS SUPPORT COUPLER, PIPE TO INSULATOR, 127mm BOLT CIRCLE FOR 78mm DIA. ALUMINUM PIPE (SCHEDULE 40)		ASBCC-L-5	HOMAC	
H63			SLIDE BUS SUPPORT, PIPE TO INSULATOR, 127mm BOLT CIRCLE FOR 78mm DIA. ALUMINUM PIPE (SCHEDULE 40)		ATB-L-5	HOMAC	

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H64			BOLTED "TEE" CONNECTOR, PIPE TO CABLE, 78mm DIA. ALUMINUM PIPE (SCHEDULE 40) TO 14.4-29.2mm DIA. AAC/ACSR CABLE		A6MT-L-100	HOMAC	
H65			BOLTED TERMINAL PIPE TO FLAT, 78mm DIA. ALUMINUM PIPE (SCHEDULE 40) TO 4-HOLE NEMA PAD		ABN-L-4NN	HOMAC	
H66			FLEXIBLE ALUMINUM STRAP, 103mm WIDE x 10mm THICK, STRAIGHT-THROUGH, 4-HOLE NEMA PADS		AVLS1-1170-4NN	HOMAC	
I1			INSULATOR, PIN-TYPE, 1" DIA. PIN, ASA CLASS 55-5, MUNSELL GREY COLOUR WITH BLACK SEMI-CONDUCTING GLAZE AS PER CEA (R&D) REPORT 77-36				
I2			INSULATOR, SECONDARY SPOOL TYPE, PORCELAIN ASA CLASS 53-2 OR POLYMER EQUIVALENT, MUNSELL GREY COLOUR, 1.36kN TENSION (MIN.) WHEN INSTALLED IN CLEVIS		99001 53-2 design	ENERSCAN	
I3			INSULATOR, SUSPENSION TYPE, AS PER ANSI STD. C29.2 ROUTINE PROOF TEST LOAD 5,000lbs, 127mm DIA. TOUGHENED GLASS PER ASA CLASS 52-9B OR 114mm DIA. PORCELAIN PER ASA CLASS 52-9A, MUNSELL GREY COLOUR, CLEVIS TYPE c/w CLEVIS BOLTS				
I4			INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 28kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS		DS-25M	MACLEAN	
I5			INSULATOR, 28kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, VERTICAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE		NPVN10XB005S0	MACLEAN	
I6a			INSULATOR, 28kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE		NPKN10XB005S0	MACLEAN	
I6b			INSULATOR, 28kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE c/w 5° GAIN BASE, HOT-DIPPED GALVANIZED		NPKG10XB005S0	MACLEAN	

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I7			INSULATOR, POLYMER DISTRIBUTION SUSPENSION TYPE, SINGLE-PIECE SILICON CONSTRUCTION WITH GALVANIZED STEEL REINFORCED EYEHOLES TO THE REQUIREMENTS OF ANSI C29.13, PROOF TEST LOAD 35kN AND TORSIONAL LOAD TO 50Nm, MUNSELL GREY COLOUR, 38kV-RATED WITH MINIMUM 25mm/kV LEAKAGE DISTANCE c/w CLEVIS BOLTS		DS-35M	MACLEAN	
I8			INSULATOR, 35kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, VERTICAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE		NPVN10XB006S0	MACLEAN	
I9a			INSULATOR, 35kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE		NPKN10XB006S0	MACLEAN	
I9b			INSULATOR, 35kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE c/w 5° GAIN BASE, HOT-DIPPED GALVANIZED		NPKG10XB006S0	MACLEAN	
I10a			INSULATOR, 46kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE c/w UNIVERSAL TRUNNION CLAMP SUITABLE FOR 0° - 45° LINE ANGLE		NPVN20XG13S0-U	MACLEAN	
I10b			INSULATOR, 46kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE c/w UNIVERSAL TRUNNION CLAMP SUITABLE FOR 0° - 45° LINE ANGLE, HORIZONTAL GAIN BASE (HOT-DIPPED GALVANIZED)		NPVV20XG13S0-U	MACLEAN	
I10c			INSULATOR, 46kV POLYMER DISTRIBUTION LINE POST TYPE, SINGLE-PIECE SILICON CONSTRUCTION, 16mm/kV LEAKAGE DISTANCE (MINIMUM), 5.5kN CANTILEVER DESIGN LOAD, HORIZONTAL TRUNION FITTING, INTEGRAL STUD MOUNTING BASE c/w UNIVERSAL TRUNNION CLAMP SUITABLE FOR 0° - 45° LINE ANGLE, VERTICAL GAIN BASE (HOT-DIPPED GALVANIZED)		NPVG20XG13S0-U	MACLEAN	
I11			34.5kV PORCELAIN STATION POST INSULATOR			LAPP	
I12			69kV POLYMER TRANSMISSION LINE INSULATOR			MACLEAN	
I13			69kV POLYMER HORIZONTAL LINE POST INSULATOR c/w HORIZONTAL CLAMPTOP, STEEL FLAT BASE		H212061VX05	MACLEAN	

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I14			69kV POLYMER STATION POST INSULATOR c/w HORIZONTAL CLAMPTOP, STEEL FLAT BASE			MACLEAN	
I15			138kV POLYMER TRANSMISSION LINE INSULATOR			MACLEAN	
I16			138kV POLYMER HORIZONTAL LINE POST INSULATOR c/w HORIZONTAL CLAMPTOP, STEEL FLAT BASE			MACLEAN	
I17			138kV POLYMER STATION POST INSULATOR c/w HORIZONTAL CLAMPTOP, STEEL FLAT BASE			MACLEAN	
I18			GUY STRAIN INSULATOR, PORCELAIN, ASA CLASS 54-4, MUNSELL GREY COLOUR, 89kN MIN. TENSILE STRENGTH, 76mm LEAKAGE DISTANCE, 40/23kV DRY/WET FLASHOVER		HCP-194	NGK-LOCKE	
I19			GUY STRAIN INSULATOR, FIBREGLASS, CLEVIS-CLEVIS, 243.8cm LONG x 19mm DIA., TWO (2) ROLLERS, MUNSELL GREY COLOUR, 93.4kN MIN. TENSILE STRENGTH, 970/500kV DRY/WET FLASHOVER		GS21096CC2	CHANCE (HUBBELL)	
I20			RESERVED FOR FUTURE USE				
G16			IRREVERSIBLE COMPRESSION CONNECTOR, #4/0 AWG CU RUN TO #4/0 AWG CU TAP		YGHP-C	BURNDY	
L1		each	400W METAL HALIDE OVERHEAD LUMINAIRE, 120V, R2 DISTRIBUTION, DROP GLASS LENS, STANDARD BALLAST, LAMP INCLUDED C/W PHOTOCELL, SINGLE LIGHTING SURGE ARRESTER, REMOVABLE POWER DOOR		CHMD400MR2DLG 120 -LPI-LSA1	LITHONIA	
L2		each	125W HIGH-PRESSURE SODIUM OVERHEAD LUMINAIRE, "COBRAHEAD", 120V, R2 DISTRIBUTION, DROP GLASS LENS, STANDARD BALLAST, LAMP INCLUDED C/W PHOTOCELL, SINGLE LIGHTING SURGE ARRESTER, REMOVABLE POWER DOOR				

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L3		each	88W LED OVERHEAD LUMINAIRE, 120V, LAMP INCLUDED C/W PHOTOCELL, SINGLE LIGHTING SURGE ARRESTER, REMOVABLE POWER DOOR		SATELLITE SERIES	LED ROADWAY LIGHTING	
M1			VINYL ELECTRICAL TAPE, BLACK, ULTRAVIOLET AND WEATHER RESISTANT, SUITABLE FOR CONTACT WITH UP TO 600Vac, CSA CERTIFIED		TEMFLEX 1700	3M	
N1a			SINGLE CONDUCTOR POLYMERIC CABLE TERMINATION KIT, INDOOR/OUTDOOR (c/w SHEDS), 35kV, RATED TO IEEE-48-1996 CLASS 1, FOR UP TO 250kcmil CONDUCTOR		TFT-352R-SG	TYCO	
N1b			SINGLE CONDUCTOR POLYMERIC CABLE TERMINATION KIT, INDOOR/OUTDOOR (c/w SHEDS), 35kV, RATED TO IEEE-48-1996 CLASS 1, FOR UP TO 500kcmil CONDUCTOR		TFT-353R-SG	TYCO	
N1c			SINGLE CONDUCTOR POLYMERIC CABLE TERMINATION KIT, INDOOR/OUTDOOR (c/w SHEDS), 35kV, RATED TO IEEE-48-1996 CLASS 1, FOR UP TO 1250kcmil CONDUCTOR		TFT-354R-SG	TYCO	
Q1		each	2.4MVAr, 34.5kV CAPACITOR BANK c/w INTERNAL FUSING, GROUNDING SWITCHES, AND SUPPORT STRUCTURE	090630.00-SP-E06			2
Q2		each	4MVAr, DVAr ASSEMBLY c/w CONTROLLER AND STEP-UP TRANSFORMER	090630.00-SP-E06			2
R1		each	FLOATING OIL SPILL ALARM C/W CONTROL PANEL, 115Vac INPUT VOLTAGE		9830 HCF	ARJAY	
R2		each	DIRECTIONAL FAULT INDICATOR FOR OVERHEAD LINE INSTALLATION, 200A PICKUP, 10A RESET, RED/GREEN LED INDICATOR, 4 HOUR AUTO RESET, LITHIUM OXIDE BATTERY, 25kA SYMMETRICAL RMS WITHSTAND FOR 170ms, 8 TO 40.6mm DIAMETER CONDUCTOR INSTALLATION, OPERATIONAL FROM -40 TO +85 ^{O}C, +/-10% ACCURACY AT 20°C, UV STABLE POLYCARBONATE CASING, 38kV MIN., MEETS ANSI/IEEE Std. 495		40-3108-001-200A4H	POWER DELIVERY PRODUCTS	
S311a		each	15kV, 100A CUTOUT				

BILL OF MATERIALS	Client: SKYPOWER CORP	Volume: 090630.00	
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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
S311b		each	15kV, 100A CUTOUT C/W LOAD-BREAK ATTACHMENT		C730-213PB	CHANCE	
S312a		each	15kV, 200A CUTOUT				
S312b		each	15kV, 200A CUTOUT C/W LOAD-BREAK ATTACHMENT				
S313a		each	15kV, 300A CUTOUT				
S313b		each	15kV, 300A CUTOUT C/W LOAD-BREAK ATTACHMENT				
S411a		each	27kV, 100A CUTOUT				
S411b		each	27kV, 100A CUTOUT C/W LOAD-BREAK ATTACHMENT		C730-213PB	CHANCE	
S412a		each	27kV, 200A CUTOUT				
S412b		each	27kV, 200A CUTOUT C/W LOAD-BREAK ATTACHMENT				
S413a		each	27kV, 300A CUTOUT				

BILL OF MATERIALS	Client: SKYPOWER CORP	Volume: 090630.00	
	Project: DIGBY WIND POWER PROJECT	Schedule No. A	Page No. 44 of 49

B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
S413b		each	27kV, 300A CUTOUT C/W LOAD-BREAK ATTACHMENT				
S414a		each	27kV, 600A DISCONNECT, BRANCH FEEDER STYLE				
S414b		each	27kV, 600A DISCONNECT, MAIN FEEDER STYLE				
S414c		each	27kV, 600A DISCONNECT, STATION VERTICAL STYLE				
S414d		each	27kV, 600A DISCONNECT, STATION INVERTED STYLE				
S415a		each	27kV, 900A DISCONNECT, BRANCH FEEDER STYLE				
S415b		each	27kV, 900A DISCONNECT, MAIN FEEDER STYLE				
S415c		each	27kV, 900A DISCONNECT, STATION VERTICAL STYLE				
S415d		each	27kV, 900A DISCONNECT, STATION INVERTED STYLE				
S415f		each	27kV, 900A DISCONNECT, OVERHEAD POLE-TOP STYLE				

BILL OF MATERIALS	Client: SKYPOWER CORP	Volume: 090630.00	
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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1]		NOTES
					CAT. NO.	MANUFACTURER	
S416			RESERVED FOR FUTURE USE				
S417			RESERVED FOR FUTURE USE				
S418			RESERVED FOR FUTURE USE				
S419			RESERVED FOR FUTURE USE				
S421a		each	38kV, 100A CUTOUT				
S421b		each	38kV, 100A CUTOUT C/W LOAD-BREAK ATTACHMENT		C730-213PB	CHANCE	
S422a		each	38kV, 200A CUTOUT				
S422b		each	38kV, 200A CUTOUT C/W LOAD-BREAK ATTACHMENT				
S423a		each	38kV, 300A CUTOUT				
S423b		each	38kV, 300A CUTOUT C/W LOAD-BREAK ATTACHMENT				

BILL OF MATERIALS	Client: SKYPOWER CORP	Volume: 090630.00	
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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
S424a			RESERVED FOR FUTURE USE				
S424b			RESERVED FOR FUTURE USE				
S424c			RESERVED FOR FUTURE USE				
S424d			RESERVED FOR FUTURE USE				
S425a			RESERVED FOR FUTURE USE				
S425b			RESERVED FOR FUTURE USE				
S425c			RESERVED FOR FUTURE USE				
S425d			RESERVED FOR FUTURE USE				
S425e		each	38kV, 900A DISCONNECT, STATION VERTICAL STYLE		14824-E	S&C	
S425f		each	38kV, 900A DISCONNECT, STATION INVERTED STYLE		4784-E	S&C	

BILL OF MATERIALS

Client: SKYPOWER CORP | Volume: 090630.00

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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
S425f		each	38kV, 900A DISCONNECT, OVERHEAD POLE-TOP STYLE		18934	S&C	
S425g		each	38kV, 900A DISCONNECT, CROSSARM VERTICAL STYLE		4873R1	S&C	
S425h		each	38kV, 900A DISCONNECT, CROSSARM INVERTED STYLE		4893R1	S&C	
S426		each	38kV FUSEHOLDER				
S427		each	38kV BYPASS SWITCH				
S428		each	38kV, THREE-POLE GROUP-OPERATED DISCONNECT, DESIGN PER TECHNICAL SPECIFICATION DOCUMENT AS NOTED				4
S429		each	38kV, THREE-POLE GROUP-OPERATED DISCONNECT c/w FUSES, DESIGN PER TECHNICAL SPECIFICATION DOCUMENT AS NOTED				4
S516a	3	each	69kV, 1-PHASE FUSE HOLDER		SMD-3 192346	S&C	
S518a		each	69kV DISCONNECT SWITCH, c/w MOTOR OPERATOR AND LOAD INTERRUPTERS				4
T1		each	10kVA 14.4kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	

BILL OF MATERIALS	Client: SKYPOWER CORP	Volume: 090630.00	
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B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
T2		each	15kVA 14.4kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T3		each	25kVA 14.4kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T4		each	50kVA 14.4kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T5		each	75kVA 14.4kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T6		each	10kVA 19.9kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T7		each	15kVA 19.9kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T8		each	25kVA 19.9kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T9		each	50kVA 19.9kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T10		each	75kVA 19.9kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	
T11		each	37.5kVA 19.9kV-120/208/240V ONAN OVERHEAD DISTRIBUTION TRANSFORMER TO CSA C2 c/w 1 COVER-MOUNTED H1 BUSHING, H2 INTERNALLY GROUNDED TO TANK, 3 XV EYEBOLT TERMINALS, Cu X0 GROUND STRAP, PRESSURE RELIEF VALVE, 2 LIFTING LUGS, 2 MOUNTING BRACKETS, +/- 5% TAPS IN 5 EQUAL STEPS (EXTERNALLY OPERABLE), GASKETTED TOP, WELDED BOTTOM, STEEL TANK GALVANIZED OR OTHERWISE CORROSION RESISTANT, SPLIT SECONDARY WINDING TO EXTERNALLY ADJUST XV BETWEEN 120/240V AND 208V, TANK CASE GROUDING LUG		--	CARTE	

BILL OF MATERIALS

Client: SKYPOWER CORP | Project No.: 090630.00

Project: DIGBY WIND POWER PROJECT | Schedule No.: A | Page No.: 49 of 49

B.O.M. ITEM NUMBER	QUANTITY	UNIT	DESCRIPTION	SPECIFICATION DOCUMENT	STANDARD OF ACCEPTANCE[1] CAT. NO.	STANDARD OF ACCEPTANCE[1] MANUFACTURER	NOTES
T42		each	25kV VOLTAGE TRANSFORMER, DRY-TYPE, TYPE 1				4
T43		each	25kV VOLTAGE TRANSFORMER, DRY-TYPE, TYPE 2				4
T51		each	15/20/25MVA 66-24.94kV SUBSTATION TRANSFORMER C/W 13 BUSHING CTS, ONE (1) SET EACH OF 42kV MCOV & 22kV MCOV STATION CLASS SURGE ARRESTERS	STANTEC 11335-44332-5-14236			2
T52		each	69kV COMBINED INSTRUMENT TRANSFORMER				4
T53		each	69kV VOLTAGE TRANSFORMER				4
W1			#4/0 AWG SOLID ALUMINUM TIE WIRE, LENGTH AS INDICATED		--	ALCAN	
W2			FORMED WIRE SUPPORT, GALVANIZED STEEL, HOT-DIPPED GALVANIZED SUPPORT THIMBLE CLEVIS 22mm IN DIA., MINIMUM, SUITABLE FOR USE WITH ADSS CABLE SPANS UP TO 75m AND MAXIMUM LINE ANGLE OF 30°, RELIEVED ENDS TO PREVENT CABLE DAMAGE				
W3			GRIP, GUY, PREFORMED FOR 5/16" GUYWIRE c/w CLASS B GALVANIZING AND CABLED LOOP PER CSA C83.129 M		GDE-1108	PREFORMED LINE PRODUCTS	
W4		metres	WIRE, GUY, GALVANIZED STEEL, 7 STRAND 8mm DIAMETER, GRADE 1300, MINIMUM BREAKING STRENGTH OF 53kN IN ACCORDANCE WITH CSA Std. CAN3-G12		PERFORMANCE SERIES 100	WIRE ROPE COMPANY LTD.	

CBCL LIMITED
Consulting Engineers

Rev	Description	Date	By	Ckd	Approved
O	ISSUED FOR TENDER	06/30/09	LO'K	RO'C	
A	ISSUED FOR FINAL REVIEW	06/15/09	LO'K	RO'C	

Date: 06/15/09 | Office: Hfx | Designed: LO'K | Drawn: LO'K | Schedule No.: | Title: BILL OF MATERIALS

SCHEDULE-A

APPENDIX A5



SKYPOWER CORP

DIGBY WIND POWER PROJECT

PRE-PURCHASED EQUIPMENT PROCUREMENT SPECIFICATIONS

Rev	Description	Date	By	Ckd	Approved
0	ISSUED FOR TENDER	06/30/09	#REF!	#REF!	#REF!

CBCL LIMITED
Consulting Engineers

Date	Office	Title:
06/30/09	Hfx	PRE-PURCHASED EQUIPMENT
Designed	Drawn	
LO'K	LO'K	

Schedule No. APPENDIX A5

DOCUMENT INDEX

Client: SKYPOWER CORP

Project: DIGBY WIND POWER PROJECT

Nova Scotia 090630.00

Schedule No. A

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DOCUMENT NUMBER	TITLE	REVISION
090630-SP-E01	Digby Wind Power Project - HV Circuit Breaker	B
090630-SP-E06	Digby Wind Power Project - Reactive Power Static Compensator (Statcom) System	B
090630-SP-E07	Digby Wind Farm Project - Pad Mounted, Oil Fired, MV Transformers	0
PWR-Transformer	Power Transformer Technical Data and Drawings	

CBCL LIMITED
Consulting Engineers

Rev	Description	Date	By	Ckd	Approved
0	ISSUED FOR TENDER	06/30/09	LO'K	RO'C	

Date: 06/30/09
Office: Hfx
Designed: LO'K
Drawn: LO'K
Schedule No.:

Title: PRE-PURCHASED EQUIPMENT

APPENDIX A5

SkyPower Corp.

Digby Wind Power Project – HV Circuit Breaker

Specification Document

090630-SP-E01

69 kV Circuit Breaker

CBCL LIMITED
Consulting Engineers

CBCL PROJECT No.: 090630.00
TENDER DATE: ……
SUBMISSION DEADLINE: ……

CBCL LIMITED
Consulting Engineers
1489 Hollis Street
PO Box 606
Halifax, NS
Canada B3J 2R7

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Signed and Sealed on Behalf of

CBCL Limited

Ivelin Radnev P. Eng

Rev. B - Issued for Final Review	L. O'Keefe	June/09	R. O'Connor
Rev. A - Issued for Review	L. O'Keefe	May/09	R. O'Connor
Issue or Revision	***Reviewed By:***	***Date:***	***Issued By:***

LIST OF POTENTIAL BIDDERS

Areva T&D
3472 Prospect Road
Whites Lake, NS B3T 1Z3

Contact: Geoff Ardern
Tel: 902-852-5333
Fax: 902-852-5233
Email: GeoffreyArdern@cs.com

Mitsubishi Electric
c/o Canadian Technical Sales (CTS)
4 Cranberry Cr
Dartmouth, NS B2W 5A1

Contact: Jim Walsh, C.E.T.
Tel: 902-240-7985
Fax: (902) 434-0241
Email: jwalsh@ctsales.ca

Siemens – Canada
Siemens Canada Limited
1550 Appleby Line
Burlington, ON, L7L 6X7

Tel: (905) 315-6868, Ext. 7211

ABB – Canada
High Voltage Products and Systems
8585 Trans-Canada Highway
Saint-Laurent, QC, H4S 1Z6

Contact: Francois Mailloux
Tel: (514) 856-6202
Fax: (514) 856-6286

Charlton & Connolly
(Pennsylvania Breaker, LLC)

Contact: Dave Thomas
Tel: (724) 837-2602
Fax: (724) 743-4850
Email: dave.thomas@pabreaker.net

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SkyPower Corp.

PART A

Bidding and Contract Requirements

Specification Document

090630-SP-E01

CBCL LIMITED
Consulting Engineers

I. INTRODUCTION

1 FORWARD

1.1 The joint venture partners SkyPower Corp. and Scotian WindFields Inc. signed a long term Power Purchase Agreement (PPA) with Nova Scotia Power to supply renewable power in the form of wind generation. The project will consist of twenty (20), GE 1.5sle, 1.5 MW wind turbine generators with a substation on the eastern portion of the site. The point of common coupling will be at the termination point of a Nova Scotia Power (NSPI) transmission line at the NSPI Conway substation (approximately 10.6 km away).

1.2 The Digby Wind Power Project wind turbines are located on various private properties on both the western side and the eastern side of Gulliver's Cove Road., Municipality of the District of Digby, Nova Scotia.

II. INSTRUCTIONS TO BIDDERS

1 DEFINITIONS

1.1 **"Balance of Plant"** means all equipment, tools, labour, and services not directly associated with the supply of the facility wind turbines.

1.2 **"Bidder"** means a person, firm or corporation who propose to submit, or who have submitted a quotation for the supply of the equipment.

1.3 **"Calender Day"** means any day including Saturday, Sunday, statutory holiday or statutory vacation day that is observed by the construction industry in the area of the Place of the Work.

1.4 **"Change Directive"** is a written instruction prepared by the Engineer and signed by the Owner directing the Vendor to proceed with a change in the work within the general scope of the Technical Specification prior to the Owner and the Vendor agreeing upon an adjustment in Contract Price and Contract Time.

1.5 **"Change Order"** is a written amendment to the Contract prepared by the Engineer and signed by the Purchaser stating their agreement upon:

- a change in the Work;
- the method of adjustment or the amount of the adjustment in the Contract Price, if any; and
- the extent of the adjustment in the Contract Time, if any.

1.6 **"Contract"** is the undertaking by the parties to perform their respective duties, responsibilities, and obligations as prescribed in the Contract Documents and represents the entire agreement between the parties.

1.7 **"Contract Time"** is the time stipulated herein from commencement of the Work to Substantial Completion of the Work.

1.8 **"Delivery Period"** means the period commencing on the date of mailing of the Purchaser's official order to the Vendor and ending on the date when delivery to the site designated for delivery, covered by the purchase order, has been complete.

1.9 **"Engineer"** means CBCL Limited (CBCL) or its duly appointed representative who has been authorized by the Owner to act on their behalf.

1.10 **"Interconnection Utility"** is Nova Scotia Power (NSPI) a division of Emera, Inc

1.11 **"Owner"** means SkyPower Corp., and includes the Owner's personal representatives or successors.

1.12 **"Place of the Installation"** is the Digby Wind Farm Substation, Municipality of the County of Digby, Nova Scotia, Canada.

1.13 **"Purchaser"** is the Owner.

1.14 **"Shop Drawings"** are drawings, diagrams, schematics, illustrations, schedules, performance charts, brochures, Product data, manuals and other data that the Vendor provides to illustrate details of the Circuit Breaker.

1.15 **"Specifications"** are that portion of the Contract Documents, wherever located and whenever issued, consisting of the written requirements and standards for Products, systems, workmanship, and the services necessary for the performance of the Work.

1.16 **"Supply Price"** is the amount stipulated herein, based on a lump sum basis of payment, including duties, tolls, shipping and transportation costs.

1.17 **"Technical Specification"** means those documents listed herein and amendments agreed upon between the parties.

1.18 **"Value Added Taxes"** means the Harmonized Sales Tax (HST), the collection and payment of which is by the Vendor as imposed by the tax legislation.

1.19 **"Vendor"** means the equipment supplier whose equipment has been selected by the Purchaser pursuant to a general contract.

1.20 **"Working Day"** means any day excluding Saturday, Sunday, statutory holiday or statutory vacation day that is observed by the construction industry in the area of the Place of the Circuit Breaker Installation.

1.21 **"Complete Submission of Tender"** means the full requested submission package including completed Form of Quotation, Appendices as indicated herein, and proposed layout drawing(s).

2 QUOTATIONS SUBMISSION

2.1 Submit complete quotation—including completed Form of Quotation, Appendices 1-3, and proposed layout drawing(s)—in Adobe Portable Document Format ("pdf"), or similar electronic format approved by the Engineer, via email as follows:

SUBJECT LINE	-	CBCL Limited (CBCL): QUOTATION NO. 090630-SP-E01
ADDRESS TO	-	larryo@cbcl.ca
CARBON COPY	-	ivor@cbcl.ca
SALUTATION	-	Larry O'Keefe, P.Eng.

2.2 Delivery to the above address shall be no later than 14:00 Atlantic Standard Time on June XX, 2009

2.3 Electronic submission shall be followed immediately by submission of three (3) copies of complete quotation, at least one (1) of which shall be reproducible—including completed Form of Quotation, Appendices 1-3, and proposed layout drawing(s)—in sealed envelope marked as follows:

QUOTATION	-	SKYPOWER CORP. DIGBY WIND POWER PROJECT

QUOTATION FOR: HV CIRCUIT BREAKER
QUOTATION NO.: 090630-SP-E01

and addressed to:

CBCL Limited
PO Box 606
1489 Hollis Street
Halifax, NS B3J 2R7

Telephone Number: (902) 421-7241, ext. 2327
Fax Number: (902) 423-3938
Attention: Larry O'Keefe, P.Eng.

2.4 Submit quotations on the Form of Quotation provided. Completely fill out forms in ink. The completed form shall be without interlineation, alterations, or erasures. Signatures must be witnessed.

2.5 No other Form of Quotation will be acceptable. The appending of any qualifying clauses to the Quotation or failure to comply with these instructions in the completing of any quotations renders such quotation liable to disqualification. The quotation as originally submitted shall be essentially complete to permit a full analysis without the need for additional information.

2.6 The Purchaser will not defray any expenses whatsoever incurred by Bidders in the preparation and submission of their quotations.

2.7 Submittal of quote signifies that Vendor fully understands all specifications listed.

2.8 Vendor shall submit quote based upon requirements noted in specification. Vendor is encouraged to quote as options that which appear to be more cost effective for this application. Any question as to the intent of the specifications or an apparent conflict or omission between this specification and other specifications shall be resolved by the Vendor contacting the Engineer for clarification.

2.9 The Vendor shall note that the Owner reserves the right to accept all or part of the full Quotation Submission, consisting of the following two (2) components:

2.9.1 Design, manufacture, factory testing, delivery, and off-loading of circuit breaker.

2.9.2 Field testing of circuit breaker.

3 CLARIFICATION AND ADDENDA

3.1 Notify Engineer of omissions, errors, or ambiguities found in the Quotation Documents. If Engineer considers that correction, explanation, or interpretation is necessary, a written addendum will be issued. All addenda will form part of quotation documents.

3.2 No oral explanation in regard to the meaning of the quotation documents will be made and no oral instructions will be given before the selection of equipment.

3.3 Address questions to Larry O'Keefe, P.Eng., at CBCL Limited, 1489 Hollis Street, Halifax, NS, B3J 2R7, telephone number (902) 421-7241 ext. 2327, fax number (902) 423-3938, e-mail: larryo@cbcl.ca, cc: ivor@cbcl.ca.

4 PURPOSE AND PROCEDURE

4.1 The purpose of receiving quotations in accordance with these documents is to permit examination of a variety of equipment on a comparable basis in order to select the equipment best fulfilling the Owner's requirements and to ensure that it is delivered on the Place of the Installation at the appropriate time.

4.2 The procedure, in general, will be as follows:

4.2.1 Receive and assess quotations for equipment.

4.2.2 Select equipment.

4.2.3 Notify Vendor and conduct correspondence as required.

4.2.4 Place order for equipment.

4.2.5 Request shop drawings, examine and approve and return shop drawings.

4.2.6 Request shipping/receiving documentation for equipment delivery.

5 INFORMATION WITH QUOTATION

5.1 Quotations shall be accompanied with all data requested in the Technical Specifications.

5.2 All Bidders must bid against the enclosed specification. In the case where a Bidder wishes to bid an alternative, they are invited to do so. However, full documentation of the potential advantages to the Owner together with reference to equivalent installation must be made.

5.3 Bidders are requested to submit a timeline indicating full estimated duration of contract, from the award of contract to the completion of commissioning as defined herein, and including any and all major milestones.

6 PRICES

6.1 Quoted prices shall include for delivery to the Place of the Installation during normal working hours including bill of lading as well as receiving report. The Owner shall provide delivery address prior to shipment. The Bidder shall arrange unloading at the Place of the Installation.

6.2 Quoted prices shall show all taxes separately.

6.3 The fixed quoted prices shall be in Canadian dollars, and shall include and cover all contingencies and provisional sums; all patents and licensing fees, duties, and handling charges, transportation and all other charges.

6.4 The prices contained in quotations shall be fixed and open for acceptance for a period of sixty (60) calendar days after the closing date for receipt of quotations. Provided that the Purchaser places a written order for the equipment within the above-mentioned period of validity of the quotation, there shall be no increase in the quoted price of the equipment.

6.5 The Bidder shall submit the quotation on the Form of Quotation without any connection, comparison of figures with, or knowledge of any other corporation, firm, or person making a quotation for similar equipment for this project and the quotation shall be in all respects fair and without collusion or fraud.

7 SHOP DRAWINGS AND PRODUCT INFORMATION MATERIAL

7.1 Following the award of contract, the Vendor shall submit to the Engineer for approval shop drawings and product information for the equipment to be supplied. Due to project schedule constraints, shop drawings may be submitted electronically or by fax with hard copies to follow by courier.

7.2 The expected schedule for receipt of Shop Drawings shall be as indicated by Appendix 3.

7.3 Include cost of shop drawings in quoted price.

7.4 The material and drawing information shall include, but not be limited to, the following:

7.4.1 Dimensional outlines, sections and detail of all equipment, with anchor bolt location plan and required clearances.

7.4.2 General assembly drawing with weights, service requirements, points of connection, recommended clearances, and complete parts list.

7.4.3 Control schematics and wiring diagrams (as applicable).

7.4.4 Detailed instruction for the erection of equipment.

7.4.5 Recommended spare parts.

7.5 Submit six (6) sets of drawings on or before the indicated dates.

7.6 The Engineer will review and mark comments as required on two (2) copies of the material and return them to the Vendor indicating "no apparent errors", "apparent errors noted", "rejected - see remarks", or "revise and resubmit", one (1) copy forwarded to Purchaser, and the Engineer will retain three (3) copies. Review of the Vendor's shop drawings by the Engineer shall not relieve the Vendor of the responsibility for the correctness thereof or for the results arising from any error or omission in details of the design. Resubmit all drawings marked "rejected - see remarks" or "revise and resubmit".

7.7 Review of shop drawings and acceptance of the equipment shall in any case be subject to final approval of the equipment and materials after they have been put in commission, all guarantees being fulfilled and the general operation of the equipment and materials having been found satisfactory by the Engineer.

7.8 After the Engineer has reviewed the drawings, information and material, no change shall be made in them without the Engineer's written permission. In the event of any alterations or changes being authorized, six (6) of each of the final drawings and specifications indicating these changes shall be immediately furnished at the Vendor's expense.

7.9 The Purchaser will not accept responsibility for cost of changes necessary if any equipment is fabricated without prior review of shop drawings. Review of shop drawings does not relieve the Supplier of responsibility to meet the requirements of the specifications.

8 OPERATIONS AND MAINTENANCE MANUALS

8.1 The Vendor shall furnish to the Owner, through the Engineer, six (6) hard copies and one (1) electronic copy in Adobe Portable Document Format ("pdf") of operations and maintenance manuals specifying instructions for the following:

8.1.1 Receiving, handling, storage.

8.1.2 Installation, alignment checks.

8.1.3 Electrical connections.

8.1.4 Technical bulletins of all components.

8.1.5 Operation.

8.1.6 Maintenance procedures.

8.1.7 Relevant drawings.

8.1.8 Detailed spare parts list complete with current price list.

8.1.9 Safety instructions.

8.1.10 Tests and Vendor inspection procedures.

8.1.11 Factory and field test results.

8.2 Provide material not later than thirty (30) days prior to scheduled shipment of equipment. Include cost of providing this material in quoted price for supply of equipment.

9 IN-PLANT INSPECTION AND TESTING

9.1 The Owner, Purchaser, Engineer, and/or their authorized agents shall have the privilege of inspecting and witnessing all testing at all times during the manufacture of the equipment or materials ordered herein.

9.2 Provide advance notice of at least ten (10) days for inspection and testing.

9.3 Shop tests shall not constitute a waiver of requirements to meet actual field operating conditions or relieve the Vendor of their responsibility.

9.4 Provide three (3) copies of the official test results to the Engineer showing all tests conducted in accordance with this Document.

10 DELIVERY, STORAGE, AND HANDLING

10.1 Vendors shall include in quotation the cost of shipment to the Place of the Installation.

10.2 The Vendor shall be responsible for employing shipping preparations necessary to ensure that all equipment arrives at the destination in excellent working condition when handled by commercial carriers. All equipment shall be suitably packaged so as to ensure delivery in good condition. The Vendor shall identify any omissions, discrepancies, or damage evident on delivery to the Engineer and the Owner, and make said omissions, discrepancies, or damage good.

10.3 The Vendor shall provide the Purchaser with proof of insurance prior to shipment to the Place of the Installation.

10.4 Vendors will provide a schedule of milestone events and, in the case of partial shipments, the Vendor will provide a proposed schedule at the time of bidding.

10.5 Unless otherwise indicated, all equipment shall be shipped completely assembled where possible. Large fabricated assemblies shall be shipped in sub-assemblies as large as practical from the point of view of moving them into and about the structures, and piece-marked to facilitate field erection, or as detailed in the Technical Specifications. Provide all clearly marked lifting points for packaged equipment.

10.6 The Vendor shall co-operate with the Purchaser in the matter of packaging, time of delivery and shipping.

10.7 The Vendor shall quote a guaranteed delivery period from the date of the purchase order for each item of equipment for which a quotation is submitted.

10.8 The quoted delivery period shall allow for:

10.8.1 The time required by the Purchaser's official order to reach the Vendor by mail.

10.8.2 A two-week period for the Engineer to review and comment on the Vendor’s shop drawings for the equipment to be supplied.

10.8.3 Delivery of anchor bolts and parts to be embedded that are required in advance of taking delivery of equipment shall be made when required by the Purchaser.

10.9 The Vendor or their authorized agent at the Place of the Installation shall sign the carrier's pro bill to indicate receipt of the required number of crates, packages, and shall note any apparent shortages of or visible damage to such crates and packages. The Vendor shall furnish to the Purchaser lists showing the contents of the crates and packages available at the job site when delivery of the equipment and appurtenances is made.

10.10 Provide advance notice of at least ten (10) working days prior to delivery to the Place of Installation to the Owner and the Engineer that either may, at their individual discretion, be in attendance if deemed necessary.

11 SERVICES REQUIRED AT SITE

11.1 The Vendor shall provide the services required as defined herein.

11.1.1 The Vendor shall, in the presence of the Owner's operating staff, operate and demonstrate the equipment.

12 AMENDMENT OR WITHDRAWAL OF QUOTATION

12.1 Quotations may be amended or withdrawn by letter or facsimile prior to date and time of closing.

12.2 Head amendment or withdrawal as follows: "Amendment/Withdrawal of Quotation Digby Wind Power Project – HV Circuit Breaker, Quotation 090630-SP-E01". Sign and seal as required for Quotation, and submit at address given for receipt of quotations prior to time of closing.

13 RIGHT TO ACCEPT OR REJECT ANY QUOTATION

13.1 The Purchaser reserves the right to waive any irregularity and to accept or reject any offer whatsoever.

13.2 Quotations, which in the opinion of the Purchaser are considered to be informal or unbalanced, may be rejected.

13.3 The Purchaser will select a Bidder based on the total technical, delivery, warranty and commercial content of the tender packages. The Purchaser will not necessarily select the low tender. The Purchaser reserves the right to reject any or all Quotations.

III. FORM OF QUOTATION

1 SALUTATION

To: CBCL Limited
PO Box 606
1489 Hollis Street
Halifax, NS B3J 2R7

Attention: Larry O'Keefe, P.Eng.

1.1 For: Digby Wind Power Project

Quotation for: HV CIRCUIT BREAKER

Quotation 090630-SP-E01

1.2. From: _____

_____

_____

We, the undersigned Bidder, having carefully examined the Quotation Documents in respect of quotations for the equipment listed in the Form of Quotation, and Specifications herewith submit in accordance with the terms set out in the documents our quotation for the specified equipment.

We agree that, in case of any conflict between the terms and conditions set out in our accompanying quotation and the terms and conditions set out in the Owner's or Engineer's quotation documents, the provisions of the quotation documents shall take precedence and shall govern.

The Bidder expressly warrants and guarantees to the Purchaser that in the event of the equipment, or part thereof, offered by the Bidder in the Form of Quotation being ordered by the Purchaser, such equipment, or part thereof, when supplied pursuant to a purchase order will be deemed to have been supplied upon the terms of the Purchaser's quotation documents with such amendments, if any, as may be required or agreed upon in writing by the Vendor and the Purchaser before the issuance of the said purchase order.

We declare that our quotation for the equipment is made without any connection, comparison of figures, or arrangements with or knowledge of any other corporation, firm or person making a quotation for similar equipment for this project and is in all respects fair, without collusion or fraud.

We undertake to keep our quotation valid and open for acceptance for a period of sixty (60) calendar days after the closing date for submission of quotations, and to make the equipment quoted on hereunder, or any item thereof available for sale to the Purchaser during the said period at the price and delivery stated herein.

The prices quoted shall be in Canadian dollars and shall include and cover all contingencies and provisional sums; all duties, and handling charges, insurance, transportation and all other. All taxes to be shown separately.

2 BID PRICE

2.1 Price Breakdown

Item	Description	Quantity	Unit Price	Total Price
2.1.1	Prepare and submit shop drawings to the Customer for review and approval.	1	$	$
2.1.2	Design, manufacture, test, deliver to the Place of the Installation, and provide a written guarantee for one (1) 69 kV, 600A circuit breaker assembly complete with accessories, special tools, and provisals per the Technical Specification Document.	1	$	$
	AND			
2.1.3	Site testing of provided circuit breaker.	Lot	$	$

2.2 Tender Bid

Included Items (Section 2.1 directly preceding):	2.1.1 to 2.1.3
Total Supply:	$
Canadian Customs Duty:	$
Harmonized Sales Tax (13%):	$
Total Carried to Form of Tender:	$

2.3 Extended Waranty (+ 12 months): $_____

2.4 Site Supervisor Per Diem Price

2.4.1 Per Diem cost including travel and other expenses for a skilled technical representative to supervise assembly of circuit breaker on site (attach schedule of prices if applicable).

$_____

2.5 Delivery Period: Complete to site (including off-loading): _____ weeks

2.6 Payment Schedule

2.6.1 Receipt of purchase order: 10 percent

2.6.2 Issue shop drawings for approval: 10 percent

2.6.3 Delivery to site: 60 percent

CBCL LIMITED
Consulting Engineers

2.6.4 Installed, commissioned, and energized: 20 percent

2.7 SIGNATURE

DATED THIS _____ DAY OF _____, 20_____.

Name of Firm Quoting

[Seal]

Address	Telephone
Signature	Name and Title (Printed)
Signature	Name and Title (Printed)
Witness	Name and Title (Printed)

*NOTE: Quotations submitted by or on behalf of any Corporation must be signed in the name of such corporation by a duly authorized officer or agent, who shall also subscribe own name and office. Affix seal.

SkyPower Corp.

PART B

Technical Specifications

Specification Document

090630-SP-E01

CBCL LIMITED
Consulting Engineers

I. GENERAL

1 SCOPE OF SUPPLY

1.1 Design, manufacture, test, assemble, deliver to the Place of the Installation and provide a written guarantee for one (1) 69kV outdoor circuit breaker assembly complete with accessories and special tools as defined herein.

1.2 Site testing of the circuit breaker assembly defined herein following installation and prior to energization, including all tests defined herein.

2 SERVICE CONDITIONS

2.1 Application

2.1.1 The circuit breaker shall be installed by others fully assembled outdoors on a concrete equipment pad, at the Digby Wind Power Project Site (the Place of Installation).

2.1.2 Field testing shall be carried out as per Section iii—Site Testing—of this document.

2.1.3 All documentation, drawings, nameplates, labels, and reports shall be in English.

2.2 Supply System Data

2.2.1 Electrical System Data

.1 Newly constructed wind farm constructed to the following parameters:

.1	Nominal service voltage	kV rms	69
.2	Rated (maximum) voltage	kV rms	72.5
.3	Nos. of phases and wiring		3P, 3W
.4	Connected wind farm capacity	MW	30
.5	Utility fault contribution	MVA	3,500
.6	Nominal frequency	Hz	60

2.3 Environmental Conditions

2.3.1 Location

.1	Elevation above sea level	m	150 (approx.)
.2	Salt-spray exposure		moderate

2.3.2 Historical Temperature Requirements

.1	Extreme Low	°C	-27.2
.2	Extreme High	°C	34
.3	Average Length of Year Below 0°C	%	38
.4	Average Length of Year Above 20°C	%	23
.5	Extreme Snow Depth	cm	40

3 EQUIPMENT, SERVICES, APPARATUS, & MATERIALS SUPPLIED BY OTHERS

3.1 Primary power conductor (i.e. high voltage) and terminations.

3.2 Field device wiring (i.e. external power supply, CT, and PT wiring).

3.3 Underground conduit.

3.4 Concrete foundations and support structures unless otherwise indicated.

4 NAMEPLATES

4.1 General

4.1.1 Each and every device shall be provided with a clearly visible rating plate and identifying nameplate of weatherproof material, inscribed with the minimum information defined herein.

4.2 Warning Signs

4.2.1 All external doors and hinged bolted panels providing access to medium or high voltage shall be provided with “Caution—High Voltage—Keep Out” signs.

4.3 Rating Nameplates

4.3.1 All devices supplied shall include all information as required by the ruling CSA Standards on an external nameplate, including the following where applicable:

.1 Manufacturer’s name.

.2 Manufacturer’s catalog number.

.3 Manufacturer’s serial number.

.4 Operating voltage class.

.5 Basic impulse level (BIL) rating.

.6 Rated maximum continuous ampacity.

.7 Maximum withstand voltage and fault current.

.8 Where a device is one of a series of similar devices part of a larger production line, the batch number of the device shall be included on an external nameplate as an indication of the production line.

.1 The batch number shall not be required where the serial number can be used to identify the device production run.

.9 Short-circuit interrupting, and closing ratings (amperes, RMS symmetrical and MVA three-phase symmetrical at rated nominal voltage).

.10 Identification of insulating medium.

.11 Quantity of SF_6 gas (where applicable) in litres.

.12 Mass in kilograms.

.13 Ratings of all internal auxiliary current transformers.

.14 Maximum tank pressure/vacuum strength.

.15 Year of manufacture.

.16 Space for Owner's serial number.

.17 Reference to Instruction Manual.

.18 Momentary withstand ratings (amperes, RMS asymmetrical).

.19 CSA and/or UL classification markings.

.20 Any and all information defined herein.

4.4 Identifying Nameplate

4.4.1 The Circuit Breaker assembly shall be provided with one (1) nameplate, engraved on 3mm thick plastic lamicoid, with the Owner's numerical designation for the Circuit Breaker.

4.4.2 The identifying nameplate shall be secured to the Circuit Breaker control cabinet using permanent adhesive or permanent mechanical connection, suitable for permanent outdoor usage in the given atmospheric conditions.

4.4.3 The identifying nameplate shall be 200mm long x 50mm high, white lettering on a black background. Letters shall be 38mm high, width as required.

4.4.4 Designation shall be of the form: "xxxV-551", where "xxx" shall be provided by the Engineer prior to delivery.

5 MATERIALS

5.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

6 WARRANTY

6.1 All equipment, including accessories and tools, shall have a minimum three (3) year warranty against manufacturer’s defects effective from the earlier date of the following:

6.1.1 Substantial completion of the work.

6.1.2 Six (6) months following delivery to the Place of the Installation.

6.2 The Owner, through the Engineer, shall promptly give the Vendor notice in writing of observed defects and deficiencies that occur during the warranty period.

6.3 The Vendor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

6.4 The Vendor shall administer the waranty claims when indicated by Owner. The Owner shall have the right to assign the woranties to:

6.4.1 The Project Company.

6.4.2 The Purchasser of all or substantially all of the project assets.

6.5 The Vendor shall name the Owner as beneficiary of the Warranty.

II. CIRCUIT BREAKER

1 EQUIPMENT

1.1 Compliance with Standards and Codes

1.1.1 The Circuit Breaker Assembly shall conform to or exceed the applicable requirements of the current edition of the following standards and codes unless otherwise indicated herein:

.1 CSA Standards

.1	CSA C13-M83	Instrument Transformers
.2	C22.2 No. 94	Special Purpose Enclosures 2, 3, 4, and 5
.3	W47.1-03	Certification of companies for fusion welding of steel structures
.4	W59-03	Welded steel constructions (Metal-Arc Welding)
.5	G164	Hot Dipped Galvanized or Irregularly Shaped Articles
.6	C22.1-06	Canadian Electrical Code Part I

.2 EEMAC Standards

.1	GL1-3	Transformer and Apparatus Bushings

.3 ANSI/IEEE Standards

.1	C37.04-1999	IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
.2	C37.06-2000	Standard for Switchgear - AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities
.3	C37.06.1-2000	Guide for High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis--Designated "Definite Purpose for Fast Transient Recovery Voltage Rise Times"
.4	C37.09-1999	IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

.5 C37.081-1981 (R1988)		IEEE Guide for Synthetic Fault Testing of AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
.6 C37.081a-1997		Supplement to C37.081-1981
.7 C37.082-1982 (R2000)		IEEE Standard Methods for the Measurement of Sound Pressure Levels of AC Power Circuit Breakers
.8 C37.11-1997		IEEE Standard Requirements for Electrical Control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
.9 C37.12-1991		Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
.10 C37.60		IEEE Standard Requirements for Overhead, Pad Mounted, Dry Vault, and Submersible Automatic Circuit Reclosers and Fault Interrupters for AC Systems
.11 C37.85-1989		American National Standard for Switchgear—Alternating-Current High-Voltage Power Vacuum Interrupters—Safety Requirements for X-Radiation Limits – Description
.12 C37.90.1		American National Standard Guide for Surge Withstand Capability (SWC) Tests
.13 ASME BPVC		Boiler and Pressure Vessels Code
.14 100		IEEE Standard Dictionary of Electrical and Electronics Terms
.15 693		Recommended Practice for Seismic Design of Substations
.16 1125 - 1993		IEEE Guide for Moisture Measurement and Control in SF6 Gas-Insulated Equipment
.4 IEC Standards		
.1 60376 Ed. 2.0 b:2005		Specification of technical grade sulfur hexafluoride (SF6) for use in electrical
.5 ISO Standards		
.1 9000: 2000		Quality Management

1.1.2 Unless otherwise noted, CSA Standards shall be given precedence when and where conflicts arise.

1.2 Ratings

1.2.1 The distribution system shall be solidly grounded.

1.2.2 The ratings for the circuit breaker assembly shall be as designated below or greater:

.1	kV, Nominal	69
.2	kV, Maximum	72.5
.3	kV, BIL Minimum	350
.4	kV, Dry Withstand (60Hz)	160
.5	kV, Wet Withstand (10 sec)	140
.6	Amperes, Rated Continuous Current	600
.7	Amperes, Short-Circuit Ratings (minimum):	
.1	Interrupting Current, RMS Symmetrical	30,000
.2	Close and Latch, Peak	70,000
.8	Cycles, Interrupting Time, Maximum	3
.9	Cycles, Closing Time Maximum	6
.10	± Per Cent, Current Sensor Accuracy	0.3 or higher
.11	Operating Temperature Range	-40°C to 50°C
.12	V, Control Voltage	120/208AC, 125DC

1.3 General

1.3.1 The circuit breaker assembly shall consist of a self-contained, three-phase 69kV circuit-interrupting, load-breaking apparatus and a low-voltage control apparatus allowing local control and connection to a microprocessor-controlled multi-function protection relay, monitoring, and communications equipment.

1.3.2 The circuit breaker shall be sulfur hexafluoride (SF_6)-type with puffer or selfblast-puffer interrupters, outdoor, dead tank, with a height adjustable supporting frame, and either a common manifold SF_6 gas system for all three poles, or independent pole systems. No other gas shall be mixed with the SF_6.

1.3.3 The assembly shall have clear external indicator of the assembly status (i.e. open or closed). The indicator shall be visible to persons within visual range of the assembly without accessing the control device. The indicator shall consist of a suitable sign utilizing green with the word "OPEN" when in the open position, and red with the word "CLOSED" when in the closed position.

1.3.4 The assembly shall be capable of manual operation in the event of failure of all low-voltage control equipment, either via an integral switch handle assembly or hot-stick operation.

1.4 Phasing

1.4.1 Each phase shall be clearly identified by means of a color code. The color code shall be as follows:

.1 Phase A – Red

.2 Phase B – Black

.3 Phase C – Blue

1.5 Functional Requirements

1.5.1 The circuit breaker shall be furnished with dual alarm and control schemes which monitor the operating system and the SF6 gas system (as applicable). The dual alarm and control schemes shall be mechanically and electrically independent with each alarm and control scheme wired into a separate trip coil circuit

1.5.2 The circuit breaker shall be equipped with all the necessary interface terminal blocks, auxiliary contacts, switches, relays, coils and other auxiliary equipment connected to the control system, to permit remote control and indication.

1.5.3 All alarm, auxiliary and spare contacts, control system remote outputs, AC and DC control and station service power supplies shall be grouped and prewired to dedicated interface terminal strips. Minimum 25% spare terminal blocks to be available on each terminal strip.

1.5.4 Alarm signals shall include but not be limited to the following:

- Low SF_6 Alarm 1
- Low SF_6 Alarm 2
- Motor Thermal Overload
- Motor Not Ready
- Trip Coil 1 Alarm
- Trip Coil 2 Alarm
- Local/Remote Control
- Control Power Failure
- Low Pressure - Hydraulic Operating Mechanism
- Control Cabinet Temperature Out Of Limits

1.5.5 Remote Control signals shall include but not be limited the following:

- Trip Coil 1
- Trip Coil 2
- Close Control

1.5.6 The terminal strips and blocks shall be clearly labeled and the purpose or function of each connection shall be identified.

1.6 Operating Mechanism

1.6.1 The HV Circuit Breaker shall be provided with one operating mechanism for all three poles and shall be suitable for three-pole group opening and closing operations.

1.6.2 The operating mechanism shall be fully-integrated spring, hydraulic or spring-hydraulic operating mechanism. It shall be hermetically sealed to the atmosphere to eliminate corrosion and help providing maintenance-free performance with long term stability. The operating mechanism shall include all auxiliary devices and other accessories for the operating mechanism furnished. The mechanism, shall be electrically trip-free and shall include anti-pump auxiliary relays and devices.

1.6.3 NEMA 3R (minimum) compartment with door gaskets shall be furnished to house the operating mechanism, including its associated charging motor, pump, or compressor. The compartment shall contain minimum of one (1) space heater with sheaths of high-temperature chrome steel to maintain air circulation inside the enclosure, complete with thermostat.

1.6.4 The operating mechanism shall be furnished with two separate and electrically independent DC trip coils. The two coils shall be arranged so that energization of either coil or of both coils simultaneously, or energization of either coil with the other coil shorted, will produce proper tripping. The primary trip coil and the close circuit shall be included in one control circuit. The secondary trip coil shall be included in a separate control circuit. The HV circuit breaker control switch shall only operate the primary trip coil for trip operations

1.6.5 If hydraulic operating mechanism is used it shall include a pressure gauge and pressure switch with two alarm contacts that close to alarm low oil/nitrogen gas pressure. A low-pressure cutout switch (with two alarm contacts) shall be provided to prevent initiating a close signal should the operating pressure be below the minimum required for a complete close-open operation. The low-pressure cutout device shall not prevent a complete close-open operation should pressure drop after the close-open operation is initiated.

1.6.6 Operating mechanism equipment including piping and linkages shall be factory installed as completely as possible. The supplier shall provide all materials for connections which must be installed in the field.

1.6.7 The operating mechanism may be located within the control cabinet.

1.7 Bushings

1.7.1 Bushings shall be porcelain or polymer, ANSI Standard Z55.1 No. 61 or No. 70; or Munsell 5.0 BG 7.0/0.4 light gray colour.

1.7.2 Bushings shall have a minimum flange seat to lower end length (strike distance) of 900 mm, with a minimum creepage distance of 1725 mm.

1.7.3 The bushing BIL rating shall meet or exceed the breaker's BIL rating.

1.8 Current Transformers

1.8.1 Current transformers shall be bushing type with fully distributed windings for relaying service. The manufacturer shall provide two (2) current transformers on each circuit breaker bushing, both load and line side.

1.8.2 All current transformers shall have multi-ratio primary ratings with a minimum of 200A, 450A, 500A, and 600A to 5A nominal secondary ratings.

1.8.3 All current transformers shall be relay class CT with C800 relaying accuracy or better at all tap settings.

1.8.4 Current transformers wiring shall be brought back to terminal blocks located within the transformer control cabinet. All secondary leads of each current transformer, including all taps of each transformer, shall be wired to shorting type terminal blocks located in the circuit breaker control cabinet. Each set of secondary winding taps shall terminate on a 6-pole shorting block, with the sixth pole permanently connected to the shorting bar and to ground.

1.8.5 All current transformers shall be left connected at the 300:5A ratio.

1.9 Control Cabinet

1.9.1 All controls shall be housed within a low-voltage, self-contained NEMA 3R (minimum) gasketed enclosure, separate from all high-voltage components to provide isolation, and shall be arranged to allow complete accessibility for operation without exposure to high voltage.

1.9.2 A rotary type pistol grip handle control switch (ElectroSwitch Series 24, or equivalent, with “Trip”, “Close”, and spring – return to normal positions) shall be provided in the control cabinet for three-pole operation for maintenance purposes only, with associated red and green LED-type indicating lights.

1.9.3 A two-position, rotary type control switch shall be provided in the control cabinet for locally enabling and disabling remote output functions.

1.9.4 The AC and DC power supply voltages shall be as specified in Section 1.2, Ratings. The AC and DC power will be provided by Others.

1.9.5 Separate auxiliary circuit breakers shall be provided for charging motor, convenience receptacle and compartment heater circuits.

1.9.6 Two unfused, double-pole, single-throw, knifeblade-type, disconnect switches shall be provided for isolating both Trip Coil DC control power circuits during maintenance.

1.9.7 The outside of the control cabinet shall be painted light gray per ANSI Standard Z55.1 No. 61 or No. 70; or Munsell 5.0 BG 7.0/0.4. The interior of the control cabinet shall be painted white,

1.9.8 The control cabinet shall contain minimum of one (1) space heater with sheaths of high-temperature chrome steel to maintain air circulation inside the enclosure, complete with thermostat.

1.9.9 Control cabinet door shall have provision for pad-locking and placement of utility tags for safety and procedure identification.

1.9.10 All external fasteners and hardware (such as bolts, screws, hinges, and handles) shall be stainless steel.

1.9.11 All external auxiliary power and control wiring will be routed in conduit or feed-through wireway to the control cabinet.

1.9.12 Grounding provisions shall be provided for the control cabinet.

1.9.13 The compartment shall be furnished with one 120 VAC, 20 amp, duplex convenience receptacle

1.10 Auxiliary Power and Control Wiring

1.10.1 All auxiliary power and control wiring shall consist of 600 volt stranded copper switchboard wire, moisture resistant or thermosetting and shall be #14 AWG minimum.

1.10.2 Use 7 strand or 19 strand conductors for #14 AWG and larger wire.

1.10.3 Terminate all wires on devices with compression type connectors. Do not use spade lugs or soldered terminals. Do not connect more than three wires to any one stud or terminal.

1.10.4 Use type written, heat shrink sleeve wire markers through out.

1.11 Accessories

1.11.1 Each operating mechanism shall be equipped with 20 spare auxiliary switch contacts (10 Form-A and 10 Form-B) used for indicating, interlocking, and alarming, wired to a separate terminal block in the control compartment. The auxiliary contacts shall be rated for 2 amps at 125 V DC.

1.11.2 The circuit breaker shall have shall be equipped with a mechanical operation counter arranged to count opening operations.

1.11.3 The circuit breaker shall have a visual mechanical position indicator effectively connected to the operating mechanism. Green shall indicate open, and red shall indicate closed.

1.11.4 A SF_6 temperature compensated gas pressure indicator(s) shall be provided for two stage alarm, indication and block of operation in the event of a loss of gas pressure. The first stage alarm shall indicate abnormal but safe SF_6 pressure. The second stage alarm shall indicate a critical pressure. At the critical pressure each pole shall still have full current interrupting and overvoltage ratings. Each mechanism shall be wired to allow the option of having the mechanism remain in its current state for critical SF_6 pressure on any pole, or having the mechanism trip when the critical pressure occurs on any pole.

1.11.5 Pole tank heaters with controls shall be provided if required for the specific ambient temperature conditions specified herein.

1.11.6 The circuit breaker shall have standard NEMA 4-hole, 4 inch x 4 inch flat terminal pad line terminals. The terminals shall be either tin-plated bronze or copper. NEMA 6-hole terminal pad line terminals is also acceptable.

1.11.7 The operating mechanism shall have a latch check switch or hydraulic latch valve, as applicable.

1.12 Physical Assembly

1.12.1 For equipment protection and personal safety a hot-deeped galvanized steel elevating structure assembly shall be provided for the assembled HV circuit breaker. The structure will also support additional framework for mounting the control cabinet.

1.12.2 The bottom plates of the structure shall be properly coated for mounting on concrete footings.

1.12.3 All exposed high-voltage unguarded live parts shall be a minimum of 3.7 vertical meters above the base of the assembly.

1.12.4 Two diagonally located legs of the elevating structure end section shall be supplied with a two-hole NEMA grounding pad. The terminals shall be either tin-plated bronze or copper

1.13 Wind and Seismic Requirements

1.13.1 The circuit breaker assembly performance shall meet the wind and seismic requirements of IEEE Standard 693 and shall be capable of remaining operational following the wind or the seismic event without need for immediate assistance.

1.13.2 The Vendor shall perform wind and seismic analyses and shall supply three (3) copies of the analysis with the final equipment drawings.

1.14 Outdoor Finish

1.14.1 The finish on painted metal parts shall be light gray, satisfying the requirements of ANSI Standard Z55.1 or No. 61 or No. 70; or Munsell 5.0 BG 7.0/0.4. Supplier shall supply one quart of touch-up paint per circuit breaker.

1.14.2 All elements of the support structure (i.e. legs, frame) not forming part of the breaker or control cabinet housing shall be hot-dipped galvanized steel.

1.14.3 During fabrication, the areas of structural parts that may later become inaccessible shall be given an anticorrosion primer to ensure that all surfaces are protected.

1.14.4 Cast aluminum, aluminum, and stainless steel components shall be left in their natural finish.

1.14.5 All external fasteners and hardware (such as bolts, screws, hinges, and handles) shall be stainless steel and shall not be painted.

2 FACTORY TESTS

2.1 Circuit Breaker

2.1.1 All standard tests as defined by ANSI/IEEE C37.09 “Test Procedure for AC High-Voltage Circuit Breakers” shall be carried out on the circuit breaker with no exceptions.

2.2 Auxiliary Devices

2.2.1 Current Transformers

.1 All Current Transformers shall be tested in accordance with CSA Standard C13 and shall include the secondary lead burdens.

.2 Tests shall include the following:

.1 Induced dielectric voltage test.

.2 Accuracy test.

.3 Polarity test.

.4 Ratio test.

.5 Winding impedance.

2.2.2 Bushings

.1 All bushings shall be tested in accordance with applicable ANSI/IEEE standards and certified by the bushing manufacturer.

.2 All bushing test results shall be stamped on the bushing nameplate and recorded in the test results.

2.2.3 Wiring

.1 Secondary circuit wiring of all auxiliary devices shall be checked to ensure correct functioning from initiating source (i.e. Purchaser’s connection point) to component operation.

.2 Auxiliary wiring insulation tests shall include dielectric tests in accordance with ANSI Standard C37.20.

2.3 Results

2.3.1 All test results shall be recorded as performed.

2.3.2 Official final documentation of the Factory Test results notwithstanding, the Vendor shall provide all test results to the Engineer in written form within 24 hours of completion by fax or email, and the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

2.3.3 All test reports shall include the following information:

.1 Date of test.

.2 Confirmation that test results are acceptable.

.3 Initialled by Vendor.

3 DOCUMENTATION

3.1 Manufacturers' Drawings

3.1.1 Circuit breaker assembly drawings submitted for review showing assembly, details, and layout shall show anchor bolts, openings for cables, and all pertinent support structure loading details.

3.1.2 The manufacturer shall furnish, with each circuit breaker assembly, a set of drawings complete with a bill of material and showing: typical front views and open side views as well as typical components, their positions, and available space for cable termination; an anchor bolt plan with dimensions; a one-line diagram; and appropriate wiring diagrams.

3.1.3 Vendor's drawings submitted for review shall show all terminals, wire and terminal numbering and incorporate equipment schematic details.

3.1.4 The Vendor shall supply three phase AC schematic diagrams and panel wiring diagrams for the circuit breaker assembly to be supplied.

3.2 Operation and Maintenance Manuals

3.2.1 The manufacturer shall furnish a comprehensive instruction manual covering installation of the circuit breaker assembly and operation of the various components.

3.2.2 Instruction manuals shall describe in detail the construction and recommend procedures for assembling, dismantling, maintaining and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturers, of component parts of the equipment, properly catalogued for easy reference.

3.2.3 Instruction manuals shall be accompanied by copies of all Vendor's Drawings in AutoCAD format.

4 SHIPPING

4.1 General

4.1.1 Prior to shipment, the following values shall be tested and recorded:

.1 Ambient temperature in °C.

.2 SF_6 Gas Pressure in PSI (if applicable).

4.1.2 Responsibility for delivery shall belong to the Vendor, who shall provide for all delivery costs from factory to the Place of Installation, including but not limited to the following:

.1 Complete delivery from the Place of Manufacture to the Place of Installation at Digby County, Nova Scotia.

.2 Transportation of all accessories, including SF_6 gas canisters if applicable, and parts to be shipped separately to the Place of Installation.

.1 If shipment of accessories and parts is to be made prior to delivery of the circuit breaker, the Vendor shall make arrangement with the Owner, through the Engineer, for an alternate delivery point.

.2 Storage at the alternate delivery point and delivery from that point to the Place of Installation shall be by others.

.3 All necessary permits and regulatory costs involved in the transport of the circuit breaker, including but not limited to those imposed by the following bodies (such costs and requirements based on the size, weight, point of origin, and materials of the final product):

.1 Canada Border Services Agency.

.2 Transport Canada.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal.

.4 Following delivery to the Place of Installation but prior to off-loading, the Vendor shall be responsible for the following:

.1 Test and record the following values:

.1 Ambient temperature in degrees Celsius.

.2 SF_6 gas shipping pressure in PSI, if applicable.

.3 Visually inspect the Works to ensure no superficial damage during the transportation process.

4.1.3 The Vendor shall include offloading of the circuit breaker to a location within the confines of the Place of Installation, as directed by the Purchaser.

.1 Any and all intermediate off-loading and on-loading of the circuit breaker as required between the Manufacturer's Plant and the Place of Installation remains the responsibility of the Vendor.

4.1.4 Equipment delivered to the Place of the Installation before 11.00 am shall be unloaded during the working day 8 am to 5 pm. Equipment received after 11.00 am may be unloaded on the next working day without incuring any demurrage charges.

4.2 Provisions

4.2.1 All auxiliary current transformers shall be shipped shorted and grounded at the terminals located in the breaker control cabinet/frame.

4.3 Follow-up

4.3.1 The Vendor shall provide to the Engineer one (1) reproducible copy of the following within 24 hours of off-loading at the Place of the Installation:

.1 Ambient temperature in °C (before shipment and before off-loading).

.2 SF_6 gas shipping pressure in PSI, if applicable (before shipment and before off-loading).

.3 List of any and all noted visible defects noted prior to off-loading.

III. SITE CIRCUIT BREAKER TESTING

1 OVERVIEW

1.1 General

1.1.1 In general, provide electrical services in the testing and commissioning of the Circuit Breaker.

1.1.2 The scheduling of all work shall be co-ordinated with Owner and Purchaser to ensure that no delays are caused by interference between persons operating on site under different contracts. The Vendor shall allow a minimum of five (5) Working Days for the Testing and Commissioning, weather-permitting.

1.1.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.

1.1.4 Should any test results be deemed unacceptable, whether due to test conditions, Vendor error, or required correction of an equipment deficiency, the Vendor shall be responsible for repeating the applicable test or tests.

1.1.5 The Vendor and the Engineer shall review all tests prior to the testing personnel leaving the site.

1.2 Compliance with Standards and Codes

1.2.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

1.2.2 The Vendor shall adhere to the following standards during the process of testing and commissioning:

.1 Nova Scotia Provincial Standards

.1 Nova Scotia Occupational Health and Safety Act

.2 Nova Scotia Workers' Compensation Act.

.2 CSA Standards

.1	C22.1-06	Canadian Electrical Code Part I
.2	C22.3	Canadian Electrical Code Part III
.3	Z462-08	Workplace Electrical Safety

.3 ANSI/IEEE Standards

.1	C37.09-1999	IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

.2 Std. No. 472 Guide for Surge Withstand Capability (SWC) Tests

1.3 Equipment

1.3.1 The Vendor shall be responsible for the supply of all test equipment including but not limited to the following:

.1 10kV Doble Test Set (or equivalent).

.2 Meggar Test Set (or equivalent).

.3 Fluke Meter (or equivalent).

.4 Three-phase generator.

.5 Current meter.

.6 Voltage meter.

.7 Testing cables.

.8 Disconnect switch.

.9 Current transformer tester.

2 TEST PROCEDURES

2.1 General

2.1.1 The Vendor shall test the circuit breaker and all accessories to the satisfaction of the Engineer as defined herein; the Vendor shall indicate and include any additional Vendor-recommended tests with the provided Tender Bid.

2.1.2 The Vendor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.

2.1.3 The Vendor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.

2.1.4 All test results shall be provided to the Engineer in written form within 24 hours of completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.

2.1.5 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

2.1.6 All test reports shall include the following information:

.1 Name of testing firm.

.2 Date of test.

.3 Ambient temperature at time of test.

.4 Relative humidity at time of test.

.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).

.6 Confirmation that test results are acceptable.

.7 Initialled by Vendor.

2.2 Circuit Breaker Testing

2.2.1 The Vendor shall be required to provide the following tests, as a minimum, in addition to a visual inspection, on the Breaker and its auxiliary devices:

.1 Contact Resistance Test

.2 Breaker Timing Test (including all contact status states)

.3 Doble Insulation Test on each phase and to ground potential (frame)

.4 Current Transformer Tests

.1 The Vendor shall perform the following tests on each transformer CT, for all taps, based on the Manufacturer's recommended test procedures:

.1 Ratio Test

.2 Magnetization Curve Test

.3 Secondary Resistance Test

.5 Operational Test of all Gauges and Contacts

3 DOCUMENTATION

3.1 Official Test Results

3.1.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Vendor shall provide six (6) copies of final, official test reports, type-written with the Vendor's signature of approval, to the Engineer following the completion of Testing.

3.1.2 The Vendor shall include the results of all on-site testing described herein, and the information defined in Part B, Section iv, Clause 2.1.6.

3.1.3 The Vendor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.

3.1.4 The Vendor shall accompany the official test report with written approval that the field test results have been reviewed and the circuit breaker and all accessories have been found acceptable for energization and operation.

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

1.0 INSTALLATION INFORMATION

Weights

	NET	SHIPPING
Complete Circuit Interrupter Assembly	_____Kg	_____ Kg

Dimensions (mm)

Overall Shipping Dimensions L _____ mm W _____ mm H _____ mm

(Provide dimensional drawings of assembly components and accessories once assembled.)

Warranty

Available warranty (attach details) _____

Accessories

List accessories to be shipped separately

_____

_____

_____

_____

_____

_____

_____

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

2.0 BIDDER INFORMATION REQUIRED

A. CIRCUIT INTERRUPTER	SPECIFICATION	BIDDER'S REMARKS
Circuit Breaker - General:		
- Manufacturer		
- Model/Designation		
- Type – Live/Dead Tank	Dead	
- Phases	3	
- Frequency	60	
Voltage Rating:		
- Rated Nominal Voltage phase–phase, kV rms	69	
- Rated Maximum Voltage, kV rms	72.5	
- Impulse Withstand (BIL), kV	350	
- 1 min Dry Withstand, kV	160	
- 10 sec Wet Withstand, kV	140	
Current Rating:		
- Rated continuous current, A	600	
- Rated Short Time Withstand Current (3 sec), A	30,000	
- Rated Short Circuit Breaking Current, A	30,000	
- Rated Making Current / peak, A	70,000	
- Rated Capacitor Switching Current, A	150	
- Rated Magnetizing Switching Current, A		
Operating Rating:		
- Maximum Interrupting Time, cycles		
- Maximum Closing Time, cycles		
Environmental Capabilities:		
- Temperature Rating (+/- °C)		
- Seismic Qualification Level		
- Wind Capability (km/h)		

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

B. OPERATOR	SPECIFICATION	BIDDER'S REMARKS
Reference Data:		
- Type		
- Individual or Common	Common	
- Motor Type		
- Motor Voltage/Power Requirements		
- Spring Charge Time		
- Maximum Number of Stored Open-Close-Open Operations		
- Number Trip Coils	2	
- Number Close Coils	1	
- Trip Coil Voltage/Current/Resistance		
- Close Coil Voltage/Current/Resistance		
Functions:		
- Trip/Close Control Switch		
- Local/Remote Switch		
- Interrupter Status Indicator		
- Manual Trip Lever		
- Charged/Discharged Indication		
- Operations Counter		
- Dry Contacts (indicate contact ratings and number of contacts)		
- SF_6 Gas Indication/Alarm		
Cabinet Data:		
- Material Type		
- Material Gauge		
- Ventilation		
- Heater		
- Control Voltage, VDC	125	
- Service Voltage, VAC	120	
- Provision for pad-lock		

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

C. SF6 SYSTEM	SPECIFICATION	BIDDER'S REMARKS
- Normal Operating Pressure at 20°C		
- Minimum Operating Pressure with Full Rating (kPag)		
- Temperature Compensated Gas Pressure/Density Alarm (kPag)		
- Temperature Compensated Gas Pressure/Density Lockout (kPag)		
- Overpressure Relief Valve		
- Weight of SF6 Gas (kg)		
- Acceptable Moisture Level (ppm/wt)		
- Pressure Below Which Breaker Must be Isolated (kPag)		

D. MOUNTING FRAME	SPECIFICATION	BIDDER'S REMARKS
- Type		
- Material Type		
- Material Gauge		

E. CURRENT TRANSFORMERS	SPECIFICATION	BIDDER'S REMARKS
Reference Data:		
- Manufacturer		
- Designation or Catalogue Number		
- Type	donut	
- Current data:		
- CT Ratio		
- CT Accuracy		
- Three-Phase Symmetrical Short Circuit Withstand Capacity (A)	30,000	

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

F. BUSHINGS	SPECIFICATION	BIDDER'S REMARKS
- Manufacturer		
- Insulation Medium		
- Voltage Rating, (V rms)		
- Current Rating (A rms)		
- Wet Withstand Test at Operating Frequency, (V rms)		
- Dry Withstand Voltage at Operating Frequency, (V rms)		
- Full-Wave Impulse Withstand Voltage Test (kV)		
- Creepage Distance (mm)		
- Extra Creep Distance (mm)		
- Additional Height Required to Remove Bushing (mm)		
- Insulation Class (BIL) (kV)		
- Permissible Safe Cantilever Strength (kg)		
- Strike Distance (Phase to Ground) (mm)		
- Strike Distance (Phase to Phase) (mm)		
- Phase spacing		

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APPENDIX 2

TECHNICAL CONFORMITY STATEMENT

BIDDER is to duly complete and sign the appropriate section below and return with the proposal.

A) No technical deviations/exceptions:

We _____ hereby confirm that our proposal No._____ dated _____ in response to Request for Quotation No. 090630-SP-E01 is in full compliance with CBCL Limited technical requirements.

B) Technical deviations/exceptions.

We _____ hereby confirm that our proposal No._____ dated _____ in response to Request for Quotation No. 090630-SP-E01 is not in full compliance with all CBCL Limited technical requirements and the following deviations/exceptions are taken.

CBCL Limited Technical Requirement	Technical Deviations/Exceptions

_____
Name of Bidder

_____
Authorized Signature

_____
Date

APPENDIX 3

SCHEDULE OF VENDOR TECHNICAL DAT

ITEM: _____ CONTRACTOR: _____		DOCUMENT TO BE ISSUED BY	COPIES OF EACH COPY OF QUOTATION	PRECEDE BY ELECTRONIC COPY/FAX	FOR REVIEW			FINAL (CERTIFIED)		
					ISSUE WEEK NO.	REVIEW BY	RETURN BY WEEK NO.	ISSUE WEEK NO.	REVIEW BY	RETURN BY WEEK NO.
ITEM	TECHNICAL DOCUMENT									
1.	Technical Specification Document	☑	1		0					
2.	Form of Quotation	☒	3		3	☑	5			
3.	Data Sheet Questionnaire	☒	3		3	☑	5			
4.	Technical Conformity Statement	☒	3		3	☑	5			
5.	Schedule of Vendor Technical Data	☒	3		3	☑	5			
6.	Anticipated Contractor's Project Timeline	☒	3		3	☑	5			
7.	Manufacturer's Supplementary Tender Documents	☒	3		3	☑	5			
8.	Index of Manufacturer's Tender Documents	☒	3		3	☑	5			
9.	Contract Documents	☑	3	✓	6	☒	7			
10.	Outline	☒	6	✓	13	☑	15			
11.	Dimensional Arrangement Drawings	☒	6	✓	13	☑	15			
12.	Bill of Materials	☒	6	✓	13	☑	15			
13.	List of Factory Tests to be Carried Out	☒	6	✓	23	☑	25			
14.	Single-Line Diagrams	☐								
15.	Three-Line Diagrams/AC Schematics	☒	6	✓	23	☑	25			
16.	Wiring Diagrams	☒	6	✓	23	☑	25			
17.	Painting Procedure	☒	6	✓	23	☑	25			
18.	Time/Current Characteristics	☒	6	✓	13	☑	15			
19.	List of Required Accessories & Special Tools	☒	6	✓	27	☑	29			
20.	Recommended Spare Parts List	☒	6	✓	27	☑	29			
21.	Certified Manufacturer's Test Reports	☒	6	✓				31	☑	33
22.	Installation, Operating, and Maintenance Manuals	☒	6					31	☑	33
23.	Final Manufacturer's Drawings	☒	6	✓				31	☑	33
24.	Field Test Results	☒	2	✓				within 24 hrs of test		

☑	OWNER/ENGINEER
☒	CONTRACTOR

CBCL LIMITED
Consulting Engineers

SkyPower Corp.

Digby Wind Power Project – Reactive Power Static Compensator (STATCOM) System

Specification Document

090630-SP-E06

Reactive Power Static Compensator (STATCOM) System

CBCL LIMITED
Consulting Engineers

CBCL PROJECT No.: 090630.00
TENDER DATE: ……
SUBMISSION DEADLINE: ……

CBCL LIMITED
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Signed and Sealed on Behalf of

CBCL Limited

Ivelin Radnev P. Eng

Rev. B – Issued for Final Review	L. O'Keefe	June/09	R. O'Connor
Rev. A – Issued for Review	L. O'Keefe	May/09	R. O'Connor
Issue or Revision	***Reviewed By:***	***Date:***	***Issued By:***

LIST OF POTENTIAL BIDDERS

Charlton & Connolly
(S&C Electric Canada Ltd)

Contact: Randy Ivens
Tel: (416) 249-9171
Email: rivens@scelectric.ca

American Superconductor

Contact: Cathy Stewart
Tel: (978) 842-3037
Email: cstewart@amsc.com

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SkyPower Corp.

PART A

Bidding and Contract Requirements

Specification Document

090630-SP-E06

CBCL LIMITED
Consulting Engineers

I. INTRODUCTION

1 FORWARD

1.1 The joint venture partners SkyPower Corp. and Scotian WindFields Inc. signed a long term Power Purchase Agreement (PPA) with Nova Scotia Power to supply renewable power in the form of wind generation. The project will consist of twenty (20), GE 1.5sle, 1.5 MW wind turbine generators with a substation on the eastern portion of the site. The point of common coupling will be at the termination point of a Nova Scotia Power (NSPI) transmission line at the NSPI Conway substation (approximately 10.6 km away).

1.2 The Digby Wind Power Project wind turbines are located on various private properties on both the western side and the eastern side of Gulliver's Cove Road., Municipality of the District of Digby, Nova Scotia.

II. INSTRUCTIONS TO BIDDERS

1 DEFINITIONS

1.1 **"Balance of Plant"** means all equipment, tools, labour, and services not directly associated with the supply of the facility wind turbines.

1.2 **"Bidder"** means a person, firm or corporation who propose to submit, or who have submitted a quotation for the supply of the equipment.

1.3 **"Calender Day"** means any day including Saturday, Sunday, statutory holiday or statutory vacation day that is observed by the construction industry in the area of the Place of the Work.

1.4 **"Change Directive"** is a written instruction prepared by the Engineer and signed by the Owner directing the Vendor to proceed with a change in the work within the general scope of the Technical Specification prior to the Owner and the Vendor agreeing upon an adjustment in Contract Price and Contract Time.

1.5 **"Change Order"** is a written amendment to the Contract prepared by the Engineer and signed by the Purchaser stating their agreement upon:

- a change in the Work;
- the method of adjustment or the amount of the adjustment in the Contract Price, if any; and
- the extent of the adjustment in the Contract Time, if any.

1.6 **"Contract"** is the undertaking by the parties to perform their respective duties, responsibilities, and obligations as prescribed in the Contract Documents and represents the entire agreement between the parties.

1.7 **"Contract Time"** is the time stipulated herein from commencement of the Work to Substantial Completion of the Work.

1.8 **"Delivery Period"** means the period commencing on the date of mailing of the Purchaser's official order to the Vendor and ending on the date when delivery to the site designated for delivery, covered by the purchase order, has been complete.

1.9 **"Engineer"** means CBCL Limited (CBCL) or its duly appointed representative who has been authorized by the Owner to act on their behalf.

1.10 **"Interconnection Utility"** is Nova Scotia Power (NSPI) a division of Emera, Inc

1.11 **"Owner"** means SkyPower Corp., and includes the Owner's personal representatives or successors.

1.12 **"Place of the Installation"** is the Digby Wind Farm Substation, Municipality of the County of Digby, Nova Scotia, Canada.

1.13 **"Purchaser"** is the Owner.

1.14 **"Shop Drawings"** are drawings, diagrams, schematics, illustrations, schedules, performance charts, brochures, Product data, manuals and other data that the Vendor provides to illustrate details of the Circuit Breaker.

1.15 **"Specifications"** are that portion of the Contract Documents, wherever located and whenever issued, consisting of the written requirements and standards for Products, systems, workmanship, and the services necessary for the performance of the Work.

1.16 **"Supply Price"** is the amount stipulated herein, based on a lump sum basis of payment, including duties, tolls, shipping and transportation costs.

1.17 **"Technical Specification"** means those documents listed herein and amendments agreed upon between the parties.

1.18 **"Value Added Taxes"** means the Harmonized Sales Tax (HST), the collection and payment of which is by the Vendor as imposed by the tax legislation.

1.19 **"Vendor"** means the equipment supplier whose equipment has been selected by the Purchaser pursuant to a general contract.

1.20 **"Working Day"** means any day excluding Saturday, Sunday, statutory holiday or statutory vacation day that is observed by the construction industry in the area of the Place of the Circuit Breaker Installation.

1.21 **"Complete Submission of Tender"** means the full requested submission package including completed Form of Quotation, Appendices as indicated herein, and proposed layout drawing(s).

2 QUOTATIONS SUBMISSION

2.1 Submit complete quotation—including completed Form of Quotation, Appendices 1-3, and proposed layout drawing(s)—in Adobe Portable Document Format ("pdf"), or similar electronic format approved by the Engineer, via email as follows:

SUBJECT LINE	-	CBCL Limited (CBCL): QUOTATION NO. 090630-SP-E06
ADDRESS TO	-	larryo@cbcl.ca
CARBON COPY	-	ivor@cbcl.ca
SALUTATION	-	Larry O'Keefe, P.Eng.

2.2 Delivery to the above address shall be no later than 14:00 Atlantic Standard Time on June XX, 2009

2.3 Electronic submission shall be followed immediately by submission of three (3) copies of complete quotation, at least one (1) of which shall be reproducible—including completed Form of Quotation, Appendices 1-3, and proposed layout drawing(s)—in sealed envelope marked as follows:

QUOTATION - SKYPOWER CORP.
DIGBY WIND POWER PROJECT
QUOTATION FOR: REACTIVE POWER STATIC COMPENSATOR (STATCOM) SYSTEM
QUOTATION NO.: 090630-SP-E06

and addressed to: CBCL Limited
PO Box 606
1489 Hollis Street
Halifax, NS B3J 2R7

Telephone Number: (902) 421-7241, ext. 2327
Fax Number: (902) 423-3938
Attention: Larry O'Keefe, P.Eng.

2.4 Submit quotations on the Form of Quotation provided. Completely fill out forms in ink. The completed form shall be without interlineation, alterations, or erasures. Signatures must be witnessed.

2.5 No other Form of Quotation will be acceptable. The appending of any qualifying clauses to the Quotation or failure to comply with these instructions in the completing of any quotations renders such quotation liable to disqualification. The quotation as originally submitted shall be essentially complete to permit a full analysis without the need for additional information.

2.6 The Purchaser will not defray any expenses whatsoever incurred by Bidders in the preparation and submission of their quotations.

2.7 Submittal of quote signifies that Vendor fully understands all specifications listed.

2.8 Vendor shall submit quote based upon requirements noted in specification. Vendor is encouraged to quote as options that which appear to be more cost effective for this application. Any question as to the intent of the specifications or an apparent conflict or omission between this specification and other specifications shall be resolved by the Vendor contacting the Engineer for clarification.

2.9 The Vendor shall note that the Owner reserves the right to accept all or part of the full Quotation Submission, consisting of the following two (2) components:

2.9.1 Design, manufacture, factory testing, delivery, and off-loading of Reactive Power Static Compensator (STATCOM) System.

2.9.2 Field testing of Reactive Power Static Compensator (STATCOM) System.

3 CLARIFICATION AND ADDENDA

3.1 Notify Engineer of omissions, errors, or ambiguities found in the Quotation Documents. If Engineer considers that correction, explanation, or interpretation is necessary, a written addendum will be issued. All addenda will form part of quotation documents.

3.2 No oral explanation in regard to the meaning of the quotation documents will be made and no oral instructions will be given before the selection of equipment.

3.3 Address questions to Larry O'Keefe, P.Eng., at CBCL Limited, 1489 Hollis Street, Halifax, NS, B3J 2R7, telephone number (902) 421-7241 ext. 2327, fax number (902) 423-3938, e-mail: larryo@cbcl.ca, cc: ivor@cbcl.ca.

4 PURPOSE AND PROCEDURE

4.1 The purpose of receiving quotations in accordance with these documents is to permit examination of a variety of equipment on a comparable basis in order to select the equipment best fulfilling the Owner's requirements and to ensure that it is delivered on site at the appropriate time.

4.2 The procedure, in general, will be as follows:

4.2.1 Receive and assess quotations for equipment.

4.2.2 Select equipment.

4.2.3 Notify Vendor and conduct correspondence as required.

4.2.4 Place order for equipment.

4.2.5 Request shop drawings, examine and approve and return shop drawings.

4.2.6 Request shipping/receiving documentation for equipment delivery.

5 INFORMATION WITH QUOTATION

5.1 Quotations shall be accompanied with all data requested in the Technical Specifications.

5.2 All Bidders must bid against the enclosed specification. In the case where a Bidder wishes to bid an alternative, they are invited to do so. However, full documentation of the potential advantages to the Owner together with reference to equivalent installation must be made.

5.3 Bidders are requested to submit a timeline indicating full estimated duration of contract, from the award of contract to the completion of commissioning as defined herein, and including any and all major milestones.

6 PRICES

6.1 Quoted prices shall include for delivery to the Place of the Installation during normal working hours including bill of lading as well as receiving report. The Owner shall provide delivery address prior to shipment. The Bidder shall arrange unloading at the Place of the Installation.

6.2 Quoted prices shall show all taxes separately.

6.3 The fixed quoted prices shall be in Canadian dollars, and shall include and cover all contingencies and provisional sums; all patents and licensing fees, duties, and handling charges, transportation and all other charges.

6.4 The prices contained in quotations shall be fixed and open for acceptance for a period of sixty (60) calendar days after the closing date for receipt of quotations. Provided that the Purchaser places a written order for the equipment within the above-mentioned period of validity of the quotation, there shall be no increase in the quoted price of the equipment.

6.5 The Bidder shall submit the quotation on the Form of Quotation without any connection, comparison of figures with, or knowledge of any other corporation, firm, or person making a quotation for similar equipment for this project and the quotation shall be in all respects fair and without collusion or fraud.

7 SHOP DRAWINGS AND PRODUCT INFORMATION MATERIAL

7.1 Following the award of contract, the Vendor shall submit to the Engineer for approval shop drawings and product information for the equipment to be supplied. Due to project schedule constraints, shop drawings may be submitted electronically or by fax with hard copies to follow by courier.

7.2 The expected schedule for receipt of Shop Drawings shall be as indicated by Appendix 3.

7.3 Include cost of shop drawings in quoted price.

7.4 The material and drawing information shall include, but not be limited to, the following:

7.4.1 Dimensional outlines, sections and detail of all equipment, with anchor bolt location plan and required clearances.

7.4.2 General assembly drawing with weights, service requirements, points of connection, recommended clearances, and complete parts list.

7.4.3 Control schematics and wiring diagrams (as applicable).

7.4.4 Detailed instruction for the erection of equipment.

7.4.5 Recommended spare parts.

7.5 Submit six (6) sets of drawings on or before the indicated dates.

7.6 The Engineer will review and mark comments as required on two (2) copies of the material and return them to the Vendor indicating "no apparent errors", "apparent errors noted", "rejected - see remarks", or "revise and resubmit", one (1) copy forwarded to Purchaser, and the Engineer will retain three (3) copies. Review of the Vendor’s shop drawings by the Engineer shall not relieve the Vendor of the responsibility for the correctness thereof or for the results arising from any error or omission in details of the design. Resubmit all drawings marked "rejected - see remarks" or "revise and resubmit".

7.7 Review of shop drawings and acceptance of the equipment shall in any case be subject to final approval of the equipment and materials after they have been put in commission, all guarantees being fulfilled and the general operation of the equipment and materials having been found satisfactory by the Engineer.

7.8 After the Engineer has reviewed the drawings, information and material, no change shall be made in them without the Engineer's written permission. In the event of any alterations or changes being authorized, six (6) of each of the final drawings and specifications indicating these changes shall be immediately furnished at the Vendor's expense.

7.9 The Purchaser will not accept responsibility for cost of changes necessary if any equipment is fabricated without prior review of shop drawings. Review of shop drawings does not relieve the Supplier of responsibility to meet the requirements of the specifications.

8 OPERATIONS AND MAINTENANCE MANUALS

8.1 The Vendor shall furnish to the Owner, through the Engineer, six (6) hard copies and one (1) electronic copy in Adobe Portable Document Format ("pdf") of operations and maintenance manuals specifying instructions for the following:

8.1.1 Receiving, handling, storage.

8.1.2 Installation, alignment checks.

8.1.3 Electrical connections.

8.1.4 Technical bulletins of all components.

8.1.5 Operation.

8.1.6 Maintenance procedures.

8.1.7 Relevant drawings.

8.1.8 Detailed spare parts list complete with current price list and supplier of spare parts contact data.

8.1.9 Safety instructions.

8.1.10 Tests and Vendor inspection procedures.

8.1.11 Factory and field test results.

8.2 Provide material not later than thirty (30) days prior to scheduled shipment of equipment. Include cost of providing this material in quoted price for supply of equipment.

9 IN-PLANT INSPECTION AND TESTING

9.1 The Owner, Purchaser, Engineer, and/or their authorized agents shall have the privilege of inspecting and witnessing all testing at all times during the manufacture of the equipment or materials ordered herein.

9.2 Provide advance notice of at least ten (10) days for inspection and testing.

9.3 Shop tests shall not constitute a waiver of requirements to meet actual field operating conditions or relieve the Vendor of their responsibility.

9.4 Provide three (3) copies of the official test results to the Engineer showing all tests conducted in accordance with this Document.

10 DELIVERY, STORAGE, AND HANDLING

10.1 Vendors shall include in quotation the cost of shipment to the Place of the Installation.

10.2 The Vendor shall be responsible for employing shipping preparations necessary to ensure that all equipment arrives at the destination in excellent working condition when handled by commercial carriers. All equipment shall be suitably packaged so as to ensure delivery in good condition. The Vendor shall identify any omissions, discrepancies, or damage evident on delivery to the Engineer and the Owner, and make said omissions, discrepancies, or damage good.

10.3 The Vendor shall provide the Purchaser with proof of insurance prior to shipment to the Place of the Installation.

10.4 Vendors will provide a schedule of milestone events and, in the case of partial shipments, the Vendor will provide a proposed schedule at the time of bidding.

10.5 Unless otherwise indicated, all equipment shall be shipped completely assembled where possible. Large fabricated assemblies shall be shipped in sub-assemblies as large as practical from the point of view of moving them into and about the structures, and piece-marked to facilitate field erection, or as detailed in the Technical Specifications. Provide all clearly marked lifting points for packaged equipment.

10.6 The Vendor shall co-operate with the Purchaser in the matter of packaging, time of delivery and shipping.

10.7 The Vendor shall quote a guaranteed delivery period from the date of the purchase order for each item of equipment for which a quotation is submitted.

10.8 The quoted delivery period shall allow for:

10.8.1 The time required by the Purchaser's official order to reach the Vendor by mail.

10.8.2 A two-week period for the Engineer to review and comment on the Vendor’s shop drawings for the equipment to be supplied.

10.8.3 Delivery of anchor bolts and parts to be embedded that are required in advance of taking delivery of equipment shall be made when required by the Purchaser.

10.9 The Vendor or their authorized agent at The Place of the Installation shall sign the carrier's pro bill to indicate receipt of the required number of crates, packages, and shall note any apparent shortages of or visible damage to such crates and packages. The Vendor shall furnish to the Purchaser lists showing the contents of the crates and packages available at the job site when delivery of the equipment and appurtenances is made.

10.10 Provide advance notice of at least ten (10) working days prior to delivery to the Place of Installation to the Owner and the Engineer that either may, at their individual discretion, be in attendance if deemed necessary.

11 SERVICES REQUIRED AT SITE

11.1 The Vendor shall provide the services required as defined herein.

11.1.1 The Vendor shall, provide a training course to the Owner’s operating staff in the operation and general day-to-day maintenance of the equipment.

12 AMENDMENT OR WITHDRAWAL OF QUOTATION

12.1 Quotations may be amended or withdrawn by letter or facsimile prior to date and time of closing.

12.2 Head amendment or withdrawal as follows: "Amendment/Withdrawal of Quotation Digby Wind Power Project – Reactive Power Static Compensator (STATCOM) System, Quotation 090630-SP-E06". Sign and seal as required for Quotation, and submit at address given for receipt of quotations prior to time of closing.

13 RIGHT TO ACCEPT OR REJECT ANY QUOTATION

13.1 The Purchaser reserves the right to waive any irregularity and to accept or reject any offer whatsoever.

13.2 Quotations, which in the opinion of the Purchaser are considered to be informal or unbalanced, may be rejected.

13.3 The Purchaser will select a Bidder based on the total technical, delivery, warranty and commercial content of the tender packages. The Purchaser will not necessarily select the low tender. The Purchaser reserves the right to reject any or all Quotations.

III. FORM OF QUOTATION

1 SALUTATION

To: CBCL Limited
PO Box 606
1489 Hollis Street
Halifax, NS B3J 2R7

Attention: Larry O'Keefe, P.Eng.

1.1 For: Digby Wind Power Project

Quotation for: REACTIVE POWER STATIC COMPENSATOR (STATCOM) SYSTEM

Quotation 090630-SP-E06

1.2. From: _____

_____

_____

We, the undersigned Bidder, having carefully examined the Quotation Documents in respect of quotations for the equipment listed in the Form of Quotation, and Specifications herewith submit in accordance with the terms set out in the documents our quotation for the specified equipment.

We agree that, in case of any conflict between the terms and conditions set out in our accompanying quotation and the terms and conditions set out in the Owner's or Engineer's quotation documents, the provisions of the quotation documents shall take precedence and shall govern.

The Bidder expressly warrants and guarantees to the Purchaser that in the event of the equipment, or part thereof, offered by the Bidder in the Form of Quotation being ordered by the Purchaser, such equipment, or part thereof, when supplied pursuant to a purchase order will be deemed to have been supplied upon the terms of the Purchaser's quotation documents with such amendments, if any, as may be required or agreed upon in writing by the Vendor and the Purchaser before the issuance of the said purchase order.

We declare that our quotation for the equipment is made without any connection, comparison of figures, or arrangements with or knowledge of any other corporation, firm or person making a quotation for similar equipment for this project and is in all respects fair, without collusion or fraud.

We undertake to keep our quotation valid and open for acceptance for a period of sixty (60) calendar days after the closing date for submission of quotations, and to make the equipment quoted on hereunder, or any item thereof available for sale to the Purchaser during the said period at the price and delivery stated herein.

The prices quoted shall be in Canadian dollars and shall include and cover all contingencies and provisional sums; all duties, and handling charges, insurance, transportation and all other. All taxes to be shown separately.

2 BID PRICE

2.1 Price Breakdown

Item	Description	Quantity	Unit Price	Total Price
2.1.1	Prepare and submit shop drawings and equipment specifications to the Customer for review and approval.	1	$	$
2.1.2	Design, manufacture, test, deliver to the Place of the Installation, and provide a written guarantee for one (1) Reactive Power Static Compensator (STATCOM) System assembly complete with inverters, connection transformers, capacitors banks, switching equipment, protection and control devices, accessories, special tools, and provisals per the Technical Specification Document.	1	$	$
	AND			
2.13	Site testing of the Reactive Power Static Compensator (STATCOM) System.	Lot	$	$

2.2 Tender Bid

Included Items (Section 2.1 directly preceding):	2.1.1 to 2.1.3
Total Supply:	$
Canadian Customs Duty:	$
Harmonized Sales Tax (13%):	$
Total Carried to Form of Tender:	$

2.3 Extended Waranty (+ 12 months): $_____

2.4 Site Supervisor Per Diem Price

2.4.1 Per Diem cost including travel and other expenses for a skilled technical representative to supervise assembly of Reactive Power Static Compensator (STATCOM) System on site (attach schedule of prices if applicable).

$_____

2.5 Delivery Period: Complete to Place of Installation (including off-loading): _____ weeks

2.6 Payment Schedule

2.6.1	Receipt of purchase order:	10 percent
2.6.2	Issue shop drawings for approval:	10 percent
2.6.3	Delivery to the Place of the Installation:	60 percent
2.6.4	Installed, commissioned, and energized:	20 percent

2.7 SIGNATURE

DATED THIS _____ DAY OF_____, 20____.

Name of Firm Quoting

[Seal]

Address	Telephone
Signature	Name and Title (Printed)
Signature	Name and Title (Printed)
Witness	Name and Title (Printed)

*NOTE: Quotations submitted by or on behalf of any Corporation must be signed in the name of such corporation by a duly authorized officer or agent, who shall also subscribe own name and office. Affix seal.

SkyPower Corp.

PART B

Technical Specifications

Specification Document

090630-SP-E06

CBCL LIMITED
Consulting Engineers

I. GENERAL

1 SCOPE OF SUPPLY

1.1 Design, manufacture, test, assemble, deliver to the Place of the Installation and provide a written guarantee for one (1) Reactive Power Static Compensator (STATCOM) System assembly complete with inverters, connection transformers, capacitors banks, switching equipment, protection and control devices, accessories, special tools, and provisals as defined herein.

1.2 Site testing of the Reactive Power Static Compensator (STATCOM) System assembly defined herein following installation and prior to energization, including all tests defined herein.

2 SERVICE CONDITIONS

2.1 Application

2.1.1 The Reactive Power Static Compensator (STATCOM) System shall be installed by others fully assembled outdoors on a concrete equipment pad, at the Digby Wind Power Project Site (the Place of Installation).

2.1.2 Field testing shall be carried out as per Section iii—Site Testing—of this document.

2.1.3 All documentation, drawings, nameplates, labels, and reports shall be in English.

2.2 Supply System Data

2.2.1 Electrical System Data

.1 Newly constructed wind farm constructed to the following parameters:

.1	Nominal service voltage	kV rms	34.5
.2	Rated (maximum) voltage	kV rms	38
.3	Nos. of phases and wiring		3P, 3W
.4	Connected wind farm capacity	MW	30
.5	Nominal frequency	Hz	60
.6	Utility fault contribution	MVA	3,500*

* Note that relative to the Reactive Power Static Compensator (STATCOM) System this value will be limited by the interconnection transformer.

2.3 Environmental Conditions

2.3.1 Location

	.1	Elevation above sea level	m	150 (approx.)
	.2	Salt-spray exposure		moderate

2.3.2 Historical Temperature Requirements

	.1	Extreme Low	°C	-27.2
	.2	Extreme High	°C	34
	.3	Average Length of Year Below 0°C	%	38
	.4	Average Length of Year Above 20°C	%	23
	.5	Extreme Snow Depth	cm	40

3 EQUIPMENT, SERVICES, APPARATUS, & MATERIALS SUPPLIED BY OTHERS

3.1 Primary power conductors (i.e. high voltage) and terminations.

3.2 Field device wiring (i.e. external power supply, CT, PT and 34.5 kV, 600A Circuit Breaker control wiring).

3.3 34.5 kV, 600A Main System (STATCOM and Capacitor Banks) Circuit Breaker.

3.4 Communication infrastructure to connect STATCOM control and monitoring system to the wind farm control system.

3.5 Concrete foundations and support structures unless otherwise indicated.

3.6 Overhead buswork interconnecting the Vendor's devices (Bid document shall include details of the required infrastructure).

3.7 Underground conduit.

4 NAMEPLATES

4.1 General

4.1.1 Each and every device shall be provided with a clearly visible rating plate and identifying nameplate of weatherproof material, inscribed with the minimum information defined herein.

4.2 Rating Nameplates

4.2.1 All devices supplied shall include all information as required by the ruling CSA Standards on an external nameplate, including the following where applicable:

.1 Manufacturer's name.

.2 Manufacturer's catalog number.

.3 Manufacturer's serial number.

.4 Operating voltage class.

.5 Continuous ratings (MVA or MVAr).

.6 Operating Frequency (Hz).

.7 Basic impulse level (BIL) rating (for connection transformers and capacitor banks).

.8 Maximum withstand voltage and fault current.

.9 Where a device is one of a series of similar devices part of a larger production line, the batch number of the device shall be included on an external nameplate as an indication of the production line.

.1 The batch number shall not be required where the serial number can be used to identify the device production run.

.10 Momentary withstand ratings (amperes, RMS asymmetrical).

.11 Mass in kilograms.

.12 Maximum tank pressure strength (for connection transformers).

.13 Volume of oil in liters (for connection transformers).

.14 Taps Ratings (for connection transformers).

.15 Year of manufacture.

.16 Space for Owner's serial number.

.17 Reference to Instruction Manual.

.18 CSA and/or cUL classification markings, as applicable; ANSI Standard Designed and Tested to as a Minimum

.19 Any and all information defined herein.

4.3 Identifying Nameplates

4.3.1 Each and every device of the Reactive Power Static Compensator (STATCOM) System shall be provided with its own nameplate, engraved on 3mm thick plastic lamicoid, with the Owner's numerical designation for the equipment.

4.3.2 The identifying nameplate shall be secured to the equipment using permanent adhesive or permanent mechanical connection, suitable for permanent outdoor usage in the given atmospheric conditions.

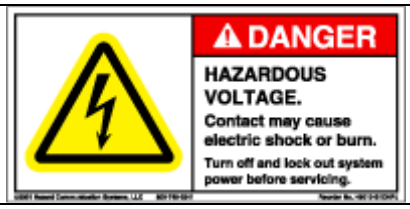
4.3.3 The identifying nameplate shall be 200mm long x 50mm high, white lettering on a black background. Letters shall be 38mm high, width as required.

4.3.4 Designation shall be provided by the Engineer prior to delivery.

4.4 Warning Signs

4.4.1 The Vendor shall identify all accessible sections of the system enclosures where the operating and maintenance personal might be subject of arc flash exposure.

4.4.2 Each door of the enclosure shall be equipped with self-adhesive vinyl warning signs that comply with ANSI Z535.4 Product Safety Label Standard dated July 1, 2002. The Incoming Compartment sign shall state:

Warning Label Requirements per above section	
	
Electric arc flash hazard. Will cause severe injury or death. Wear proper protective equipment before opening or performing diagnostic measurements while energized.	*HAZARDOUS VOLTAGE. Contact may cause electric shock or burn. Turn off and lock out system power before servicing.*

5 MATERIALS

5.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

6 WARRANTY

6.1 All equipment, including accessories and tools, shall have a minimum five (5) year warranty against manufacturer’s defects effective from the earlier date of the following:

6.1.1 Substantial completion of the work.

6.1.2 Six (6) months following delivery to the Place of the Installation.

6.2 The Owner, through the Engineer, shall promptly give the Vendor notice in writing of observed defects and deficiencies that occur during the warranty period.

6.3 The Vendor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

6.4 The Vendor shall administer the waranty claims when indicated by Owner. The Owner shall have the right to assign the woranties to:

6.4.1 The Project Company.

6.4.2 The Purchasser of all or substantially all of the project assets.

6.5 The Vendor shall name the Owner as beneficiary of the Warranty.

II. REACTIVE POWER STATIC COMPENSATOR (STATCOM) SYSTEM ASSEMBLY

1 EQUIPMENT

1.1 Compliance with Standards and Codes

1.1.1 The Reactive Power Static Compensator (STATCOM) System shall conform to or exceed the applicable requirements of the current edition of the following standards and codes unless otherwise indicated herein:

.1 CSA Standards

.1	C22.2 No. 94	Special Purpose Enclosures 2, 3, 4, and 5
.2	W47.1-03	Certification of companies for fusion welding of steel structures
.3	W59-03	Welded steel construction (Metal-Arc Welding)
.4	C22.1-06	Canadian Electrical Code Part I
.5	C88-M90 (R2004)	Power Transformers and Reactors
.6	CSA C227.4	Three-Phase, Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors
.7	C88.1-96 (R2005)	Power Transformer and Reactor Bushings
.8	C802.3-01 (R2007)	Maximum Losses for Power Transformers
.9	C22.2 No 31 M89	Switchgear assemblies.

.2 EEMAC Standards

.1	GL1-3	Transformer and Apparatus Bushings
.2	G8-3.2	Metal-Clad and Station-Type Cubicle Switchgear
.3	G11-1	Measurement of Corona in Switchgear Assemblies

.3 NEMA Standards

.1	CP 1-2000 (R2008)	Shunt Capacitors
.2	SG4-1990	Alternating current high-voltage circuit breakers
.3	SG5-1990	Power switchgear assemblies

.4 ANSI/IEEE Standards

.1	Std C63.16-1993	American National Standard Guide for Electrostatic Discharge Tests Methodologies and Criteria for Electronic Equipment.
.2	Std 18-2002	IEEE Standard for Shunt Power Capacitors.
.3	Std 519-1992	IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
.4	C57.12.00	General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
.5	C57.12.28	IEEE Standard for Pad-Mounted Equipment - Enclosure Integrity
.6	C57.21-1990	IEEE Standard Requirements, Terminology and Test Code for Shunt Reactors Rated over 500 kVA
.7	100-2000	IEEE Standard Dictionary of Electrical and Electronics Terms
.8	1031-2000	IEEE Guide for the Functional Specification of Transmission Static VAR Compensators
.9	1036-1992	IEEE Guide for Application of Shunt Power Capacitors
.10	693-2005	Recommended Practice for Seismic Design of Substations
.11	587 (ANSI/IEEE C62.41)	IEEE Recommended Practice on Surge Voltages in AC Power Circuits
.12	Z535.4-01-2002	Product Safety Signs and Labels
.13	Std. 62040-1-2	General and safety requirements for UPS used in restricted access locations
.14	C37.20.2-1993	IEEE Standard for Metal-Clad and Station-Type Cubicle Switchgear
.15	C37.55-1989	Metal-Clad Switchgear Assemblies - Conformance Test Procedures
.16	C37.20.7	Guide for testing metal-enclosed switchgear for internal arcing faults

.5 IEC (EMC Directive including relevant test for):

.1	60376 Ed. 2.0 b:2005	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical
.2	EN 61000-4-5:1995	(Modified Procedure) Surge Immunity
.3	EN 61000-4-8:1993	Power Frequency Magnetic Field Immunity
.4	EN 61000-4-11:1994	Voltage Dips & Interruptions Immunity
.5	EN 61000-4-2:1995	Electrostatic Discharge Immunity, passed criteria level B
.6	EN 61000-4-3:1995	Radiated Electromagnetic Field Immunity. Amplitude Modulated, passed criteria level A
.7	EN 61000-4-4: 1995	Electrical Fast Transient / Burst Immunity, passed criteria level B
.8	EN 61000-4-6: 1996	Common Mode Conducted Immunity, passed criteria level A
.9	EN55011: 1998	Radiated Emissions, passed criteria level Class A, Group 1
.10	EN55011: 1998	Conducted Emissions, passed criteria level Class A, Group 1 (Note 1)

.6 ISO Standards

.1	9000: 2000	Quality Management

1.1.2 Unless otherwise noted, CSA Standards shall be given precedence when and where conflicts arise.

1.1.3 The final assembled product shall be certified by a nationally accredited certification agency in Canada.

1.2 Equipment Ratings

1.2.1 The transmission system shall be a solidly grounded 60 Hz system.

1.2.2 The ratings for the Reactive Power Static Compensator (STATCOM) System shall be as designated below or greater:

Base System Ratings:

.1	Dynamic VAR Compensation – steady state, MVAr	To be provided by Vendor
.2	Dynamic VAR Compensation – short time, MVAr	To be provided by Vendor
.3	Switched Static Shunt Capacitor Banks, MVAr	To be provided by Vendor

.4	Temporary Reactive Power Capability	250% (min.) of rated, 2 Sec.
.5	Efficiency	To be provided by Vendor
.6	Harmonic Profile (current & voltage per IEEE 519)	5% THD (≤ 3% for any single harmonic)

Power Inverter Assembly:

.1	Continuous Current Ratings, A	To be provided by Vendor
.2	Short Time Current Ratings (A/sec)	To be provided by Vendor
.3	DC Bus Voltage (nom., +/-%)	To be provided by Vendor
.4	DC Bus over/under voltage protection	To be provided by Vendor
.5	Short Time Current Performance Curve	To be provided by Vendor

System Control:

.1	Voltage/pf Control Response:	To provide Volt. Reg. PF & Reactive Power Mgmt.
.2	Response to system voltage disturbances:	1-3 cycles
.3	Increment of Adjustment:	0.1%
.4	Voltage Settings:	
	.1 Deadband limits	To be provided by Vendor
	.2 Droop limits	To be provided by Vendor
.5	Monitoring, Control and Alarm Points:	To be provided by Vendor

Monitor and Data Capture:

.1	Sequence of Events Recording:	Yes
.2	Disturbance Recording:	Yes

Communications:

.1	Protocols:	To be provided by Vendor

Shunt Capacitor Bank:

.1	MVAR ratings:	To be provided by Vendor
.2	Continuous overvoltage rating:	125%
.3	Short time overvoltage rating:	130%, 1 minute

.4	Control – No. Switched Stages:	To be provided by Vendor
.5	Fusing (internal/external):	External
.6	Series Reactor Required?	To be provided by Vendor

Connection Transformer:

.1	Full load kVA rating:	To be provided by Vendor
.2	Cooling:	ONAN
.3	Winding Configuration:	To be provided by Vendor
.4	% Z @ base kVA rating:	To be provided by Vendor
.5	Off-load Tap Changing:	+/-5% in 2.5% steps
.6	Windings Material:	Copper
.7	Tank Construction	Oil-filled, sealed,
.8	Transformer Oil MSDS	Required

1.3 General

1.3.1 The Reactive Power Static Compensator (STATCOM) System shall be a shunt connected voltage control and dynamic reactive compensation system, classified as a Flexible AC Transmission System (FACTS) device.

1.3.2 The Reactive Power Static Compensator (STATCOM) System shall utilize a proprietary and advanced control and monitoring system that detects and instantaneously compensates for voltage disturbances by injecting leading or lagging reactive power, measured in VARs (Volt Amperes – reactive).

1.3.3 The Reactive Power Static Compensator (STATCOM) System shall be designed to meet the reactive power requirements determined in the System Impact Study performed by the Nova Scotia Power; these requirements are listed below:

.1 Total reactive power to range between +/-0.95 at PCC.

.2 6 MVAR minimum capacitive compensation at 34.5 kV bus.

1.3.4 The Reactive Power Static Compensator (STATCOM) System shall be fast acting, multi-mode control system, providing voltage control as well as VAR/power factor control. Changes between control modes shall be dynamic and bumpless.

1.3.5 The Reactive Power Static Compensator (STATCOM) System shall be capable of providing additional control schemes as phase balancing (by injecting of negative phase sequence current), active filtering (acting as shunt active filter using frequency domain or time domain techniques) and flicker reduction (using sub-cycle control scheme).

1.3.6 The Reactive Power Static Compensator (STATCOM) System shall be a low-harmonic system compliant with IEEE 519 and shall have little effect on the current and voltage harmonics. The capacitor banks shall have in series detuning reactors, sized to minimize any harmonic distortions.

1.3.7 The Reactive Power Static Compensator (STATCOM) System shall be designed with redundant operational capabilities such that no single equipment failure will render the package inoperable. The Vendor shall identify probable failure modes and describe design features to prevent loss of reactive power generation.

1.3.8 The Vendor shall provide information about the real power requirements or losses for all components of The Reactive Power Static Compensator (STATCOM) System.

1.3.9 EMI emissions from the system components shall be suppressed so as not to interfere with other substation electronic equipment.

1.3.10 The following studies shall be performed by the Vendor upon receipt of contract:

.1 Dynamic Performance Study.

.2 Steady State Performance Study.

.3 Harmonic Analysis (Harmonic Resonance).

1.3.11 The the system impedance diagram of the STATCOM system interconnection is attached in Appendix 5.:

1.4 Power Inverter

1.4.1 The inverter shall be a low voltage (<1000V) four quadrant power converter composed of rack-mounted inverter blocks capable of producing capacitive and inductive VArs.

1.4.2 The inverter shall be a fully integrated power converter which combines high power density with IGBT (Insulated Gate Bipolar Transistor), IGCT (Integrated Gate Commutated Thyristor) or ETO (Emitter Turn-Off Thyristor) power modules and appropriate harmonic filtering.

1.4.3 The inverter shall be a 100% ambient air cooled system. Liquid cooling will not be accepted.

1.4.4 The inverter shall not be subject to the square of voltage de-rating factor.

1.4.5 The inverter shall be segmented into independent modules that can be shutdown and isolated without affecting the remaining modules.

1.4.6 The electronic power modules shall be designed so that no single power module or component failure will render the system inoperable.

1.4.7 Each independent module shall have continuous on-line diagnostic circuitry that will detect power component failures and will automatically shutdown the failed module. Failed modules shall be designed to be replaceable while the remaining modules are energized and operating.

1.4.8 Communications between the inverter and remote devices or controllers shall be handled through a fiber optic link in order to provide high noise immunity.

1.4.9 The inverter shall have minimum 2.5X current overload capability for a 2 second duration.

1.4.10 The inverter monitoring and control system shall provide but not be limited to the alarms listed below.

.1 Breaker Fault Alarm

.2 Inverter Fault Alarm

.3 Communication Alarm

.4 Emergency Stop Alarm

.5 DC Bus Voltage Alarm

.6 Frequency Lock Alarm

.7 Temperature Alarm

.8 Power Supply Alarm

.9 Uncalibrated Inverter Alarm

1.4.11 The inverter shall be capable of controlling externally supplied switched shunt capacitor banks for voltage regulation/power factor control. The value and timing of the applied steps shall parameterized and selectable dependent upon field operating conditions.

1.5 Control and Monitoring System

1.5.1 The proposed Reactive Power Static Compensator (STATCOM) System shall employ an advanced control and monitoring system for optimized performance. Reliability of operating equipment, availability of STATCOM and safety of the personnel shall be considered in the overall design.

1.5.2 The control system shall employ current microprocessor digital technology and open architecture bus and communication systems.

1.5.3 Data acquisition system shall be provided for monitoring of transmission voltages, and system output current during a system operation. Digital information shall be collected for a broad range of system parameters such as internal currents and voltages, temperatures, alarms, etc. Data to be transferred back to a host computer via modem connection.

1.5.4 The control and monitoring system shall be equipped with an UPS for power outage hold-up of critical data, control and signals.

1.5.5 The system shall continually regulate the desired system parameters and control the shunt capacitor banks. The Vendor shall specify the number of switching stages and capacitor banks.

1.5.6 The control and monitoring system shall comprise both local and remote control points. It shall be possible to monitor/view plant status, control settings, and other STATCOM system parameters at all control points.

1.5.7 A computer screen based operator interface shall be located in both, STATCOM equipment building (if available) and the substation control building. The program shall run on any standard Windows™, computer operating system.

1.5.8 The control and monitoring system shall interface to the customer equipment (SCADA) via a communication bus. The vendor shall supply a Modbus TCP connection for the customer.

1.6 Reactive Power Static Compensator (STATCOM) System Remote Monitoring

1.6.1 Internet Monitoring shall be provided through a secure internet site that enables customers to logon and view system operational data from the suppliers system.

1.6.2 Data shall be provided in several different ways, including a raw format viewed in html tables, graphical charts of system events, trend analysis, and historical searching of system parameters, faults and events.

1.6.3 The data shall be up to date as of the last time the unit called into the server, typically within the previous 8 hours.

1.6.4 The web site security and account permissions are described below:

.1 Secured Socket Layer (SSL) to encrypt data transferred to/from web pages

.2 Supplier generates server certificates and 128 bit key for maximum security

.3 Firewall is employed to aid in security and restrict ports

.4 Microsoft® Windows Server running IIS to enhance security

.5 URL Scan

.6 Web server is owned and fully controlled by supplier

1.6.5 Logons and passwords for the site shall be strictly controlled by supplier.

1.7 Protections

1.7.1 The Reactive Power Static Compensator (STATCOM) System protections shall be properly coordinated to prevent incorrect operation of its or other system protection devices. Protective schemes shall be designed such that no single failure will leave the system unprotected. The Vendor shall specify and describe the complete protection scheme.

1.7.2 The Reactive Power Static Compensator (STATCOM) System shall be provided with phase and ground short-circuit and overcurrent protection and over/under voltage protection.

1.7.3 Each power module shall be equipped with individual short-circuit and overcurrent protection that can detect component faults and disconnect faulted devices or circuits from the rest of the unit.

1.7.4 The STATCOM system shall provide a trip signal to one main breaker (by others) in the event of a failure requiring isolation of the system. Likewise, the system shall be capable of withstanding sudden isolation by this breaker in the event of ouside failure.

1.7.5 Vendor shall note that the NS Electrical Inspection Department requires that each high voltage transformer requires a disconnecting means to meet CSA C22.1-09, rules 36-204(1) and 36-214(2).

1.8 Shunt Capacitor Banks

1.8.1 The capacitor banks shall be designed, fabricated, tested, and delivered in accordance with ANSI/IEEE Std. 18-2002 “IEEE Standard for Shunt Power Capacitors” and/or NEMA CP 1-2000 (R2008) “Shunt Capacitors”.

1.8.2 The shunt capacitor banks shall be outdoor, open structured type with capacitors connected in series and parallel groups.

1.8.3 The capacitor units shall have a minimum continuous overvoltage rating of 125%, and a minimum short time overvoltage rating of 130% of nominal voltage for 1 minute.

1.8.4 The capacitor units shall be interchangeable among all capacitor banks.

1.8.5 All hardware and materials for electrical and mechanical connections shall be furnished with the capacitor bank.

1.8.6 Those capacitor banks and the associated vacuum stage switches, ground switch, serial reactors (if required) and arresters shall be manufactured to the Reactive Power Static Compensator (STATCOM) System Vendor specification by a firm regularly engaged in such activity. The specification and the shop drawings shall be submitted to the Engineer for review and approval.

1.9 Connection Transformer(s)

1.9.1 The Reactive Power Static Compensator (STATCOM) System connection transformer(s) shall be designed and built to CAN/CSA-C88-M90 (R2004) “Power Transformers and Reactors” or CSA C227.4 “Three-Phase, Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors”.

1.9.2 The transformer(s) shall be designed to comply with the continuous and short-time MVAR requirements of this Reactive Power Static Compensator (STATCOM) System.

1.9.3 The rating of the transformer(s) shall be specified at a 65°C (winding/top oil) average temperature rise over a 40°C ambient temperature.

1.9.4 The transformer impedance shall be determined by the Vendor as required by the Reactive Power Static Compensator (STATCOM) System design.

1.9.5 Gauges and meters shall be calibrated in SI designations. Nameplates and labels shall be in English.

1.9.6 The connection transformer(s) shall have the following details:

.1 Oil filled, ONAN type, secondary unit substation transformers with epoxy coated, copper windings. Windings configuration shall be specified by the Vendor.

.2 High voltage ratings:

.1 34,5 kV with 200 kV BIL.

.2 Off load tap changing:: +/-5% in 2.5% steps.

.3 Low voltage ratings:

.1 480V (or 600V) with 30 kV BIL.

.4 Eyebolt high voltage bushings or bushing wells c/w bushing-well inserts.

.5 NEMA eight-hole spade low voltage bushings.

.6 Transformer tank designed to withstand a pressure 25% greater than the maximum operating pressure.

.7 Mineral oil per ASTM D3487, type 2 rated to -40°C shall be used. The transformer shall be shipped filled with oil.

.8 Exterior paint color shall be ANSI 61 Gray. The exterior coating system shall meet or exceed the requirements of ANSI C57.12.28.

1.9.7 The transformer(s) shall be equipped with the following accessories:

.1 Gas sample valve

.2 2 inch drain and sample valve

.3 1 inch upper fill valve

.4 Pressure relief valve

.5 Bleeder valve

.6 Thermometer with 2 Type C contacts

.7 Liquid level gauge with 2 Type C contacts

.8 Pressure vacuum gauge with 2 Type C contacts

.9 3 each C-400 (minimum) internal HV bushing CTs

.10 22kV MCOV station arrestors suitable for mounting in or on the provided transformer.

.11 NEMA 4X auxiliary wiring cabinet, as applicable

.12 Positive pressure system with nitrogen bottle, as applicable

.13 Core ground bushing

.14 Two (2) NEMA copper faced two-hole tank ground pads

.15 Directional shroud for pressure relief device

.16 Epoxy paint

.17 Durethane top coat over epoxy paint

.18 Base construction designed for 15° tilt stability

.19 Seismic zone 4 holddowns

.20 Non-PCB label

1.9.8 The connection transformer(s) shall be manufactured to the Reactive Power Static Compensator (STATCOM) System Vendor specification by a firm regularly engaged in such activity. The specification and the shop drawings shall be submitted to the Engineer for review and approval.

1.10 Incoming Circuit Breaker / Switchgear

1.10.1 The 34.5 kV breaker supplying the DVAR / Cap bank bus shall be supplied by others.

1.10.2 The Vendor shall supply the reactive current breaking requirements of the Reactive Power Static Compensator (STATCOM) System with their Tender submittal.

1.10.3 Refer to “34.5 kV Circuit Breaker” CBCL Specification No. 090630-SP-E04 “34.5 Circuit Breaker” in Appendix 4 for details of Owner-supplied breaker. Vendor to confirm breaker specification meets the DVAR load breaking requirements.

1.11 Phasing

1.11.1 Each phase shall be clearly identified by means of a color code. The color code shall be as follows:

.1 Phase A – Red

.2 Phase B – Black

.3 Phase C – Blue

1.12 Enclosure Construction

1.12.1 The overall assembly enclosure(s) shall provide protection from ingress of rodents, insects, and moisture; and the possibility of arcing faults within the enclosure.

1.12.2 The material for all external sides of the enclosure and internal circuitry housing shall be minimum 12 gauge steel sheet.

1.12.3 All hardware (including door fittings, fasteners, etc.), all operating-mechanism parts, and other parts subject to abrasive action from mechanical motion shall be of either nonferrous materials, or galvanized or zinc-nickel-plated materials.

1.12.4 Grounding provisions shall also be provided for all assembly enclosures.

1.12.5 The inverter enclosure(s) shall be able to control its internal environment by monitoring temperature and humidity and controlling those air qualities with fans, louvers and heaters (if necessary).

1.12.6 Each enclosure vent shall have an inside screen and baffle to exclude insects, to filter dust, and to protect against insertion of foreign objects.

1.12.7 Each enclosure vent shall be rain-resistant and corrosion-resistant

1.12.8 The major equipment enclosures shall have fire detection capabilities and shall have a suppression system capable of preventing catastrophic destruction or damage to the system enclosures and internal equipment

1.13 Outdoor Finish

1.13.1 All enclosures shall be complete with a finish that shall conform to or exceed the applicable requirements of ANSI C57.12.28.

1.13.2 During fabrication, the areas of structural parts that may later become inaccessible shall be given an anticorrosion primer to ensure that all surfaces are protected.

1.13.3 Representative test specimens coated by the enclosure manufacturer's finishing system shall satisfactorily pass the following tests:

.1 2000 hours of exposure to salt-spray testing per ASTM B 117 with:

.1 Underfilm corrosion not to extend more than 1/32" from the scribe as evaluated per ASTM D 1654, Procedure A, Method 2 (scraping); and

.2 Loss of adhesion from bare metal not to extend more than 1/8" from the scribe.

.2 1000 hours of humidity testing per ASTM D 4585 with no blistering as evaluated per ASTM D 714.

.3 500 hours of ultraviolet accelerated weathering testing per ASTM G 53 using lamp UVB-313 with no chalking as evaluated per ASTM D 659, and no more than a 10% reduction of paint gloss as evaluated per ASTM D 523.

.4 Crosshatch adhesion testing per ASTM D 3359 Method B with no loss of paint.

.5 160-inch-pound impact adhesion testing per ASTM D 2794 with no paint chipping or cracking.

.6 Oil resistance testing consisting of a 72-hour immersion bath in mineral oil with no shift in color, no streaking, no blistering, and no loss of hardness.

.7 3000 cycles of abrasion testing per ASTM 4060 with no penetration to the substrate.

1.13.4 Certified test abstracts substantiating the above capabilities shall be furnished upon request.

1.13.5 Touch-up materials—with complete instructions—shall be included for touch-up in the field.

1.13.6 The finish shall be light gray, satisfying the requirements of ANSI Standard Z55.1 or No. 61 or No. 70; or shall be olive green, Munsell 7GY3.29/1.5.

1.13.7 All elements of the support structure (i.e. legs, frame) not forming part of the Reactive Power Static Compensator (STATCOM) System or control cabinet housing shall be hot-dipped galvanized steel.

1.14 Gasketing and Sealing

1.14.1 Door openings and openings for hinged bolted panels (and bolted panels providing access to low-voltage components) shall have resilient compression gasketing to prevent water from entering the enclosure.

1.15 Control Cabinet

1.15.1 All controls shall be housed within a low-voltage, self-contained enclosure, meeting all of the enclosure requirements as defined by this document.

1.15.2 Each control cabinet shall contain minimum of one (1) space heater with sheaths of high-temperature chrome steel to maintain air circulation inside the enclosure, complete with thermostat.

1.15.3 Control cabinet door shall have provision for pad-locking and placement of utility tags for safety and procedure identification.

1.15.4 The control cabinet shall be rated NEMA 4X if located outside.

1.15.5 Grounding provisions shall be provided for the control cabinet.

1.15.6 Use 600 volt stranded copper switchboard wire, moisture resistant or thermosetting for wiring inside the control panel.

1.15.7 Use 7 strand or 19 strand conductors for #14 AWG and larger wire.

1.15.8 Terminate all wires on devices with compression type connectors. Do not use spade lugs or soldered terminals. Do not connect more than three wires to any one stud or terminal.

1.15.9 Use typewritten, heat shrink sleeve wire markers through out.

2 FACTORY TESTS

2.1 Reactive Power Static Compensator (STATCOM) System Tests

2.1.1 The Vendor shall submit for approval to the Engineer comprehensive FAT (Factory Acceptance Testing) procedures for the Reactive Power Static Compensator (STATCOM) System and its components.

2.1.2 System tests shall include but not limited to the following:

.1 Control wiring and Power cabling inspection.

.2 Control power supply testing.

.3 Low power controls operational testing.

.4 Computer controls operational testing.

.5 Inverter power testing with burn-in at full power.

.6 System-level control of the voltage and switching control of all of the associated capacitor banks.

.7 SCADA and HMI testing.

.8 Alarms and emergency protection device setup.

2.2 Inverter

2.2.1 The Inverter shall be tested in accordance with the applicable IEC EMC Directive standards and regulations (see Section 1.1.4 for reference). The tests shall include but not limited to the following:

.1 Board level test - Each board shall be inspected and electrically tested prior to installation into a sub-assembly.

.2 Sub-assembly test - Each sub-assembly shall be inspected and functionally tested prior to installation into an inverter assembly.

.3 Inverter assembly test – Each inverter shall be inspected, functionally tested (power and communications), and burned-in.

.4 ESS (environmental stress screening) extended product test – After passing final and burn-in testing each inverter shall be programmed and functionally exercised during a series of overloads, operation at elevated temperature and a final burn-in using a standard power supply connection.

.5 Equipment calibration – Inspection and test equipment shall be calibrated by traceable means. The equipment shall be labeled to indicate the calibration status and next due date.

2.3 Connection Transformer(s)

2.3.1 The Connection Transformer(s) shall be tested in accordance with C88-M90 (R2004) “Power Transformers and Reactors” or CSA C227.4 “Three-Phase, Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors”as follows:

.1 Resistance.

.2 Ratio.

.3 Polarity.

.4 Phase Rotation.

.5 No-Load Loss.

.6 Excitation Current.

.7 Impedance.

.8 Load Loss.

.9 Applied Potential Test.

.10 Induced Potential Test.

.11 QC Impulse Test.

.12 Pressure Leak test.

.13 Insulation Resistance (Megger).

.14 Insulation Power Factor Test (Dissipation, similar to Doble).

.15 Temperature Test (typical data from previous unit is acceptable).

.16 Sound Test (typical data from previous unit is acceptable).

2.3.2 Bushings

.1 All bushings shall be tested in accordance with C88.1-96 (R2005) Power Transformer and Reactor Bushings standards and certified by the bushing manufacturer.

.2 All bushing test results shall be stamped on the bushing nameplate and recorded in the test results.

2.4 Capacitor Banks

2.4.1 The Reactive Power Static Compensator (STATCOM) System Vendor shall insure that the capacitor banks are tested in accordance with NEMA CP 1-2000 (R2008) or ANSI/IEEE Std. 18-1992. The tests shall include but not limited to the following:

2.4.2 All NEMA routine production tests shall be performed.

2.4.3 All units shall be routine tested at 4.3 times rated voltage DC or 2.0 times rated voltage AC.

2.4.4 Five percent of the capacitor units from each impregnation lot shall be energized at 130% of rated voltage for a minimum of 2 hours in a room temperature ambient. If a unit subjected to this sample test fails, the production lot represented shall be placed on hold until the following analysis has been made:

.1 The failed capacitor shall be dissected and inspected carefully for any major problems such as improper construction or poor impregnation.

.2 If none are found, additional units shall be selected from the production lot and shall be subjected to the energization sample test.

.3 Should inspection reveal any major problem or if failures occur during additional tests, all of the units represented by the sampling shall be rejected.

2.4.5 After the successful completion of these tests, the production lot represented shall be released and all capacitor units are then subjected to final electrical tests in accordance with applicable NEMA standards.

2.4.6 The associated with the capacitors banks enclosed vacuum switches and arresters shall be tested in accordance with the applicable standards.

2.5 Results

2.5.1 All test results shall be recorded as performed.

2.5.2 Official final documentation of the Factory Test results notwithstanding, the Vendor shall provide all test results to the Engineer in written form within 24 hours of completion by fax or email, and the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

2.5.3 All test reports shall include the following information:

.1 Date of test.

.2 Confirmation that test results are acceptable.

.3 Initialled by Vendor.

3 DOCUMENTATION

3.1 Manufacturers' Drawings

3.1.1 Each major subassembly shall be furnished with a set of drawings complete with a bill of material and showing: typical front views and open side views as well as typical components, their positions, and available space for cable termination; an anchor bolt plan with dimensions; a one-line diagram; three-line schematics, termination drawings and appropriate wiring diagrams.

3.1.2 All issued for review Vendor's Drawings shall be submitted in PDF format.

3.1.3 All issued for construction Vendor's Drawings shall be submitted in AutoCAD format.

3.2 Operation and Maintenance Manuals

3.2.1 The manufacturer shall provide four (4) sets of operation manuals including safety requirements and instruction sheets for all third party supplied equipment.

3.2.2 The operation manuals shall include comprehensive instructions covering installation of the feeder protection assembly and operation of the various components.

3.2.3 Instruction manuals shall describe in detail the construction and recommend procedures for assembling, dismantling, maintaining and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturers, of component parts of the equipment, properly catalogued for easy reference.

3.2.4 Instruction manuals shall be accompanied by copies of all Vendor's Drawings in AutoCAD format.

3.2.5 Summing inverter tests, transformer tests and capacitor bank tests results shall be included in the documentation package provided.

4 SHIPPING

4.1 General

4.1.1 Prior to shipment, the following values shall be tested and recorded:

.1 Ambient temperature in °C.

4.1.2 Responsibility for delivery shall belong to the Vendor, who shall provide for all delivery costs from factory to the Place of Installation, including but not limited to the following:

.1 Complete delivery from the Place of Manufacture to the Place of Installation at Digby County, Nova Scotia.

.2 Transportation of all accessories and parts to be shipped separately to the Place of Installation.

.1 If shipment of accessories and parts is to be made prior to delivery of the Reactive Power Static Compensator (STATCOM) System, the Vendor shall make arrangement with the Owner, through the Engineer, for an alternate delivery point.

.2 Storage at the alternate delivery point and delivery from that point to the Place of Installation shall be by others.

.3 All necessary permits and regulatory costs involved in the transport of the Reactive Power Static Compensator (STATCOM) System, including but not limited to those imposed by the following bodies (such costs and

requirements to be based on the size, weight, point of origin, and materials of the final product):

.1 Canada Border Services Agency.

.2 Transport Canada.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal.

.4 Following delivery to the Place of Installation but prior to off-loading, the Vendor shall be responsible for the following:

.1 Test and record the following values:

.1 Ambient temperature in °C.

.2 Visually inspect the Works to ensure no superficial damage during the transportation process.

4.1.3 Equipment delivered to the Place of the Installation before 11.00 am shall be unloaded during the working day 8 am to 5 pm. Equipment received after 11.00 am may be unloaded on the next working day without incuring any demurrage charges.

4.1.4 The Vendor shall include offloading of the Reactive Power Static Compensator (STATCOM) System to a location within the confines of the Place of Installation, as directed by the Purchaser.

.1 Any and all intermediate off-loading and on-loading of the Reactive Power Static Compensator (STATCOM) System as required between the Manufacturer's Plant and the Place of Installation remains the responsibility of the Vendor.

4.2 Follow-up

4.2.1 The Vendor shall provide to the Engineer one (1) reproducible copy of the following within 24 hours of off-loading at site:

.1 Ambient temperature in °C (before shipment and before off-loading).

.2 List of any and all noted visible defects noted prior to off-loading.

III. SITE REACTIVE POWER STATIC COMPENSATOR (STATCOM) SYSTEM TESTING

1 OVERVIEW

1.1 General

1.1.1 In general, provide electrical services in the testing and commissioning of the Reactive Power Static Compensator (STATCOM) System.

1.1.2 The scheduling of all work shall be coordinated with Owner and Purchaser to ensure that no delays are caused by interference between persons operating on site under different contracts. The Vendor shall allow a minimum of five (15) Working Days for the Testing and Commissioning, weather-permitting.

1.1.3 Note that the work shall also include the supply of all test equipment to fulfill the requirements of the Contract.

1.1.4 Should any test results be deemed unacceptable, whether due to test conditions, Vendor error, or required correction of an equipment deficiency, the Vendor shall be responsible for repeating the applicable test or tests.

1.1.5 The Vendor and the Engineer shall review all tests prior to the testing personnel leaving the site.

1.2 Compliance with Standards and Codes

1.2.1 The testing and commissioning shall confirm that the Product conforms to or exceeds the applicable requirements of the current edition of all standards and codes contained herein where applicable.

1.2.2 The Vendor shall adhere to the following standards during the process of testing and commissioning:

.1 Nova Scotia Standards

.1 Nova Scotia Workplace Health, Safety and Compensation Act

.2 Nova Scotia Occupational Health and Safety Act

.2 CSA Standards

.1	C22.1-06	Canadian Electrical Code Part I
.2	C88-M90 (R2004)	Power Transformers and Reactors
.3	C88.1-96 (R2005)	Power Transformer and Reactor Bushings
.4	CSA C227.4	Three-Phase, Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors

.3 ANSI/IEEE Standards

	.1	Std 18-1980	IEEE Standard for Shunt Power Capacitors
	.2	Std C57	Transformers
	.3	Std C37	Switchgear
.4	NEMA Standards		
	.1	CP 1-2000 (R2008)	Shunt Capacitors
.5	IEC Standards		
	.1	IEC EMC	Directive standards and regulations (see Section 1.1.4 for details)

1.3 Equipment

1.3.1 The Vendor shall be responsible for the supply of all test equipment including but not limited to the following:

.1 10kV Doble Test Set (or equivalent).

.2 Meggar Test Set (or equivalent).

.3 Fluke Meter (or equivalent).

.4 Three-phase generator.

.5 Current meter.

.6 Voltage meter.

.7 Testing cables.

.8 Disconnect switch.

.9 Current transformer tester.

2 TEST PROCEDURES

2.1 General

2.1.1 The Vendor shall submit for approval to the Engineer comprehensive Site Testing and Commissioning procedures for the Reactive Power Static Compensator (STATCOM) System.

2.1.2 The Vendor shall indicate and include any additional Vendor-recommended tests with the provided Tender Bid.

2.1.3 The Vendor shall test the STATCOM system and all accessories to the satisfaction of the Engineer as defined herein.

2.1.4 The Vendor shall provide the qualifications of the field testing team to the Engineer prior to engagement of the testing agency.

2.1.5 The Vendor shall not perform any test during weather conditions that would be deemed detrimental to the accuracy of the test.

2.1.6 The Vendor shall demonstrate at the installation site of the Automatic Voltage Regulation Capability of the STATCOM system in accordance with the local grid operator requirements, including operation with voltage regulation set-point, adjustable slope setting, speed of response to set-point changes. Coordination with NS Power is necessary for this testing.

2.1.7 The Vendor shall demonstrate at the installation site of the Reactive Power Capability of the STATCOM system in accordance with the local grid operator requirements. Suitable wind turbine conditions and utility grid conditions must be available for the tests.

2.1.8 All test results shall be provided to the Engineer in written form within 24 hours of completion by fax or email. If neither method is readily available, the Engineer shall be informed and the results forwarded to the Engineer at the first available opportunity.

2.1.9 Submittal of the test results notwithstanding, the Engineer shall be informed immediately of any readily-apparent deficiencies noted by the tests.

2.1.10 All test reports shall include the following information:

.1 Name of testing firm.

.2 Date of test.

.3 Ambient temperature at time of test.

.4 Relative humidity at time of test.

.5 Weather conditions at time of test (i.e. rain, clear, cloud cover, etc.).

.6 Confirmation that test results are acceptable.

.7 Initialled by Vendor.

2.2 Capacitor Banks.

2.2.1 Inspection of connections, leaks, etc.

2.2.2 Standard medium voltage capacitor & reactor bank electrical tests.

2.3 Connection transformer(s).

2.3.1 Inspection of connections, leaks, etc.

2.3.2 Standard medium voltage transformer electrical tests.

2.4 Inverter power electronic blocks.

2.4.1 Inspection of connections, etc.

2.4.2 Protection device setup.

2.5 STATCOM system tests.

2.5.1 Inspection of installation and wiring.

2.5.2 Torque check of connections.

2.5.3 Control power energization and testing.

2.5.4 System voltage and current sensor calibration.

2.5.5 SCADA/Internet connectivity tests.

2.5.6 HMI tests.

2.5.7 System I/O tests.

2.5.8 System phasing tests.

2.5.9 Capacitor bank vacuum switches operational test.

2.5.10 Protection system setup and testing.

2.5.11 Medium voltage energisation.

2.5.12 Individual inverter tests.

2.5.13 System operational tests.

2.5.14 System regulation tests without dynamic regulation (capacitor banks only).

2.5.15 System regulation tests with dynamic regulation (inverter & capacitor banks).

3 DOCUMENTATION

3.1 Official Test Results

3.1.1 Initial test reports provided to the Engineer within 24 hours of completion notwithstanding, the Vendor shall provide six (6) copies of final, official test reports, type-written with the Vendor's signature of approval, to the Engineer following the completion of Testing.

3.1.2 The Vendor shall include the results of all on-site testing described herein, and the information defined in Part B, Section iv, Clause 2.1.6.

3.1.3 The Vendor shall include with the test results a description of the test performed or indication that the test was performed as defined by this document, as well as name the equipment used to perform the test.

3.1.4 The Vendor shall accompany the official test report with written approval that the field test results have been reviewed and the Reactive Power Static Compensator (STATCOM) System and all accessories have been found acceptable for energization and operation.

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

1.0 INSTALLATION INFORMATION

(separate sheet to be completed for each equipment, part of the System Assembly packed separately)

Weights

	NET	SHIPPING
……..	_____Kg	_____ Kg

Dimensions (mm)

Overall Shipping Dimensions L _____ mm W _____ mm H _____ mm

(Provide dimensional drawings of assembly components and accessories once assembled.)

ENCLOSURE MATERIAL

Material Type _____

Gauge of Material _____

Warranty

Available warranty (attach details) _____

Accessories

List accessories to be shipped separately

_____

_____

_____

_____

_____

_____

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

2.0 BIDDER INFORMATION REQUIRED

STATCOM SYSTEM		SPECIFICATION	BIDDER'S REMARKS
Base System Ratings:			
.1	Dynamic VAR Compensation – steady state, MVAr		
.2	Dynamic VAR Compensation – short time, MVAr		
.3	Switched Static Shunt Capacitor Banks, MVAr		
.4	Temporary Reactive Power Capability	250% (min.) of rated, 2Sec.	
.5	Efficiency		
.6	Harmonic Profile	comply with IEEE519	
Power Inverter Assembly:			
.1	Continuous Current Ratings, A		
.2	Output Voltage Ratings, V		
.3	Frequency, Hz	60 Hz	
.4	Rated BIL, kV		
.5	Response Time, cycles		
.6	Fault Level, kA		
.7	Type (IGBT, IGCT, ETO)		
.8	Short Time Current Ratings (A/sec)		
.9	DC Bus Voltage (nom., +/-%)		
.10	DC Bus over/under voltage protection		
.11	Enclosure		
.12	Cooling		

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

System Control:		
.1 Voltage/pf Control Response:	Volt. Reg., PF & Reactive Power Mgmt.	
.2 Increment of Adjustment:	0.1%	
.3 Voltage Settings:		
• Deadband limits:		
• Droop limits:		
.4 Monitoring, Control and Alarm Points:	See Section 1.4.10	
Monitor and Data Capture:		
.1 Sequence of Events Recording:	Yes	
.2 Disturbance Recording:	Yes	
Communications:		
.1 Protocols:		
Shunt Capacitor Bank:		
.1 Manufacturer:		
.2 Model/Designation		
.3 MVAR ratings		
.4 Continuous overvoltage rating:	125%	
.5 Short time overvoltage rating:	130%, 1 minute	
.6 Control – No. of Switched Stages:	____@ ____MVAr	
.7 Fusing (internal/external):	External	
.8 Series Reactor Required?		
Capacitor Bank Switch:		
.1 Manufacturer:		
.2 Model/Designation		
.3 Voltage Rating, kV	38	
.4 Continuous Current Rating, A		
.5 Control Voltage, (VAC, VDC)		
.6 Operating Mechanism (solenoid; motor)		
.7 Mounting Stand	substation frame	

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

Connection Transformer:

.1	Manufacturer:	
.2	Model/Designation	
.3	Full Load kVA Rating:	
.4	No. of Phases and Frequency	3 Phase, 60 Hz
.5	HV Winding Voltage, kV	34.5
.6	LV Winding Voltage, V	
.7	Cooling:	ONAN
.8	Winding Configuration:	
.9	% Z @ base kVA rating:	
.10	Off-load Tap Changing	+/-5% in 2.5% steps
.11	Windings Material	Copper
.12	Tank Construction	Oil-filled, sealed
.13	Oil Mass (kG); Volume (L)	
.14	Oil Brand/Type	
.15	Bushings Manufacturer/Model	
.16	Bushings Type (porcelain, polymer)	
.17	Bushings BIL	
.18	Bushings Current Rating	
.19	Bushings Creepage, mm	
.20	Arrester MCOV (kV rms)	

APPENDIX 2

TECHNICAL CONFORMITY STATEMENT

BIDDER is to duly complete and sign the appropriate section below and return with his proposal.

A) No technical deviations/exceptions:

We _____ hereby confirm that our proposal No._____ dated _____ in response to Request for Quotation No. 090630-SP-E06 is in full compliance with CBCL Limited technical requirements.

B) Technical deviations/exceptions.

We _____ hereby confirm that our proposal No._____ dated _____ in response to Request for Quotation No. 090630-SP-E06 is not in full compliance with all CBCL Limited technical requirements and the following deviations/exceptions are taken.

CBCL Limited Technical Requirement	Technical Deviations/Exceptions

_____
Name of Bidder

_____
Authorized Signature

_____
Date

APPENDIX 3

SCHEDULE OF VENDOR TECHNICAL DATA

ITEM: _____ CONTRACTOR: _____		DOCUMENT TO BE ISSUED BY	COPIES OF EACH COPY OF QUOTATION	PRECEDE BY ELECTRONIC COPY/FAX	FOR REVIEW			FINAL (CERTIFIED)		
					ISSUE WEEK NO.	REVIEW BY	RETURN BY WEEK NO.	ISSUE WEEK NO.	REVIEW BY	RETURN BY WEEK NO.
ITEM	TECHNICAL DOCUMENT									
1.	Technical Specification Document	☑	1		0					
2.	Form of Quotation	☒	3		3	☑	5			
3.	Data Sheet Questionnaire	☒	3		3	☑	5			
4.	Technical Conformity Statement	☒	3		3	☑	5			
5.	Schedule of Vendor Technical Data	☒	3		3	☑	5			
6.	Anticipated Contractor's Project Timeline	☒	3		3	☑	5			
7.	Manufacturer's Supplementary Tender Documents	☒	3		3	☑	5			
8.	Index of Manufacturer's Tender Documents	☒	3		3	☑	5			
9.	Contract Documents	☑	3	✓	6	☒	7			
10.	Outline	☒	6	✓	13	☑	15			
11.	Dimensional Arrangement Drawings	☒	6	✓	13	☑	15			
12.	Bill of Materials	☒	6	✓	13	☑	15			
13.	List of Factory Tests to be Carried Out	☒	6	✓	23	☑	25			
14.	Single-Line Diagrams	☒	6	✓	23	☑	25			
15.	Three-Line Diagrams/AC Schematics	☒	6	✓	23	☑	25			
16.	Wiring Diagrams	☒	6	✓	23	☑	25			
17.	Painting Procedure	☒	6	✓	27	☑	29			
18.	Time/Current Characteristics	☒	6	✓	13	☑	15			
19.	List of Required Accessories & Special Tools	☒	6	✓	27	☑	29			
20.	Recommended Spare Parts List	☒	6	✓	27	☑	29			
21.	Certified Manufacturer's Test Reports	☒	6	✓				31	☑	33
22.	Installation, Operating, and Maintenance Manuals	☒	6					31	☑	33
23.	Final Manufacturer's Drawings	☒	6	✓				31	☑	33
24.	Field Test Results	☒	2	✓				within 24 hrs of test		
25.	Release for Energization	☒	6					34		

☑	OWNER/ENGINEER
☒	CONTRACTOR

SkyPower Corp.

Digby Wind Power Project
Pad Mounted, Oil Filled, MV Transformers

Specification Document

090630-SP-E07

Pad Mounted Transformer

CBCL LIMITED
Consulting Engineers

CBCL PROJECT No.: 090630.00
TENDER DATE: June 25, 2009
SUBMISSION DEADLINE: July 15, 2009

CBCL LIMITED
Consulting Engineers
1489 Hollis Street
PO Box 606
Halifax, NS
Canada B3J 2R7

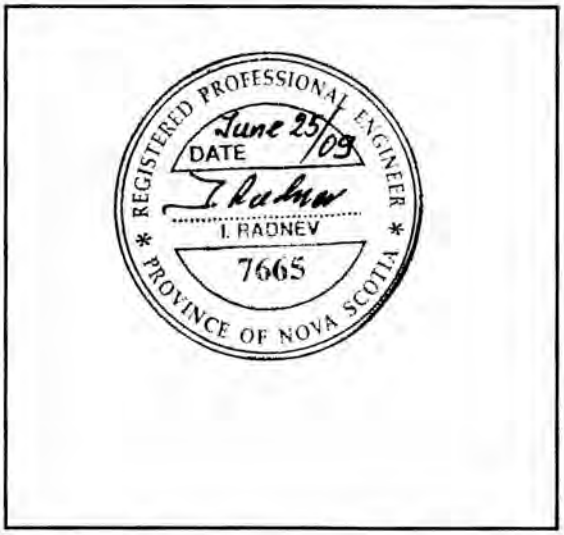
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Signed and Sealed on Behalf of

CBCL Limited

Ivelin Radnev P. Eng



Rev. 0 - Issued for Tender	Larry O'Keefe	June/09	
Rev. B - Issued for Final Review	L. O'Keefe	June/09	R. O'Connor
Rev. A - Issued for Review	L. O'Keefe	June/09	R. O'Connor
Issue or Revision	***Reviewed By:***	***Date:***	***Issued By:***

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SkyPower Corp.

PART A

Bidding and Contract Requirements

Specification Document

090630-SP-E07

CBCL LIMITED
Consulting Engineers

I. INTRODUCTION

1 FORWARD

1.1 The joint venture partners SkyPower Corp. and Scotian WindFields Inc. signed a long term Power Purchase Agreement (PPA) with Nova Scotia Power to supply renewable power in the form of wind generation. The project will consist of twenty (20), GE 1.5sle, 1.5 MW wind turbine generators with a substation on the eastern portion of the site. The point of common coupling will be at the termination point of a Nova Scotia Power (NSPI) transmission line at the NSPI Conway substation (approximately 10.6 km away).

1.2 The Digby Wind Power Project wind turbines are located on various private properties on both the western side and the eastern side of Gulliver's Cove Road., Municipality of the District of Digby, Nova Scotia.

II. INSTRUCTIONS TO BIDDERS

1 DEFINITIONS

1.1 **"Balance of Plant"** means all equipment, tools, labour, and services not directly associated with the supply of the facility wind turbines.

1.2 **"Bidder"** means a person, firm or corporation who propose to submit, or who have submitted a quotation for the supply of the equipment.

1.3 **"Calender Day"** means any day including Saturday, Sunday, statutory holiday or statutory vacation day that is observed by the construction industry in the area of the Place of the Work.

1.4 **"Change Directive"** is a written instruction prepared by the Engineer and signed by the Owner directing the Vendor to proceed with a change in the work within the general scope of the Technical Specification prior to the Owner and the Vendor agreeing upon an adjustment in Contract Price and Contract Time.

1.5 **"Change Order"** is a written amendment to the Contract prepared by the Engineer and signed by the Purchaser stating their agreement upon:

- a change in the Work;
- the method of adjustment or the amount of the adjustment in the Contract Price, if any; and
- the extent of the adjustment in the Contract Time, if any.

1.6 **"Contract"** is the undertaking by the parties to perform their respective duties, responsibilities, and obligations as prescribed in the Contract Documents and represents the entire agreement between the parties.

1.7 **"Contract Time"** is the time stipulated herein from commencement of the Work to Substantial Completion of the Work.

1.8 **"Delivery Period"** means the period commencing on the date of mailing of the Purchaser's official order to the Vendor and ending on the date when delivery to the site designated for delivery, covered by the purchase order, has been complete.

1.9 **"Engineer"** means CBCL Limited (CBCL) or its duly appointed representative who has been authorized by the Owner to act on their behalf.

1.10 **"Interconnection Utility"** is Nova Scotia Power (NSPI) a division of Emera, Inc

1.11 **"Owner"** means SkyPower Corp., and includes the Owner's personal representatives or successors.

1.12 **"Place of the Installation"** is the Digby Wind Farm Substation, Municipality of the County of Digby, Nova Scotia, Canada.

1.13 **"Purchaser"** is the Owner.

1.14 **"Shop Drawings"** are drawings, diagrams, schematics, illustrations, schedules, performance charts, brochures, Product data, manuals and other data that the Vendor provides to illustrate details of the Pad Mounted Transformer.

1.15 **"Specifications"** are that portion of the Contract Documents, wherever located and whenever issued, consisting of the written requirements and standards for Products, systems, workmanship, and the services necessary for the performance of the Work.

1.16 **"Supply Price"** is the amount stipulated herein, based on a lump sum basis of payment, including duties, tolls, shipping and transportation costs.

1.17 **"Technical Specification"** means those documents listed herein and amendments agreed upon between the parties.

1.18 **"Value Added Taxes"** means the Harmonized Sales Tax (HST), the collection and payment of which is by the Vendor as imposed by the tax legislation.

1.19 **"Vendor"** means the equipment supplier whose equipment has been selected by the Purchaser pursuant to a general contract.

1.20 **"Working Day"** means any day excluding Saturday, Sunday, statutory holiday or statutory vacation day that is observed by the construction industry in the area of the Place of the Pad Mounted Transformer Installation.

1.21 **"Complete Submission of Tender"** means the full requested submission package including completed Form of Quotation, Appendices as indicated herein, and proposed layout drawing(s).

2 QUOTATIONS SUBMISSION

2.1 Submit complete quotation—including completed Form of Quotation, Appendices 1-3 including, and proposed layout drawing(s)—in Adobe Portable Document Format ("pdf"), or similar electronic format approved by the Engineer, via email as follows:

SUBJECT LINE	-	CBCL Limited (CBCL): QUOTATION NO. 090630-SP-E07
ADDRESS TO	-	larryo@cbcl.ca
CARBON COPY	-	ivor@cbcl.ca
SALUTATION	-	Larry O'Keefe, P.Eng.

2.2 Delivery to the above address shall be no later than 14:00 Atlantic Standard Time on July 15, 2009.

2.3 Electronic submission shall be followed immediately by submission of three (3) copies of complete quotation, at least one (1) of which shall be reproducible—including completed Form of Quotation, Appendices 1-3 including, and proposed layout drawing(s)—in sealed envelope marked as follows:

QUOTATION	-	SKYPOWER CORP. DIGBY WIND POWER PROJECT

QUOTATION FOR: PAD MOUNTED TRANSFORMER
QUOTATION NO.: 090630-SP-E07

and addressed to:

CBCL Limited
PO Box 606
1489 Hollis Street
Halifax, NS B3J 2R7

Telephone Number: (902) 421-7241, ext. 2327
Fax Number: (902) 423-3938
Attention: Larry O'Keefe, P.Eng.

2.4 Submit quotations on the Form of Quotation provided. Completely fill out forms in ink. The completed form shall be without interlineation, alterations, or erasures. Signatures must be witnessed.

2.5 No other Form of Quotation will be acceptable. The appending of any qualifying clauses to the Quotation or failure to comply with these instructions in the completing of any quotations renders such quotation liable to disqualification. The quotation as originally submitted shall be essentially complete to permit a full analysis without the need for additional information.

2.6 The Purchaser will not defray any expenses whatsoever incurred by Bidders in the preparation and submission of their quotations.

2.7 Submittal of quote signifies that Vendor fully understands all specifications listed.

2.8 Vendor shall submit quote based upon requirements noted in specification. Vendor is encouraged to quote as options that which appear to be more cost effective for this application. Any question as to the intent of the specifications or an apparent conflict or omission between this specification and other specifications shall be resolved by the Vendor contacting the Engineer for clarification.

2.9 The Vendor shall note that the Owner reserves the right to accept all or part of the full Quotation Submission, consisting of the following components:

2.9.1 Design, manufacture, factory testing, delivery, and off-loading of the Pad Mounted Transformer.

3 CLARIFICATION AND ADDENDA

3.1 Notify Engineer of omissions, errors, or ambiguities found in the Quotation Documents. If Engineer considers that correction, explanation, or interpretation is necessary, a written addendum will be issued. All addenda will form part of quotation documents.

3.2 No oral explanation in regard to the meaning of the quotation documents will be made and no oral instructions will be given before the selection of equipment.

3.3 Address questions to Larry O'Keefe, P.Eng., at CBCL Limited, 1489 Hollis Street, Halifax, NS, B3J 2R7, telephone number (902) 421-7241 ext. 2327, fax number (902) 423-3938, e-mail: larryo@cbcl.ca, cc: ivor@cbcl.ca.

4 PURPOSE AND PROCEDURE

4.1 The purpose of receiving quotations in accordance with these documents is to permit examination of a variety of equipment on a comparable basis in order to select the equipment best fulfilling the Owner's requirements and to ensure that it is delivered at site at the appropriate time.

4.2 The procedure, in general, will be as follows:

4.2.1 Receive and assess quotations for equipment.

4.2.2 Select equipment.

4.2.3 Notify Vendor and conduct correspondence as required.

4.2.4 Place order for equipment.

4.2.5 Request shop drawings, examine and approve and return shop drawings.

4.2.6 Request shipping/receiving documentation for equipment delivery.

5 INFORMATION WITH QUOTATION

5.1 Quotations shall be accompanied with all data requested in the Technical Specifications.

5.2 All Bidders must bid against the enclosed specification. In the case where a Bidder wishes to bid an alternative, they are invited to do so. However, full documentation of the potential advantages to the Owner together with reference to equivalent installation must be made.

5.3 Bidders are requested to submit a timeline indicating full estimated duration of contract, from the award of contract to the completion of commissioning as defined herein, and including any and all major milestones.

6 PRICES

6.1 Quoted prices shall include for delivery to the Place of the Installation during normal working hours including bill of lading as well as receiving report. The Owner shall provide delivery address prior to shipment. The Bidder shall arrange unloading at the Place of the Installation.

6.2 Quoted prices shall show all taxes separately.

6.3 The fixed quoted prices shall be in Canadian dollars, and shall include and cover all contingencies and provisional sums; all patents and licensing fees, duties, and handling charges, transportation and all other charges.

6.4 The prices contained in quotations shall be fixed and open for acceptance for a period of sixty (60) calendar days after the closing date for receipt of quotations. Provided that the Purchaser places a written order for the equipment within the above-mentioned period of validity of the quotation, there shall be no increase in the quoted price of the equipment.

6.5 The Bidder shall submit the quotation on the Form of Quotation without any connection, comparison of figures with, or knowledge of any other corporation, firm, or person making a quotation for similar equipment for this project and the quotation shall be in all respects fair and without collusion or fraud.

7 SHOP DRAWINGS AND PRODUCT INFORMATION MATERIAL

7.1 Following the award of contract, the Vendor shall submit to the Engineer for approval shop drawings and product information for the equipment to be supplied. Due to project schedule constraints, shop drawings may be submitted electronically or by fax.

7.2 The expected schedule for receipt of Shop Drawings shall be as indicated by Appendix 3.

7.3 Include cost of shop drawings in quoted price.

7.4 The material and drawing information shall include, but not be limited to, the following:

7.4.1 Dimensional outlines, sections and detail of all equipment, with anchor bolt location plan and required clearances.

7.4.2 General assembly drawing with weights, service requirements, points of connection, recommended clearances, and complete parts list.

7.4.3 Control schematics and wiring diagrams (as applicable).

7.4.4 Detailed instruction for the erection of equipment.

7.4.5 Recommended spare parts.

7.5 Shop Drawings shall be reproductible/printable.

7.6 The Engineer will review and mark comments as required on two (2) copies of the material and return them to the Vendor indicating "no apparent errors", "apparent errors noted", "rejected - see remarks", or "revise and resubmit", with carbon copy to the Purchaser. Review of the Vendor’s shop drawings by the Engineer shall not relieve the Vendor of the responsibility for the correctness thereof or for the results arising from any error or omission in details of the design. Resubmit all drawings marked "rejected - see remarks" or "revise and resubmit".

7.7 Review of shop drawings and acceptance of the equipment shall in any case be subject to final approval of the equipment and materials after they have been put in commission, all guarantees being fulfilled and the general operation of the equipment and materials having been found satisfactory by the Engineer.

7.8 After the Engineer has reviewed the drawings, information and material, no change shall be made in them without the Engineer's written permission. In the event of any alterations or changes being authorized, electronic copied of each of the final drawings and specifications indicating these changes shall be immediately furnished at the Vendor's expense.

7.9 The Purchaser will not accept responsibility for cost of changes necessary if any equipment is fabricated without prior review of shop drawings. Review of shop drawings does not relieve the Supplier of responsibility to meet the requirements of the specifications.

8 OPERATIONS AND MAINTENANCE MANUALS

8.1 The Vendor shall furnish to the Owner, through the Engineer, six (6) hard copies and one (1) electronic copy in Adobe Portable Document Format ("pdf") of operations and maintenance manuals specifying instructions for the following:

8.1.1 Receiving, handling, storage.

8.1.2 Installation, alignment checks.

8.1.3 Electrical connections.

8.1.4 Technical bulletins of all components.

8.1.5 Operation.

8.1.6 Maintenance procedures.

8.1.7 Relevant drawings.

8.1.8 Detailed spare parts list complete with current price list.

8.1.9 Safety instructions.

8.1.10 Tests and Vendor inspection procedures.

8.1.11 Factory and field test results.

8.2 Provide material not later than thirty (30) days prior to scheduled shipment of equipment. Include cost of providing this material in quoted price for supply of equipment.

9 IN-PLANT INSPECTION AND TESTING

9.1 The Owner, Purchaser, Engineer, and/or their authorized agents shall have the privilege of inspecting and witnessing all testing at all times during the manufacture of the equipment or materials ordered herein.

9.2 Provide advance notice of at least ten (10) days for inspection and testing.

9.3 Shop tests shall not constitute a waiver of requirements to meet actual field operating conditions or relieve the Vendor of their responsibility.

9.4 Provide three (3) copies of the official test results to the Engineer showing all tests conducted in accordance with this Document.

10 DELIVERY, STORAGE, AND HANDLING

10.1 Vendors shall include in quotation the cost of shipment to the Place of the Installation.

10.2 The Vendor shall be responsible for employing shipping preparations necessary to ensure that all equipment arrives at the destination in excellent working condition when handled by commercial carriers. All equipment shall be suitably packaged so as to ensure delivery in good condition. The Vendor shall identify any omissions, discrepancies, or damage evident on delivery to the Engineer and the Owner, and make said omissions, discrepancies, or damage good.

10.3 The Vendor shall provide the Purchaser with proof of insurance prior to shipment to the Place of the Installation.

10.4 Vendors will provide a schedule of milestone events and, in the case of partial shipments, the Vendor will provide a proposed schedule at the time of bidding.

10.5 Unless otherwise indicated, all equipment shall be shipped completely assembled where possible. Large fabricated assemblies shall be shipped in sub-assemblies as large as practical from the point of view of moving them into and about the structures, and piece-marked to facilitate field erection, or as detailed in the Technical Specifications. Provide all clearly marked lifting points for packaged equipment.

10.6 The Vendor shall co-operate with the Purchaser in the matter of packaging, time of delivery and shipping.

10.7 The Vendor shall quote a guaranteed delivery period from the date of the purchase order for each item of equipment for which a quotation is submitted.

10.8 The quoted delivery period shall allow for:

10.8.1 The time required by the Purchaser's official order to reach the Vendor by mail.

10.8.2 A two-week period for the Engineer to review and comment on the Vendor’s shop drawings for the equipment to be supplied.

10.8.3 Delivery of anchor bolts and parts to be embedded that are required in advance of taking delivery of equipment shall be made when required by the Purchaser.

10.9 The Vendor or their authorized agent at the Place of the Installation shall sign the carrier's pro bill to indicate receipt of the required number of crates, packages, and shall note any apparent shortages of or visible damage to such crates and packages. The Vendor shall furnish to the Purchaser lists showing the contents of the crates and packages available at the job site when delivery of the equipment and appurtenances is made.

10.10 Provide advance notice of at least ten (10) working days prior to delivery to the Place of Installation to the Owner and the Engineer that either may, at their individual discretion, be in attendance if deemed necessary.

11 AMENDMENT OR WITHDRAWAL OF QUOTATION

11.1 Quotations may be amended or withdrawn by letter or facsimile prior to date and time of closing.

11.2 Head amendment or withdrawal as follows: "Amendment/Withdrawal of Quotation Digby Wind Power Project – Pad Mounted Transformer, Quotation 090630-SP-E07". Sign and seal as required for Quotation, and submit at address given for receipt of quotations prior to time of closing.

12 RIGHT TO ACCEPT OR REJECT ANY QUOTATION

12.1 The Purchaser reserves the right to waive any irregularity and to accept or reject any offer whatsoever.

12.2 Quotations, which in the opinion of the Purchaser are considered to be informal or unbalanced, may be rejected.

12.3 The Purchaser will select a Bidder based on the total technical, delivery, warranty and commercial content of the tender packages. The Purchaser will not necessarily select the low tender. The Purchaser reserves the right to reject any or all Quotations.

III. FORM OF QUOTATION

1 SALUTATION

To: CBCL Limited
PO Box 606
1489 Hollis Street
Halifax, NS B3J 2R7

Attention: Larry O'Keefe, P.Eng.

1.1 For: Digby Wind Power Project

Quotation for: PAD MOUNTED TRANSFORMER

Quotation 090630-SP-E07

1.2. From: _____

_____

_____

We, the undersigned Bidder, having carefully examined the Quotation Documents in respect of quotations for the equipment listed in the Form of Quotation, and Specifications herewith submit in accordance with the terms set out in the documents our quotation for the specified equipment.

We agree that, in case of any conflict between the terms and conditions set out in our accompanying quotation and the terms and conditions set out in the Owner's or Engineer's quotation documents, the provisions of the quotation documents shall take precedence and shall govern.

The Bidder expressly warrants and guarantees to the Purchaser that in the event of the equipment, or part thereof, offered by the Bidder in the Form of Quotation being ordered by the Purchaser, such equipment, or part thereof, when supplied pursuant to a purchase order will be deemed to have been supplied upon the terms of the Purchaser's quotation documents with such amendments, if any, as may be required or agreed upon in writing by the Vendor and the Purchaser before the issuance of the said purchase order.

We declare that our quotation for the equipment is made without any connection, comparison of figures, or arrangements with or knowledge of any other corporation, firm or person making a quotation for similar equipment for this project and is in all respects fair, without collusion or fraud.

We undertake to keep our quotation valid and open for acceptance for a period of sixty (60) calendar days after the closing date for submission of quotations, and to make the equipment quoted on hereunder, or any item thereof available for sale to the Purchaser during the said period at the price and delivery stated herein.

The prices quoted shall be in Canadian dollars and shall include and cover all contingencies and provisional sums; all duties, and handling charges, insurance, transportation and all other. All taxes to be shown separately.

2 BID PRICE

2.1 Price Breakdown

Item	Description	Quantity	Unit Price	Total Price
2.1.1	Prepare and submit shop drawings to the Customer for review and approval.	1	$	$
2.1.2	Design, manufacture, test, deliver to the Place of the Installation, and provide a written guarantee for twenty (20) three (3) phase, 34.5kV/ 690V, 1750 kVA Pad Mounted Transformers assembly, accessories, special tools, and provisals per the Technical Specification Document.	20	$	$

2.2 Tender Bid

Included Items (Section 2.1 directly preceding):	2.1.1 +2.1.2
Total Supply:	$
Canadian Customs Duty:	$
Harmonized Sales Tax (13%):	$
Total Carried to Form of Tender:	$

2.3 Extended Waranty (+ 12 months): $_____

2.4 Site Supervisor Per Diem Price

2.4.1 Per Diem cost including travel and other expenses for a skilled technical representative to supervise assembly of the Pad Mounted Transformer on site (attach schedule of prices if applicable).

$_____

2.5 Delivery Period: Complete to site (including off-loading): _____ weeks

2.6 Payment Schedule

2.6.1 Receipt of purchase order: 10 percent

2.6.2 Issue shop drawings for approval: 10 percent

2.6.3 Delivery to site: 60 percent

2.6.4 Installed, commissioned, and energized: 20 percent

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2.7 SIGNATURE

DATED THIS _____ DAY OF_____, 20_____.

Name of Firm Quoting

[Seal]

Address	Telephone
Signature	Name and Title (Printed)
Signature	Name and Title (Printed)
Witness	Name and Title (Printed)

*NOTE: Quotations submitted by or on behalf of any Corporation must be signed in the name of such corporation by a duly authorized officer or agent, who shall also subscribe own name and office. Affix seal.

SkyPower Corp.

PART B

Technical Specifications

Specification Document

090630-SP-E07

CBCL LIMITED
Consulting Engineers

I. GENERAL

1 SCOPE OF SUPPLY

1.1 Design, manufacture, test, assemble, deliver to the Place of the Installation and provide a written guarantee for twenty (20) three (3) phase, 34.5kV/ 690V, 1750 kVA Pad Mounted Transformer assemblies c/w accessories and special tools as defined herein.

2 SERVICE CONDITIONS

2.1 Application

2.1.1 The Pad Mounted Transformers shall be installed by others fully assembled outdoors at the Digby Wind Power Project Site (the Place of Installation).

2.1.2 All documentation, drawings, nameplates, labels, and reports shall be in English.

2.2 Supply System Data

2.2.1 Electrical System Data

.1	Nominal Primary Voltage	kV	34.5
.1	Nominal Secondary Voltage	V	690
.2	Nos. of Phases and Wiring		3Ph, 3W
.6	Nominal frequency	Hz	60
.5	Maximum Fault Current (RMS Symmetrical)	kA	25

2.3 Environmental Conditions

2.3.1 Location

.1	Elevation above sea level	m	150 (approx.)
.2	Salt-spray exposure		high

2.3.2 Historical Temperature Requirements

.1	Extreme Low	°C	-27.2
.2	Extreme High	°C	34
.3	Average Length of Year Below 0°C	%	38
.4	Average Length of Year Above 20°C	%	23
.5	Extreme Snow Depth	cm	40

3 NAMEPLATES

3.1 General

3.1.1 Each and every device shall be provided with a clearly visible rating plate of weatherproof material, inscribed with the minimum information defined herein, and legible for the life of the device.

3.2 Ratings Nameplates

3.2.1 The Pad Mounted Transformer assembly shall be provided with an external nameplate secured next to the switch gang-operating handle containing the following information:

.1 The kind of transformer (i.e. “Liquid-Filled Padmount Transformer”).

.2 Type designation of cooling (i.e. “ONAN”).

.3 The manufacturer.

.4 The manufacturer’s serial number.

.5 Frequency.

.6 Rating in kVA for each winding at usual service conditions.

.7 Voltage ratings of all windings (kV, nominal; kV, maximum; kV, BIL).

.8 Tap designations in percent of rated voltage.

.9 Terminal markings and arrangement in plan view.

.10 Vector diagram.

.11 Impedance at 85ºC expressed as percentage (measured).

.12 Mass, including liquid, in kilograms.

.13 Quantity of insulating liquid in litres.

.14 Identification of insulating liquid.

.15 Temperature rise (i.e. 65ºC).

.16 Month and year of manufacture.

.17 Indication that liquid is PCB-free/non-PCB.

.18 Number of phases.

.19 Space for Owner's serial number.

.20 When the assembly is CSA or ULC listed, the external nameplate shall include the classification markings.

.21 Any and all information defined herein.

3.2.2 The nameplate shall include the following information pertaining to the insulating oil:

.1 The words: "Electrical Insulating Oil [Class], [Type]".

.2 The name of the insulating oil supplier.

.3 The insulating oil supplier's tradename or designation for the insulating oil.

.4 The volume of insulating oil contained in the device in litres at 25ºC.

.5 The mass of insulating oil contained in the device in kilograms.

3.3 Safety Labels

3.3.1 All external doors and hinged bolted panels providing access to energized equipment shall be provided with "Caution—High Voltage—Keep Out" signs.

3.3.2 Labels indicating "Warning—Arc Flash and Shock Hazard—Appropriate PPE Required" shall be provided, suitable for outdoor installation, either factory-installed or prepared for field installation.

4 MATERIALS

4.1 All materials, components and parts comprising the package shall be new and of the highest quality and of current and readily available manufacture. Vendor shall clearly indicate the name of the manufacturer's catalog/serial number of each component, quantity, rating and type of components of the package that is being furnished.

4.2 Any and all exposed surfaces and hardware shall be resistant to corrosion.

5 WARRANTY

5.1 All equipment, including accessories and tools, shall have a minimum five (5) year warranty against manufacturer's defects effective from the earlier date of the following:

5.1.1 Substantial completion of the work.

5.1.2 Six (6) months following delivery to the Place of the Installation.

5.2 The Owner, through the Engineer, shall promptly give the Vendor notice in writing of observed defects and deficiencies that occur during the warranty period.

5.3 The Vendor shall correct or pay for damage resulting from corrections made under the requirements of the Warranty.

5.4 The Vendor shall administer the warranty claims when indicated by Owner. The Owner shall have the right to assign the warranties to:

5.4.1 The Project Company.

5.4.2 The Purchaser of all or substantially all of the project assets.

5.5 The Vendor shall name the Owner as beneficiary of the Warranty.

II. PAD MOUNTED TRANSFORMER

1 EQUIPMENT

1.1 Compliance with Standards and Codes

1.1.1 The Padmount Transformer Assembly and Accessories shall conform to or exceed the applicable requirements of the current edition of the following standards and codes:

CAN/CSA Standards

.1	C227.4	Three-Phase Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors
.2	C802.1	Minimum Efficiency Values for Liquid-Filled Distribution Transformers
.3	C50-97	Insulating Oil, Electrical for Transformers and Switches
.4	C22.1	Canadian Electrical Code Part I
.5	W47.1	Certification of Companies for Fusion Welding of Steel
.6	W59	Welded Steel Construction (Metal Arc Welding)

ANSI/IEEE Standards

.1	386	Separable Insulated Connector Systems for Power Distribution Systems Above 600V
.2	C57.12.29	Pad Mounted Equipment—Enclosure Integrity for Coastal Environments
.3	C57.12.90	Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers

ISO Standards

.1	ISO 9001	Quality Systems

1.1.2 Unless otherwise noted, CSA Standards shall be given precedence when and where conflicts arise.

1.1.3 The Pad Mounted Transformer assembly shall meet all applicable CSA requirements. If necessary, the Vendor shall obtain special inspection of the assembly, by an authorized CSA inspector or equivalent, at either the manufacturing facility or at the Site, as and if required.

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.1 If special field approval is required, that field approval shall meet or exceed the requirements of CSA SPE-1000-99 Model Code for the Field Evaluation of Electrical Equipment, with the inspection performed by one of the following found to be acceptable under the Nova Scotia Electrical Installation and Inspection Act:

- Canadian Standards Association (CSA).
- Intertek Services.
- QPS Evaluation Services.
- Electrical Safety Authority (ESA).

1.2 Ratings

1.2.1 The system shall be a solidly grounded 60 Hz system.

1.2.2 Primary Winding (HV)

.1	Rated line-to-line voltage	kV rms	34.5
.2	Rated (maximum) voltage	kV rms	38
.3	Basic impulse level (BIL)	kV	200
.4	Connection configuration		delta
.5	Design maximum fault level withstand	kA	25
.6	Nominal frequency	Hz	60
.7	ONAN base rating	MVA	1.75

1.2.3 Secondary Winding (XV)

.1	Rated line-to-line voltage	V rms	690
.2	Rated line-to-neutral voltage	V rms	400
.3	Rated (maximum) voltage	V rms	760
.4	Basic impulse level (BIL)	kV	30
.5	Connection configuration		gr. wye
.6	Nominal frequency	Hz	60
.7	ONAN base rating	MVA	1.75
.8	Neutral terminal (X0) brought out		

1.3 General

1.3.1 The transformer shall be rated for a base maximum operating limit of 1.75 MVA, unless the Vendor chooses to quote the optional base maximum operating limit of 2.0MVA (or other) as defined herein.

1.3.2 The transformer shall be of dead-front construction.

1.3.3 The transformer shall have one (1) medium-voltage winding, delta connected, ratings as indicated, complete with three (3) enclosed front-mounted bushing wells H1, H2, and H3.

1.3.4 The transformer shall have one (1) low-voltage winding, wye connected, ratings as indicated, complete with four (4) enclosed front-mounted low-voltage bushings, consisting of spade-type terminals, X0, X1, X2, and X3.

1.3.5 All external connections to the transformer shall be via power cables run in underground conduit through bottom entry.

1.3.6 The transformer shall be supplied with insulating oil as defined herein.

1.3.7 The transformer shall have a impedance of 5.75% and X/R ratio 7.5 as per GE 1.5sle Wind Turbine Grid Interconnection requirements.

1.3.8 Medium-voltage terminations shall be made via separable insulated connectors inserted into load-break bushing wells.

1.3.9 Low-voltage terminations shall be made via spade-type terminals.

1.3.10 Neutral connection shall not be internally grounded.

1.3.11 The medium-voltage winding shall have five (5) offload tap settings, enabling the rating of the medium-voltage winding to be set at 105%, 102.5%, 100%, 97.5%, and 95% of the nominal voltage of 34.5kV.

.1 Taps shall include provision for padlocking, and shall be located inside the termination compartment.

.2 Operation of the tap changer shall be by manual tap switch located inside the transformer termination cabinet.

1.4 Performance

1.4.1 The temperature ratings of the Padmount Transformer shall be based on the following conditions:

.1 An average winding temperature rise of 65˚C above the ambient.

.2 A maximum hottest spot conductor temperature not exceeding 140˚C at the greater of the maximum overload rating and maximum temperature condition, while under maximum ambient temperature conditions.

1.4.2 Ancillary equipment such as bushings, winding leads, etc. shall not restrict the transformer loading to levels below those permitted by the winding conductor and other metallic part hot spots.

1.4.3 The short circuit design of the transformer shall be based on a solidly-grounded neutral connection at the low voltage winding and a solidly grounded medium voltage system.

1.4.4 Each transformer shall be capable of carrying up to 5% total harmonic distortion currents under normal operation without appreciable loss of transformer life expectancy.

1.4.5 The Vendor shall provide guaranteed values of load and no-load transformer losses, to within the defined CSA and ANSI markings for error, with the submission of the bid documents.

1.5 Windings

1.5.1 The windings shall be rectangular.

1.5.2 The winding material shall be copper.

1.6 Construction

1.6.1 The tank shall be of welded, sheet-steel construction, free from distortion and suitable for permanent installation on flat concrete pad.

1.6.2 All welding shall conform to the requirements of CSA W59. The welders shall be qualified in accordance with CSA W47.1.

1.6.3 The tank cover shall be peaked or sloped, and the compartment roof coated with anti-condensation material to prevent water accumulation.

1.6.4 Entry to the pad-mounted transformer shall be via compartment doors secured by hex-head bolts and complete with provision for installation of a padlock.

1.6.5 Stays shall be provided to hold compartment doors in 110º open position.

1.6.6 Tank shall have permanently affixed lifting provisions consisting of lifting lugs and jacking lugs of sufficient strength and location to provide for lifting the oil-filled transformer into position on the concrete pad and adjusting its position.

1.6.7 Transformer shall have tamper-proof hand holes to permit access to the tank where necessary.

1.7 Layout

1.7.1 Terminals shall be located on the transformer tank wall.

1.7.2 The medium-voltage terminals shall be arranged such that, when facing the open termination compartment of the transformer, the terminals shall be in the order H1, H2, H3 from left to right to the observer.

.1 One (1) parking stand, suitable for a medium-voltage separably insulated connector (loadbreak/deadbreak elbow), shall be affixed to the transformer tank inside the termination cabinet beside each medium voltage terminal H1, H2, and H3; each parking stand to be constructed from the same material as the tank, welded in place, and painted to match the tank.

1.7.3 The low-voltage terminals shall be arranged such that, when facing the open termination compartment of the transformer, the terminals shall be in the order X0, X1, X2, X3 from left to right to the observer.

1.8 Paint Finish

1.8.1 The exterior paint colour shall be Equipment Green, Munsell No. 7 GY3.29/1.5.

1.8.2 A suitable quantity of primer and finish paint shall be supplied with the equipment for touch-up purposes.

1.8.3 Paint finish shall be suitable for mounting of the unit outdoors and capable of resisting the following minimum conditions:

.1 Salt spray for a minimum of 2000 hours.

.2 Humidity for a minimum of 2000 hours.

.3 Impacts of a minimum of 18J.

.4 Ultraviolet resistance to 500 hours at no more than 5% loss of gloss.

.5 Taber abrasion test resistance to 5000 cycles.

.6 Oil and heat resistant.

1.9 Grounding

1.9.1 A solid copper grounding bus, 25mm x 6mm x required length, shall be secured to the exterior transformer tank wall along the inside base of each compartment, and insulated from contact with the tank using standoff insulators, size 21mm x 6mm, grey in colour, except where bonded to tank at either end by NEMA ground pads, complete with two (2) ½ - 13 tapped holes and suitable hardware.

1.9.2 Grounding connectors shall be suitable for up to and including #250 kcmil copper conductor.

1.9.3 All compartment doors, covers, and non-energized extraneous devices shall be bonded to the transformer tank by use of a bonding strap.

2 ACCESSORIES

2.1 Insulating Oil

2.1.1 The transformer shall be supplied with insulating oil conforming to CSA C50.

2.1.2 The insulating oil shall be refined petroleum oil that is free from any and all materials detrimental to its insulating properties.

2.1.3 The insulating oil shall not contain more than 2 ppm of PCBs.

2.1.4 The insulating oil shall be Class A Type I as defined in CSA C50 (uninhibited mineral oil suitable for use in power transformers and associated tap changers

operating in ambient temperatures below –25 ºC); Class A Type II oil (inhibited) shall also be acceptable.

2.1.5 The insulating oil shall meet or exceed the following property limits:

.1 Flash point greater than or equal to 145ºC.

.2 Kinematic viscosity less than or equal to the following:

- 10 mm^2/s at 40ºC.
- 75 mm^2/s at 0ºC.
- 2500 mm^2/s at –40ºC.

.3 Pour point less than or equal to –46ºC.

.4 Colour number less than or equal to 0.5.

.5 Dielectric breakdown voltage characteristics, at 60Hz, as follows:

- Greater than or equal to 24kV with 1mm gap following transport as per ASTM D1816.

.6 Dielectric breakdown impulse voltage of greater than or equal to 145kV as per ASTM D3300.

.7 Gassing tendency no greater than 17 μL/min.

.8 Interfacial tension greater than or equal to 40 mN/m.

.9 Relative density at 15ºC of no more than 0.906.

.10 Dissipation factor of no more than the following:

- 0.0005 at 25ºC.
- 0.005 at 100ºC.
- No appreciable increase in oxidation levels following oxidation.

.11 Neutralization number no greater than 0.03 mgKOH/g.

.12 No detectable strong acids.

.13 No detectable sulphur content.

.14 Inhibitor percentage content of no more than 0.08% if Type I, and less than 0.40%, but greater than 0.08%, if Type II.

.15 Oxidation stability to the following limits:

- Type I (uninhibited):
  - At 72 hours:

- ≤ 0.1% sludge.
- ≤ 0.4 mgKOH/g neutralization number.

o At 164 hours:

- ≤ 0.2% sludge.
- ≤ 0.5 mgKOH/g neutralization number.

- Type II (inhibited):

o At 164 hours:

- ≤ 0.05% sludge.
- ≤ 0.2 mgKOH/g neutralization number.

.16 No more than 35 ppm of water content.

2.1.6 The insulating oil volume shall be measured at 15ºC and adjusted accordingly for temperature.

2.2 Relays, Gauges, Indicators, and Valves

2.2.1 Transformer shall be supplied with the following accessories with all auxiliary contacts of the devices wired to terminal blocks in the control cabinet:

.1 Liquid Temperature Thermometer.

.2 Liquid Level Gauge.

.3 Pressure Relief Device.

.4 21mm Drain Valve

.5 21mm Filler Plug.

.6 Tap Switch.

.7 Non-PCB Label.

2.3 Terminals and Connections

2.3.1 All terminals shall be capable of accepting either Aluminum or Copper conductor with no deleterious electrochemical effects.

2.3.2 Medium-voltage terminals shall consist of bushing wells complete with 35kV bushing well inserts for the acceptance of 35kV separable connectors (loadbreak/deadbreak elbows), one per phase.

.1 Approved manufacturers for the bushing well inserts shall be:

- Cooper Power Systems.

- Elastimold (Thomas & Betts).

2.3.3 Medium-voltage bushing wells shall be provided and shipped with a protective cap.

.1 Approved manufacturers for the protective caps shall be:

- Cooper Power Systems.
- Elastimold (Thomas & Betts).
- ABB

2.3.4 Three (3) insulated parking bushings, suitable for the tank-mounted parking stands defined herein, for parking of connectors/elbows shall be included for the medium-voltage connections, one (1) per bushing well, to IEEE Std. 386.

.1 Approved manufacturers for the parking bushings shall be:

- Cooper Power Systems.
- Elastimold (Thomas & Betts).
- ABB

2.3.5 Six-hole brass spade-type low- and neutral-voltage terminals.

2.3.6 Each neutral termination shall be provided complete with one (1) ½ - 13 tapped ground pad with a removable ground strap.

2.3.7 All bushings/wells shall afford clearances and characteristics to CSA C227.4 and C22.1 with the following basic impulse levels:

.1 H1, H2, H3 (34.5kV bushings): 200kV BIL

.2 X0, X1, X2, X3 (690V bushings): 45kV BIL

3 FACTORY TESTS

3.1 All standard tests as defined by CSA Standard C227.4 and ANSI Standard C57.12.29 shall be carried out on the Pad Mounted Transformer.

3.2 Submit to Engineer factory test results and certificates of type tests within 48 hours of completion of tests.

4 DOCUMENTATION

4.1 Manufacturers' Drawings

4.1.1 The Pad Mounted Transformer assembly drawings submitted for review showing assembly, details, and layout showing anchor bolts, openings for cables, and all pertinent support structure loading details.

4.1.2 The manufacturer shall furnish a set of drawings complete with a bill of material and showing: typical front views and open side views as well as typical components, their positions, and available space for cable termination; and an anchor bolt plan with dimensions.

4.1.3 Drawings submitted for review shall show all terminals, wire and terminal numbering and incorporate equipment schematic details.

4.2 Operation and Maintenance Manuals

4.2.1 The manufacturer shall furnish a comprehensive instruction manual covering installation of the pad-mounted transformer assembly and operation of the various components.

4.2.2 Instruction manuals shall describe in detail the construction and recommend procedures for assembling, dismantling, maintaining, and operating all equipment and listing all replacement parts. These shall include copies of all pertinent bulletins and instructions prepared by the manufacturer, of component parts of the equipment, properly catalogued for easy reference.

5 SHIPPING

5.1 General

5.1.1 Responsibility for delivery shall belong to the Vendor, who shall provide for all delivery costs from factory to the Place of Installation, including but not limited to the following:

.1 Complete delivery from the Place of Manufacture to the Place of Installation at Digby County, Nova Scotia.

.2 Transportation of all accessories and parts to be shipped separately to the Place of Installation.

.3 If shipment of accessories and parts is to be made prior to delivery of the Pad Mounted Transformer assembly, the Vendor shall make arrangement with the Owner, through the Engineer, for an alternate delivery point.

.1 Storage at the alternate delivery point and delivery from that point to the Place of Installation shall be by others.

.4 All necessary permits and regulatory costs involved in the transport of the power transformer, including but not limited to those imposed by the following bodies (such costs and requirements to be based on the size, weight, point of origin, and materials of the final product):

.1 Canada Border Services Agency.

.2 Transport Canada.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal.

.5 Following delivery to the Place of Installation but prior to off-loading, the Vendor shall be responsible for the following:

.1 Visually inspect the Works to ensure no superficial damage during the transportation process:

5.1.2 The Vendor shall include offloading of the Pad Mounted Transformer assembly at the Place of Installation.

.1 Any and all intermediate off-loading and on-loading of the Pad Mounted Transformer assembly as required between the Manufacturer's Plant and the Place of Installation remains the responsibility of the Vendor.

5.1.3 Equipment delivered to the Place of the Installation before 11.00 am shall be unloaded during the working day 8 am to 5 pm. Equipment received after 11.00 am may be unloaded on the next working day without incuring any demurrage charges.

5.2 Follow-up

5.2.1 The Vendor shall provide to the Engineer one (1) reproducible copy of the following within 24 hours of off-loading at the Place of the Installation:

.1 List of any and all noted visible defects noted prior to off-loading.

5.3 Late delivery

5.3.1 Late delivery of the Subject Equipment will result in automatic adjustment of the Purchase Price as follows: a 1.5% decrease in the Purchase Price for each week by which shipment is late, up to a maximum of 8% of the Purchase Price. This is the sole remedy for late shipment. Late delivery will be any time after twenty (20) weeks of date of Owner's Purchase Order.

5.4 Liquidated damage

5.4.1 Notwithstanding the previous paragraph, SkyPower reserves the right to find supplier to be in breach of its commitments and to terminate the agreement, cancel its order and receive a full refund of all previously-paid fees if supplier causes delivery to be delayed or equipment is damaged in transportation or transit to such an extent that it puts SkyPower's project in jeopardy.

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

1.0 INSTALLATION INFORMATION

PAD MOUNTED TRANSFORMER

Weights

	NET	SHIPPING
Complete Transformer Assembly	_____Kg	_____ Kg

Dimensions (mm)

Overall Shipping Dimensions L _____ mm W _____ mm H _____ mm

(Provide dimensional drawings of assembly components and accessories once assembled.)

Warranty

Available warranty (attach details) _____

Accessories

List accessories to be shipped separately

_____

_____

_____

_____

_____

_____

_____

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

2.0 BIDDER INFORMATION REQUIRED

PAD MOUNTED TRANSFORMER	SPECIFICATION	BIDDER'S REMARKS
General:		
- Manufacturer	_____	_____
- Model/Designation	_____	_____
- Type	_____	_____
Electrical Data:		
- Rated Power (self cooled)	1.75 MVA	_____
- Rated Frequency	60 Hz	_____
- Number of Phases	3	_____
- Symmetrical Short-Circuit (kA)		
Withstand	_____	_____
Duration	_____	_____
- Losses (kW)		
No-Load	_____	_____
Load	_____	_____
Auxiliary	_____	_____
- Impedance (@ 1.75 MVA, %)	5.75	_____
- X/R Ratio	7.5	_____
Primary (Medium-Voltage Winding) Data:		
- Configuration	delta	_____
- Nominal Service Voltage	34.5 kV	_____
- Rated Maximum Voltage	38 kV	_____
- Basic Impulse Level	200 kV	_____
- Number of Bushings	3	_____
- Location of Bushings	front	_____
Secondary Data:		
- Configuration	gr. wye	_____
- Nominal Service Voltage	690/400 V	_____
- Rated Maximum Voltage	760 V	_____
- Basic Impulse Level	30 kV	_____
- Number of Terminals	4	_____
- Location of Terminals	front	_____

CBCL LIMITED
Consulting Engineers

APPENDIX 1

DATA SHEETS QUESTIONNAIRE

Environmental Data:

-	Temperature Range	-40 / +50 ºC	
-	Height Above Sea Level	150 m	
-	Noise Level (dB)		

Construction Data:

-	Cooling Type	ONAN	
-	Insulation Class		

Insulating Oil Data:

-	Oil Manufacturer		
-	Oil Descriptor		
-	Oil Type		
-	Oil Class		
-	Dielectric Breakdown Voltage (kV) (D-877, D-1816)		

Accessories:

-	Liquid Temperature		
-	Thermometer		
-	Liquid Level Gauge		
-	Pressure Relief Device		
-	21mm Drain Valve		
-	21mm Filler Plug		
-	Tap Switch		
-	Non-PCB Label		

APPENDIX 2

TECHNICAL CONFORMITY STATEMENT

BIDDER is to duly complete and sign the appropriate section below and return with his proposal.

A) No technical deviations/exceptions:

We _____ hereby confirm that our proposal No._____ dated _____ in response to Request for Quotation No. 090630-SP-E07 is in full compliance with CBCL Limited technical requirements.

B) Technical deviations/exceptions.

We _____ hereby confirm that our proposal No._____ dated _____ in response to Request for Quotation No. 090630-SP-E07 is not in full compliance with all CBCL Limited technical requirements and the following deviations/exceptions are taken.

CBCL Limited Technical Requirement	Technical Deviations/Exceptions

_____
Name of Bidder

_____
Authorized Signature

_____
Date

APPENDIX 3

SCHEDULE OF VENDOR TECHNICAL DATA

ITEM: _____ CONTRACTOR: _____		DOCUMENT TO BE ISSUED BY	COPIES OF EACH COPY OF QUOTATION	PRECEDE BY ELECTRONIC COPY/FAX	FOR REVIEW			FINAL (CERTIFIED)		
					ISSUE WEEK NO.	REVIEW BY	RETURN BY WEEK NO.	ISSUE WEEK NO.	REVIEW BY	RETURN BY WEEK NO.
ITEM	TECHNICAL DOCUMENT									
1.	Technical Specification Document	☑	1		0					
2.	Form of Quotation	☒	3		2	☑	3			
3.	Data Sheet Questionnaire	☒	3		2	☑	3			
4.	Technical Conformity Statement	☒	3		2	☑	3			
5.	Schedule of Vendor Technical Data	☒	3		2	☑	3			
6.	Anticipated Contractor's Project Timeline	☒	3		2	☑	3			
7.	Manufacturer's Supplementary Tender Documents	☒	3		2	☑	3			
8.	Index of Manufacturer's Tender Documents	☒	3		2	☑	3			
9.	Contract Documents	☑	3	✓	3	☒	4			
10.	Outline	☒	6	✓	8	☑	10			
11.	Dimensional Arrangement Drawings	☒	6	✓	8	☑	10			
12.	Bill of Materials	☒	6	✓	8	☑	10			
13.	List of Factory Tests to be Carried Out	☒	6	✓	8	☑	10			
14.	Single-Line Diagrams	☐								
15.	Three-Line Diagrams/AC Schematics	☒	6	✓	8	☑	10			
16.	Wiring Diagrams	☒	6	✓	8	☑	10			
17.	Painting Procedure	☐								
18.	Time/Current Characteristics	☒	6	✓	8	☑	10			
19.	List of Required Accessories & Special Tools	☒	6	✓	8	☑	10			
20.	Recommended Spare Parts List	☒	6	✓	8	☑	10			
21.	Certified Manufacturer's Test Reports	☒	6	✓				10	☑	12
22.	Installation, Operating, and Maintenance Manuals	☒	6					10	☑	12
23.	Final Manufacturer's Drawings	☒	6	✓				10	☑	12
24.	Field Test Results	☒	2	✓				within 24 hrs of test		

☑	OWNER/ENGINEER
☒	CONTRACTOR

CBCL LIMITED
Consulting Engineers

APPENDIX 4

SKYPOWER – PURCHASE ORDER TERMS AND CONDITIONS

SKYPOWER
A Lehman Brothers Company

00000-GEN-GTC-01

August 26, 2008

PURCHASE ORDER TERMS AND CONDITIONS

1. ACCEPTANCE; PURCHASE ORDER CONSTITUTES ENTIRE AGREEMENT. This Order constitutes Buyer's offer and may be accepted by Seller (or Contractor where applicable) only in accordance with the terms hereof. Any acceptance herein of an offer of Seller, or any confirmation herein of a prior agreement between Buyer and Seller, is expressly made conditional on Seller's assent to the additional or different terms contained herein. This Order may be accepted by Seller by commencement of work, shipment of goods, or furnishing of services hereunder. Dispatch of Seller's acknowledgement form or other written document will also act as an acceptance if it agrees with this Order with respect to the description, amount, price and time of delivery of the goods or services ordered. Notwithstanding any waiver in any instance, or any oral agreement, or any instructions, terms and conditions that may be contained in any quotation, acknowledgement, invoice or other written document of Seller, no addition to, waiver for the future or modification of, any of the provisions herein contained shall be of any force or effect unless made in writing and executed by Buyer.
2. CHANGES. Buyer shall have the right at any time to make changes in this Order by written notice to Seller, and Seller agrees to comply with such changes. If such changes cause a material increase or decrease in Seller's costs or time of performance of this Order, Seller shall notify Buyer immediately and negotiate an adjustment.
3. PRICE. If this Order is not priced it shall not be filled at prices higher than those last quoted and charged Buyer for the same articles. Charges for boxing, packaging or cartage will not be allowed or paid by Buyer unless otherwise expressly stated on this Order. Goods are purchased on a delivered basis. An element of freight is included in the purchase price of the materials. All freight charges are to be paid by the Seller to the carrier without further liability to Buyer.
4. SHIPPING. Buyer reserves the right to route all shipments. Delays in shipment shall be reported immediately by Seller to Buyer. Every package or other shipping unit, bill of lading, shipping memorandum and invoice must be marked with Buyer's Purchase Order Number. Seller's serial numbers must be shown on all shipping papers and invoices.
5. TIME OF THE ESSENCE. Time of shipment and of other aspects of performance hereunder is of the essence of this agreement.
6. DELIVERY/TITLE. Unless otherwise agreed, delivery shall be DDP (Incoterms 2000) point of destination and title shall pass to Buyer upon acceptance at the final delivery point. Risk of damages or loss following shipment and prior to acceptance by Buyer shall be the responsibility of Seller.
7. RIGHT OF INSPECTION AND REJECTION. Material and equipment supplied by Seller shall be received subject to Buyer's inspection and approval within a reasonable time after delivery, notwithstanding prior payment. If specifications or warranties are not met, material and equipment may be returned at Seller's expense. No material or equipment returned to Seller as defective shall be replaced except upon Buyer's formal authorization.
8. ASSIGNMENT. Neither this Order nor any interest therein nor any claim arising hereunder shall be transferred or assigned by Seller without the prior written consent of Buyer. Buyer may transfer or assign the benefits of this agreement, in whole or in part, including without limitation the Seller's warranty, without the approval of Seller.
9. GOVERNING LAW. This Order, and the rights and obligations of the parties thereto, shall be determined in accordance with the laws of the Province wherein the equipment or material shall be installed, or wherein the work shall be performed herein.
10. WARRANTY. Seller warrants that all goods or services furnished pursuant to this Order will be free from defects in material or workmanship and will be in conformity with the requirements of this Order, including drawings and specifications, if any, and reasonably fit for the purpose disclosed in this Order or in such drawings and specifications, and Seller further warrants that such goods or services will be merchantable and fit for the purpose for which they are sold, and where design is Seller's responsibility, will be free from defects in design. Buyer's approval of Seller's design or material shall not be construed to relieve Seller of the warranties set forth herein. Without limitation of any rights which Buyer may have at law by reason of any breach of warranty, goods which are not as warranted may at any time within sixty (60) months after delivery be returned at Seller's expense. Buyer at its option may require Seller either to replace such goods at no increase in price (Seller must pay all repacking, transportation and handling charges both ways) or to refund the purchase price and any charges in connection therewith.
11. INVOICES. All invoices shall be mailed to Buyer at its office as indicated on the face of this Order and will state Buyer's Purchase Order Number clearly on the Invoice. If delivery is made by carrier, an itemized delivery ticket must be attached to the package or other shipping unit. Seller shall use the lowest published freight rates and any excess transportation charges incurred, including any that deviate from the published tariff rates, are to be borne by the Seller.
12. PATENT INDEMNITY -- Seller agrees to indemnify, save harmless and defend Buyer from and against any and all suits, claims, damages, costs, and attorney's fees arising out of or in connection with any infringement or claimed infringement of any Canadian or United States patent, trademark or copyright in the manufacture, use or sale of the equipment or materials furnished under this Order. In case said equipment or material is in such suit, or in final adjudication elsewhere, held to constitute infringement, and the use thereof is enjoined, Seller shall, at its own expense, either procure for Buyer the right to continue using said equipment or material, or at the option of Buyer either replace same with equally efficient non-infringing equipment or material, or modify it without impairing its efficiency so it becomes non-infringing, or remove said equipment or

material and refund the purchase price and the transportation and installation costs thereof.

13. INDEMNITY AND INSURANCE -- Seller shall defend, indemnify and hold harmless Buyer from any claims, suits, judgments, fees and costs (including attorney's fees) based on or arising out of the Seller's products, services and/or the resale or use of the products purchased hereunder including death, personal injury, or damage to property. Seller agrees to procure and maintain the following insurance coverage: (a) Commercial General Liability insurance, endorsed to name Buyer as an additional insured, with limits not less than $1,000,000 per occurrence, $1,000,000 Products/Completed Operations, $1,000,000 Personal/Advertising, (b) Commercial Auto insuring all vehicles used by Seller (including all owned, hired and non-owned vehicles), and (c) Worker's Compensation with statutory limits and a waiver of subrogation in favor of Buyer, and Employer's Liability with limits not less than $500,000 each accident and $5,000,000 Disease – Each Employee. Evidence of such coverage, in the form of a Certificate of Insurance and providing for thirty (30) days notice to International Paper prior to cancellation, shall be sent to Buyer not later than seven (7) days following Seller's acceptance of this Order.

14. COMPLIANCE WITH LAWS -- Seller, in the performance of this Order, shall comply with all applicable Federal, provincial (or state as applicable), and local laws, regulations, rules and ordinances, including but not limited to the those dealing with the protection of the environment.

15. TERMINATION. Buyer, by written notice, may terminate this order, in whole or in part. In the event this order is terminated as a result of Seller's default, the Seller shall be liable for all damages allowed in law or equity, including the excess cost of re-procuring similar items. If this order is terminated for the convenience of Buyer, Seller will be compensated to the extent that items have been accepted by Buyer prior to the effective date of termination. Other than to this extent, Buyer shall not be liable to Seller for any damages on account of its failure to accept all of the items ordered.

16. CONFIDENTIALITY/TRADE SECRETS. All specifications, data and other information furnished by Buyer or its agents, to Seller in connection with this order remain the exclusive intellectual property of Buyer and shall be treated by the Seller as proprietary and shall not be disclosed or used, outside the limitation of this order, without prior written approval of the Director - Purchases of Buyer. In addition, the purchase of the Seller's product does not authorize the Seller to use the name of or make reference to Buyer for any purpose in any releases for public or private dissemination, nor shall the Seller divulge or use in any advertisement or publication any specifications, data, or other information pertaining to or relating to this usage without prior written approval of Buyer's Procurement Manager or their designate.

QUOTATION FILL IN SHEETS FOR 69KV UNIT

1.0 SCHEDULE OF

Time from date of order that the bidder will guarantee to provide the following:

1.1 Drawings for Approval	Guaranteed
Production Schedule	8 weeks ARO
Transformer Outline	8 weeks ARO
Nameplate	8 weeks ARO
Diagram of Connectors	8 weeks ARO
Schematics	8 weeks ARO
Testing:	30 Weeks ARO
Shipping	32 Weeks ARO
Instruction Manuals	2 weeks prior to shipment of equipment

1.2 Delivery 38 weeks after order for 69kV transformer

PROPOSAL BY: Magna Electric Corporation
851 - 58th Street
Saskatoon SK S7K 6X5
877-955-8131

69KV DETC

QUOTATION FILL IN SHEETS

2.0 LOCATION OF MANUFACTURER AND QUALITY ASSURANCE PROGRAM LEVEL ESTABLISHED.

	LOCATION	Q.A. LEVEL
Tank	TAIWAN	ISO 9001
Radiators	CHINA	ISO 9001
Fans / Pumps	KRENZ-VENT(USA)or EquaINA	ISO 9001
Core	JAPAN	ISO 9001
Winding	TAIWAN	ISO 9001
Instrument Transformers	TAIWAN	ISO 9001
Tap-Changer	France	ISO 9001
Bushings	SWEDEN	ISO 9001
Final Assembly	TAIWAN	ISO 9001

2.1 Please list below the documents attached with the proposal.

QUOTATION FILL IN SHEETS

		INQUIRY ITEM NO	
3.0	**TRANSFORMER RATING.**		
3.1	Manufacturer	Shihlin Electric	
3.2	No. of Phases & Frequency	3 Phases 60Hz	
3.3	Rated Capacity @ 65℃ Rise	20 / 27 / 33	MVA
3.4	Cooling	ONAN / ONAF / ONAF	MVA
3.5	Rated Capacity - H Winding	20 / 27 / 33	MVA
3.6	Rated Capacity - X Winding	20 / 27 / 33	MVA
3.7	Rated Capacity - Y Winding	N/A / N/A / N/A	MVA
3.8	H Winding Voltage	69	kV
3.9	H Winding Connection	Wye	
3.10	H Winding BIL Line End	350	kV
3.11	H Winding BIL Neutral End	200	kV
3.12	X Winding Voltage	34.5	kV
3.13	X Winding Connection	Wye	kV
3.14	X Winding BIL Line End	200	kV
3.15	X Winding BIL Neutral End	110	kV
3.16	Y Winding Voltage	N/A	kV
3.17	Y Winding Connection	N/A	kV
3.18	Y Winding BIL	N/A	kV
3.19	Regulation @ 0.80 PF	4.88	
3.20	Estimated Hot Spot Temp. Rise	80	°C
3.21	Exciting Current at Rated Voltage	0.5%	A
3.22	Guaranteed No Load Loss	21	kW
3.23	Guaranteed Load Loss @ ONAN	65	kW
3.24	Guaranteed Load Loss @ Max. Rating:	169	kW
3.25	Auxiliary Losses @.Max. Rating	3	kW
3.26	Impedance H-X	7.0%	
3.27	Impedance H-Y	N/A	
3.28	Impedance X-Y	N/A	
3.29	Zero Sequence Impedance H-X	5.88%	
3.30	Zero Sequence. Impedance H-Y	N/A	
3.31	Zero Sequence Impedance X-Y	N/A	

QUOTATION FILL IN SHEETS

4.0	TRANSFORMER TAP CHANGERS	INQUIRY ITEM NO.	
4.1	Load Tap Changer		
	.1 Manufacturer	N/A	
	.2 Model	N/A	
	.3 Type (Resistor, Reactor)	N/A	
	.4 Range in Percent	N/A	
	.5 No. of Step	N/A	
	.6 Location	N/A	
	.7 Rated Voltage	N/A	kV
	.8 Rated Current	N/A	A
	.9 Rated BIL	N/A	kV
	.10 Temperature rise @ rated current	N/A	°C
	.11 No. of Operations at rated current	N/A	
4.2	Off Circuit Tap Changer		
	.1 Manufacturer	ASP	
	.2 Model	FII	
	.3 Range in Percent	±5%	
	.4 No. of Taps	5	
	.5 Location	High Voltage Winding	

QUOTATION FILL IN SHEETS

5.0	TRANSFORMER CONSTRUCTION	INQUIRY ITEM NO.	
.1	Type e.g. Sealed, Conservator	Conservator with Breather	
.2	H Winding Material	Copper	
.3	X Winding Material	Copper	
.4	Y Winding Material	Copper	
.5	Core Type e.g., Shell, Core	Core Type	
.6	Flux Density @ Rated Voltage	1.689	
.7	Flux Density 115% Rated Voltage	1.942	
.8	Mass Core and Coils	23100	kg
.9	Mass Tank Fittings	12070	kg
.10	Oil Mass Volume	12700 litres, 11430kg	
.11	Oil Brand / Type	Nytro Libra (Nynas)	
.12	Total Mass	46600	kg
.13	Shipping Mass (Heaviest)	30400(Without oil)	kg
.14	Noise Level @ ONAN Ratio	71	dB
.15	Noise Level @ Max. Rating	74	dB
.16	No. of Cooling Fans per stage	6	
.17	No. of Oil Pumps	N/A	
.18	Fan Motor Rating	221	W
.19	Fan Motor Voltage	120/240	V
.20	Fan Motor Current FLA / LRA	0.96/3.14	A
.21	Pump Motor Rating	N/A	W
.22	Pump Motor Voltage	N/A	V
.23	Pump Motor Current FLA / LRA	N/A	A

QUOTATION FILL IN SHEETS

6.0 TRANSFORMER BUSHINGS	INQUIRY ITEM NO.	
.1 H Bushing. Manufacturer	ABB	
.2 H Bushing Type / Model	GOB 380	
.3 H Bushing BIL	380	kV
.4 H Bushing Current Rating	800	A
.5 H Bushing Creepage Offered	2210±70	mm
.6 H Bushing Creepage (Standard)	1755	mm
.7 X Bushing Manufacturer	ABB	
.8 X Bushing Type/Model	GOB 250	
.9 X Bushing BIL	250	kV
.10 X Bushing Current Rating	800	A
.11 X Bushing Creepage Offered	1500±50	mm
.12 X Bushing Creepage (Standard)	880	mm
.13 Y Bushing Manufacturer	N/A	
.14 Y Bushing Type/Model	N/A	
.15 Y Bushing BIL	N/A	kV
.16 Y Bushing Current Rating.	N/A	A
.17 Y Bushing Creepage Offered	N/A	mm
.18 Y Bushing Creepage (Standard)	N/A	mm
.19 Ho/Xo Bushing Manufacturer	ABB/ZHIDA(CHINA)	
.20 Ho/Xo Bushing Type / Model	GOB 250/Solid	
.21 Ho/Xo Bushing B1L	250/110	kV
.22 Ho/Xo Bushing current Rating	800/2000	A
.23 Ho/Xo Bushing Creepage Offered	1500±50/450±50	mm
.24 Ho/Xo Bushing Creepage (Standard)	880/	mm

QUOTATION FILL IN SHEETS

7.0 CURRENT TRANSFORMERS **INQUIRY ITEM NO;**

	Bushing	QTY	Ratio	Accuracy
1	H	6/3	600:5/400:5	C800
2	X	6	800:5	C800
3	Y	N/A	N/A	N/A
4	HO	1	600:5	C800
5	XO	1	800:5	C800
6	TERTIAR	1	100:5	C400

7.1 Location of CT for LDC N/A

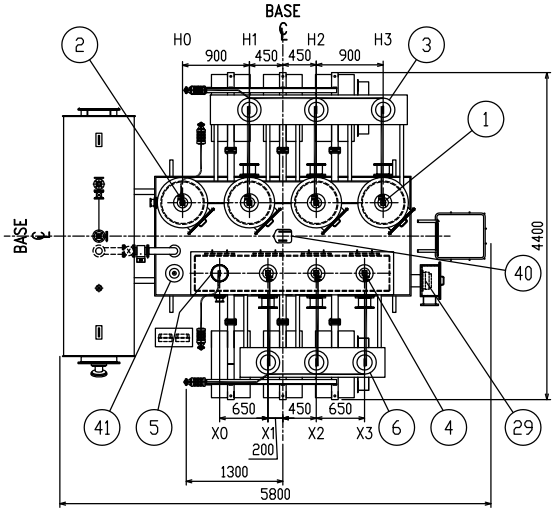
7.2 Voltage Regulating Relay Type N/A

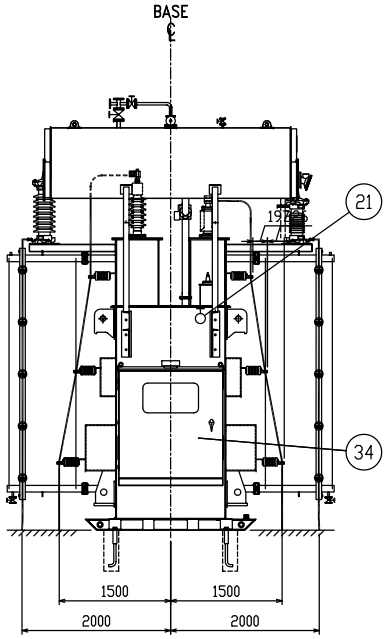
POWER TRANSFORMER

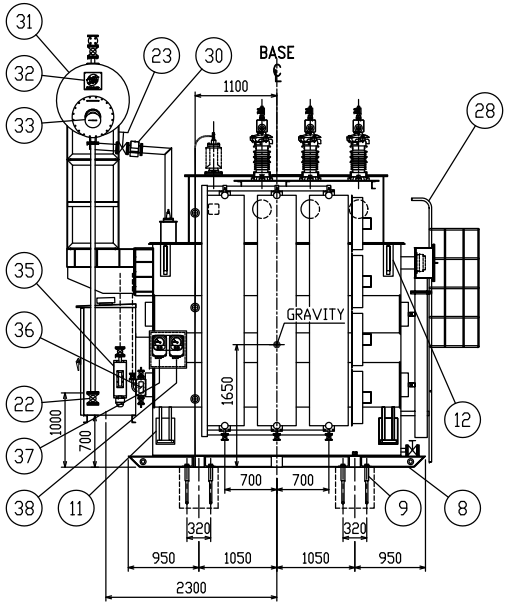
RATED CAPACITY	:	20/27/33	KVA
PHASE	:	3	ø
FREQUENCY	:	60	Hz
TYPE	:	ONAN/ONAF/ONAF	
RATED HIGHT VOLTAGE	:	72.45F~70.725F~69R~67.275F~65.55F	kV (人)
RATED LOW VOLTAGE	:	34.5	kV (人)
		WEIGHT (APPROX.)	
CORE AND COILS	:	25700	kg
TANK AND FITTINGS	:	12200	kg
TOTAL OIL (13100L)	:	11800	kg
TOTAL	:	49700	kg

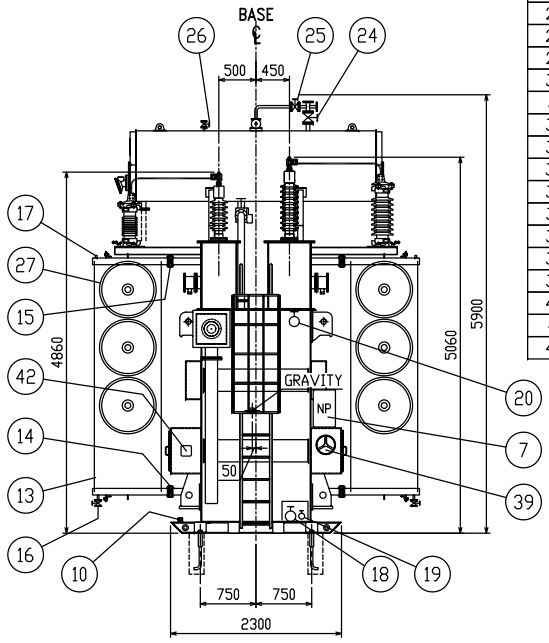
DIMENSIONS ARE DESIGN VALUES AND ARE SUBJECT TO MANUFACTURING TOLERANCES EXCEPT WHERE TOLERANCES ARE SHOWN ON THIS DRAWING.

ITEM	DESCRIPTION
1	HV BUSHING
2	HVN BUSHING
3	HV SURGE ARRESTER
4	LV BUSHING
5	LVN BUSHING
6	LV SURGE ARRESTER
7	NAMEPLATE
8	BASE
9	Foundation Bolts
10	GROUNDING PADS
11	JACKING PADS
12	Lifting Lugs
13	RADIATORS
14	RADIATOR VALVES (BOTTOM)
15	RADIATOR VALVES (TOP)
16	OIL DRAIN VALVE FOR RADIATOR
17	RADIATOR VENT PLUG
18	OIL DRAIN VALVE
19	OIL SAMPLING VALVE
20	VACUUM PUMP VALVE
21	OIL FILTER VALVE
22	CONSERVATOR DRAIN VALVE
23	GATE VALVE
24	CONSERVATOR VACUUM VALVE
25	CONSERVATOR VACUUM EQUALIZING VALVE
26	CONSERVATOR AIR VENT VALVE
27	COOLING FANS
28	LADDER
29	Pressure Relief Device
30	BUCHHOLZ RELAY
31	CONSERVATOR
32	Logo ID Plate
33	OIL LEVEL GAUGE
34	CONTROL CABINET
35	BREATHER
36	GAS SAMPLING DEVICE
37	OIL TEMPERATURE INDICATOR
38	WINDING TEMPERATURE INDICATOR
39	NO-VOLTAGE TAP CHANGER
40	FALL ARREST
41	CORE EARTHING BUSHING
42	THE TERMINAL BOX OF CT (TERTIARY)









REV.	SUMMARY 修改記要	REV./DATE	APPR/DATE
A	ISSUE / 發行		

REV.	SUMMARY 修改記要	REV./DATE	APPR/DATE

保留圖一時圖

士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

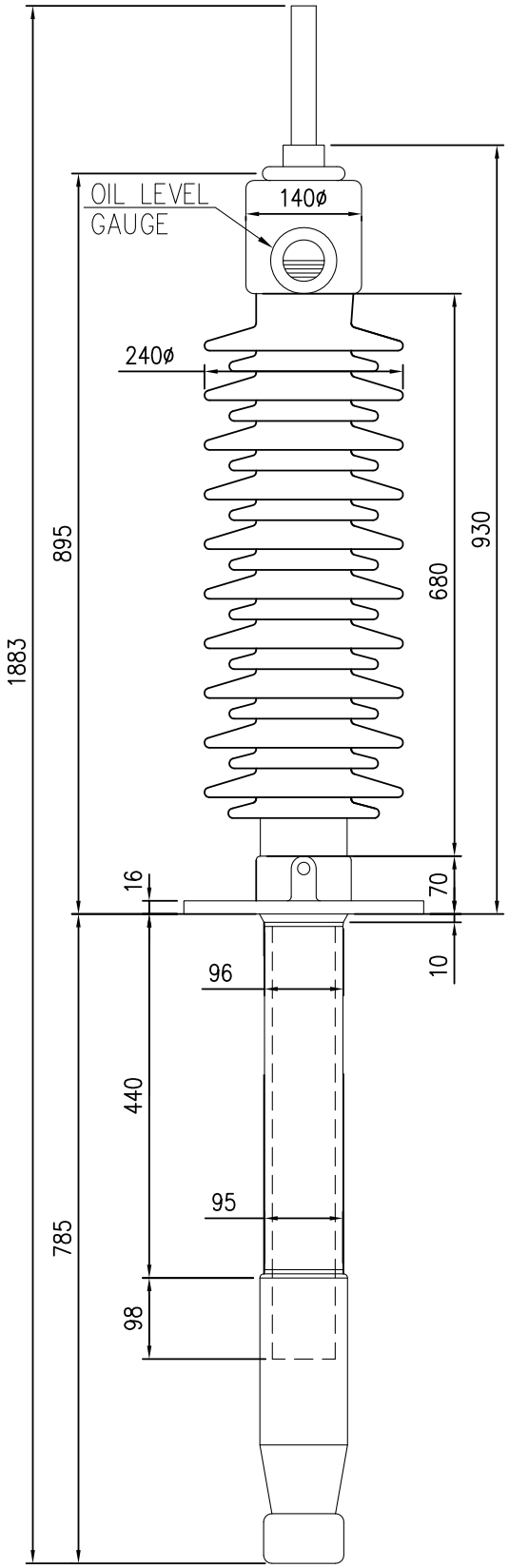
第三角圖法	3RD ANGLE PROJECTION	繪圖 DRAWN	設計 DESIGNED	校對 CHECKED	核准 APPROVED
單位 DIM	mm				
比例 SCALE	1/50	H.J.Chiang	H.J.Chiang	Steven Hsu	Steven Hsu
日期 DATE	JUN- 03 - 09'				

圖名 TITLE: OUTLINE OF TRANSFORMER

圖號 DWG. No.: E203496

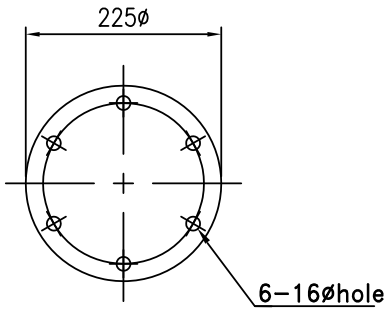
SH. No. | REV.: A

Digby Wind Project UARB IR-12 Attachment 10 Page 747 of 1067



CHARACTERISTICS

1. STANDARD	:	ANSI
2. MANUFACTURER	:	A.B.B.
3. TYPE	:	GOB 380-800
4. CAT No. #	:	LF 123-187-L
5. RATED VOLTAGE	:	69 kV
6. RATED CURRENT	:	800 A
7. FREQUENCY	:	50/60 Hz
8. BIL	:	380 kV
9. 60Hz WITHSTAND	:	
1 min DRY	:	162 kV
10 sec WET	:	150 kV
10. COLOR	:	GREY
11. CREEPAGE DISTANCE	:	2210±70 mm
12. WEIGHT	:	40 kg



REV.	修改記要 SUMMARY	REV/DATE	APPR/DATE
A	ISSUE / 發行	---	---

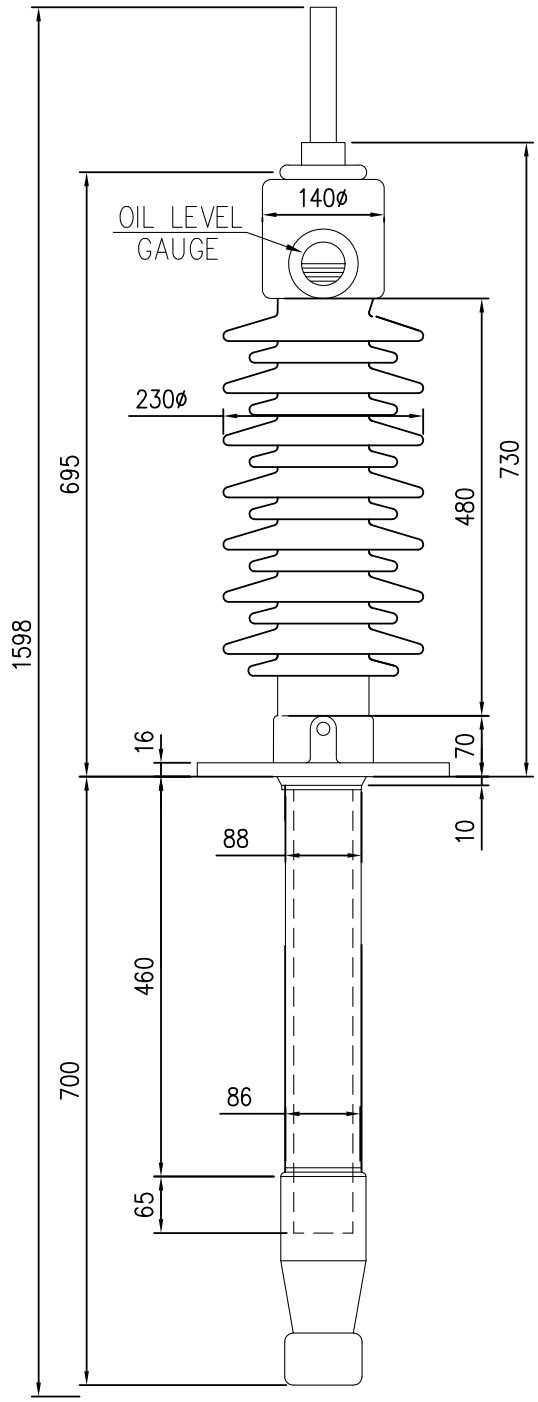
士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

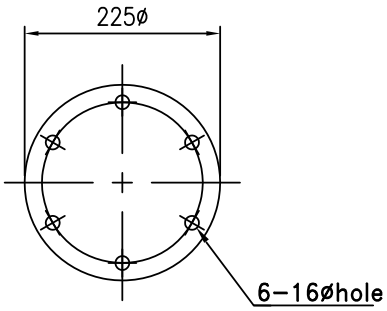
第三角圖法	3RD ANGLE PROJECTION	設 計 DESIGNED	校 對 CHECKED	批 准 APPROVED
單 位 DIM	mm	S.Y.Jhan	L.P.Wang	Steven Hsu
比 例 SCALE	1 / 8.5			
日 期 DATE	06 – 03 – '09			

圖 名 TITLE: OUTLINE OF BUSHING

圖 號 DWG. No. E438823 A

Digby Wind Project UARB IR-12 Attachment 10 Page 748 of 1067





CHARACTERISTICS

1. STANDARD	:	ANSI
2. MANUFACTURER	:	A.B.B.
3. TYPE	:	GOB 250-800
4. CAT No. #	:	LF 123-175-L
5. RATED VOLTAGE	:	34.8 kV
6. RATED CURRENT	:	800 A
7. FREQUENCY	:	50/60 Hz
8. BIL	:	250 kV
9. 60Hz WITHSTAND	:	
1 min DRY	:	120 kV
10 sec WET	:	105 kV
10. COLOR	:	GREY
11. CREEPAGE DISTANCE	:	1500±50 mm
12. WEIGHT	:	28 kg

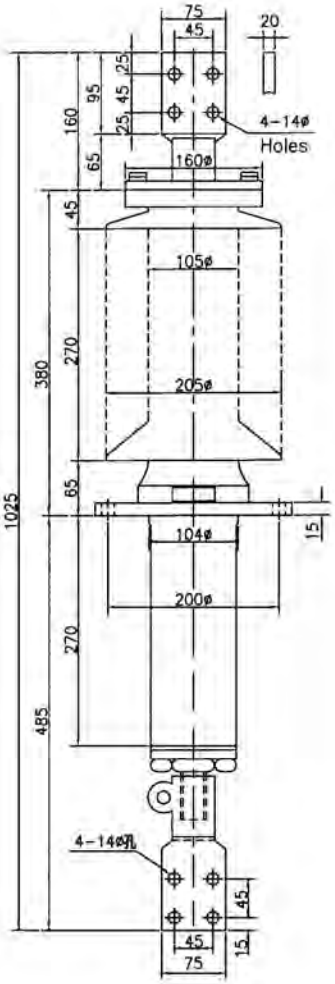
REV.	修改記要 SUMMARY	REV/DATE	APPR/DATE
A	ISSUE / 發行	---	---

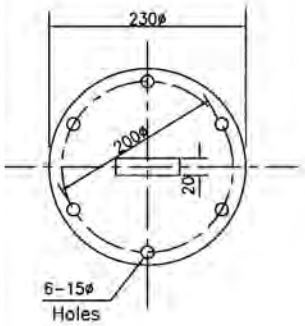
士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

第三角圖法	3RD ANGLE PROJECTION	設計 DESIGNED	校對 CHECKED	批准 APPROVED
單位 DIM	mm	S.Y.Jhan	L.P.Wang	Steven Hsu
比例 SCALE	1 / 8.5			
日期 DATE	06 - 03 - '09			

圖名 TITLE
OUTLINE OF BUSHING

圖號 DWG. No. E438824 A

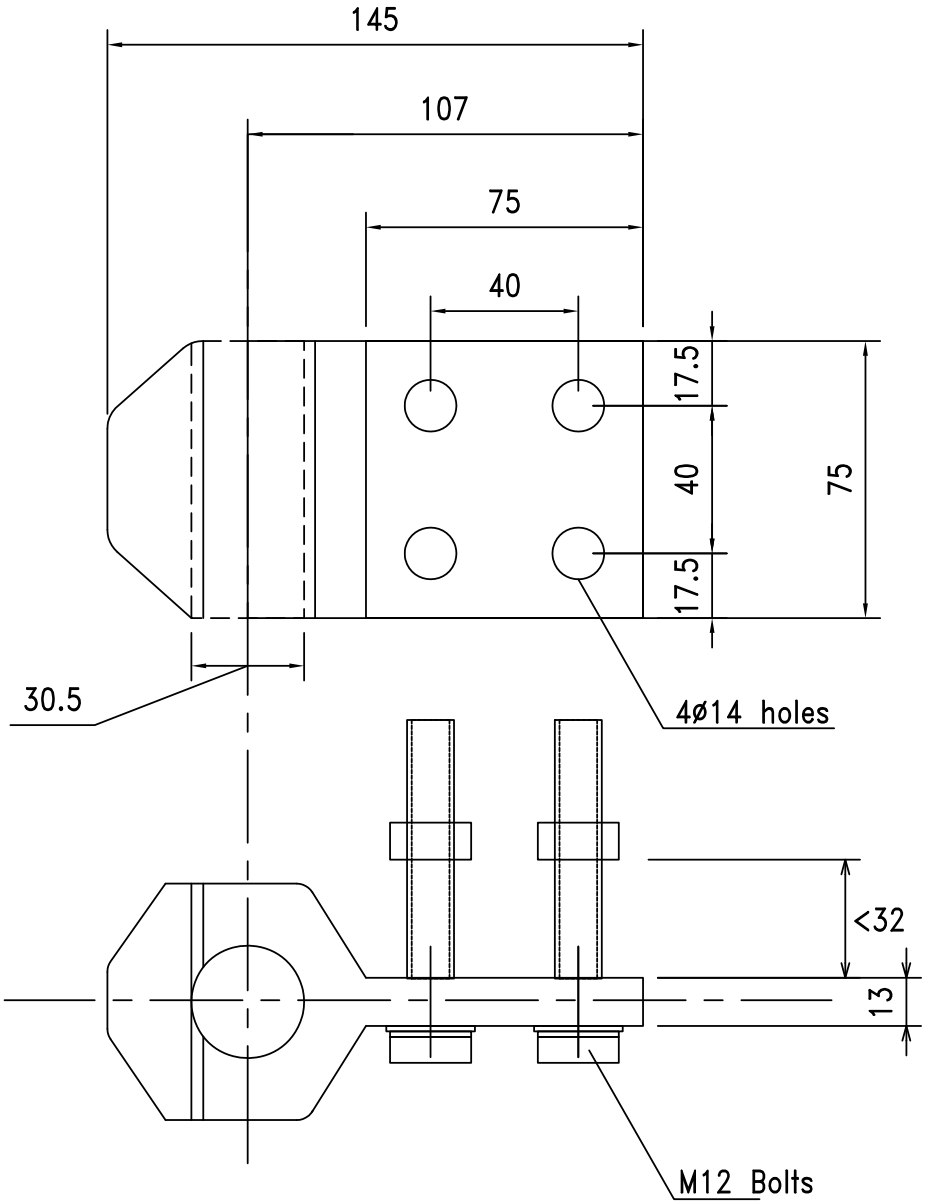




Manufacturer	: SEEC
Type	: PO
Rated voltage	: 25 KV
Rated current	: 2000 A
B.I.L.	: 150 KV
60Hz Withstand	
1 min dry	: 60 KV
10 sec wet	: 50 KV
Total creepage distance	: 570 mm
Color	: Brown
Weight	: 35 KG

				士林電機廠股份有限公司 SHIHLIN ELECTRIC & ENGINEERING CORP.				圖名 TITLE: OUTLINE OF BUSHING
				第三角圖法 3RD ANGLE PROJECTION		設計 DESIGNED	校對 CHECKED	核准 APPROVED
				單位 DIM	mm	T.L.Chuang	J.M.Lee	J.M.Lee
A	ISSUE / 發行	---	---	比例 SCALE	※			圖號 DWG. No. E414872
REV.	修改記要 SUMMARY	REV/DATE	APPR/DATE	日期 DATE	Nov.- 05 -2007			

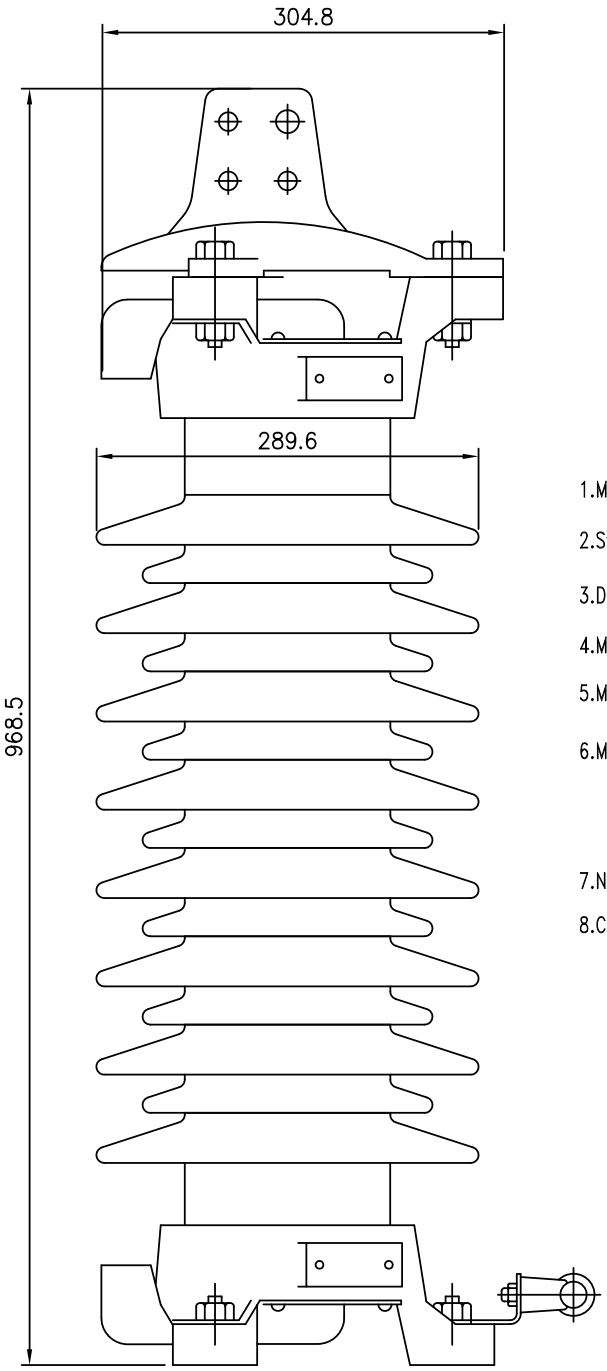
Digby Wind Project UARB IR-12 Attachment 10 Page 750 of 1067



Material : Nickel-plated copper

				士林電機廠股份有限公司 SHIHLIN ELECTRIC & ENGINEERING CORP.				圖名 TITLE: H.V.& L.V. BUSHING UPPER SEPARATE TERMINALS
				第三角圖法	3RD ANGLE PROJECTION	設計 DESIGNED	校對 CHECKED	批准 APPROVED
				單位 DIM	mm	S.Y.Jhan	L.P.Wang	Steven Hsu
A	ISSUE / 發行	---	---	比例 SCALE	×			圖號 DWG. No. E438842 A
REV.	修改記要 SUMMARY	REV/DATE	APPR/DATE	日期 DATE	98 – 06 – 05			

Digby Wind Project UARB IR-12 Attachment 10 Page 751 of 1067



CHARACTERISTICS

1.Manuffacturer	OHIO/BRASS
2.Standard Arrester Catalog Number	VN-219548
3.Duty Cycle Rating kV rms	60 kV
4.Maximum Continuous Operating Voltage kV rms	48 kV
5.Minimum Leakage Distance	1524mm
6.Minimum Mounting Spacing on center	
Phase to phase (in-line)	635mm
Phase to Ground	482.6mm
7.Net Weight	407.9kg
8.Color	Grey Glaze

REV.	修改記要 SUMMARY	REV/DATE	APPR/DATE
A	ISSUE / 發行	---	---

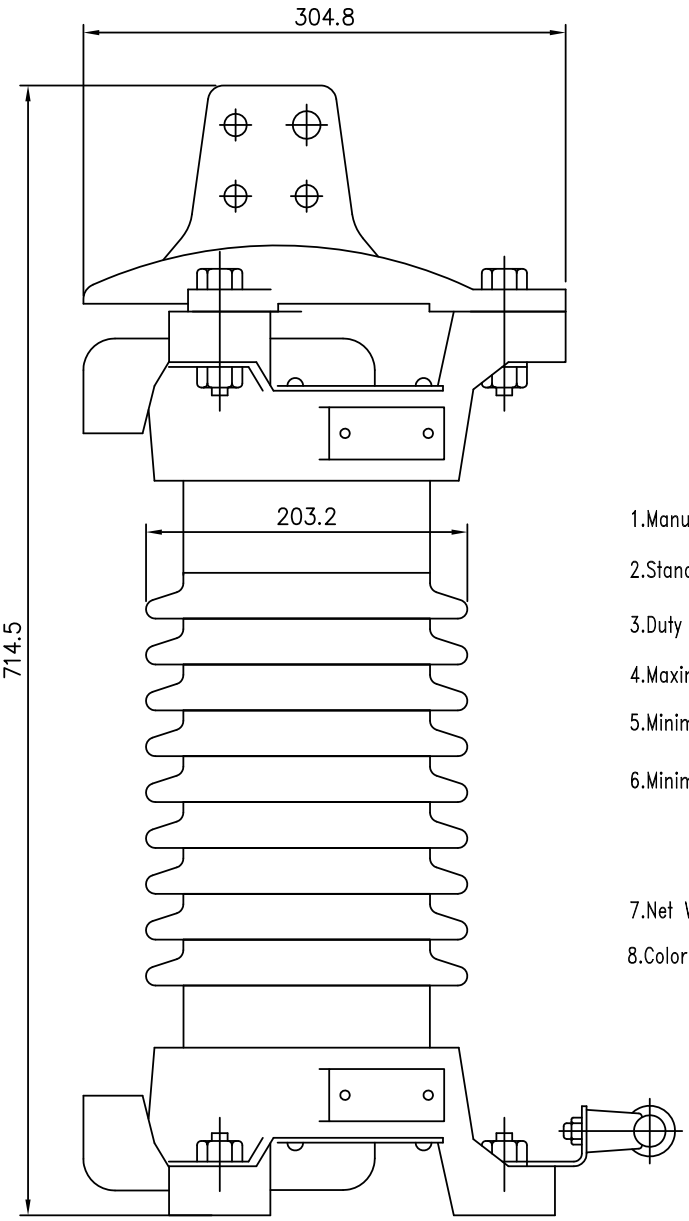
士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

第三角圖法	3RD ANGLE PROJECTION	設計 DESIGNED	校對 CHECKED	批准 APPROVED
單位 DIM	mm	S.Y.Jhan	L.P.Wang	Steven Hsu
比例 SCALE	※			
日期 DATE	06 – 03 – '09			

圖名 TITLE: H.V. LIGHTNING ARRESTER

圖號 DWG. No. E438825 A

Digby Wind Project UARB IR-12 Attachment 10 Page 752 of 1067



CHARACTERISTICS

1.Manuffacturer	OHIO/BRASS
2.Standard Arrester Catalog Number	VL-216022
3.Duty Cycle Rating kV rms	27 kV
4.Maximum Continuous Operating Voltage kV rms	22 kV
5.Minimum Leakage Distance	805.2mm
6.Minimum Mounting Spacing on center	
Phase to phase (in-line)	457.2mm
Phase to Ground	304.8mm
7.Net Weight	198.4kg
8.Color	Grey Glaze

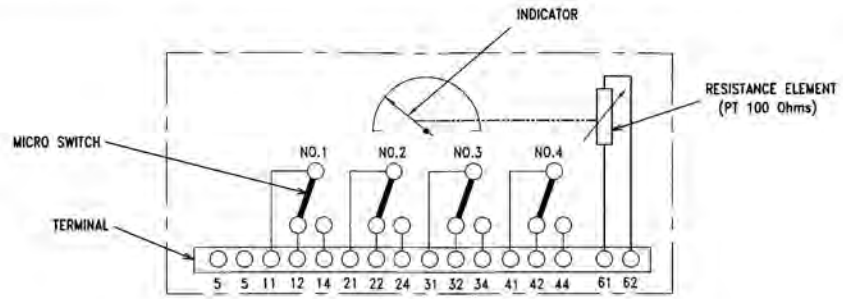
REV.	修改記要 SUMMARY	REV/DATE	APPR/DATE
A	ISSUE / 發行	---	---

士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

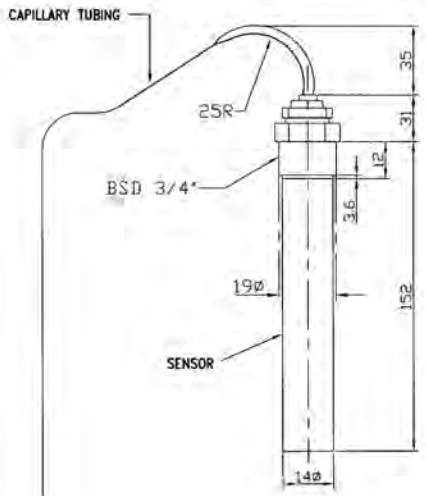
第三角圖法	3RD ANGLE PROJECTION	設計 DESIGNED	校對 CHECKED	批准 APPROVED
單位 DIM	mm	S.Y.Jhan	L.P.Wang	Steven Hsu
比例 SCALE	/			
日期 DATE	06 – 03 – '09			

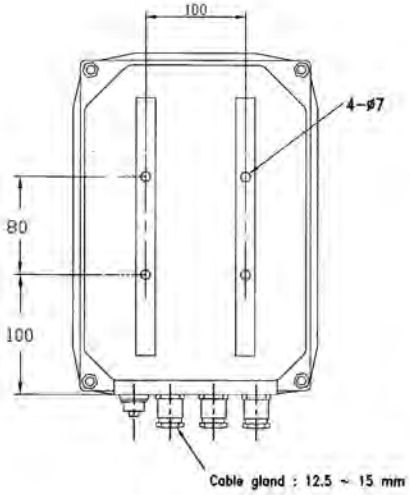
圖名 TITLE: L.V. LIGHTNING ARRESTER

圖號 DWG. No. E438826 A

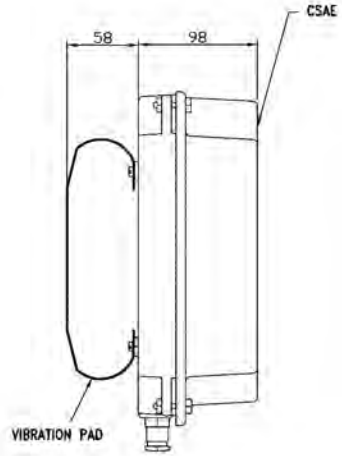


MICRO SWITCH	NO.1	NO.2	NO.3	NO.4
ON	85°C	95°C	SPARE	SPARE
OFF	80°C	90°C	SPARE	SPARE
ASSIGNMENT	ALARM	TRIP	SPARE	SPARE

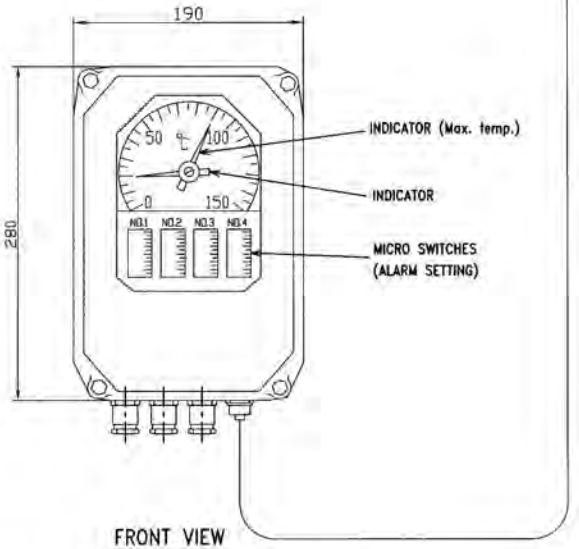




REAR VIEW



SIDE VIEW



FRONT VIEW

TYPE : OTI SERIES 34
MAKER : AKM (SWEDEN)

REV.	SUMMARY 修改記要	REV./DATE	APPR/DATE
B	Revised According Client Comments	H. J. Chen Mar.26,2008	C. M. Lee Mar.26,2008
A	ISSUE / 發行	---	---

保留圖一時圖

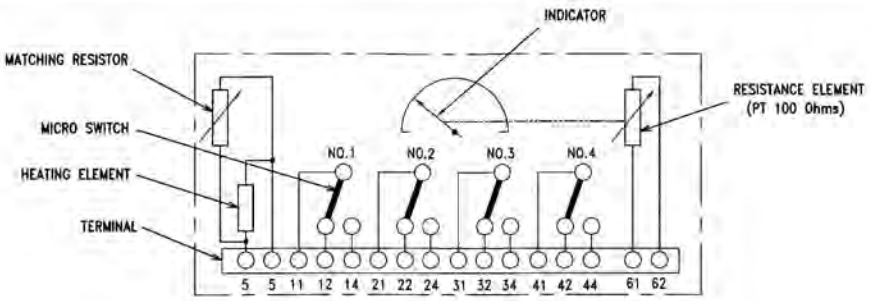
士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

第三角圖法 3RD ANGLE PROJECTION		繪圖 DRAWN	設計 DESIGNED	校對 CHECKED	核准 APPROVED
單位 DIM	mm	H. J. Chen	H. J. Chen	C. C. Lin	C. M. Lee
比例 SCALE	1/5				
日期 DATE	FEB - 02 -2008				

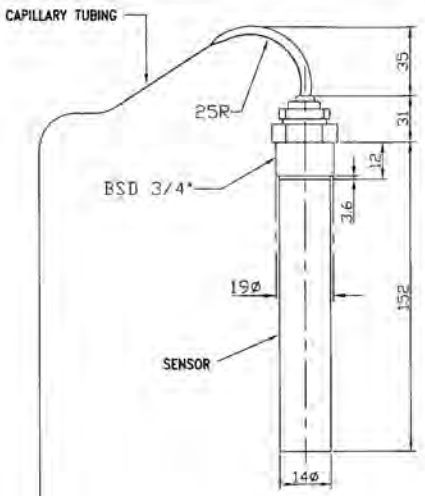
圖名 TITLE: OIL TEMPERATURE INDICATOR

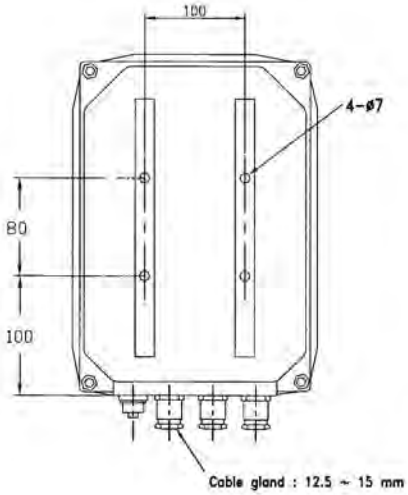
圖號 DWG. No. E335813

SH. No. | REV. B

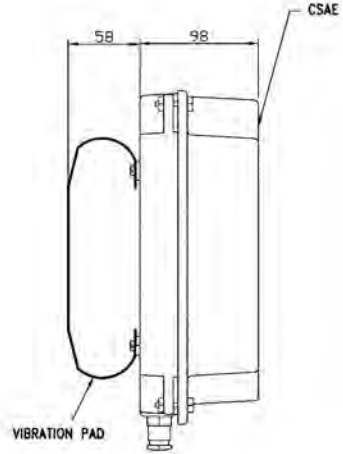


MICRO SWITCH	NO.1	NO.2	NO.3	NO.4
ON	100°C	65°C	70°C	110°C
OFF	95°C	60°C	65°C	105°C
ASSIGNMENT	ALARM	COOLING START	COOLING FAIL	ALARM/TRIP

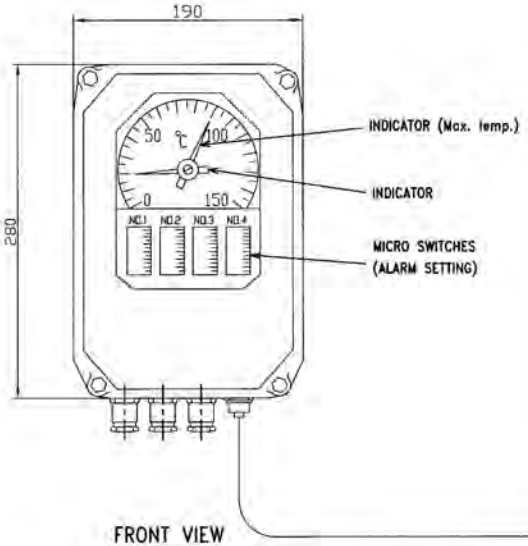




REAR VIEW



SIDE VIEW



FRONT VIEW

TYPE : OTI SERIES 35
MAKER : AKM (SWEDEN)

REV.	SUMMARY 修改記要	REV./DATE	APPR/DATE
C	Revised According Client Comments	H. J. Chen Apr.08.2008	C. M. Lee Apr.08.2008
B	Revised According Client Comments	H. J. Chen Mar.26.2008	C. M. Lee Mar.26.2008
A	ISSUE / 發行	---	---

保留圖・一時圖

士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

第三角圖法 3RD ANGLE PROJECTION		繪圖 DRAWN	設計 DESIGNED	校對 CHECKED	核准 APPROVED
單位 DIM	mm	H. J. Chen	H. J. Chen	C. C. Lin	C. M. Lee
比例 SCALE	1/5				
日期 DATE	FEB - 01 - 2008				

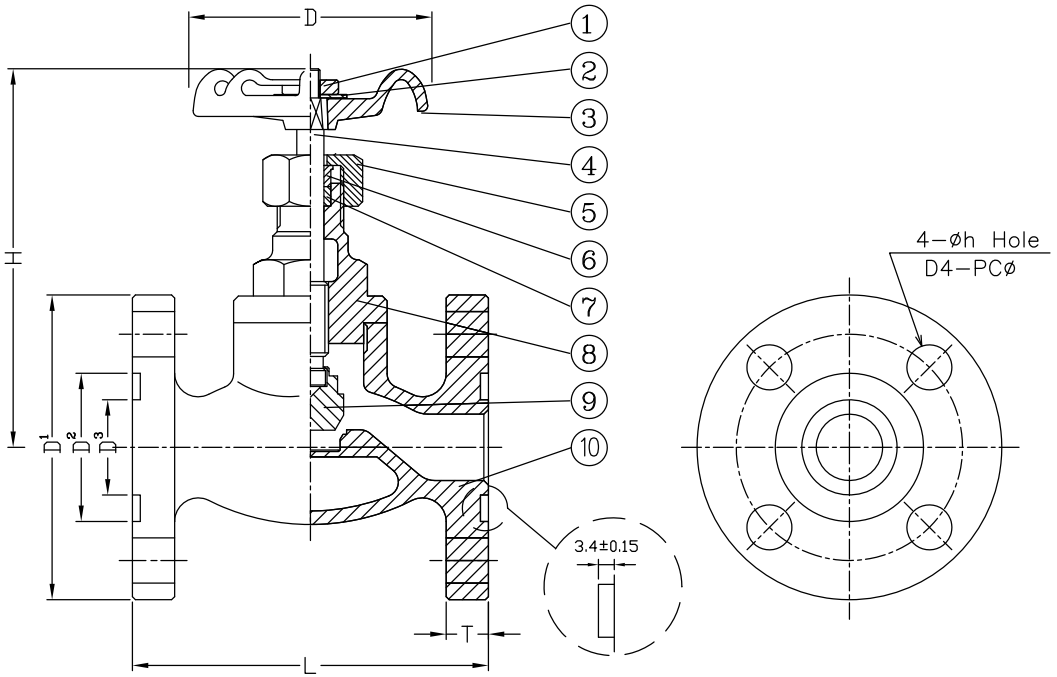
圖名 TITLE: WINDING TEMPERATURE INDICATOR

圖號 DWG. No.: E335814

SH. No. | REV.: C

NO.	Parts	Material	Remark
1	NUT	SS41B-D	
2	NAME PLATE	ALUMINUM	
3	HAND WHEEL	ALUMINUM	
4	STEM	C3604	
5	NUT	C3604	
6	GLAND	C3604	
7	PACKING	PTFE	
8	BONNET	BC6	
9	DISC	BC6	
10	BODY	BC6	

WORKING PRESSURE : 142 psi



SIZE	PIPE	L	H	T	h	D	D_1	D_2	D_3	D_4
1/2 B	1/2"	81	75	8	12	55	80			60
1 B	1"	110	105	12	19	70	125	64	44	90
1 1/2 B	1 1/2"	150	130	14	19	85	140	74	54	105
2 B	2"	180	155	14	19	110	155	91	71	120

REV.	SUMMARY 修改記要	REV./DATE	APPR/DATE
A	ISSUE / 發行	---	---

保留圖・一時圖

士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

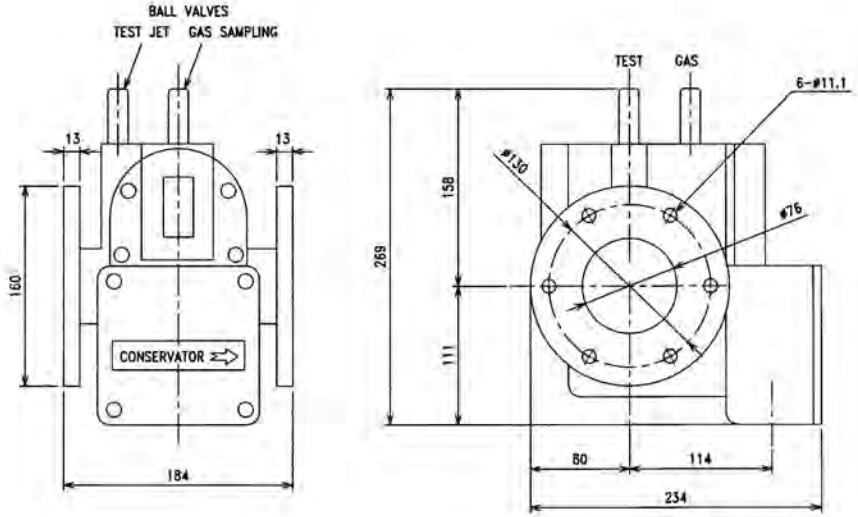
第三角圖法	3RD ANGLE PROJECTION	繪圖 DRAWN	設計 DESIGNED	校對 CHECKED	批准 APPROVED
單位 DIM	mm	S.Y. Jhan	S.Y. Jhan	Steven Hsu	Steven Hsu
比例 SCALE	⊗				
日期 DATE	June- 09 -2009				

圖名 TITLE: GLOBAL VALVE

圖號 DWG. No.: E 3 3 8 8 4 3

SH. No.	REV.

TYPE : 3DE/VO (REED SWITCH TYPE)
MAKER : P&B WEIR ELECTRICAL
OPERATE TRIP ELEMENT SWITCH : STEADY OIL FLOW 1200 ~ 1600 mm/sec
OPERATE ALARM ELEMENT SWITCH : OIL LEVEL 200 ~ 300 c.c.



REV.	SUMMARY 修改記要	REV./DATE	APPR/DATE
A	ISSUE / 發行	---	---

保留圖一時圖

士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

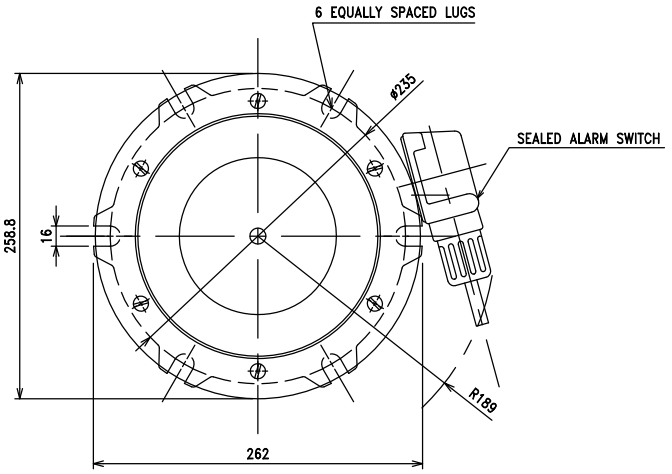
第三角圖法	3RD ANGLE PROJECTION	繪圖 DRAWN	設計 DESIGNED	校對 CHECKED	核准 APPROVED
單位 DIM	mm	H. J. Chen	H. J. Chen	C. C. Lin	C. M. Lee
比例 SCALE	1/4				
日期 DATE	FEB - 01 - 2008				

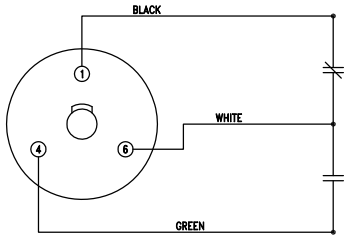
圖名 TITLE: BUCHHOLZ RELAY

圖號 DWG. No.: E335820

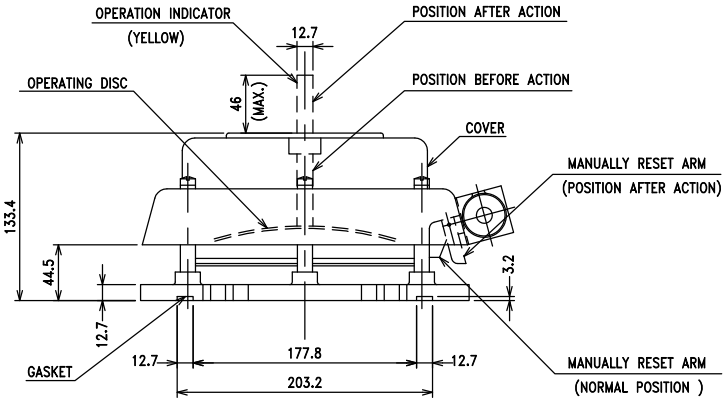
SH. No.	REV.
	A

TYPE : 208-60 F
MAKER : QUALITROL CORPORATION (USA)
OPERATING PRESSURE : 10 PSI





WIRING DIAGRAM



ALARM OR SIGNAL SWITCH

Type	Single-pole Double-throw
Operation :	a.) Contact #1 normally closed, #2 normally open b.) Contact #2 closes and #1 opens when device operates c.) Manual reset from b to a
Rating :	15 amps @ 125, 250 and 480V AC 1/2 amps @ 125V DC, non-inducive 1/4 amps @ 250V DC, non-inducive

REV.	SUMMARY 修改記要	REV./DATE	APPR/DATE
A	ISSUE / 發行	---	---

保留圖一時圖

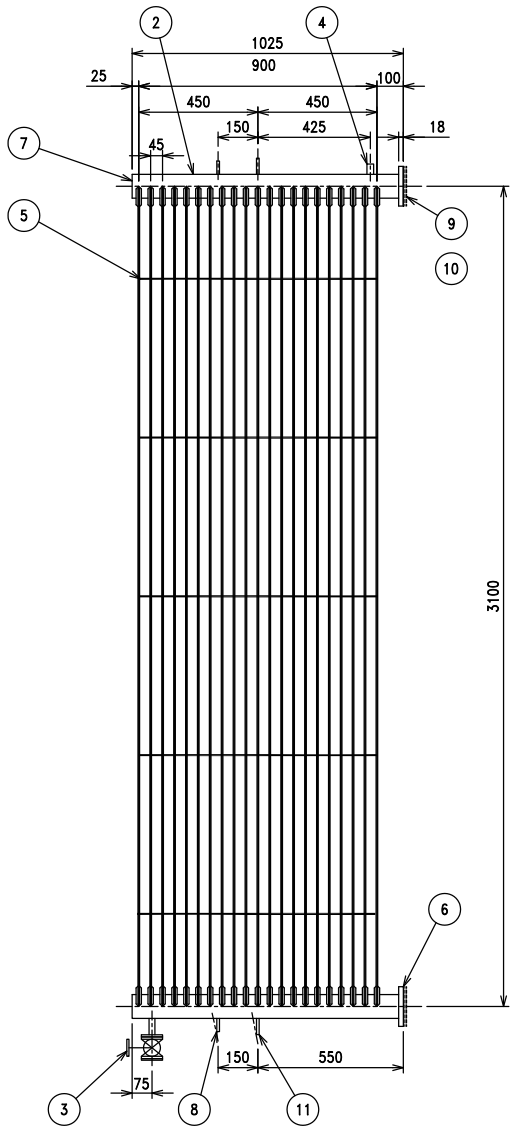
士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

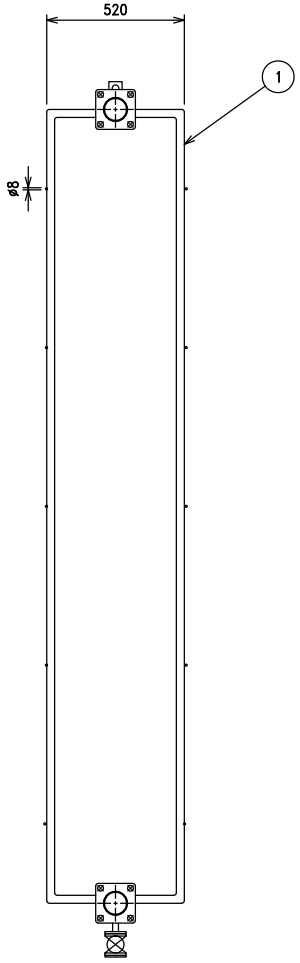
第三角圖法 3RD ANGLE PROJECTION		繪圖 DRAWN	設計 DESIGNED	校對 CHECKED	批准 APPROVED
單位 DIM	mm	H. J. Chen	H. J. Chen	C. C. Lin	C. M. Lee
比例 SCALE	1/4				
日期 DATE	FEB - 01 -2008				

圖名 TITLE: PRESSURE RELIEF DEVICE

圖號 DWG. No.: E335819

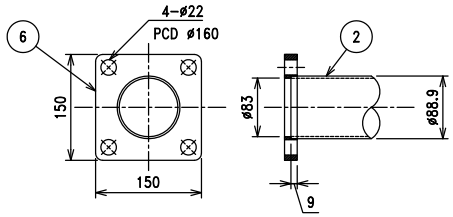
SH. No. | REV.: A

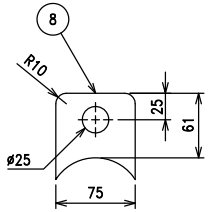


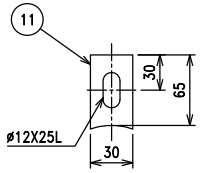


MAKER : TTP (INDIA)
TYPE : ER-53121
SURFACE : 73.07 M²
PAINTING : HOT-DIP GALVANIZED 55u
OIL VOLUME : 171.0 Liter
WEIGHT : 645.8 kg

Item	DESCRIPTION	Q'ty
1	RADIATOR ELEMENT	21
2	HEADER PIPE	2
3	Oil Drain Valve	1
4	AIR RELEASE PLUG	1
5	BRACING STRAP	6
6	FLANGE	2
7	END PLATE	2
8	LIFTING LUG	2
9	BLANKING PLATE	2
10	RUBBER GASKET	2
11	BRACING LUG	2
12	STEEL PLATE	1







REV.	SUMMARY 修改記要	REV./DATE	APPR/DATE
A	ISSUE / 發行	---	---

保留圖・一時圖

士林電機廠股份有限公司
SHIHLIN ELECTRIC & ENGINEERING CORP.

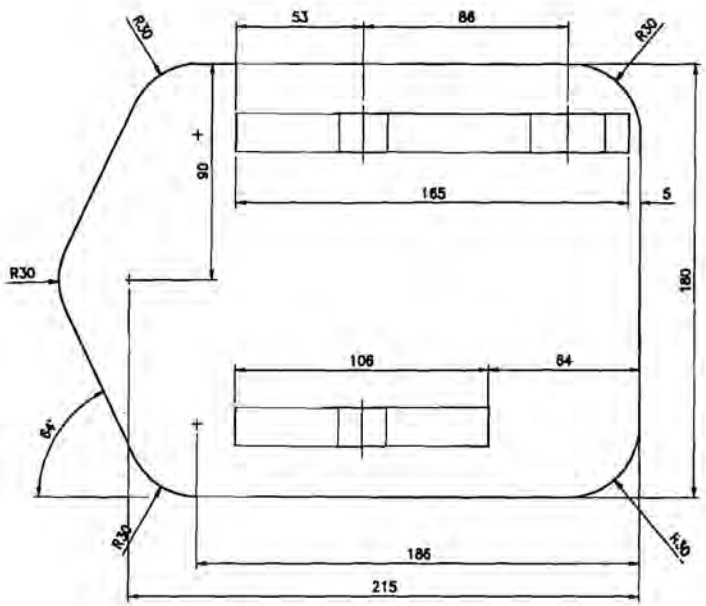
第三角圖法	3RD ANGLE PROJECTION	繪圖 DRAWN	設計 DESIGNED	校對 CHECKED	批准 APPROVED
單位 DIM	mm	S.Y. Jhan	S.Y. Jhan	Steven Hsu	Steven Hsu
比例 SCALE	1/20				
日期 DATE	June- 09 -2009				

圖名 TITLE: RADIATOR

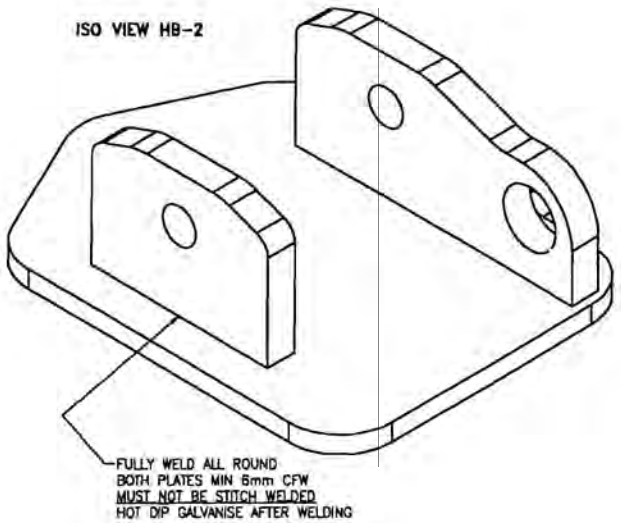
圖號 DWG. No.: E338845

SH. No.	REV.
	A

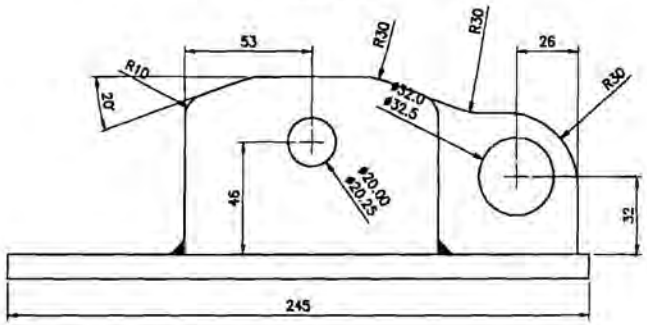
PLAN VIEW



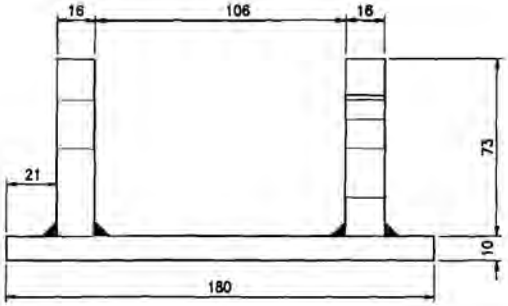
ISO VIEW HB-2



SIDE VIEW



END VIEW



DRAWN KLS	POWERCOR AUSTRALIA	SCALE 1:2	PC14/301/1
CHECKED GP	MAYPOLE BRACKET		
DESIGNED HARRYBUILT	ARREST FRAME PLATE HB-2		
GP STANDARDS ENGINEER	FOR TRANSFORMER LIDS		

REFERENCE DRAWINGS | REVISION

283 X 400mm A3

ACAD DRAWN

This document reflects the combined efforts of a group of Nova Scotia consultants, contractors, owner representatives and regulatory agencies who make up the Joint Committee on Contract Documents responding to problems voiced within the municipal servicing industry. They have developed and currently maintain the Standard Specification for Municipal Services to provide uniform standards for the construction of municipal services throughout Nova Scotia. Present committee members are:

PRESENT MEMBERS

Bruce Colborne, P.Eng.	Halifax Regional Municipality
Willard D'Eon, P.Eng.	CBCL Limited
Jamie Hannam, MBA, P.Eng.	Halifax Regional Water Commission
Curtis Isenor, Manager-Estimating	Basin Contracting Limited
Stan Kochanoff, MCIP	Environova Planning Group Inc.
Lew Landers, P.Eng.	Municipality of East Hants
Sandy McClearn, P.Eng.	SNC-Lavalin Inc.
Brian Reimer	Dexter Construction Limited
Jeff Spares, P.Eng.	Halifax Regional Municipality
Walter Strachan, RSW, PQS	CBCL Limited
Norman Seymour, CET	S.W. Weeks Construction Limited

Thanks are due to the Consulting Engineers Association of Nova Scotia and to the Nova Scotia Road Builders Association for their support and endorsement of this document.

END

Title	Section	Revision Date	Colour
PART I			
User's Guide	00 10 00	JAN 2009	Pink
User's Guide Tender Advertisements	00 11 00	JAN 2009	Pink
Information to Tenderers	00 21 00	JAN 2009	White
Tender Form	00 41 43	JAN 2009	White
Form of Agreement	00 53 43	JAN 2009	White
PART II			
Definitions	00 71 00	JAN 2009	Yellow
General Conditions of the Civil Works Contract	00 72 45	JAN 2009	Yellow
Supplementary General Conditions	00 73 00	JAN 2009	Yellow
General Requirements	01 10 00	JAN 2009	Grey
Measurement and Payment	01 22 00	JAN 2009	Grey
References	01 42 00	JAN 2009	Grey
Environmental Protection	01 57 00	JAN 2009	Grey
Concrete	03 30 00	JAN 2009	Blue
Metal Fabrications	05 50 00	JAN 2009	Blue
Clearing and Grubbing	31 10 00	JAN 2009	Blue
Earthwork	31 20 00	JAN 2009	Blue
Gabions	31 36 00	JAN 2009	Blue
Asphalt Concrete Paving	32 12 16	JAN 2009	Blue
Interlocking Concrete Paving	32 14 13	JAN 2009	Blue
Walks, Curbs and Gutters	32 16 00	JAN 2009	Blue
Chain Link Fence	32 31 00	JAN 2009	Blue
Modular Block Retaining Walls	32 32 19	JAN 2009	Blue
Planting Trees, Shrubs and Groundcover	32 90 00	JAN 2009	Blue
Protection of Existing Trees	32 91 10	JAN 2009	Blue
Topsoiling and Finish Grading	32 91 19	JAN 2009	Blue
Seeding and Sodding	32 92 00	JAN 2009	Blue
Reinstatement	32 98 00	JAN 2009	Blue
Water Main	33 11 00	JAN 2009	Blue
Sanitary Sewers	33 31 00	JAN 2009	Blue
Suction Lift Pump Station Equipment	33 32 13	JAN 2006	Blue
Submersible Pump Station	33 32 14	JAN 2009	Blue
Pressure Sewers	33 34 00	JAN 2009	Blue
Precast Manholes, Catch Basins and Structures	33 39 00	JAN 2009	Blue
Storm Sewers and Culverts	33 40 00	JAN 2009	Blue
Natural Gas Distribution Piping	33 51 00	JAN 2009	Blue
Guardrail	37 71 13	JAN 2009	Blue

Title	Section
STANDARD DETAILS (INDEX)	39 00 00
Trench Payment Details for Additional Items	01 22 00-01
Concrete Curb and Gutter Section	32 16 00-01
Concrete Curb Section	32 16 00-02
Mountable Curb and Gutter Section	32 16 00-03
Guyed Tree Planting Detail	32 90 00-01
Staked Tree Planting Detail	32 90 00-02
Shrub Planting Detail	32 90 00-03
Soil Texture Classes, Canadian System of Soil Classification	32 90 00-04
Standard Tree Protection for Single Trees	32 90 00-05
Standard Tree Trunk Protection for Single Trees When Protective Fencing cannot be Installed	32 90 00-06
Fire Hydrant	33 11 00-01
Gate Valve and Valve Box	33 11 00-02
Water Service Connection	33 11 00-03
Thrust Block Details	33 11 00-04
Thrust Block Requirements	33 11 00-05
Typical Zinc Anode Installation on Valves and Copper Services	33 11 00-06
Polyethylene Encasement on Ductile Iron Water Pipes	33 11 00-07
Sanitary Sewer Service Connection	33 31 00-01
Deflection Gauge	33 31 00-02
Precast Manhole with Flat Top	33 39 00-01
1050 Dia. Precast Manhole with Cone Section	33 39 00-02
Precast Manhole with Internal Drop	33 39 00-03
Cast-in-Place Base for Precast Manhole	33 39 00-04
600 Sq. Precast Catch Basin	33 39 00-05
1050 Dia. Precast Catchbasin	33 39 00-06
Asphalt Depression at Catchbasin	33 39 00-07
Storm Sewer Service Connection	33 40 00-01
Guardrail	37 71 13-01

END

1. INTRODUCTION

.1 This document reflects the combined efforts of a group of Nova Scotia consultants, contractors, owner representatives and regulatory agencies who make up the Joint Committee on Contract Documents responding to problems voiced within the municipal servicing industry. They have developed and currently maintain the Standard Specification for Municipal Services to provide uniform standards for the construction of municipal services throughout Nova Scotia.

.2 Preparation of this document was undertaken with the prime objective of bringing about significant reductions in the cost of design and construction of municipal services through:

.1 The development of uniform practices;

.2 The elimination of the need to prepare full specification documents for each project;

.3 The reduction of retraining personnel transferred from one project to another; and

.4 The elimination of disputes over misinterpretations.

The sponsors of the Specification believe it achieves these objectives.

.3 THE SPONSORING ASSOCIATIONS STRONGLY URGE OWNERS AND ENGINEERS TO UTILIZE THIS DOCUMENT TO THE MAXIMUM EXTENT POSSIBLE TO TAKE ADVANTAGE OF THE POTENTIAL DESIGN AND CONSTRUCTION SAVINGS.

.4 The Standard Specification for Municipal Services reflects industry practices. Users are cautioned that the Standard Specification does not deal with any specific project, situation or circumstance. The Standard Specification does not constitute legal or other professional advice. The Joint Committee on Contract Documents, its sponsors and contributors do not accept any responsibility or liability for loss or damage which may be suffered as a result of its use.

.5 Use of this standard specification does not preclude the necessity of applying for and receiving all permits and approvals and meeting all requirements of authorities having jurisdiction.

2. DESCRIPTION OF DOCUMENT

.1 The document is presented in two parts. **Part I** includes Information for Tenderers, Tender Form, and Form of Agreement. These sections are presented as a "standard format" which will **require editing for each project**. Part II includes Definitions, General Conditions, Supplementary General Conditions, Measurement and Payment, General Requirements, Technical Specifications and Standard Details. The sections of **Part II** are "standard" and **shall not be revised or amended except by Supplementary Specifications.**

.2 The document is written in the style recommended by Construction Specifications Canada (CSC), using Masterformat 2004 classifications and CSC, three part format:

Part 1 - General
Part 2 - Products
Part 3 - Execution

.3 Annually, registered subscribers will receive hardcopy updates along with an updated CD. Part I will be provided in Microsoft Word® as it requires editing for each project. Part II will be provided in Adobe Acrobat® format. The primary objectives of the CD version are twofold: to provide an electronic version of the document for use in the field and to provide Part I sections for easier editing on projects. Subscribers are reminded that the only acceptable editing of Part II sections is by way of Supplementary Specifications. Amending of Part II sections in any other way **is an infringement of copyright**. Additional CDs, if required, are available from the Joint Committee on Contract Documents. Copying of the CD is prohibited.

3. USAGE OF DOCUMENT

.1 This document is intended to be used as a standard for all Municipal Services Contracts.

.2 Project Documents are the documents that are prepared to supplement the Standard Specifications. Project Documents are the only documents to be prepared and issued for each specific project. They include the following:

Information to Tenderers (Section 00 21 00)
Tender Form (Section 00 41 43)
Form of Agreement (Section 00 52 43)
Supplementary Specifications
Drawings
Addenda

.3 The Standard Specifications, Part II, consisting of Definitions, General Conditions, Supplementary General Conditions, Measurement and Payment, General Requirements, Technical Specifications and Standard Details apply to all projects but will not be issued with the Project Documents. All owners, engineers, contractors and interested parties should have a sufficient number of copies of this standard document on hand for easy reference.

.4 Recommendations and guidelines for preparation of each Section of the Project Documents are outlined in Subsection 5.

4. TENDER ADVERTISING

.1 A tender advertisement, Section 00 11 00 is included as a guide. The requirements outlined in this Section should be included.

5. PREPARATION OF PROJECT DOCUMENTS

.1 Preface

.1 It is recommended that the following statement should be included immediately inside the front cover of the Project Documents.

THESE PROJECT DOCUMENTS HAVE BEEN PREPARED FOR USE WITH AND REQUIRE BEING READ IN CONJUNCTION WITH THE **STANDARD SPECIFICATION FOR MUNICIPAL SERVICES** AS PUBLISHED BY THE NOVA SCOTIA ROAD

BUILDERS ASSOCIATION - CONSULTING ENGINEERS OF NOVA SCOTIA **JOINT COMMITTEE ON CONTRACT DOCUMENTS.** COPIES OF THE STANDARD SPECIFICATIONS ARE AVAILABLE FROM THE JOINT COMMITTEE ON CONTRACT DOCUMENTS, 455 COLBY DRIVE, DARTMOUTH, NS, B2V 2K4; TELEPHONE: (902) 430-2534, (902) 233-9362 OR e-mail june_strachan@ns.sympatico.ca

.2 Information to Tenderers (Section 00 21 00)

.1 Information for Tenderers is to be prepared as part of the Project Documents for each project. The text which follows is presented as a standard with options and required information indicated by brackets. Retype the text as presented, fill in the blanks and select the required options.

.2 Specify the amount of Tender Security as a fixed amount. This allows Tenderers to assess their ability to tender and also permits Tenderers to obtain their Tender Security prior to finalizing the Total Tender Price.

.3 If applicable, add subsections for soils information, site investigation, authorized site visits, contingency allowances and any other special tendering requirements. Suggested wording follows; edit as appropriate.

SOILS INFORMATION

Soils investigation has been carried out at the Site of the Works. Information from this investigation is available at [_____]. Soils investigation was carried out to determine the character of the sub-soil for design purposes. The Owner assumes no responsibility for this information. Soils information does not form a part of the Contract Documents but is available for information only.

SITE INVESTIGATION

With permission of the Owner, Tenderers may visit and examine the Site and subsurface conditions to satisfy

themselves of the conditions which may be encountered.

AUTHORIZED SITE VISITS

The Tenderer requires authorization to visit the site.

For authorization, contact:

[Name of Person]

[Address]

[Telephone Number]

CONTINGENCY ALLOWANCE

A Contingency Allowance is included in Section 00 41 43. This amount covers any cost for extra work as directed by the Engineer which is not included in the items in the Schedule of Quantities and Unit Prices. Specific information regarding the use of this Contingency Allowance is provided in Section 01 22 00.

.3 Tender Form (Section 00 41 43)

.1 The Tender Form is to be prepared as part of the Project Documents for each project. The Tender Form includes:

- .1 Salutation
- .2 Declaration
- .3 Agreement
- .4 Schedule of Quantities and Unit Prices
- .5 Completion Time
- .6 Signatures

.2 Complete subsections 1.1 and 1.2; and list the Contract Documents in subsection 3.9. Prepare subsection 4, Schedule of Quantities and Unit Prices using the same format and corresponding numbers for the same items in Section 01 22 00, Measurement and Payment. Extra numbers have been reserved under each division of the Schedule for additional items.

.3 When reserved numbers are used or additional numbers added, Section 01 22 00, Measurement and Payment must be supplemented to include descriptions for

these items. These items are to be presented in the standard format of Section 01 22 00.

.4 Agreement (Section 00 52 43)

.1 The Form of Agreement is to be prepared as part of the Project Documents for each project. The Form of Agreement is included for information purposes only. Complete pertinent portions known at the time of tendering.

.5 Supplementary Specifications

.1 Supplementary Specifications are prepared to modify the existing Standard Specifications when necessary, or to add new Sections as required. Supplementary Specifications are similar to an addendum except they are issued with the Project Documents rather than after the tender call.

.2 Supplementary Specifications which modify existing Sections should refer to the same Section and subsection numbers and should be presented using the same format. Clearly state the subsection to be deleted and present the new subsection to replace the existing one.

.3 New specification sections being added using the Supplementary Specifications are to be numbered using the appropriate sections and section numbers of the CSC/CSI Masterformat.

.4 Make every effort to keep Supplementary Specifications to a minimum. Certain supplements are required for all projects as applicable:

.1 Project description.

.2 Project schedule and requirements.

.3 Site access conditions.

.4 Technical Sections for items not included in the Standard Specifications, i.e. street lighting.

.5 Bonding and insurance requirements.

.6 Measurement and Payment for additional items.

.7 Pipe bedding and backfill materials and applications.

.5 A sample Supplementary Specifications is included under subsection 7.

.6 Drawings:

.1 Standard Specifications requires certain information to be included on the Drawings. The Drawings must clearly indicate the following:

.1 Existing conditions and required reinstatement.

.2 Diameter, type and class of pipes.

.3 Horizontal and vertical locations complete with dimensions and elevations.

.4 Typical trench details indicating bedding and backfill requirements.

.5 Size and type of precast manhole, catchbasins and structures.

6. EDITORIAL UPDATE

.1 An ongoing committee of the sponsor organizations has been established to review feedback from engineers, owners, contractors, suppliers and other interested individuals or organizations and to provide an editorial service to keep the document current. Updates will be issued annually, and more often if deemed appropriate, to registered holders of the document.

.2 The Joint Committee on Contract Documents has retained the services of SpecTech Limited, specification consultants to maintain the Standard Specifications current, promote its use, and co-ordinate between the Joint Committee and users.

.3 Contact SpecTech Limited, 455 Colby Drive, Dartmouth, NS, B2V 2K4; telephone: (902)430-2534, (902) 233-9362 OR e-mail june_strachan@ns.sympatico.ca

7. SAMPLE SUPPLEMENTARY SPECIFICATION

.1 Intent:

.1 The Work of this Contract is to be constructed in accordance with the Standard Specifications for Municipal Services as developed and published by the Nova Scotia Road Builders Association and the Consulting Engineers of Nova

Scotia Joint Committee on Contract Documents, except as modified herein.

.2 These Supplementary Specifications modify the specification sections to which they refer.

.3 The Supplementary Specifications take precedence over the *Standard* Specification to which they refer.

SECTION 00 72 45 - GENERAL CONDITIONS

GC 11.2 BONDS

Delete subsection .1 and replace with the following:

.1 The Contractor shall provide to the Owner a performance bond in the amount of 100% of the Estimated Contract Price.

SECTION 01 10 00 - GENERAL REQUIREMENTS

2. Summary of Work

Add the following:

.2 The work to be completed under this Contract includes the following:

.1 Construction of the watermain on Main Street from King Street to Queen Street.

.2 Connection of existing services to new watermain.

.3 Reinstatement of all disturbed surfaces.

SECTION 01 22 00 - MEASUREMENT AND PAYMENT

Water System

Add the following:

18. Meter Chamber

Unit of Measurement: each

This item includes: chamber as indicated, including piped by-pass, valves, auxiliary piping, drains, insulation, miscellaneous metals and other incidentals. Watermain will be measured straight through the chamber and paid under Item 10 Pipe.

SECTION 31 20 00 - EARTHWORK

3.7 Backfilling — Delete subsection .2 and replace with the following

.2 Backfill pipes and structures with Type 2 Gravel.

ADD THE FOLLOWING SECTIONS

SECTION 34 10 00 - RAILROAD WORK

PART 1 - GENERAL

1.1 Work Included

.1 This Section specifies requirements for all work associated with the railway crossing on Main Street.

1.2 Related Sections

1.3 Railway Regulations

END OF EXAMPLE SUPPLEMENTARY SPECIFICATION

8. NSDTIR SPECIAL PROVISIONS

.1 The Standard Specification makes several references to the Province of Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification, Metric Edition. The Engineer shall also be aware of and take into consideration when preparing Project Documents, any NSDTIR Special Provisions in force and their applications to the Project Documents.

9. ASPHALT INDEX

.1 Several highway and public works tendering authorities employ an asphalt price escalation/de-escalation clause for performance graded asphalt binder in their tenders to manage the price volatility. The Engineer may consider including such an index as follows on projects where asphalt makes up a considerable part of the project and the Project Documents include such provision.

.2 If included, the process will be in accordance with the NSDTIR program or as specifically modified in the Project Documents.

.3 As an illustrative example, the following

NSDTIR program provides a guide to the process.

Price Escalation/De-escalation – Performance Graded Asphalt Binder (PGAB)

The Contractor may be assessed a price increase or decrease for asphalt concrete mix place under this contract if the Monthly Asphalt Binder Rack Price (MABRP) for the PGAB specified differs by more than $10.00 per tonne of PGAB, from the month in which this tender closes and the month(s) in which the asphaltic concrete placement is performed. The MABRP will be the weighted average posted rack price established for the month, based on the rack prices provided by each approved supplier. This information can be reviewed on the Nova Scotia Department of Transportation and Infrastructure Renewal website at the end of each month: www.gov.ns.ca/tran

10. CHECKLIST .1 A checklist is included in the User's Guide to help the specifier prepare Project Documents to supplement the Standard Specification for Municipal Services. The Standard Specification requires the user to include project specific contract requirements in the Supplementary Specifications. For example, if your project requires a site office for the Engineer, the Project Documents would have to state that requirement. The checklist is intended to assist users in identifying that their project specific requirements have been included. This is not a complete or exhaustive list of project editing requirements. Refer to individual sections. Develop own checklist for each proposed project.

PROJECT COORDINATION CHECKLIST

Name and Location of Project: _____

Name and Address of Owner: _____

Name and Address of Engineer: _____

Contract No.: _____ Date:

REFER SECTION AND SUBSECTION	REMARKS
00 11 00 4.1	Provide brief description of work:
00 11 00 5.2	Enter amount of tender security:
00 11 00 6.1	Include locations where tender–documents can be obtained or viewed:
00 11 00 6.3	Enter document charge required to obtain tender documents:
00 21 00 1.1	Enter time and date when tenders will be received:

REFER SECTION AND SUBSECTION	REMARKS
00 21 00 1.1	Enter name and address of receiving individual:
00 21 00 1.1	Enter location for delivery of tenders
00 21 00 2.1	Edit tender opening details:
00 21 00 10.1	Enter amount of tender security:
00 21 00 11	Enter project name:
00 21 00 19.	Add new subsection 20. to cover geotechnical report, if applicable:
00 41 43 1.	Edit salutation
00 41 43 9.4	Add list of sections modified or added
00 41 43 9.5	Add list of project drawings

REFER SECTION AND SUBSECTION	REMARKS
00 41 43 4.	Add new subsection 4. for conversion table if project is in imperial units and renumber remaining subsections
00 41 43 4.	Edit items and quantities
00 53 43 A 3.4	Add list of sections modified or added
00 53 43 A 3.5	Add list of project drawings
00 53 43 A 5.4	Enter last day of payment period
00 53 43 A 5.8.1	Enter annual interest rate
01 10 00 4.1	Check drawings for survey control points
01 10 00 7.1	Add shop drawing requirements to Supplementary Specifications
01 10 00 7.2	Add sample requirements to Supplementary Specifications
01 10 00 7.3	Include requirements for mix design of concrete and asphalt to Supplementary Specifications
01 10 00 7.6	Include requirements for inspection report submittal

REFER SECTION AND SUBSECTION	REMARKS
01 10 00 10.2	Include requirements for Engineer's site office in Supplementary Specifications
01 22 00	Generate a new section for Measurement and Payment on each project.
03 30 00 1.4	Add shop drawing, sample and mix design requirements to Supplementary Specifications
03 30 00 2.2.5	Ensure strengths are indicated on Drawings
03 30 00 2.2.*6*	Ensure ratios are indicated on Drawings
05 50 00 1.4	Add shop drawing requirements to Supplementary Specifications
05 50 00 2.1.1	Indicate grade of steel section/plates
05 50 00 2.1.2	Indicate pipe schedule
05 50 00 2.1.3	Indicate grade and finish
05 50 00 2.1.4	Indicate grade for SS plate
05 50 00 2.1.5	Indicate grade for SS bars

REFER SECTION AND SUBSECTION	REMARKS
05 50 00 2.1.8	Indicate colour of paint
31 20 00 2.1.7	If riprap is used, ensure mass and sizes are indicated on drawings
31 20 00 2.1.8	Specify pipe bedding and backfill in Project Documents
31 20 00 3.1.11	Specify whether site material, granular fill or unshrinkable fill is used
31 20 00 3.2	If topsoil is excavated, ensure limits and depths are indicated on drawings
31 20 00 3.7.2	State backfill material
31 36 00 2.1.1	Enter size of gabion baskets
31 36 00 2.3	Indicate geosynthetic
31 36 00 3.5	Specify backfill requirements
32 12 16 2.1.1	Ensure asphalt is indicated on drawings.
32 12 16 2.1.2	Indicate paint colour.
32 12 16 2.2	Ensure type of asphalt *concrete* is indicated on Drawings

REFER SECTION AND SUBSECTION	REMARKS
32 31 00 2.1	Ensure height, fabric type and style, class and grade of coating is indicated on Drawings
32 31 00 3.2.9	Specify method, driving depths, diameter of drill hole
32 32 19 2.1.4	Specify texture and colour of blocks
32 32 19 2.2.1	Specify geotextile filler
32 32 19 2.3.1	Specify backfill
32 32 19 3.2.1	Indicate base material level thickness
32 90 00 1.6	Add sample requirements to Supplementary Specifications.
32 92 00 1.5	Add sample requirements to Supplementary Specifications
33 11 00 2.1	Ensure diameters and types are indicated on drawings
33 11 00 2.6.1.1	Indicate depth of hydrant bury
33 31 00 2.1	Ensure diameters and types are indicated on drawings

REFER SECTION AND SUBSECTION	REMARKS
33 31 00 2.4.2	Indicate in Project Documents
33 31 00 3.1.2	State backfill material
33 31 00 3.5	Specify reinstatement requirements in Project Documents
33 31 00 3.8.2	Indicate when CCTV inspection to occur
33 32 13 1.4	Specify shop drawing submittal requirements
33 32 13 2.1.1	Specify pump characteristics in Project Documents
33 32 13 2.5.1	Specify equipment mounting structure in Project Documents
33 32 14 1.4	Specify shop drawing submittal requirements
33 32 14 2.1.1	Specify pump characteristics in Project Document
33 32 14 2.2.2	Specify pump flow and TDH in Project Documents
33 32 14 2.2.12.2	Specify impeller vane design and passing sphere in Project Documents

NO.	REFER SECTION AND SUBSECTION	REMARKS
1	33 32 14 2.8.1	Specify pipe and fitting material in Project Documents
2	33 32 14 2.10.1	Specify motor speed and electrical characteristics in Project Documents
3	33 34 00 2.1	Ensure diameters and types are indicated on drawings
4	33 39 00 2.5	If waterproofing is used, specify type and details in Supplementary Specification
5	33 39 00 3.3.1	Show details on project documents
6	33 39 00 3.3.3	Specify material under bases.
7	33 39 00 3.7.5	Indicate test method or authority having jurisdiction
8	33 40 00 2.1	Ensure diameters and types are indicated on drawings
9	33 40 00 2.3.2	Indicate profile of PVC sewer pipe and fittings
10	33 40 00 2.4.2	Indicate bell or welded gaskets
11	37 71 13 1.4.1	Add sample requirements to Supplementary Specification

END

INSTRUCTIONS FOR TENDER ADVERTISEMENT

1. GENERAL

.1 The following is required to provide minimum information to properly advertise a project.

2. PLACEMENT OF ADVERTISEMENT

.1 Place Tender Advertisement in section of newspaper reserved for this purpose. Advertise in minimum of 2 issues.

3. HEADING

.1 Place the word "**TENDER**" in bold type across the top of each advertisement.

.2 State the name of the Owner.

.3 State project name and specific location.

4. DESCRIPTION OF WORK

.1 Identify type and scope of work indicating approximate quantities of major items.

5. SECURITY DEPOSIT

.1 Identify name to whom Tender Security is payable.

.2 Identify dollar amount of Tender Security.

6. PROJECT DOCUMENTS

.1 Identify locations where Project Documents may be obtained and locations where they may be viewed.

.2 State that the Standard Specification for Municipal Services is available from the Joint Committee on Contract Documents c/o Spectech Limited, 455 Colby Drive, Dartmouth, NS, B2V 2K4; telephone: (902)430-2534, (902) 233-9362 OR e-mail walters@cbcl.ca.

.3 State details of charge required to obtain Project Documents.

.4 It is recommended that documents be on view in the plans rooms of the Construction Association of Nova Scotia, the Cape Breton Island Builders Exchange and other associated Plans Rooms as required.

END

[Name of Project]

[Location]

[Name and Address of Owner]

[Name and Address of Engineer]

1. Tender Submission	.1	Submit completed Tender Form for above project in sealed envelope marked as follows: TENDER [Name of Project] [and Contract Number if applicable]. [Closing up to [3:00 p.m.], local time [date]] [Name of Owner] [Name and Title of receiving individual] [Address [street] [mailing]]
2. Tender Opening	.1	Tenders will be opened on [day] [date] [time] [place]. Opening will be [public/private].
3. Document Fee	.1	Fee for Project Documents is non-refundable.
4. Accuracy of Referencing	.1	Indexing and cross-referencing are for convenience only.
5. Conditions of Tendering	.1	Take full cognizance of content of all Contract Documents in preparation of Tender. Refer to Section 00 41 43 – Tender Form, Subsection 3.9 for a complete list of Contract Documents.
6. Tenderers to Investigate	.1	Tenderers will be deemed to have familiarized themselves with existing site and working conditions and all other conditions which may affect performance of the Contract. No plea of ignorance of such conditions as a result of failure to make all necessary examinations will be accepted as a basis for any claims for extra compensation or an extension of time.

7. Clarification and Addenda	.1	Notify Engineer not less than 2 working days before Tender Closing of omissions, errors or ambiguities found in Contract Documents. If Engineer considers that correction, explanation or interpretation is necessary, a written addendum will be issued. All addenda will form part of Contract Documents.
	.2	Confirm in the Tender Form that all addenda have been received.
8. Preparation of Tender	.1	Complete Tender Form provided with Project Documents in ink. Tender all items and fill in all blanks. Have corrections initialed by person signing Tender.
9. Taxes	.1	Include all taxes except Harmonized Sales Tax (HST) in tender unit prices.
10. Tender Security	.1	Provide Tender Security in amount of $[_____] with Tender in the form of a Certified Cheque or Money Order payable to the Owner, or a Bid Bond on CCDC Form 220.
11. Contract Security	.1	Refer to Section 00 72 45 - General Conditions, subsection GC11.2 – Contract Security for form of Contract Security. Refer to project documents for amount of contract security and alternate type of contract security, if applicable.
12. Insurance	.1	Refer to Section 00 72 45, General Conditions, subsection GC11.1 - INSURANCE, for insurance required.
13. Form of Agreement	.1	Form of Agreement is attached for information purposes only.
14. Return of Tender Security	.1	Tender Security will be returned to: .1 All except the three lowest acceptable Tenderers within 7 days of Tender Opening. .2 Two remaining unsuccessful Tenderers within 14 days of date of Award. .3 Successful Tenderer following receipt by Owner of executed Agreement, specified Contract Security, and Insurance documents.
15. Amendment or Withdrawal of Tender	.1	Tenders may be amended or withdrawn by post or facsimile.

.2 Amendment of individual unit prices is the only acceptable price amendment. Amendments shall not disclose either original or revised total price.

.3 Head amendment or withdrawal as follows: "[Amendment]/[Withdrawal] of Tender for [Name of Project] [Contract Number]". Sign as required for Tender, and submit at address given for receipt of Tenders prior to Tender Closing. All submissions must be received prior to time of Tender Closing.

16. Informal or Unbalanced Tenders

.1 Tenders which in the opinion of the Owner are considered to be informal or unbalanced may be rejected.

17. Right to Accept or Reject any Tender

.1 Owner reserves right to accept or reject any Tender.

18. Safety Certification

.1 Submit with Tender, a copy of Tenderer's current and valid Certificate of Registration issued by a Workers' Compensation Board approved audit company.

.2 Out of province companies shall submit, with their Tender, a current and valid Certificate of Recognition from their province of origin or from a recognized Safety Association which utilizes an external audit element.

.3 Out of province companies may obtain a Certificate of Recognition from a Workers' Compensation Board approved audit company upon submission of documentation verifying training and compliance with the NS OH&S Act and Regulations.

.4 In any event, out of province Tenderers will have to satisfy a Workers' Compensation Board approved audit company in respect to their safety status prior to being awarded a contract.

19. Clearance Letter from Workers Compensation Board

.1 Submit with Tender, a copy of Tenderer's current valid clearance letter, issued by the Workers Compensation Board of Nova Scotia.

END

1. SALUTATION:

.1 To: [Name of Owner]
[Address]

.2 For: [Contract No.]
[Project Name]
[Location(s)]

.3 From: _____

2. TENDERER DECLARES:

.1 That this tender was made without collusion or fraud.

.2 That the proposed work was carefully examined.

.3 That the Tenderer was familiar with local conditions.

.4 That Contract Documents and Addenda No. ___ to ___ inclusive were carefully examined.

.5 That all the above were taken into consideration in preparation of this Tender.

3. TENDERER AGREES:

.1 To enter into a contract to supply all labour, material and equipment and to do all work necessary to construct the Work as described and specified herein for the unit prices stated in Subsection 4 hereunder, Schedule of Quantities and Unit Prices.

.2 That the Estimated Contract *Price* shall be the sum of the products of the tendered unit prices times the estimated quantities in Subsection 4 hereunder.

.3 That this Tender is valid for acceptance for 60 days from Tender Closing.

.4 That measurement and payment for items listed in Subsection 4 hereunder shall be in accordance with corresponding items in Section 01 22 00 Measurement and Payment.

.5 To provide evidence of ability and experience within 7 days of request, including: experience in similar work, work currently under contract, senior supervisory staff available for the project, equipment available for use on the Work, and financial resources.

.6 To execute in triplicate the Agreement and forward same together with the specified contract security and insurance documents to the Owner within 14 days of written notice of award.

.7 That failure to enter into a formal contract and give specified insurance documents and contract security within time required will constitute grounds for forfeiture of certified cheque or enforcement of bid bond.

.8 That if certified cheque is forfeited, Owner will retain difference in money between amount of Tender and amount for which Owner legally contracts with another party to perform the Work and will refund balance, if any, to Tenderer.

.9 That the Contract Documents include:

.1 Standard Specification for Municipal Services listed in Table of Contents Page Dated [MONTH YEAR].

.2 Tender Form
.3 Form of Agreement
.4 Supplementary Specifications [Section No. of sections modified or added]
.5 Drawings
[Drawing No. / Title / Date / Revision]
[Drawing No. / Title / Date / Revision]
[Drawing No. / Title / Date / Revision]
.6 Addenda as issued and as confirmed in subsection 2.4 of this section.

4. SCHEDULE OF QUANTITIES AND UNIT PRICES

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
EARTHWORK					
1.	Clearing	ha	_____	_____	_____
2.	Grubbing	ha	_____	_____	_____
3.	Mass Excavation and Embankment - Common	m^3	_____	_____	_____
4.	Mass Excavation and Embankment - Rock	m^3	_____	_____	_____
5.	Mass Excavation - Unsuitable Material	m^3	_____	_____	_____
6.	Borrow	m^3 or t	_____	_____	_____
7.	Breaking Mass Rock Without Removal	m^3	_____	_____	_____
8.	Reserved		_____	_____	_____
9.	Reserved		_____	_____	_____
10.	Reserved		_____	_____	_____

SUB TOTAL EARTHWORK: $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
	WATER SYSTEM				
11.	Pipe				
.1	[diameter, type, class]	m	_____	_____	_____
.2	[diameter, type, class]	m	_____	_____	_____
12.	Fire Hydrants	Each	_____	_____	_____
13.	Valve Chambers				
.1	[type]	Each	_____	_____	_____
.2	[type]	Each	_____	_____	_____
14.	Direct Buried Valves				
.1	[diameter, type]	Each	_____	_____	_____
.2	[diameter, type]	Each	_____	_____	_____
15.	Services				
.1	Set of Fittings - [diameter]	Each	_____	_____	_____
.2	Service Pipe - [diameter, type, class]	m	_____	_____	_____
16.	Connections to Existing Main				
.1	[diameter, location]	Each	_____	_____	_____
.2	[diameter, location]	Each	_____	_____	_____
17.	Corrosion Protection				
.1	Zinc Anodes	Each	_____	_____	_____
.2	Polyethylene Encasement	m	_____	_____	_____
18.	[Reserved]		_____	_____	_____
19.	[Reserved]		_____	_____	_____
20.	[Reserved]		_____	_____	_____

SUB TOTAL WATER SYSTEM: $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
	SANITARY SEWER				
21.	Gravity Pipe				
	.1 [diameter, type, class]	m	_____	_____	_____
	.2 [diameter, type, class]	m	_____	_____	_____
22.	Pressure Pipe				
	.1 [diameter, type, class]	m	_____	_____	_____
	.2 [diameter, type, class]	m	_____	_____	_____
23.	Manholes				
	.1 [diameter, type]	Each	_____	_____	_____
	.2 [diameter, type]	Each	_____	_____	_____
24.	Services				
	.1 [diameter, type, class]	m	_____	_____	_____
25.	Connections to Existing Main				
	.1 [diameter, location]	Each	_____	_____	_____
	.2 [diameter, location]	Each	_____	_____	_____
26.	Closed Circuit Television Inspection	m	_____	_____	_____
27.	[Reserved]		_____	_____	_____
28.	[Reserved]		_____	_____	_____
29.	[Reserved]		_____	_____	_____
30.	[Reserved]		_____	_____	_____

SUB TOTAL SANITARY SEWER: $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
	STORM SEWER				
31.	Pipe				
.1	[diameter, type, class]	m	_____	_____	_____
.2	[diameter, type, class]	m	_____	_____	_____
32.	Manholes				
.1	[diameter, type]	Each	_____	_____	_____
.2	[diameter, type]	Each	_____	_____	_____
33.	Catch Basin				
.1	[type]	Each	_____	_____	_____
.2	[type]	Each	_____	_____	_____
34.	Catch Basin Leads				
.1	[diameter, type, class]	m	_____	_____	_____
.2	[diameter, type, class]	m	_____	_____	_____
35.	Services				
.1	[diameter, type, class]	m	_____	_____	_____
36.	Connections to Existing Main				
.1	[diameter, location]	Each	_____	_____	_____
.2	[diameter, location]	Each	_____	_____	_____
37.	Culverts				
.1	[diameter, type, class]	m	_____	_____	_____
38.	Closed Circuit Television Inspection	m	_____	_____	_____
39.	[Reserved]		_____	_____	_____
40.	[Reserved]		_____	_____	_____

SUB TOTAL STORM SEWER: $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
NATURAL GAS					
41.	Pipeline Installation				
.1	NPS 6	m	_____	_____	_____
.2	NPS 4	m	_____	_____	_____
.3	NPS 3	m	_____	_____	_____
.4	NPS 2	m	_____	_____	_____
.5	NPS 1¼	m	_____	_____	_____
.6	NPS 1	m	_____	_____	_____
.7	NPS ½	m	_____	_____	_____
42.	[Reserved]				
43.	[Reserved]				
44.	[Reserved]				
45.	[Reserved]				
46.	[Reserved]				
47.	[Reserved]				
48.	[Reserved]				
49.	[Reserved]				
50.	[Reserved]				

SUB TOTAL NATURAL GAS: $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
	STREET CONSTRUCTION				
51.	Gravels				
	.1 [Type]	[m^2] or [t]	_____	_____	_____
	.2 [Type]	[m^2] or [t]	_____	_____	_____
52.	Prime	m^2 or (L)	_____	_____	_____
53.	Asphalt Concrete [type]	[m^2] or [t]	_____	_____	_____
54.	Curb [type]	m	_____	_____	_____
55.	Sidewalk				
	.1 [type]	m^2	_____	_____	_____
	.2 [type]	m^2	_____	_____	_____
56.	Gabions	m^3	_____	_____	_____
57.	Guardrail	m	_____	_____	_____
58.	Adjust Existing Valve Box Covers				
	.1 [Depth]	Each	_____	_____	_____
	.2 [Depth]	Each	_____	_____	_____
59.	Adjust Existing Manhole Frames and Covers				
	.1 Shaft Only	Each	_____	_____	_____
	.2 Shaft and Intermediate Sections	Each	_____	_____	_____
60.	Adjust Existing Catch Basin Frames and Covers				
	.1 Shaft Only	Each	_____	_____	_____
	.2 Shaft and Intermediate Sections	Each	_____	_____	_____
61.	Modular Block Retaining Walls				
	.1 [Type]	m^2	_____	_____	_____
	.1 [Type]	m^2	_____	_____	_____

SUB TOTAL STREET CONSTRUCTION: $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
	LANDSCAPING				
62.	Topsoil and Sod	m^2			
63.	Topsoil and Seed	m^2			
64.	Trees, Shrubs and Groundcover				
	.1 Trees [species and size]	Each			
	.2 Shrubs [species and size]	Each			
	.3 Groundcover [species]	Each			
65.	Chain Link Fence [type and height]	m			
66.	Interlocking Concrete Pavers				
	.1 [Type]	m^2			
	.1 [Type]	m^2			
67.	[Reserved]				
68	[Reserved]				
69.	[Reserved]				
70.	[Reserved]				

SUB TOTAL LANDSCAPING: $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
ADDITIONAL ITEMS					
71.	Trench Excavation-Rock	m^3			
72.	Trench Excavation - Unsuitable Material	m^3			
73.	Replacement of Unsuitable Material with Selected Site Material	m^3			
74.	Topsoil Excavation	m^3			
75.	Breaking Trench Rock Without Removal	m^3			
76.	[Reserved]				
77.	[Reserved]				
78.	[Reserved]				
79.	[Reserved]				
80.	[Reserved]				

SUB TOTAL ADDITIONAL ITEMS: $_____

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
	ENVIRONMENTAL PROTECTION				
81.	Silt Fence	m			
82.	Flow Checks	Each			
83.	Straw or Hay Cover	M^2			
84.	Gravel Cover	M^2			
85.	Soaker Bags	Each			
86.	Diversion Ditches	m			
87.	Rip Rap and Storm Drain Protection Stone: .1 Mean Stone Diameter				
	.1 80-100	m^3			
	.2 100-180	m^3			
	.3 180-220	m^3			
	.4 220-330	m^3			
	.5 330-600	m^3			
88.	Bark or Wood Chips	m^2			
89.	Silt Curtain	m			
90.	[Reserved]				

SUB TOTAL ENVIRONMENTAL PROTECTION: $_____

SUB TOTAL EARTHWORK	$_____
SUB TOTAL WATER SYSTEM	$_____
SUB TOTAL SANITARY SEWER	$_____
SUB TOTAL STORM SEWER	$_____
SUB TOTAL NATURAL GAS	$_____
SUB TOTAL STREET CONSTRUCTION	$_____
SUB TOTAL LANDSCAPING	$_____
SUB TOTAL ADDITIONAL ITEMS	$_____
SUB TOTAL ENVIRONMENTAL PROTECTION	$_____
CONTINGENCY ALLOWANCE	$ [AMOUNT]
ESTIMATED CONTRACT PRICE (EXCLUDING HST)	$_____
ADD HARMONIZED SALES TAX (13%)	$_____
TOTAL PRICE	$_____
TENDERER'S HST REGISTRATION NO.	_____

5. COMPLETION TIME

.1 Tenderer agrees to complete the Work within _____ weeks of written notification of award.

6. SIGNATURES*

DATED THIS _____ DAY OF _____ , 20 _____.

[Seal]

_____
Name of Firm Tendering

_____
Signature of Signing Officer

_____ _____
Witness Name and Title (Printed)

_____ _____
Witness Signature of Signing Officer

_____
Name and Title (Printed)

_____
Company Address

_____
Telephone No.

_____
Fax No.

*NOTE: Tenders submitted by or on behalf of any Corporation must be signed and sealed in the name of such Corporation by a duly authorized officer or agent.

END

This Agreement made on the ___ day of _____ in the year_____.

BY AND BETWEEN

[Owner]

hereinafter called the "Owner"

and

hereinafter called the "Contractor"

The Owner and the Contractor agree as follows:

ARTICLE A1 - THE WORK

The Contractor shall:

.1 Perform the Work required by the Contract Documents for

[Title of Work] [Project] [Project Number]

located at

for which the Agreement has been signed by the parties, and for which

(Insert above the name of the Engineer)

is acting as and is hereinafter called the “Engineer”

and

.2 do and fulfill everything indicated by this Agreement, and

.3 commence the Work by the _____ day of _____in the year _____ and attain Substantial Performance of the work as certified by the Engineer by the ___ day of _____in the Year ___.

ARTICLE A2 – AGREEMENTS AND AMENDMENTS

The Contract supersedes all prior negotiations, representations or agreements, either written or oral, relating in any manner to the work, including the bidding documents that are not expressly listed in Article A3 of the Agreement.

ARTICLE A3 - CONTRACT DOCUMENTS

The following is an exact list of the Contract Documents referred to in subsection 1.1 of this Agreement and as defined in subsection 6 of Section 00 71 00 DEFINITIONS. This list is subject to subsequent amendments in accordance with the provisions of the Contract Documents.

.1 STANDARD SPECIFICATION FOR MUNICIPAL SERVICES.
Table of Contents Dated [MONTH YEAR]

.2 Tender Form
.3 Form of Agreement
.4 Supplementary Specifications
[Section Numbers of Sections modified or added]
.5 Drawings:
list [Number/Title / Date/Revision]
.6 Addenda
.1 [Addendum 1]
.2 [Addendum 2]

ARTICLE A4 - CONTRACT PRICE

.1 The Contract Price is the sum of the products of the estimated quantities multiplied by the appropriate Unit Prices in the Tender Form *excluding* the amount of Harmonized Sales Tax.

.2 The Contract Price is $ _____

.3 All amounts shall be in Canadian funds and exclude value added taxes.

.4 The amounts shall be subject to adjustment as provided in the Contract Documents.

ARTICLE A5 - PAYMENT

.1 The Owner shall pay the Contractor in Canadian funds for the performance of the Contract.

.2 The Owner shall make monthly payments on account to the Contractor for the Work performed, as certified by the Engineer, subject to a 10% holdback.
.3 The amount of the monthly payments shall be calculated as follows:

.1 The quantity for each pay item on which actual work has been performed shall be measured.

.2 For each Unit Price item this quantity shall be multiplied by the applicable Unit Price as provided in the Tender Form.

.3 For each lump sum item, multiply the percent complete by the value of the lump sum item.

.4 The total value of work completed for the payment period shall be calculated by adding the total of the products for all pay items from subsection 5.3.2 and 5.3.3 of this section.

.5 The amount of the monthly payment shall be determined by deducting the 10% holdback and the total of all previous payments from the total value of such completed work as determined under subsection 5.3.4 of this section.

.6 To the amount calculated above, the Harmonized Tax will be added.

.4 The last day of the payment period shall be the [ ] of the month.

.5 Upon Substantial Performance of the Work as certified by the Engineer the Owner shall pay to the Contractor the holdback monies then due in accordance with the provisions of Section 00 72 45 - General Conditions, subsection GC5.8 – PAYMENTS OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK.

.6 Upon the issuance of the final certificate for payment, Work as certified by the Engineer the Owner shall pay to the Contractor the balance of monies then due in accordance with the provision of Section 00 72 45 - General Conditions, subsection GC5.10 – FINAL PAYMENT.

.7 In the event of loss or damage occurring where payment becomes due under the property and boiler insurance policies, payment shall be made to the Contractor in accordance with the provisions of Section 00 72 45 - General Conditions, subsection GC11.1 - INSURANCE.

.8 If the Owner fails to make payments to the Contractor as they become due under the terms of the Contract, interest shall be payable as follows:

.1 The annual interest rate applicable to the contract is [2]% compounded semi-annually.

.2 Interest shall be calculated on the overdue balance from the due date.

ARTICLE A6 - RECEIPT OF AND ADDRESSES FOR NOTICES

.1 Notices in writing between the parties or between them and the *Engineer* shall be considered to have been received by the addressee on the date of delivery if delivered to the individual, or to a member of the firm, or to an officer of the corporation for whom they are intended by hand or by registered post; or if sent by regular post, to have been delivered within 5 *Working Days* of the date of mailing when addressed as follows:

.1 The Owner at [Address of Owner]

.2 The Contractor at _____

.3 The Engineer at [Address of Engineer]

ARTICLE A7 - QUANTITIES AND MEASUREMENT

.1 The quantities shown in Section 00 41 43 Tender Form - Schedule of Quantities and Unit Prices are estimated.

.2 Measurement for the actual quantities used to determine payments and Contract Price shall be in accordance with Section 01 22 00 - Measurement and Payment.

ARTICLE A8 - SUCCESSION

The aforesaid Contract Documents are to be read into and form part of the Agreement and the whole shall constitute the Contract between the parties and subject to law and the provisions of the Contract Documents shall enure to the benefit of and be binding upon the parties hereto, their respective heirs, legal representatives, successors and assigns.

ARTICLE A9 - RIGHTS AND REMEDIES

No action or failure to act by the Owner, Engineer, or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

ARTICLE A10 - TIME

Time shall be construed as being of the essence of the Contract.

In witness whereof the parties hereto have executed this Agreement and by the hands of their duly authorized representatives.

SIGNED AND DELIVERED
In the presence of:

OWNER

_____
Name of Owner

WITNESS

_____
Signature

_____
Name and Title of Person Signing

_____
Signature

_____
Name and Title of Person Signing

_____
Signature

_____
Name and Title of Person Signing

CONTRACTOR

_____
Name of Contractor

WITNESS

_____
Signature

_____
Name and Title of Person Signing

_____
Signature

_____
Name and Title of Person Signing

_____
Signature

_____
Name and Title of Person Signing

N.B. Where legal jurisdiction, local practice or Owner or Contractor requirements calls for (a) proof of authority to execute this document, attach such proof of authority in the form of a certified copy of a resolution naming the representative(s) authorized to sign the Agreement for and on behalf of the corporation or partnership; or (b) the affixing of a corporate seal, this Agreement should be properly sealed.

END

This section intentionally omitted from CD.

Please refer to hard copy of Section 00 71 00

END

This section intentionally omitted from CD.

Please refer to hard copy of Section 00 72 45.

END

These Supplementary General Conditions amend Section 00 71 00 DEFINITIONS and Section 00 72 45 - GENERAL CONDITIONS.

SECTION 00 71 00 - DEFINITIONS

1. Page 2, after definitions for Project, add new definitions for Project Documents as follows:

   Project Documents
   Project Documents are those documents prepared to supplement the Standard Specifications for the Work on a specific Project. Where applicable, they consist of the Information for Tenderers, Tender Form, Form of Agreement, Supplementary Specifications, drawings and addenda.

2. Page 3, after definitions for Specifications, add new definitions for Standard Specification as follows:

   Standard Specification
   The Standard Specifications consist of Definitions, General Conditions, Supplementary General Conditions, Measurement and Payment, General Requirements, other Technical Specifications and standard details developed by the Nova Scotia Road Builders Association and the Consulting Engineers of Nova Scotia Joint Committee on Contract Documents and published with the title of Standard Specifications for Municipal Services.

3. Page 3, after definitions for Supplemental Instruction, add new definitions for Supplemental Specifications as follows:

   Supplementary Specifications
   Supplementary Specifications are the specifications for a specific project which amend or add to the Standard Specifications.

4. Where the term “Consultant” is used throughout the General Conditions, revise to read “Engineer”.

SECTION 00 72 45 - GENERAL CONDITIONS

1. GC5.6 PROGRESS PAYMENT

   Page 18, in clause 5.6.1, line 1, change “5 working days” to read “10 calendar days” and in line 2, change “GC5.2” to read “GC5.5”.

   Page 18, delete clause 5.6.2 in its entirety and replace with the following

   “5.6.2 The Owner shall make payment to the Contractor on account as provided in Article A-5 of the Agreement –

PAYMENT on or before twenty (2) calendar days after the later of:
.1 receipt by the Consultant of the application for payment; or
.2 the last day of the monthly payment period covered by the application for payment."

2. GC10.1 TAXES AND DUTIES

Add the following:

10.1.3 The Contractor will indicate on each application for payment, as a separate amount, the appropriate Harmonized Sales Tax the Owner is legally obliged to pay. This amount will be paid to the Contractor in addition to the amount certified for payment under the Contract.

3. GC10.2 LAWS, NOTICES, PERMITS AND FEES

Add the following:

10.2.8 Various areas of Nova Scotia have requirements for posting non-refundable fees before excavations are carried out within public right-of-way. The Contractor is responsible for the determination of the requirement for each specific project and for the required deposits.

END

INDEX TO CLAUSES

1. General
2. Summary of Work
3. Scheduling and Coordination
4. Setting Out the Work
5. Existing Site Conditions
6. Project Meetings
7. Submittals
   7.1 Shop Drawings
   7.2 Samples
   7.3 Mix Design
   7.4 Design Verification
   7.5 Operating and Maintenance Data
   7.6 Test Results
8. Record Drawings
9. Quality Control
10. Temporary Facilities
11. Delivery of Materials and Use of the Site
12. Traffic Control
13. Substitutions
14. Standards and Reference Documents
15. Waste Management and Disposal
16. Sanitary Sewage Disposal
17. Project Closeout

END

1. GENERAL	.1	This section specifies administrative, procedural and temporary requirements.
2. SUMMARY OF WORK	.1	Refer to Supplementary Specifications for summary description of work.
3. SCHEDULING AND COORDINATION	.1	Submit within 7 days of date of award detailed schedule for critical operations and performance of the Work by Completion Date. Revise, update and submit schedule as directed.
	.2	Schedule and perform work within hours and days established by authorities having jurisdiction in the Place of the Work.
	.3	Engineer will carry out necessary tests and inspections and will take measurements required for record drawings so as not to cause delay.
	.4	Provide submittals and schedule delivery of products, as required, to meet Contract schedule.
4. SETTING OUT THE WORK	.1	Refer to Project Documents for survey control points.
	.2	Give Engineer reasonable notice of date when control points are required.
	.3	Set elevations and lay out work in detail from control points.
5. EXISTING SITE CONDITIONS	.1	Before commencing any work, notify Engineer if existing surface elevations differ from those indicated.
	.2	Notify Engineer if site conditions at the Place of the Work differ significantly from those indicated.
	.3	Engineer will investigate and issue appropriate instructions.
6. PROJECT MEETINGS	.1	Engineer will arrange project meetings, set times and record and distribute minutes.

7. SUBMITTALS

7.1 Shop Drawings

.1 On shop drawings clearly show in detail dimensions, materials of construction, finish, performance, service and installation requirements, and other pertinent information.

.2 Check all shop drawings prior to submission. Determine and verify all field measurements, field construction criteria, materials, catalogue numbers and similar data and check and coordinate each shop drawing with the requirements of the Work and the Contract Documents. Sign and date each shop drawing to confirm compliance with above requirements.

.3 Engineer will not review shop drawings where it is evident that they do not meet the requirements of 7.1.2 and 7.1.3 above.

.4 Submit for review six copies of shop drawings or as indicated in the Project Documents.

.5 After review Engineer will return four copies of shop drawings or as indicated in the Project Documents.

.6 Make any corrections as noted, and resubmit.

.7 Do not proceed with work involving relevant products until completion of shop drawing review.

7.2 Samples

.1 Submit samples for review as required in Supplementary Specifications. Indicate locations of sources.

.2 Do not deliver relevant products to site until completion of review.

7.3 Mix Design

.1 Submit mix design for concrete and asphalt materials as required in Supplementary Specifications.

7.4 Design Verification	.1	Submit copy of plans sealed by a professional engineer registered to practice in Nova Scotia for shoring.
7.5 Operating and Maintenance Data	.1	Submit three (3) copies of the following, or as indicated in the Project Documents, prior to application for Final Payment: .1 General description, list of equipment including nameplate information, installation, operation and maintenance instructions, and parts list. .2 Names, addresses and phone numbers of Sub-Contractors, suppliers and manufacturers. .3 Guarantees and warranties
	.2	Type lists and notes. Use clear drawings, diagrams and manufacturer's literature.
7.6 Test Results	.1	Submit two (2) copies of certificates and monitoring, test and inspection reports or as indicated in the Project Documents.
8. RECORD DRAWINGS	.1	Assist Engineer in obtaining data necessary to prepare record drawings.
	.2	Do not bury pipework and appurtenances or other portions of the Work until Engineer has advised that necessary measurements have been taken.
9. QUALITY CONTROL	.1	Provide Owner and Engineer with access to the Work, and to locations where products to be incorporated into the Work are being prepared.
	.2	Cooperate with and assist Engineer in conducting necessary tests.
	.3	Notify Engineer in advance of requirements for tests and inspections.
	.4	Arrange for inspections or tests by authorities other than the Engineer.
	.5	Do not bury pipework and appurtenances or other portions of the Work until Engineer has advised that necessary tests or inspections are completed.

.6 Engineer may order any buried work to be uncovered for examination. Defective work shall be repaired by Contractor. If no defects are found, Owner shall reimburse Contractor's costs.

.7 Owner will appoint and pay for services of testing laboratory except for:
.1 inspection and testing required by laws, ordinances, rules and regulations.
.2 tests specified to be performed by Contractor.
.3 inspection and testing performed exclusively for convenience of Contractor.
.4 testing, adjustment and balancing of mechanical and electrical equipment systems.

10. TEMPORARY FACILITIES

.1 Access:
.1 Provide and maintain adequate access to project site.
.2 Build and maintain temporary roads and walks as required.
.3 Provide access for pedestrians to property and premises adjacent to the Work.

.2 Engineer's Site Office:
.1 Provide Engineer's site office, when required by Project Documents, as follows:
.1 minimum floor area of ten square metres.
.2 heat, light and private telephone and facsimile machine. Engineer will pay for long distance calls.
.3 desk, 1.0 x 1.5 m plan table, shelving and a four-drawer lockable filing cabinet.
.2 Maintain in clean condition.
.3 Remove when no longer required by Engineer but not later than attainment of Substantial Performance of the Work.

.3 Provide and maintain sanitary facilities for site personnel.

.4 Remove temporary facilities from site when no longer required.

11. DELIVERY OF MATERIALS AND USE OF THE SITE

.1 Confine equipment, products, and operations to limits indicated.

.2 Deliver, store and maintain materials so as to avoid damage.

12. TRAFFIC CONTROL

.1 Provide traffic control in accordance with Temporary Workplace Traffic Control Manual issued by Nova Scotia Department of Transportation and Infrastructure Renewal.

.2 In urban areas, consult with local authorities having jurisdiction for possible additional or special requirements.

.3 Meet with local authorities having jurisdiction prior to start of construction to determine allowable diversions of traffic and access to construction area.

.4 Provide traffic control personnel, signals, lights and other traffic control methods where required.

.5 Provide and maintain signs, delineators, barricades, barriers, and miscellaneous warning devices to indicate construction activities or other temporary and unusual conditions.

13. SUBSTITUTIONS

.1 Requests for substitutions will not be considered until after award of Contract.

.2 Proposals for substitution will only be considered by Engineer in following circumstances:
.1 Products specified are not available;
.2 Delivery of specified products would unduly delay completion;
.3 Alternate products will result in reduction in Contract Price.

.3 Provide information on proposed substitutions in adequate detail to permit evaluation.

.4 Submit to Engineer drawings and specifications for modifications, adjustments or additions required by substitutions in same detail as presented in Contract Documents.

.5 Do not make changes or substitutions without written consent of Engineer.

.6 Subject to prior notice Contractor may be back-charged for time spent by Engineer in evaluating substitutions.

14. STANDARDS AND REFERENCE DOCUMENTS

.1 Standards and reference documents in effect at time of Tender Closing referred to in Specifications are an integral part of Contract Documents.

15. WASTE MANAGEMENT AND DISPOSAL

.1 Prepare, for review, waste management plan including source separating plan and waste disposal plan.

.2 Maintain site and adjacent areas in tidy condition free from accumulation of waste products and debris.

.3 Upon attaining Substantial Performance of the Work remove surplus products, tools, machinery and equipment.

.4 Completion of cleanup is required for Substantial Performance of the Work.

16. SANITARY SEWAGE DISPOSAL

.1 Obtain all approvals required for the disposal of sanitary sewage from any facilities including offices, washrooms and bunkhouses.

17. PROJECT CLOSEOUT

.1 Final Cleaning

.1 When the work is substantially performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining work.

.2 Remove waste materials and debris from site at regularly scheduled times or dispose of as directed by Owner. Do not burn waste materials on site.

.3 Leave work broom clean before inspection process commences.

.2 Inspection/Takeover Procedures

.1 Prior to application for certificate of Substantial Performance, carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete. Notify Engineer, in writing, of satisfactory completion of the Work and request an inspection.

.2 During Engineer's inspection, a list of deficiencies and defects will be tabulated. Correct same.

.3 When Engineer considers deficiencies and defects have been corrected and it appears requirements of Contract have been performed, make application for final payment.

END

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CONTINGENCY ALLOWANCE

END

GENERAL

1. Unit prices are full compensation for the work necessary to complete each item in the Contract and in combination for all work necessary to complete the Work as a whole.

2. For water, sanitary sewers and storm sewer systems include all of the following as required where individual quantities are not provided in the Tender Form: environmental protection, protection of existing trees, clearing and grubbing, common excavation, shoring, dewatering, bedding, backfilling, compaction, disposal of surplus common, joint restraints and thrust blocks, thrust anchors, testing, flushing and disinfection, dechlorination, marker stakes, tracer wire, reinstatement and all incidentals.

3. All measurement shall be along a horizontal plane unless otherwise indicated.

4. The numbers of the items described below correspond to the numbers of the items in Section 00 41 43, subsection 4 - Schedule of Quantities and Unit Prices.

EARTHWORK

1. Clearing

Unit of Measurement: hectare (ha)

This item includes: cutting and disposal of all trees and brush from areas indicated.

2. Grubbing

Unit of Measurement: hectare (ha)

This item includes: removal and disposal of all stumps, roots, downed timber, embedded logs, rootmat, humus, and topsoil from areas indicated.

3. Mass Excavation and Embankment - Common

Unit of Measurement: cubic metre (m^3) of cut

Method of Measurement: average end area method between cross sections taken after grubbing or topsoil removal and lines and elevations indicated.

This item includes: excavation, placement and compaction to lines and elevations indicated, and disposal of surplus or unsuitable material.

4. Mass Excavation and Embankment - Rock

Unit of Measurement: cubic metre (m^3) of cut

Method of Measurement: average end area method between cross sections taken after rock is exposed and lines and elevations indicated. Boulders greater than one cubic metre will be classified as rock. Boulders removed from the excavation shall be measured along the three maximum perpendicular axes.

This item includes: excavation, placement and compaction to lines and elevations indicated, and disposal of surplus or unsuitable material.

5. Mass Excavation - Unsuitable Material

Unit of Measurement: cubic metre (m^3)

Method of Measurement: truck measure or average end area method of volume of unsuitable material between cross sections taken before and after excavation.

This item includes: all excavation of unsuitable material and disposal. Written authorization of Engineer required.

6. Borrow

Unit of Measurement: cubic metre (m^3)

Method of Measurement: average end area method between cross sections taken before placement of borrow and lines and elevations indicated.

This item includes: supply, placement and compaction.

7. Breaking Mass Rock Without Removal

Unit of Measurement: cubic metre (m^3)

Method of Measurement: average end area method between cross sections taken between surface of rock and lines and elevations indicated excluding the volume of mass excavation.

This item includes: breaking of rock to the size indicated, and excavation and backfilling test holes.

8. Reserved.

9. Reserved.

10. Reserved.

WATER SYSTEM

11. Pipe

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings, valves and valve chambers.

This item includes: pipe complete with all fittings.

12. Fire Hydrants

Unit of Measurement: Each

This item includes: hydrant complete with lead, gate valve and valve box.

13. Valve Chambers

Unit of measurement: Each

This item includes: valve chamber as indicated, including all auxiliary piping, valves, drains, insulation, miscellaneous metals and other incidentals.

14. Direct Buried Valves

Unit of Measurement: Each

This item includes: direct buried valves complete with valve boxes and appurtenances.

15. Services

.1 Set of Fittings

Unit of Measurement: Each

This item includes: saddle as required, corporation stop, curb stop, and service box.

.2 Service Pipe

Unit of Measurement: metre (m)

Method of Measurement: along centre of pipe from centre of main to the termination point indicated.

This item includes: pipe.

16. Connections to Existing Main

Unit of Measurement: Each

This item includes: locating existing main and supply and installation of pipe, nipples, valves, fittings, and incidentals.

17. Corrosion Protection

.1 Zinc Anodes

Unit of Measurement: Each

This item includes: zinc anodes, wire and accessories.

.2 Polyethylene Encasement

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings and valves.

This item includes: polyethylene tube or sheet and tape.

18. Reserved.

19. Reserved.

20. Reserved.

SANITARY SEWER

21. Gravity Pipe

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through manholes.

This item includes: pipe complete with all fittings.

22. Pressure Pipe

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings.

This item includes: pipe complete with all fittings.

23. Manholes

Unit of Measurement: Each

This item includes: manhole as indicated.

24. Services

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe from centre of main to termination point indicated.

This item includes: pipe complete with all fittings.

25. Connections to Existing Main

Unit of Measurement: Each

This item includes: locating existing line or structure, and supply and installation of all fittings or manhole as indicated.

26. Closed Circuit Television Inspection

Unit of Measurement: metre (m) for each inspection

Method of Measurement: along centreline of pipe through manholes.

This item includes: television inspections, records and reports.

27. Reserved.

28. Reserved.

29. Reserved.

30. Reserved.

STORM SEWER

31. Pipe

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through manholes.

This item includes: pipe complete with all fittings.

32. Manholes

Unit of Measurement: Each

This item includes: manholes as indicated.

33. Catch Basins

Unit of Measurement: Each

Method of Measurement: number of units installed by type and size.

This item includes: catchbasins as indicated.

34. Catch Basin Leads

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe from centre of catchbasin to centre of main sewer, centre of manhole, or termination point indicated.

This item includes: pipe complete with all fittings.

35. Services

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe from centre of main to termination point indicated.

This item includes: pipe complete with all fittings.

36. Connections to Existing Main

Unit of Measurement: Each

This item includes: locating existing line or structure and supply and installation of all fittings, catchbasin, or manhole as indicated.

37. Culverts

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe.

This item includes: pipe, excavation and backfilling, pipe bedding, rip rap, and pipe screens.

38. Closed Circuit Television Inspection

Unit of Measurement: metre (m) for each inspection

Method of Measurement: along centreline of pipe through manholes.

This item includes: television inspections, records and reports.

39. Reserved.

40. Reserved.

NATURAL GAS

41. Pipeline Installation

Unit of Measurement: metre (m)

Method of Measurement: along centerline of pipe through fittings, valves and chambers.

This item includes: installation of owner supplied materials, complete with all fittings and appurtenances.

42. Reserved

43. Reserved

44. Reserved

45. Reserved

46. Reserved

47. Reserved

48. Reserved

49. Reserved

50. Reserved

STREET CONSTRUCTION

51. Gravels

Unit of Measurement: tonne (t) or square metre (m^2)

Method of Measurement: scale tickets signed by Engineer or slope measure of indicated area at mean depth.

This item includes: supply, placement and compaction of gravel as indicated.

52. Prime

Unit of Measurement: square metre (m^2) or litre (l)

Method of Measurement: slope measure or by volume.

This item includes: supply and application.

53. Asphalt Concrete

Unit of Measurement: tonne (t) or square metre (m^2)

Method of Measurement: scale tickets signed by Engineer or slope measure of surface area.

This item includes: supply, placement and compaction as indicated including tack coat.

54. Curb

Unit of Measurement: metre (m)

Method of Measurement: slope measure.

This item includes: curb, including supply and placing of backfill as indicated.

55. Sidewalk

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure.

This item includes: sidewalk, including supply and placing of base gravels and backfill as indicated.

56. Gabions

Unit of Measurement: cubic metre (m^3)

Method of Measurement: volume in place.

This item includes: excavation, foundation preparation, supply and installation of gabion baskets, stone fill, geosynthetic, and backfilling.

57. Guardrail

Unit of Measurement: metre (m)

Method of Measurement: slope measure.

This item includes: excavation, supply and placing posts, rail, accessories, and surface reinstatement.

58. Adjust Existing Valve Box Covers

Unit of Measurement: Each

This item includes: raising or lowering existing valve box covers including replacement of any components as necessary.

59. Adjust Existing Manhole Frames and Covers

Unit of Measurement: Each

This item includes raising and lowering existing frames and covers including replacement of shaft sections, intermediate sections and grade rings as necessary.

60. Adjust Existing Catch Basin Frames and Covers

Unit of Measurement: Each

This item includes raising and lowering existing frames and covers including replacement of shaft sections, intermediate sections and grade rings as necessary.

61. Modular Block Retaining Walls

Unit of Measurement: square metre (m^2)

Method of Measurement: total area of wall face excluding fastening.

This item includes: excavation, installation of foundation preparation, supply and modular wall units, geotextile, *guards,* infill soil and backfilling.

LANDSCAPING

62. Topsoil and Sod

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure.

This item includes: supply and placing of topsoil, lime and fertilizer, sod, required accessories, and maintenance.

63. Topsoil and Seed

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure.

This item includes: supply and placing of topsoil, lime, fertilizer, mulch, erosion control agent, seed, and maintenance.

64. Trees, Shrubs and Groundcover

Unit of Measurement: Each

This item includes: supply and placing of trees, shrubs and groundcover, planting mixture, mulch, lime and fertilizer, tree supports and accessories and maintenance.

65. Chain Link Fence

Unit of Measurement: metre (m)

Method of Measurement: slope measure along top rail.

This item includes: excavation and backfill, supply and placing concrete footings, posts, rails, gates, fabric, fittings and accessories and surface reinstatement.

66. Interlocking Concrete Pavers

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure

This item includes: excavation, pavers, edge restraint, geotextiles, base gravels and backfilling.

67. Reserved

68. Reserved

69. Reserved

70. Reserved

ADDITIONAL ITEMS

71. Trench Excavation - Rock

Unit of Measurement: cubic metre (m^3)

Method of Measurement:

Average end area method between changes in rock cross section. Dimensions used to calculate end areas shall be theoretical trench width as indicated in Section 39 00 00 - Standard Detail 01 22 00 - 01, and depth from surface of rock as exposed on sides of trench after excavation to bottom of specified bedding for each pipe in trench.

Boulders larger than one-half cubic metre, any portion of which is within theoretical trench, will be classified as rock. Boulders removed from trench shall be measured along the three maximum perpendicular axes.

This item includes: all incremental work for rock excavation and disposal of surplus material over and above cost of common excavation which is included in price for pipe and related items.

72. Trench Excavation - Unsuitable Material

Unit of Measurement: cubic metre (m^3)

Method of Measurement: average end area method for volume of unsuitable material less theoretical trench volume.

This item includes: all excavation of unsuitable material beyond limits of the theoretical trench as indicated in Section 39 00 00 - Standard Detail 01 22 00 - 01, and disposal. Written authorization of Engineer required.

73. Replacement of Unsuitable Material with Selected Site Material

Unit of Measurement: cubic metre (m^3)

Method of Measurement: average end area method for volume of unsuitable material less theoretical trench volume.

This item includes: placing and compacting selected site material in locations where unsuitable material has been excavated from the trench beyond the limits of the theoretical trench as indicated in Section 39 00 00 - Standard Detail 01 22 00-01. Written authorization of Engineer required.

74. Topsoil Excavation

Unit of Measurement: cubic metre (m^3)

Method of Measurement: average end area method between cross sections taken before and after stripping topsoil.

This item includes: stripping and stock-piling or disposal of topsoil as directed.

75. Breaking Trench Rock Without Removal

Unit of Measurement: cubic metre (m^3)

Method of Measurement: average end area method between changes in rock cross section. Dimensions used to calculate end areas to be theoretical trench width as indicated in Section 39 00 00 - Standard Detail 01 22 00-01, and depth from surface of rock as encountered during drilling to the lines and elevations indicated.

This item includes: breaking of rock to size indicated and excavation and backfilling test holes.

76. Reserved.

77. Reserved.

78. Reserved.

79. Reserved.

80. Reserved.

ENVIRONMENTAL PROTECTION

81. Silt Fence

Unit of Measurement: metre (m)

Method of Measurement: slope measure.

This item includes: supply, installation, maintenance and removal including stakes and fabric.

82. Flow Checks

Unit of Measurement: Each

This item includes: supply, installation and removal.

83. Straw or Hay Cover

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure.

This item includes: supply, installation, minimum 50 mm, and maintenance until exposed soil has stablized.

84. Gravel Cover

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure.

This item includes: supply, installation and maintenance.

85. Soaker Bags

Unit of Measurement: Each.

This item includes: supply, maintenance and removal.

86. Diversion Ditches

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure.

This item includes: laying out grades and lines, excavation and lining as required.

87. Rip Rap and Storm Drain Protection Stone

Unit of Measurement: cubic metres (m^3)

This item includes: supply and installation

88. Bark or Wood Chips

Unit of Measurement: square metre (m^2)

This item includes: supply and installation, minimum thickness 50 mm, and maintenance until the exposed soil has stablized.

89. Silt Curtain

Unit of Measurement: metre (m)

This item includes: supply, installation and maintenance until such time as the exposed soil is stablized and removal as directed.

90. Reserved

CONTINGENCY ALLOWANCE No payment will be made under this item unless authorized by Engineer.

Expenditures under the Contingency Allowance shall be authorized in accordance with Part 6, CHANGES - in the General Conditions.

END

INDEX TO CLAUSES

1. General
2. Associations

END

1.0 General

.1 This Section identifies abbreviations and reference standards for various standards writing organizations and professional, trade and manufacturing associations referenced in the Standard Specification. Prior to issuing this section as part of a project all addresses should be checked.

2.0 Associations

.1 AASHTO - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 URL http://www.aashto.org

.2 ANSI - American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, New York, U.S.A. 10036 URL http://www.ansi.org

.3 API - American Petroleum Institute,1220 L St. Northwest, Washington, D.C., U.S.A. 20005-4070 URL http://www.api.org

.4 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 URL http://www.ashrae.org

.5 ASME - American Society of Mechanical Engineers, ASME Headquarters, 3 Park Avenue, New York, New York, U.S.A. 10016-5990 URL http://www.asme.org

.6 ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428-2959 URL http://www.astm.org

.7 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 URL http://www.amweld.org

.8 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 URL http://www.awwa.org

.9 CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, Ontario M4R 1K8 URL http://www.cga.ca

.10 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 0S5 URL http://w3.pwgsc.gc.ca/cgsb

.11 CNLA - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, Ontario. L9T 2X8 URL http://www.canadanursery.com

.12 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL http://www.csa-international.org

.13 CSC - Construction Specifications Canada, 120 Carlton Street, Suite 312, Toronto, Ontario M5A 4K2 URL http://www.csc-dcc.ca

.14 CSPI - Corrugated Steel Pipe Institute, 652 Bishop Street N, Unit 2A, Cambridge, Ontario N3H 4V6 URL http://www.cspi.ca

.15 MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6 URL http://www.paintinfo.com

.16 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A. 22180-4602 URL http://www.mss-hq.com

.17 NEMA - National Electrical Manufacturers Association,1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL http://www.nema.org

.18 NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101Quincy, Massachusetts, U.S.A. 02269-9101 URL http://www.nfpa.org

.19 SCC - Standards Council of Canada, 270 Albert Street, Suite 2000, Ottawa, Ontario K1P 6N7 URL http://www.scc.ca

.20 SSPC - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, Pennsylvania 15222-4656 URL http://www.sspc.org

.21 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062-2096 URL http://www.ul.com

.22 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL http://www.ulc.ca

END

INDEX TO CLAUSES

1. Reference Documents
2. Disposal of Wastes
3. Drainage
4. Work in or Adjacent to Watercourses
5. Pollution Control
6. Permits and Approvals

END

1. Reference Documents

.1 The following reference documents form a part of this specification and are available at the Nova Scotia Environment and Labour or Department of Fisheries and Oceans:

.1 Sulphide Bearing Material Disposal Regulations and Guidelines for Development on Slates in Nova Scotia.

.2 Nova Scotia Water Course Alteration Specifications in affect at the time of tender.

- .1 Legal Conditions
- .2 General Specifications
- .3 Bank Stabilization
- .4 Beach Enhancement
- .5 Bridges
- .6 Culverts
- .7 Dams
- .8 Diversion of Watercourse
- .9 Dredging
- .10 Dry Hydrants
- .11 Fishing Equipment
- .12 Fords
- .13 Pipelines
- .14 Ponds
- .15 Wharves

.3 Department of Fisheries and Oceans: Guidelines for a Stationary Type Screen at Water Intakes to Prevent Losses of Juvenile Salmon and Trout.

.4 Guidelines for Temporary Intake Screens.

.5 N.S. Department of Environment Pit and Quarry Guidelines (latest edition).

.6 N.S. Department of the Environment Construction and Demolition Debris Disposal Site Guidelines (latest edition).

.7 Guidelines for the Application and Removal of Structural Steel Protective Coatings.

2. Disposal of Wastes

.1 Dispose of rubbish and waste materials at authorized site.

.2 Do not dispose of waste, volatile or deleterious materials into waterways, storm or sanitary sewers.

3. Drainage

.1 Do not pump or drain water containing suspended materials into waterways, sewer or drainage systems.

.2 Control disposal or runoff of water containing suspended materials or other harmful substances with use of siltation fences, sedimentation ponds, diversion ditches, silt curtains, sedimentation blankets, slope stabilization and the like, all in accordance with required environmental regulations, permits or approvals.

4. Work in or Adjacent to Watercourses

.1 Do not operate construction equipment in watercourse or in any way alter a watercourse or withdraw water from a watercourse without first obtaining necessary permits or approvals.

.2 Do not use watercourse beds or banks for borrow material.

.3 Do not dump excavated fill, waste material or debris in watercourse.

.4 Design and construct temporary crossings to minimize erosion to watercourse.

.5 Do not skid logs or construction materials across watercourses.

.6 Avoid spawning beds when constructing temporary crossings of watercourses.

.7 Do not blast under watercourses or within 100 m of spawning beds without obtaining necessary permits or approvals.

.8 Provide a buffer zone in combination with appropriate erosion and sedimentation control when working adjacent to watercourse. Consult with regulatory agencies.

5. Pollution Control

.1 Prior to the commencement of construction activities, prepare a contingency plan, which addresses procedures to follow in the event of a pollution incident and ensure all staff are aware of these procedures. Provide copy of contingency plan to the Owner.

.2 Immediately report any environmental emergency, such as a spill of a contaminant, to environmental emergencies at 1-800-565-1633.

.3 Maintain temporary erosion and pollution control devices installed under this contract until the Work is completed is as specified in the Project Document.

.4 Remove temporary erosion and pollution control measures prior to project completion unless directed otherwise.

.5 Control emissions from equipment to requirement of authority having jurisdiction.

.6 Provide temporary enclosures to protect environment from effects of sandblasting.

.7 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

.8 Keep paved surfaces clean. Control dust by application of calcium chloride or water.

6. Permits and Approvals

.1 Obtain copies of any permits or approvals issued by approval agencies. Review and comply with all conditions contained in permit or approval.

.2 Where permits or approval are required and not obtained at time of bidding; be responsible for obtaining permits or approvals. The Activity Designation Regulations made under the Nova Scotia Environment Act list all activities which require an approval from the Nova Scotia Department of Environment and Labour.

.3 Ensure all staff and subcontractors are aware of all terms and conditions of any permit/approval issues.

END

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1.2 Related Sections
1.3 Reference Standards
1.4 Submittals

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3.8 Curing and Protection
3.9 Concrete Quality
3.10 Defective Work

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing cast-in-place concrete. Work includes supply and installation of formwork, reinforcement, concrete and accessories.

1.2 Related Sections

.1	Metal Fabrication	Section 05 50 00
.2	Earthwork	Section 31 20 00
.3	Walks, Curbs and Gutters	Section 32 16 00
.4	Reinstatement	Section 32 98 00
.5	Water Mains	Section 33 11 00
.6	Sanitary Sewers	Section 33 31 00
.7	Pressure Sewers	Section 33 34 00
.8	Precast Manholes, Catch Basins and Structures	Section 33 39 00
.9	Storm Sewers and Culverts	Section 33 40 00
.10	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 ASTM C171-07, Standard Specification for Sheet Materials for Curing Concrete.

.2 ASTM C260-06, Air-Entraining Admixtures for Concrete

.3 ASTM C309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.4 ASTM C494/C494M-08a, Standard Specification for Chemical Admixtures for Concrete.

.5 AASHTO M182 Burlap Cloth Made from Jute or Kenaf.

.6 CAN/CSA-A3000 Series-03, Cementitious Materials Compendium

.7 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test Standard Practice for Concrete

.8 CSA S269.3-M92(R2008), Concrete Formwork

.9 CSA G3O.18-M92(R2007), Billet-Steel Bars for Concrete Reinforcement

1.4 Submittals

.1 Submit shop drawings and samples in accordance with Section 01 10 00 for items listed in Supplementary Specification.

PART 2 - PRODUCTS

2.1 Materials

.1 Portland Cement: to CSA Standard A3000, Type 1O, Normal and CSA A23.1, Table 6, type GU.

.2 Blended Hydraulic Cement: CSA Standard A3000 and CSA A23.1, Table 7. Ternary blended cements may be used with the concurrence of the Engineer.

.3 Aggregates: to CSA-A23.1. For exposure Classes C-XL, C-1, C-2, C-3, C-4 and F-1, supply certification that the concrete mixtures have been evaluated for alkali-aggregate reaction and that measures have been taken to improve the reaction.

.4 Water: to CSA-A23.1, Table 9.

.5 Admixtures:
.1 Air Entraining: to ASTM C260.
.2 Chemical: to ASTM C494/C494M or C1017 for flowing Concrete.

.6 Supplementary Cementing Materials:
.1 Low Calcium Fly Ash (Class F): to CSA A3000 and CSA 23.1, Table 8. Certification shall be provided for the fly ash used in the concrete.

.7 Reinforcement:
.1 Bars: to CSA G30.18, billet steel, grade 400, deformed.
.2 Welded Steel Wire Fabric: to CSA G30.5.

.3 Bar Supports and Spacers: to CSA-A23.1.

.8 Formwork:
.1 Forms: to CSA-A23.1, plywood and lumber, clean and free of loose knots, splits or metal.
.2 Form Ties: to CSA-A23.1, removable or snap-off metal ties, fixed or adjustable length. Form ties, tie wire, spacers or other embedded fixtures shall not be positioned closer than 20 mm of the surface. For severe environments, the dimension shall be as shown on the project drawings.
.3 Release Agent: non-staining natural organic chemicals of sprayable consistency which prevent adhesion of concrete to forms.
.4 Design: to CSA S269.3.

.9 Curing Compound: to CSA A23.1, white. Refer to AASHTO M182; ASTM C171; ASTM 309.

.10 Waterstops: ribbed, extruded PVC of type and size indicated.

.11 Non-shrink Grout: pre-mixed, dry pack or pourable, containing non-metallic aggregate, plasticizing agents and cement, minimum compressive strength of 45 MPa at 28 days.

2.2 Concrete Mix

.1 Provide in accordance with CSA A23.1, Table 5, Alternate (1) or (2).

.2 Mix proportions to provide workable concrete having required durability and strength.

.3 Air entraining admixtures: to obtain Air Content Category as defined in CSA A23.1, Tables 1, 2 and 4.

.4 Slump: to CAN/CSA A23.1, Section 4.3.2.3.

.5 Compressive strength at 28 days: unless for mixtures containing supplementary cementing materials other ages may be appropriate as determined by the

Engineer. The strength shall be evaluated in accordance with CSA A23.1.

.6 Water/cement ratio: to CSA A23.1, Tables 1, 2 and 4 as required for exposure conditions.

.7 Ready mix plant shall conform to CSA and possess a current active membership in the Atlantic Provinces Ready Mix Concrete Association.

PART 3 - EXECUTION

3.1 General

.1 Do concrete work to CSA-A23.1 and as herein specified.

.2 Use ready-mixed concrete unless on-site mixing approved.

.3 Do not change concrete mix without prior approval of Engineer. Changes in material supply will require submission of a new mix design for review.

.4 If on-site mixing is approved, equipment to be capable of accurately proportioning ingredients to produce required concrete.

3.2 Formwork and Falsework

.1 Construct formwork and falsework to CSA-A23.1.

.2 Construct formwork to produce finished concrete to required shape, dimensions, and levels indicated within tolerances required by CSA-A23.1. Provide close fitting joints to prevent leakage of mortar, and form ties and bracing sufficient to withstand pressure of plastic concrete without deflection.

.3 Falsework to be of sufficient strength to support total load of formwork, concrete, reinforcing steel, workers and equipment.

.4 Use approved form release agent.

.5 Formwork removal shall be in accordance with CSA A23.1.

.6 Fill form tie holes with non-shrink mortar and finish to texture of adjacent concrete.

3.3 Reinforcement and Embedded Items

.1 Clean reinforcing of rust build-up, mill scale or other coatings that prevent or reduce bond.

.2 Bend all bars cold to measurements required.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Place and support reinforcing using bar supports and side form spacers to ensure cover, spacing and location indicated.

3.4 Waterstops

.1 Install waterstops where indicated.

.2 Do not pierce, except near edges as required for securing, or distort waterstops, or displace reinforcement.

.3 Tie waterstops securely in place.

.4 Weld all joints in waterstop in accordance with manufacturer's published instructions.

3.5 Placing

.1 Place concrete to CSA A23.1, Section 7.

.2 Convey concrete from mixer to forms by methods that will maintain specified slump and prevent segregation.

.3 Do not drop concrete more than 1.5 metres vertically unless it can be shown that the concrete will not segregate. Deposit concrete in final position in forms to avoid lateral movement.

.4 Place concrete in continuous operation, starting from lowest point in form, in lifts not greater than 500 mm.

.5 Vibrate or tamp each layer to obtain dense homogeneous structure free of cold joints, fill planes, voids and honeycombing. For vertical installation vibrate at least 150 mm into previously placed layers. Concrete to be well bonded to all reinforcing steel,

anchors, waterstops and other embedded parts.

3.6 Joints

.1 Make joints in accordance with CSA-A23.1, Section 7.3.

3.7 Finishing

.1 Finish concrete in accordance with CSA A23.1, Section 7.5.

3.8 Curing and Protection

.1 Provide curing and protection to CSA A23.1, Section 7.4. The temperature of the concrete as placed to be within the limits of Table 14.

.2 Do not place concrete on frozen base. Remove all snow, ice and frost from area prior to placing concrete. Do not place concrete on, or against, any surface that will lower the temperature of the concrete in place below the minimum value shown in Table 14.

.3 When air temperature may drop below 5°C or when there is a probability that it will drop below 5°C within 24 hours of placing, raise temperature of base, reinforcing steel, embedded parts and forms above 5°C prior to placing concrete. In addition, before placement have available all materials and equipment needed for adequate protection and curing.

.4 When air temperature is at or above 27°C, or when there is a probability of its rising to 27°C during the placing period, provide facilities for protection of concrete in place from effects of hot and/or drying weather conditions. Under severe drying conditions, protect formwork reinforcement and concreting equipment from direct rays of sun, or cool by fogging.

.5 After placing is completed, maintain minimum curing conditions for the concrete in accordance with CSA-A23.1, Section 7.4.

3.9 Concrete Quality	.1	Engineer may require inspection or testing of concrete in accordance with CSA-A23.1, using CSA certified concrete laboratory.
3.10 Defective Work	.1	Remediate defective concrete or remove and replace concrete not in accordance with these specifications, blemishes and embedded debris, and repair as directed.

END

INDEX TO CLAUSES

PART 1 - GENERAL

1.1 Work Included
1.2 Related Sections
1.3 Reference Standards
1.4 Shop Drawings

PART 2 - PRODUCTS

2.1 Materials
2.2 Fabrication
2.3 Hot-Dip Galvanizing
2.4 Shop Painting

PART 3 - EXECUTION

3.1 Installation

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing miscellaneous metal items. Work includes supply of materials, fabrication, shop painting and installation.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Water Mains	Section 33 11 00
.3	Sanitary Sewers	Section 33 31 00
.4	Pressure Sewers	Section 33 34 00
.5	Precast Manholes, Catch Basins and Structures	Section 33 39 00
.6	Storm Sewers and Culverts	Section 33 40 00
.7	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 ASTM A53-07, Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.

.2 ASTM A269-08, Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-07b, Carbon Steel Bolts and Studs, 60000 psi Tensile Strength.

.4 ASTM A480/A480M-08b, Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

.5 ASTM A484/A484M-08, Stainless Steel Bars, Billets and Forgings.

.6 CAN/CGSB-1.40M-97, Primer, Anti-corrosive, Structural Steel, Alkyd.

.7 CAN/CGSB.1-59M-97, Alkyd, Exterior Gloss Enamel.

.8 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.9 CAN/CSA S157-05, Strength Design in Aluminum.

.10 CSA-G40.20/G40.21-04, Rolled or Welded Structural Quality Steels.

.11 CSA S164-06, Limit States of Steel Structures.

.12 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.

.13 CSA W47.2M-1987(R2008), Certification of Companies for Fusion Welding of Aluminum

.14 CSA W59M-1991(R2008), Welded Steel Construction (Metal-Arc Welding)

.15 CSA W59.2M-1991(R2008), Welded Aluminum Construction.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Clearly indicate materials, core thicknesses, finishes, connections, joints, method of storage, number of anchors, supports, reinforcement, details and accessories.

PART 2 - PRODUCTS

2.1 Materials

.1 Steel Sections and Plates: to CAN/CSA-G40.21M, grade as indicated.

.2 Steel Pipe: to ASTM A53, Type S, Grade A, Schedule as indicated.

.3 Stainless Steel Tubing: to ASTM A269, grade and finish as indicated.

.4 Stainless Steel Plate: to ASTM A480, grade as indicated.

.5 Stainless Steel Bars: to ASTM A484, grade as indicated.

.6 Steel Bolts and Anchor Bolts: to ASTM A307.

.7 Welding Materials:
.1 Steel: to CSA W59-M.
.2 Aluminum: to CSA W59.2 and CSA W47.2-M.

.8 Surface Coatings:
.1 Shop coat primer: to CAN/CGSB 1.40M.
.2 Finish paint: to CAN/CGSB 1.59M, colour as directed.
.3 Galvanized primer: to CGSB 1-GP-181M.
.4 Galvanizing: hot-dipped.

2.2 Fabrication

.1 Using materials indicated, fabricate items to shapes and dimensions indicated, true and accurate, with joints closely fitted and secure.

.2 Where possible fit and shop assemble items ready for installation.

.3 Make welds continuous for length of each joint unless otherwise indicated. Grind exposed welds smooth and flush.

.4 Fabricate aluminum items to CSA-S157-M; weld to CSA W59.2.

.5 Apply two coats of asphaltic paint to aluminum surfaces in contact with dissimilar metals, concrete, or masonry.

2.3 Hot-Dip Galvanizing

.1 Complete all cutting, bending, drilling and welding prior to galvanizing. Do galvanizing with minimum zinc coating of 600 gm^2.

2.4 Shop Painting

.1 Prepare surfaces and apply one coat of primer to metal items except aluminum, galvanized surfaces or items to be encased to concrete.

.2 Apply paint only to clean, dry surfaces.

.3 Do not paint surfaces to be field welded.

PART 3 - EXECUTION

3.1 Installation

.1 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.2 Provide suitable means of anchorage acceptable to Engineer such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.3 Exposed fastening devices to match finish and be compatible with material through which they pass.

.4 Provide components for building by other sections in accordance with shop drawings and schedule.

.5 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.7 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.8 Prepare surfaces and apply two coats of finish paint to items scheduled for painting in Supplementary Specifications.

END

INDEX TO CLAUSES

PART 1 - GENERAL

1.1 Work Included
1.2 Related Sections
1.3 Definitions

PART 2 - PRODUCTS

Not Applicable to this Section

PART 3 - EXECUTION

3.1 General
3.2 Removal and Disposal
3.3 Finished Surfaces

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for clearing, grubbing, chipping and disposal.

1.2 Related Sections

.1 Environmental Protection: Section 01 57 00

.2 Earthwork: Section 31 20 00

1.3 Definitions

.1 Clearing: cutting, burning, chipping and disposal of all designated trees and brush within rights-of-way and other areas as indicated including felled trees, previously up-rooted trees, and surface debris.

.2 Grubbing: excavation and disposal, removal of all stumps, roots, embedded timber, rock fragment, humus, rootmat and topsoil.

PART 2 - PRODUCTS

.1 Not applicable to this Section.

PART 3 - EXECUTION

3.1 General

.1 Comply with conditions of all permits.

.2 Do not remove trees or brush from outside limits indicated except for any tree or branch considered unsafe.

.3 Cut trees and brush close to ground leaving no stump higher than 300 mm.

.4 Grub out stumps and roots to not less than 200 mm below ground surface.

.5 Grub out visible rock fragments and boulders, greater than 300 mm in greater dimension, but less than 0.25 m^3.

3.2 Removal and Disposal

.1 Remove cleared and grubbed material off-site.

.2 In areas designated as quarantine by the Canadian Food Inspection Agency (CFIA), ensure all CFIA requirements are met.

.3 Alternately, material may be disposed of by burning or burying on-site, after obtaining necessary permits and written permission.

.4 If permitted, burn in area designated under constant care of competent fire watch, at such times and so that surrounding vegetation, adjacent property or anything to remain will not be jeopardized.

.5 If permitted, bury by consolidating and covering with minimum 500 mm soils and finishing surface.

.6 If permitted, chip or mulch and stockpile or spread vegetation matter on-site as directed.

.7 Dispose of surplus chips off-site.

3.3 Finished Surfaces

.1 Leave ground surface in condition suitable for immediate grading operation.

END

INDEX TO CLAUSES

PART 1 - GENERAL

1.1 Work Included
1.2 Related Sections
1.3 Reference Standards
1.4 Definitions
1.5 Submittals

PART 2 - PRODUCTS

2.1 Materials

PART 3 - EXECUTION

3.1 Excavation
3.2 Topsoil Excavation
3.3 Unsuitable Excavation
3.4 Blasting
3.5 Support of Excavation
3.6 Dewatering
3.7 Bedding and Backfilling
3.8 Backfilling Structures
3.9 Mass Excavation and Embankment
3.10 Breaking Rock Without Removal
3.11 Road Gravels

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for all earthwork operations. Work includes supply of products and excavating, bedding, backfilling, compacting, shoring, dewatering, and disposal of unsuitable and surplus materials.

1.2 Related Sections

.1	Environmental Protection	Section 01 57 00
.2	Concrete	Section 03 30 00
.2	Clearing and Grubbing	Section 31 10 00
.4	Gabions	Section 31 36 00
.5	Asphalt Paving	Section 32 12 16
.6	Walks, Curbs and Gutters	Section 32 16 00
.7	Planting of Trees, Shrubs & Groundcover:	Section 32 90 00
.8	Topsoiling and Finish Grading	Section 32 91 19
.9	Seeding and Sodding	Section 32 92 00
.10	Reinstatement	Section 32 98 00
.11	Water Mains	Section 33 11 00
.12	Sanitary Sewers	Section 33 31 00
.13	Pressure Sewers	Section 33 34 00
.14	Precast Manholes, Catch Basins and Structures	Section 33 39 00
.15	Storm Sewers and Culverts	Section 33 40 00
.16	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 ASTM D698-07el, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

.2 ASTM D4253-00(R2006), Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

.3 ASTM D4254-00el(R2006), Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

.4 CAN/CSA A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard for Concrete.

.5 Province of Nova Scotia Department of Transportation and Public Works Standard Specification, Highway Construction and Maintenance.

1.4 Definitions

.1 Rock: material which requires drilling, blasting, ripping or breaking up with power-operated tools for its removal, and boulders and pieces of concrete exceeding volume limits below. Frozen material will not be classified as rock.

Volume limits:

.1 Trench excavation: 0.5 m^3
.2 Mass excavation: 1.0 m^3

.2 Topsoil: soil capable of supporting good vegetative growth and suitable for use in top dressing and landscaping.

.3 Common: excavated soil which is not rock, unsuitable, or topsoil.

.4 Unsuitable material: all material which is not suitable for use in work and must be disposed of.

.5 Surplus material: excavated material not required for re-use.

.6 Subgrade: the surface of mass excavation and embankment finished to lines and elevations indicated.

1.5 Submittals

.1 Submit samples, sieve analysis, mix design, and the like, in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

PART 2 - PRODUCTS

2.1 Materials

.1 Selected Backfill: common which is free from: stumps, trees, roots, sod, organics; rocks, boulders and masonry larger than 200 mm in any dimension; and other deleterious materials.

.2 Borrow: well-graded material from Contractor's own sources meeting the specification for Selected Backfill.

.3 Sand: hard, granular, sharp material, well-graded from coarse to fine, free of impurities, chemicals or organic matter, and graded as follows:

Sieve Designation	Cum. % Passing
5 mm	100
0.l6 mm	0 - 5

.4 Clear Stone: crushed and screened, hard, durable stone, free from clay and organic matter, and graded as follows:

.1 Clear Stone, 25 mm:

Sieve Designation	Cum. % Passing
25 000	95 - 100
14 000	25 - 60
5 000	0 - 10

.2 Clear Stone, 80 mm:

Sieve Designation	Cum. % Passing
80 000	100
56 000	25 - 60
28 000	0 - 5

.5 Gravels: crushed and screened pit gravel or crushed and screened rock. Material shall consist of hard and durable stone particles. Gradation shall be dense, well graded and as follows:

.1 Type 1:

Sieve Size, µm	Percent Passing
20 000	100
14 000	50 - 85
5 000	20 - 50
160	5 - 12
80*	3 - 8

.2 Type 1S:

Sieve Size, µm	Percent Passing
20 000	100
14 000	50 - 85
5 000	30 - 55
160	7 - 20
80**	5 - 12

.3 Type 2:

Sieve Size, µm	Percent Passing
80 000	100
56 000	70 - 100
28 000	50 - 80
14 000	35 - 65
5 000	20 - 50
160	5 - 12
80*	0 - 7

* For gravel sources not classified as quarries, the allowable percentage passing the 80 µm sieve shall be 3 to 5%.

** Where percentages passing the 5000 µm sieve are between 30 and 45%, the allowable percentage passing the 80 µm sieve shall be 3 to 12%.

.6 Unshrinkable fill: proportioned and mixed to provide:
.1 Maximum compressive strength of 1.0 MPa at 28 days.
.2 Maximum Portland cement content of 25 kg/m^3.
.3 Minimum strength of 0.07 MPa at 24 h.
.4 Concrete aggregates: to CAN/CSA-A23.1.
.5 Portland cement: Type 10.

.6 Slump: 150 mm minimum.

.7 Rip Rap: specially selected and graded field or quarried rock with angular shape and free from rounded, flat or elongated particles, non ore-bearing, non toxic, size specified in the Project Documents.

.8 Pipe bedding and backfill: as specified in the Project Documents.

.9 Lumber: construction grade stamped by Maritime Lumber Board or approved equal.

PART 3 - EXECUTION

3.1 Excavation

.1 Excavate all types of materials to lines and elevations indicated and as necessary for construction.

.2 Notify Engineer if in doubt as to definition of material.

.3 When rock is encountered, notify Engineer for measurement.

.4 Select method of excavation, support, and dewatering unless otherwise indicated or directed. Protect property and structures from damage.

.5 Cut paved surfaces in straight lines.

.6 Extend excavations sufficient distance from footings and walls to allow placing and removal of forms and for placing backfill materials indicated.

.7 Do not excavate more than 30 metres of trench in advance of pipe laying, unless otherwise directed.

.8 Prepare trench bottom so pipe can be laid to required line and grade. Remove any boulders or rock within theoretical trench payment area as shown in Section 39 00 00 - Standard Detail 01 22 00-01.

.9 Handle materials in a manner that will not endanger the public, personnel, property or the work. Do not reduce

sight distances, or obstruct roadways or utilities. Do not obstruct flow of surface drainage or natural watercourses.

.10 Do not stockpile materials alongside of excavations in such manner that stockpiling will cause side failure or bottom uplift.

.11 Replace over excavation of trench bottom with selected site material, granular material, or unshrinkable fill as directed.

.12 Notify Engineer whenever unsuitable materials are encountered and remove to depth and extent directed.
.1 If such work is due to nature of soil, Engineer and Contractor will jointly measure work for payment.
.2 If such work is due to any act or fault of Contractor remedial work is responsibility of Contractor.

.13 Dispose of unsuitable or surplus materials off site unless otherwise directed. Engineer may instruct Contractor to stockpile or place unsuitable or surplus material within site.

3.2 Topsoil Excavation

.1 Strip topsoil to limits and depth indicated or directed.

.2 Stockpile in designated areas or dispose as directed. Minimize loss and wastage.

3.3 Unsuitable Excavation

.1 When unsuitable is encountered notify Engineer for measurement and assist in investigation to determine depth and type of material. Isolate area to minimize entry of water into excavation.

.2 Excavate unsuitable to extent directed.

.3 Dispose of material unsuitable for reuse off site.

3.4 Blasting

.1 Obtain appropriate permits before proceeding with blasting.

.2 Conduct blasting with all possible care to avoid injury to persons and property.

Sound an audible warning in vicinity of work immediately prior to blasting. Make certain there are no persons within danger area before blasting.

3.5 Support of Excavation

.1 Install and be responsible for shoring, and underpinning as required.

.2 When support of excavation is required, engage services of a Professional Engineer, registered or licensed in the Province of Nova Scotia, to design shoring and inspect its installation.

.3 Provide record copy of drawings signed and sealed by Professional Engineer responsible for their preparation.

3.6 Dewatering

.1 Keep bottom of excavation free of water by draining or pumping.

.2 Dewater excavation in a manner which will not endanger stability of the work.

.3 Dispose of water from excavation in a manner that is not injurious to property, public health or any operation of the work.

.4 Take precautions to prevent uplift of pipe or structures.

.5 Do not drain water from excavation into sewer unless approved by Engineer.

3.7 Bedding and Backfilling

.1 Remove all timber, snow, ice, frozen material, and debris from excavation before backfilling. Do not backfill until work has been inspected by Engineer.

.2 Backfill with materials indicated.

.3 Place and compact foundation layer of bedding to depth indicated, shaped to provide uniform support to pipe and structures.

.4 After installation of pipe, place and compact bedding material in 150 mm layers to horizontal centreline of pipe.

.5 Place and compact remaining bedding material to depth indicated above the top of pipe before further compaction.

.6 Complete backfilling by placing and compacting material indicated in 300 mm layers. Bring backfill up evenly around structures.

.7 Compact all materials to 95% Standard Proctor Density with the following exceptions:
.1 Top 300 mm below subgrade to 98% Standard Proctor Density.
.2 Gravel under paved surface to 100% Standard Proctor Density.
.3 Clear Stone to 70% Relative Density.

.8 Density Tests: Standard Proctor in accordance with Method B, ASTM D 698. Relative Density in accordance with ASTM D 4253 and D4254.

.9 Control moisture content of backfill materials so that specified compaction may be obtained.

.10 Place unshrinkable fill in areas as indicated. Consolidate and level unshrinkable fill with internal vibrators.

.11 In areas of pedestrian and vehicular traffic, maintain surfaces level with existing surface until reinstatement.

3.8 Backfilling Structures

.1 After installation of foundations, clean excavations of trash and debris. Backfill shall consist of Selected Backfill material or material shown on drawings. Place material to meet following requirements and approval of the Engineer.
.1 Place backfill in horizontal layers not more than 300 mm deep.
.2 Compact each layer by rollers, mechanical tampers, or other suitable equipment to obtain a density of not less than 98% Standard Proctor density.

3.9 Mass Excavation and Embankment

.1 Establish with Engineer lead time required to take cross-sections. Notify Engineer in accordance with agreed lead time.

.2 Excavate and place fill to lines and grades indicated.

.3 Maintain crowns and cross slopes to provide surface drainage.

.4 When rock, or unsuitable material is encountered notify Engineer for measurement.

.5 Break rock to a depth 300 mm below subgrade. Excavate broken rock where indicated. Remove loose rock fragments from slopes.

.6 Remove existing pavement encountered within 300 mm of subgrade elevation.

.7 Do not place material which is frozen or place material on frozen surfaces.

.8 When constructing embankment with common material place in uniform layers to full width of embankment. Compact to 95% Standard Proctor Density throughout full width and depth. Maximum rock size: 65% of compacted lift thickness.

.9 When constructing embankment with rock fill, place to full width of embankment in layers of sufficient depth to contain maximum sized rocks, but in no case is thickness to exceed 1 metre. Fill interstices with rock fragments or earth to form compact mass. Fill voids at subgrade level to prevent migration of fine material.

.10 Do not place boulders or broken rock fragments with dimensions greater than 200 mm within 300 mm of subgrade.

.11 Shape and compact material to within 40mm of design subgrade elevation, but not uniformly high or low.

.12 Finish side slopes uniformly to lines and elevations indicated. Remove boulders

encountered in cut slopes and fill resulting cavities.

3.10 Breaking Rock Without Removal

.1 Break rock without removal to lines and grades indicated.

.2 Break rock below street subgrade to a maximum size of 200 mm such that maximum dimension of rock fragments within 300 mm of subgrade is 200 mm.

.3 Break rock for future removal as follows:
.1 Mass: maximum size of 90 percent of volume of rock broken is less than 0.5 cubic metre with no fragments exceeding one cubic metre.
.2 Trench: maximum size of 90 percent of volume of rock broken is less than 0.3 cubic metre with no fragments to exceed 0.5 cubic metre.

.4 Excavate broken rock to depth indicated at test locations selected by Engineer in accordance with following criteria:
.1 Mass: one test hole for each 1000 square metres of surface area with a minimum of one test hole in each location.
.2 Trench: one test hole for each 30 metres along trench with a minimum of one test hole at each separate trench.

.5 Should test excavation indicate that breaking techniques do not give required results, do remedial work.

.6 Backfill test excavations after inspection using excavated materials.

3.11 Road Gravels

.1 Prior to placing gravels, grade surface to within 40 mm of elevations and cross sections indicated but not uniformly high or low. Compact top 300 mm to 98% Standard Proctor Density.

.2 Place gravels in uniform layers not exceeding 200 mm to thickness indicated. Grade intermediate gravel courses to within 30 mm of elevations and cross-sections indicated, but not uniformly high or low. Compact to 100% Standard Proctor Density.

END

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1.2 Related Sections
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1.4 Certificates

PART 2 - PRODUCTS

2.1 Gabion Baskets
2.2 Stone Fill
2.3 Geosynthetic

PART 3 - EXECUTION

3.1 Foundation Preparation
3.2 Placing Gabions
3.3 Filling Baskets and Mats
3.4 Placing Geosynthetic
3.5 Backfilling

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing gabion structures. Work includes foundation preparation, supply and installation of gabion baskets, stone fill, geosynthetic, and backfilling.

1.2 Related Sections

.1 Earthwork: Section 31 20 00

.2 Reinstatement: Section 32 98 00

1.3 Reference Standards

.1 ASTM A975-97(R2003), Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses.

.2 ASTM D638M-08, Standard Test Method for Tensile Properties of Plastics.

.3 ASTM D1499-05, Filtered Open-Flame Carbon Arc Exposures of Plastics.

.4 ASTM G152-06, Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Non-Metallic Materials.

.5 ASTM G153-04, Standard Practice for Operating Enclosed Flame Arc Light Apparatus for Exposure of Non-Metallic Materials.

1.4 Certificates

.1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

.2 All retaining wall design and shop drawings, for walls over one metre, to be stamped by a professional engineer licensed to practice in the Province of Nova Scotia.

.3 Submit manufacturer’s proof of minimum design life based upon independent testing.

PART 2 - PRODUCTS

2.1 Gabion Baskets

.1 Gabion Baskets:

.1 Factory fabricated so sides, ends, lid and internal diaphragms readily assemble at site into rectangular baskets of sizes indicated.

.2 Single unit construction, or with joints having strength and flexibility equal to that of mesh.

.3 When length exceeds width, diaphragms to be provided of same mesh as gabion walls to divide baskets into equal cells of a length not in excess of horizontal width.

.4 Wire mesh to be woven uniform hexagonal pattern with double twisted to ASTM A975, with openings approximately 80 mm by 100 mm and fabricated to be non-ravelling. Perimeter edges of mesh to be securely selvedged so that joints formed by connecting selvedges are as strong as body of mesh. All material shall be PVC coated galvanized wire.

.5 Wire to have following minimum properties:

.1 Wire for mesh: 2.7 mm diameter.

.2 Wire for selvedges: 3.8 mm diameter.

.3 Wire for binding: 2.2 mm diameter.

.2 Geogrid gabions:

.1 Geogrid mesh to be rigid type, uniform, square pattern, non corrosive, high density polyethylene with inhibitors added to resist deterioration by ultra-violet and heat exposure. Geogrid openings to be 50 x 50 mm.

.2 Geogrid to have following mechanical properties: Tensile modulus at 2% elongation: to ANSI/ASTM D638M, modified to manufacturer’s recommendations, minimum 290 kN/m. Junction strength: to ANSI/ASTM D 638M, modified to manufacturer’s recommendations, minimum 90% of single rib strength.

.3 Gabion mats:

.1 Factory fabricated so that sides, ends, lid and internal diaphragms readily assemble at site into rectangular mats.

.2 Single unit construction or with joints having strength and flexibility equal to that of mesh.

.3 When length exceeds horizontal width, provide diaphragms of same mesh as gabion walls to divide mat into equal cells not in excess of 1 m x 3 m.

.4 Wire mesh gabion mats:

.1 Wire mesh to be uniform hexagonal pattern wire woven in double twisted pattern to ASTM A975 with openings of approximately 80 x 100 mm and fabricated to be non ravelling. Perimeter edges of mesh to be securely selvedged so that joints formed by connecting selvedges are as strong as body of mesh. All material shall be PVC coated galvanized wire.

.2 Wire to have following dimensions:

.1 Mesh: 2.20 mm diameter.

.2 Selvedges: 2.65 mm diameter.

.3 Binding: 2.20 mm diameter.

.3 Wire: double twisted to ASTM A965.

.4 Interlocking wire fasteners: double twisted to ASTM A975.

.5 Geogrid gabion mats:

.1 Geogrid mesh to be rigid type, uniform, square pattern, non corrosive, high density polyethylene with inhibitors added to resist deterioration by ultra-violet and heat exposure. Geogrid opening to be 50 x 50 mm.

.2 Geogrid to have following mechanical properties:

.1 Tensile modulus at 2% elongation: to ANSI/ASTM D 638M, modified to manufacturer’s recommendations, minimum 290 kN/m.

.2 Junction strength: to ANSI/ASTM D638M, modified to manufacturer's recommendations, minimum 90% of single rib strength.

.6 All polymers used, PVC and HDPE, in the manufacturing and assembly of gabion mats shall show no effect to exposure to UV light with test exposure of 3000 hours using apparatus type E and 63°C, when tested to ASTM D1499, Practice D and ASTM G153 and G153.

2.2 Stone Fill

.1 Hard, durable and abrasion resistant and such that it will not disintegrate from action of wetting and drying, wave action, freezing and thawing cycles.

.2 Stones to be minimum 100 mm to maximum 200 mm dimension.

2.3 Geosynthetic

.1 Geosynthetic as indicated.

PART 3 - EXECUTION

3.1 Foundation Preparation

.1 Prepare base to required lines and grades with material indicated and compact to 95% Standard Proctor Density or as indicated.

3.2 Placing Gabions

.1 When possible, place and secure baskets in position prior to filling with stones. Maintain rectangular shape and indicated alignment of exposed face.

.2 Join adjacent baskets and mats together at corners as recommended by manufacturers, so that joints are as strong as mesh.

3.3 Filling Baskets and Mats

.1 Tension geogrid gabions according to manufacturer's instructions before filling with stone. Do not release wall tension until sufficient stone fill has been placed to prevent wall slackening.

.2 On exposed faces of gabions, place stones by hand with flattest surfaces bearing against face mesh to produce satisfactory alignment and appearance.

.3 For wire mesh gabions, fill gabion cells in lifts not exceeding 300 mm and connect opposite walls with 2 tie wires after each lift.

.4 For geogrid gabions, fill cells in lifts not exceeding 300 mm and connect opposite walls with 2 polyethylene braids after each lift.

3.4 Placing Geosynthetic

.1 Place geosynthetic, if indicated, along the excavated face in continuous sheet. Where joints are required, overlap 500 mm.

3.5 Backfilling

.1 Backfill to required lines and grades with materials indicated.

END

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PART 2 - PRODUCTS

2.1 Materials
2.2 Asphalt Concrete

PART 3 - EXECUTION

3.1 General
3.2 Fine Grading
3.3 Adjusting Tops of Castings
3.4 Prime Coat
3.5 Tack Coat
3.6 Paving
3.7 Pavement Markings

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing asphalt concrete pavement. Work includes fine grading, supply and placing of prime or tack coat, hot mix asphalt concrete, and pavement markings.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Earthwork	Section 31 20 00
.3	Walks, Curbs and Gutters	Section 32 16 00
.4	Reinstatement	Section 32 98 00
.5	Precast Manholes, Catch Basins and Structures	Section 33 39 00
.6	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 CAN/CGSB 1-74-2001, Alkyd Traffic Paint.

.2 Nova Scotia Transportation and Infrastructure Renewal Standard Specification – Highway Construction and Maintenance.

.3 Transportation Association of Canada: Manual of Uniform Traffic Control Devices for Canada

1.4 PGAB Escalation/ DeEscalation

.1 If required by the Project Documents an Asphalt Index mechanism is applicable to the Work. Where applicable, the mechanism shall be in accordance with NSDTIR Program or as specifically modified in the Project Documents.

.2 Refer to Section 00 10 00 for details of application.

PART 2 - PRODUCTS

2.1 Materials

.1 Asphalt materials: to Province of Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification - Highway Construction and Maintenance.

.2 Paint for pavement marking: to CGSB 1-GP-74M, colour as directed.

2.2 Asphalt Concrete

.1 Asphalt concrete mix: to Nova Scotia Transportation and Infrastructure Renewal Standard Specification – Highway Construction and Maintenance, Division 4, Section 4, and type indicated.

PART 3 - EXECUTION

3.1 General

.1 Use workers skilled in placing asphalt concrete.

3.2 Fine Grading

.1 Fine grade gravel surface to within 10 mm of elevations and cross sections indicated immediately prior to placement of asphalt materials. Add or remove gravel as required. Compact to 100% Standard Proctor Density or as directed by the Engineer.

3.3 Adjusting Tops of Castings

.1 Prior to placing asphalt surface course:
.1 Adjust manhole covers and catch basin frames to match asphalt surface, using manufactured or cast-in-place grade rings.
.2 Adjust valve boxes to finished asphalt surface. Raise or lower top sections of valve boxes.

3.4 Prime Coat

.1 When required by the Project Documents, apply prime coat to Nova Scotia Transportation and Infrastructure Renewal Standard Specification – Highway Construction and Maintenance, Division 4, Section 5.

3.5 Tack Coat

.1 Apply tack coat on existing asphalt concrete to Nova Scotia Transportation and Infrastructure Renewal Standard Specification – Highway Construction and Maintenance, Division 4, Section 1. Apply tack coat to contact surface of curbs, castings and structures.

3.6 Paving

.1 Transport, place and compact asphalt concrete mix to Province of Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification – Highway Construction and Maintenance. Construct pavement within

specified tolerances to lines, elevations, cross sections and dimensions at locations indicated.

.2 Thickness of asphalt courses not to vary more than 6 mm from thickness indicated, with average thickness as indicated.

.3 Finished asphalt surfaces to be within 6 mm of design elevation, but not uniformly high or low. Finished asphalt surface not to have irregularities exceeding 6 mm when checked with a 3 metre straightedge placed in any direction.

3.7 Pavement Markings

.1 Temporary markings shall be applied as soon as possible.

.2 Allow asphalt concrete to cure a minimum of 7 days before application of permanent markings paint. Surface to be dry and clean prior to application. Apply paint at application rate indicated with spray gun to lines and at locations indicated. Dimensions and colour to Transportation Association of Canada Manual of Uniform Traffic Control Devices for Canada, Part C.

END

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PART 1 - GENERAL

1.1 Work Included
1.2 Related Sections
1.3 Reference Standards
1.4 Submittals
1.5 Delivery, Storage and Handling
1.6 Environmental Conditions

PART 2 - PRODUCTS

2.1 Pavers, Bedding and Edging

PART 3 - EXECUTION

3.1 Subgrade
3.2 Geotextile Filter
3.3 Granular Base
3.4 Edging
3.5 Bedding Sand
3.6 Surface Course

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies the work required to install interlocking concrete paving. Work includes preparation of bedding, compacting, and installation of concrete paver units, joint sand and edge restraints.

1.2 Related Sections

.1 Earthwork Section 31 20 00

1.3 Reference Standards

.1 American Society for Testing and Materials

.1 ASTM C136-06, Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM C140-08a, Sampling and Testing Masonry Units

.3 ASTM C979-05, Specification for Pigments for Integrally Colored Concrete

.4 ASTM C936-08, Specification for Solid Interlocking Concrete Paving Units.

.5 ASTM D698-07e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort(600kN-m/m^3).

.6 ASTM D1557-07, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/m^3).

.2 Canadian Standards Association

.1 CSA A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete

.2 CSA-A231.1/ A231.2-06, Precast Concrete Paving Slabs/Precast Concrete.

.3 CSA A179-04, Mortar and Grout for Unit Masonry.

.3 Interlocking Concrete Paving Institute

.1 Tech Spec Technical Bulletins, Vol. 1-latest edition.

1.4 Submittals

.1 Submit samples in accordance with Section 01 10 00.

.2 Indicate layout, pattern and relationship of paving joints to fixtures and project formed details on shop drawings.

.3 Full size samples of concrete paving units to indicate and shape selections. Color will be selected by Engineer from manufacturer's available colors.

.4 Sieve analysis for grading and bedding and joint sand.

.5 Test results from an independent testing laboratory for compliance of paving unit requirements to ASTM C936 or other applicable requirements.

.6 Manufacturer's certification of concrete pavers ICPI as having passed applicable ASTM or CSA standards.

1.5 Delivery, Storage and Handling

.1 Delivery concrete pavers to the site in steel banded, plastic branded or plastic wrapped cubes capable of transfer lift or clamp lift. Unload pavers at job site in such a manner that no damage occurs to the product.

.2 Cover sand with waterproof covering to prevent exposure to rainfall or removal by wind. Secure the covering in place.

1.6 Environmental Conditions

.1 Do not install sand or pavers during heavy rain or snow.

.2 do not install sand and pavers over frozen base materials.

.3 Do not install frozen sand.

PART 2 - PRODUCTS

2.1 Pavers, Bedding and Edging

.1 Suppliers: approved by the ICPI.

.2 Concrete pavers: meet or exceed requirements set forth in CSA A231.2 and ASTM C140:
.1 minimum average cube compressive strength of 7250 psi (50 MPa).
.2 Resistance to 50 freeze-thaw cycles while immersed in 3% saline solution

.3 Pigment: conform to ASTM C979.

.4 Manufactured sand for bedding: hard, durable, crushed stone particles, conforming to the gradation of concrete sand as specified in CAN/CSA A23.1, Section 5.3.2 and ASTM C136. Sand shall be free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Do not use limestone screenings or stone dust.
.1 Gradations: within limits specified when tested to CSA 23.1.

Sieve Designation	% Passing
10 mm	100
5 mm	95-100
2.5 mm	80-100
1.25 mm	50-90
0.630 mm	25-60
0.315 mm	10-35
0.160 mm	2-10

.5 Joint sand: to CSA A179, hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.6 Edging: as specified in the project documents.

.7 Geotextile filter: as specified in Section 31 20 00.

PART 3 - EXECUTION

3.1 Subgrade

.1 Ensure that subgrade preparation conforms to ASTM D698 or ASTM D1557 to allow for installation of granular base.

3.2 Geotextile

.1 Install geotextile filter as specified in the project documents.

3.3 Granular Base

.1 Base minimum thickness: conform to ASTM 698 and ASTM D1557.

.2 Spread and compact crushed stone or gravel base in uniform layers not exceeding 150 mm compacted thickness.

.3 Compact base to a density of not less than 95% of Standard Proctor Density in accordance with ASTM D698 and D1557.

.4 Shape and roll alternately to obtain a smooth, even and uniformly compacted granular base and ensure conformity of grades with finish surface.

.5 Apply water as necessary during compaction to obtain specified density. If granular base is excessively moist, remove it and install more granular material to rid it of sponginess.

.6 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

.7 Ensure top of granular base does not exceed plus or minus 10 mm over a 3 m straightedge.

3.4 Edging

.1 Install edging true to grade, in location, layout, and pattern as indicated.

3.5 Bedding Sand

.1 Place and spread bedding sand to compacted thickness as indicated.

.2 Maximum thickness after compaction: 25 mm.

.3 Use material other than bedding sand to compensate for depressions that exceed specified tolerances in surface of base.

.4 Do not use joint sand for bedding sand.

3.6 Surface Course

.1 Ensure bedding sand and granular base are not saturated and free of foreign material prior to placement of concrete pavers.

.2 Spread bedding sand evenly over the base course and screed to a nominal 25mm thickness, not exceeding 40mm thickness. Do not disturb screeded sand. Place sufficient sand to stay ahead of the laid pavers. Do not use bedding sand to fill in depressions in the base surface.

.3 Install unit paving true to grade on the bedding sand, in location, layout and pattern as indicated.

.4 Joint between pavers shall be between 2mm-5mm wide or as indicted in the project documents.

.5 Precast concrete paving slabs:
.1 Install paving slabs with joints of the prescribed width as indicated on the drawings.
.2 Compact and level units with a minimum 22 kN force mechanical plate vibrator. Use minimum 19 mm thick

plywood or neoprene pad under plate compactor and over paving units until units are true to grade and free of movement.

.3 Do not compact unit paving within 1 m of unrestrained edges.

.4 Fill spaces between pavers by sweeping in sand. Sweep excess sand off.

.5 Pass mechanical plate vibrator over unit paving several times to achieve compaction of sand in joints. Ensure joints are full at completion of compaction.

.6 At the completion of each work day, ensure all work within 1 m of laying face is left fully compacted with sand filled joints. Cover laying face with plastic sheets overnight not closed with cut and compacted pavers.

.7 Surface of finished pavement: free from depressions exceeding 10 mm as measured with 3 m straight edge.

.8 Surface elevations of pavers shall be 3mm-6mm above adjacent drainage inlets, concrete collars or channels.

.9 Sweep surface clean and check final elevations as indicated.

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3.4 Asphalt Concrete Surfaces
3.5 Extruding Portland Cement Concrete and Asphalt Concrete
3.6 Backfilling

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing walks, curbs and gutters. Work includes fine grading; supply, placing and finishing of Portland cement concrete and asphalt concrete; and backfilling.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Earthwork	Section 31 20 00
.3	Asphalt Concrete Paving	Section 32 12 16
.4	Reinstatement	Section 32 98 00
.5	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 ASTM D1751-04(R2008), Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

.2 CAN/CSA A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.3 Province of Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification - Highway Construction and Maintenance.

1.4 Protection

.1 Provide protection, including watchman if necessary, to prevent damage to newly installed walks, curbs and gutters.

.2 Keep sufficient covering on site to protect fresh concrete from damage by weather.

PART 2 - PRODUCTS

2.1 Materials

.1 Concrete: to Section 03 30 00, minimum compressive strength of 35 MPa, and maximum water cement ratio of 0.45, air entrainment, 5.8%.

.2 Isolation Joint Filler: to ASTM D 1751.

.3 Granular Base: Type 1 Gravel to Section 31 20 00.

.4 Asphalt Materials: to Section 32 12 16.

.5 Curing Compound: to CSA A23.1-M, white in colour.

2.2 Asphalt Concrete Mix

.1 Asphalt Concrete Mix: to Province of Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification, Division 4, Section 4 - Highway Construction and Maintenance type indicated.

PART 3 – EXECUTION

3.1 Fine Grading

.1 Fine grade gravel surface prior to placing Portland cement concrete or asphalt concrete.

3.2 Adjusting Tops of Castings

.1 Adjust castings to match finished surface prior to placing surface course of asphalt concrete or Portland cement concrete.

3.3 Concrete Surfaces

.1 Do concrete work in accordance with Section 03 30 00 and as specified herein:

.1 Placing: Place concrete in continuous operation beginning at lowest point. Tamp or vibrate to prevent honeycombing.

.2 Jointing:

.1 Control joints to be minimum of one quarter of section thickness.

.2 Space control joints every 3 metres for curbs and every 1.5 metres for concrete walks unless otherwise indicated. Match joints in abutting curb and walk to extent practical.

.3 Provide control joints within 150 mm of change in cross section of curbs, gutters and walks.

.4 Finish perimeter of all slabs with an edger.

.5 Saw cutting may be allowed if done as soon as concrete has set sufficiently to resist ravelling and before shrinkage cracks appear.

.6 Install isolation joint filler where concrete abuts permanent structure or curb, or as indicated.

.7 Provide expansion joints every 50 m and at every cold joint.

.3 Finishing: Use experienced workers to finish surface. Do not apply water to newly placed concrete surfaces.

.1 Broom all exposed concrete surfaces to provide evenly textured, non-skid surface.

.2 Curing: Apply curing compound in accordance with CSA A23.1.

.4 Form Stripping: Strip forms only when concrete has developed sufficient strength to resist damage to corners and edges.

3.4 Asphalt Concrete Surfaces

.1 Place asphalt concrete mix in accordance with Division 4, Section 4, Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification - Highway Construction and Maintenance and Section 32 12 16.

.2 Finish to smooth dense surface.

3.5 Extruding Portland Cement Concrete and Asphalt Concrete

.1 Extruding equipment and mule configuration must be approved.

3.6 Backfilling

.1 Backfill when Portland cement concrete or asphalt concrete have strength sufficient to resist damage from backfilling operations. Do backfilling to Section 31 20 00.

END

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1.6 Handling and Storage

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2.1 General
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PART 3 - EXECUTION

3.1 Grading
3.2 Erection of Fence
3.3 Installation of Gates
3.4 Touch Up
3.5 Cleaning

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing chain link fence. Work includes excavation, supply and installation of concrete footings, chain link fence, gates and accessories, and reinstatement.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Earthwork	Section 31 20 00
.3	Reinstatement	Section 32 98 00

1.3 Reference Standards

.1 ASTM F657-07, Standard Practice for Installation of Chain Link Fence.

.2 CAN/CGSB-138.1M-97, Fabric for Chain Link Fence.

.3 CAN/CGSB-138.2M-96, Steel Framework for Chain Link Fence.

.4 CAN/CGSB-138.3M-96, Installation of Chain Link Fence.

.5 CAN/CGSB-138.4M-96, Gates for Chain Link Fence.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

1.5 Certificates

.1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

1.6 Handling and Storage

.1 Handle and store fence materials in such a manner as to avoid damage. Do not damage coatings.

PART 2 - PRODUCTS

2.1 General

.1 Height, fabric type and style, class and grade of coating: as indicated.

2.2 Materials

.1 Concrete: to Section 03 30 00, minimum compressive strength 20 MPa.

.2 Fabric and coating: to CAN2-138.1-M.

.3 Posts, rails, and Fittings: to CAN2-138.2-M, schedule 40, galvanized steel. Dimensions in accordance with the following table:

FENCE HEIGHT (Metres)

	1.0	1.2	1.5	1.8
LINE POSTS				
100 Wall				
O.D. (mm)	60.3	60.3	60.3	60.3
Length (m)	1.8	2.0	2.3	2.6
END, GATES & CORNER POSTS				
125 Wall				
O.D. (mm)	88.9	88.9	88.9	88.9
Length (m)	2.1	2.3	2.6	2.9
RAILS				
100 Wall				
O.D. (mm)	42.2	42.2	42.2	42.2

FENCE HEIGHT (Metres)

	2.1	2.4	3.0	3.6
SCH. 40 LINE POSTS				
O.D. (mm)	60.3	60.3	60.3	73.0
Length (m)	2.9	3.8	4.4	5.0
SCH. 40 END, GATES & CORNER POSTS				
O.D. (mm)	88.9	88.9	88.9	114.3
Length (m)	3.2	3.5	4.7	5.3
RAILS				
100 Wall				
O.D. (mm)	42.2	42.2	42.2	42.2

.4 Gates and accessories: to CAN2-138.4-M, type as indicated. Framing dimensions in accordance with the following table:

GATE TYPE	OPENING (metres)	FRAMING O.D.(mm)	FRAMING Wall mm
Single swing	3.0	42.9	100wall
Double swing	6.0	42.9	100wall
Single swing	4.5	42.9	100wall
Double swing	9.0	42.9	100wall

PART 3 – EXECUTION

3.1 Grading

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.2 Erection of Fence

.1 Erect fence along lines as indicated and in accordance with CAN/CGSB-138.3.

.2 Excavate post holes to dimensions indicated by methods approved by Engineer.

.3 Space line posts 3 m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not exceeding 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 m.

.5 Install additional straining posts at sharp changes in grade and where directed by Engineer.

.6 Install corner post where change in alignment exceeds 10°.

.7 Install end posts at end of fence and at buildings. Install gateposts on both sides of gate openings.

.8 Place concrete in post holes then embed posts into concrete to depths indicated. Extend concrete 50 mm above ground level and slope to drain away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 When driving posts directly into the

ground or setting posts in bedrock as an approved method, driving depths, diameter of drill hole, grouting compound and the like shall be as specified in the Project Documents.

.10 Do not install fence fabric until concrete has cured sufficiently. Submit concrete mix to Engineer for review.

.11 Install brace between end and gate posts and nearest line post, at inclination as indicated. Install braces on both sides of corner and straining posts in similar manner.

.12 Install overhang tops and caps.

.13 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.14 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.15 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals. Knuckled selvedge at bottom. Twisted selvedge at top.

.16 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals. Give tie wires minimum two twists.

.17 Install barbed wire strands and clip securely to lugs of each projection where indicated.

.18 Install grounding rods as indicated.

3.3 Installation of Gates

.1 Install gates in locations as indicated.

.2 Level ground between gate posts and set gate bottom approximately 40 mm above ground surface.

.3 Install gate stops where indicated.

3.4 Touch up

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas. Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.5 Cleaning

.1 Clean and trim areas disturbed by operations. Dispose of surplus material and replace damaged turf with sod as directed by Engineer.

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2.1 Modular Wall Units
2.2 Geotextile Filter
2.3 Infill Soil

PART 3 - EXECUTION

3.1 Soil Preparation
3.2 Base
3.3 Unit Installation
3.4 Protection
3.5 Adjustment and Cleaning

END

PART 1 - GENERAL

1.1 Work Included

.1 This Section specifies requirements for supplying and installing modular block retaining walls as indicated on the Project Documents.

.2 The work included in this section consists of but is not limited to the following:

.1 Design, inspection and certification by a registered professional engineer

.2 Excavation and foundation soil preparation

.3 Furnishing and placement of leveling base.

.4 Furnishing and placement of drainage system

.5 Furnishing and placement of geotextiles.

.6 Furnishing and placement of segmental retaining wall facing units

.7 Furnish and placement of geosynthetic reinforcement.

.8 Furnishing and compaction of infill, drainage and retained soils.

1.2 Related Work

.1 Earthwork: Section 31 20 00

1.3 Reference Standards

.1 ASTM C1372-04e1, Standard Specifications for Segmental Retaining Wall Units.

.2 ASTM D698-07el, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12400 ft-lbs/ft^3 or 600 kN-m/m^3)

.3 National Concrete Masonry Association (NCMA) Design Manual for Segmental Walls, Second Edition.

1.4 Protection

.1 Prevent damage to buildings, landscaping, fences, adjacent property

and all other items designated to remain.

1.5 Delivery and Storage

.1 Check materials upon delivery to assure proper material have been received and are in good condition.

.2 Prevent excessive mud, wet cement, and like material from coming in contact with the materials.

.3 Protect materials from damage and deterioration from excessive moisture, temperature changes, contaminants, breaking, chipping or other causes. Do not incorporate damaged materials into the project. Promptly remove damaged units from the site.

1.6 Allowable Tolerances

.1 Finish concrete block retaining wall with top of wall surfaces to within 25 mm of specified elevations and locations, and within a tolerance of 12 mm for both top and face surfaces when measured under a 3 m long straightedge.

1.7 Shop Drawings

.1 Provide shop drawings in accordance with Section 01 10 00.

PART 2 - PRODUCTS

2.1 Modular Wall Units

.1 Concrete block wall units shall have minimum 28 day compressive strength of 20 MPa in accordance with ASTM C1372. The concrete units shall have adequate freeze-thaw protection with an average absorbance rate of 120 kg/m^3 for northern climates and 160 kg/m^3.

.2 Exterior dimensions of blocks to be uniform and consistent. Maximum dimensional deviations shall be 3 mm, not including textured face.

.3 Retaining wall units to provide a minimum of 110 lbs total weight per square foot of wall face area 555kg/m^2. Fill contained within the units may be considered 80% effective weight.

.4 Exterior face texture and colour to be indicated in the Project Documents or as selected by Engineer.

2.2 Geotextile Filler

.1 As specified in Project Documents.

2.3 Infill Soil

.1 Infill material shall be site excavated soils when approved by the on-site Engineer unless otherwise specified in the Project Documents. Unsuitable soils for backfill (heavy clays or organic soils) shall not be used in the reinforced soil mass. Typically clay soils with high plasticity will not be acceptable, unless specifically addressed by the Engineer.

.2 The infill soil used must or exceed the designed friction angle and description noted on the design cross-section, and must be free of debris.

.3 Where additional fill is required, submit samples and specifications to the Engineer for approval.

PART 3 - EXECUTION

3.1 Soil Preparation

.1 Complete excavation in accordance with in Project Documents.

.2 Ensure actual foundation soil strength meets or exceeds assumed design strength.

.3 Remove and replace soil not meeting the required strength with acceptable material. Compact to a minimum 98%

Standard Proctor Density in accordance with ASTM D698.

3.2 Base

.1 Base materials shall be placed as shown in the Project Documents. Top of base shall allow bottom wall units to be buried to the proper depths as per wall heights and specifications.

.2 Base shall be compacted to 95% of Standard Proctor Compression as per ASTM D698. The base shall be constructed to ensure proper wall embedment and the final elevations indicated. Well-graded sand can be used to smooth the top 13mm on the base of the material.

.3 Base material shall be a 100mm minimum depth for walls under 1.2m and a 150mm minimum depth for walls over 1.2m or as specified in Project Documents.

3.3 Unit Installation

.1 Segmental Retaining wall is to be designed in accordance with recommendations of the NCMA Design Manual for Segmental Retaining Walls, Latest Edition.

.2 The first course of wall units shall be placed on the prepared base with the raised lip facing up and out and the front edges tight together. Check units for level and alignment.

.3 Ensure units are in full contact with the base.

.4 Fill and compact all cavities in and around the base row with wall rock approved by the Engineer. Backfill in front and back of the base row. Check again for level and alignment. Sweep excess granular material from the top of the level of blocks prior to placing next row of blocks.

.5 Install next course of wall units on top of base row. Position blocks to be a minimum 75mm offset from seams of blocks below. Fill all cavities in and around walls units to a 300mm depth and behind block with wall rock. Spread backfill in uniform lifts not exceeding 200mm in un-compacted thickness and compact to 95% of Standard Proctor density, in accordance with ASTM D698, behind the consolidation.

.6 Consolidation zone: 1m behind the wall or as indicated in Project Documents. Compaction is accomplished with hand operated compactor and shall begin by running the plate compactor directly on the block and then compacting in two parallel paths to the wall face until the entire consolidation zone is compacted. A minimum of two passes are required and more are required for fine grained soils. Final compaction requirements to be determined by Engineer.

.7 Lay each subsequent row of blocks in a like manner as stated above. Repeat procedure to the extent of wall height.

3.4 Protection

.1 Protect and maintain work of this Section including accessories, until acceptance of project work.

3.5 Adjustment and Cleaning

.1 Replace entire masonry units that are defective. Immediately remove form site defective and damaged materials. Replace, repair, re-finish, according to Engineer's approval.

END

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PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for planting of trees, shrubs and groundcover. Work includes supply and placement of planting soil mix or soil amendments, supply and planting of trees, shrubs and groundcover complete with all related component and accessories.

1.2 Related Sections

.1	Environmental Protection	Section 01 57 00
.2	Clearing and Grubbing	Section 31 10 00
.3	Earthwork	Section 31 20 00
.4	Protection of Existing Trees	Section 32 91 10
.5	Topsoiling and Finish Grading	Section 32 91 19
.6	Seeding and Sodding	Section 32 92 00

1.3 Reference Standards

.1 Canadian Nursery Trades Association; Canadian Standards for Nursery Stock – latest edition.

1.4 Quality Control

.1 Obtain approval of plant material prior to planting.

.2 Supply necessary permits and import licenses in compliance with federal and provincial regulations for imported plant material.

.3 Acceptance of plant material does not prevent rejection, after planting operations, as a result of damage during plant or failure of growth.

1.5 Delivery, Storage and Protection

.1 Protect plant material from damage during transportation. Use enclosed vehicle or other approved method.

.2 Immediately store and protect plant material which will not be installed within 1 hour after arrival at site in approved storage location.

.3 Protect plant material from frost, excessive heat, wind and sun during and after delivery as follows:

.1 For pots and containers, maintain moisture level in containers.
.2 For balled and burlapped (BB) and wire basket (WB) root balls, place to protect branches from damage. Maintain adequate moisture level in root zones.
.3 For bare root (BR) plant material, preserve moisture around roots by heeling-in or burying roots in approved moisture-retaining medium and watering to full depth of root zone.

1.6 Samples

.1 Submit samples in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

1.7 Warranty

.1 Notwithstanding GC 12.3 - WARRANTY, provide warrant that plant material provided will be maintained to remain healthy and free of defects for one full growing season from final acceptance date or other as specified in Project Documents, subject to section 3.9.10.

.2 Extend warranty period an additional one year for plant materials if leaf development and growth is not sufficient to ensure future survival.

PART 2 - PRODUCTS

2.1 Plant Materials

.1 Type of root preparation, sizing, grading and quality: comply with Canadian Nursery Trades Association (CNLA) Standards.

.2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system, root pruned regularly.

.3 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.

.4 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

.5 Collected native stock not acceptable unless otherwise approved.

.6 Substitution to plant materials: not permitted unless otherwise approved.

.7 Plant materials must be of appropriate zone and location for its species.

2.2 Water

.1 Free of impurities that would inhibit plant growth.

2.3 Tree Support

.1 Stakes: wood, regular or treated, 25 x 40 x 2400 mm long, or as detailed in Project Documents.

.2 Turnbuckle: galvanized steel, 9 mm diameter with 250 mm open length. Painted fluorescent orange.

.3 Guying wire: galvanized steel, 3 mm wire or 3 mm diameter multi-wire steel cable.

.4 Anchors:
.1 Wood: 50 mm x 50 mm x 600 mm.
.2 Steel: T-bar, 600 mm.

.5 Guying collar: tube, plastic 13 mm diameter nylon reinforced, rubber hose or approved commercial equivalent or as detailed in Project Documents.

2.4 Mulch

.1 Organic:
.1 Bark chip: varying in size from 25 to 50 mm diameter, from bark of coniferous trees.
.2 Wood chip: varying in size from 50 to 75 mm and 5 mm to 20 mm thick, free of bark, small branches and leaves.
.3 Shredded bark: varying in size from 25 mm to 100 mm in length, from coniferous trees.
.4 Approved commercial bark nugget.

.2 Inorganic:
.1 Well rounded beach stone, lava rock, brick or marble chips or other approved products.

2.5 Fertilizer

.1 Complete slow release commercial type ratio as determined by soil test. Organic product acceptable substitute provided it will supply the nutrient requirements determined by soil sample test. Fertilizer not to contain a herbicide.

2.6 Anti-Desiccant

.1 Wax-like emulsion.

2.7 Flagging Tape

.1 Fluorescent, colour choice optional.

PART 3 - EXECUTION

3.1 General

.1 The Contractor shall supply at least one person who shall be a member in good standing of Landscape Nova Scotia.

3.2 Pre-planting Operations

.1 Prune and remove damaged roots and branches from plant material using proper pruning cuts.

.2 Apply anti-desiccant when directed to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.3 Preparation of Planting Beds and Pits

.1 Obtain approval of plant materials prior to use.

.2 Excavate to depth and width as indicated.

.3 Remove damaged roots and branches from plant material.

.4 Apply anti-desiccant in accordance with manufacturer’s instructions, when plant material is dug out of the recommended season for protection, during extreme temperatures and such other conditions deemed necessary by the Engineer.

3.4 Planting

.1 For bare root stock, place 50 mm planting mixture in bottom of pit. Plant trees and shrubs with roots placed straight in pit.

.2 For jute or biodegradable burlapped root balls, untie and fold back top one third to one half of wrapping. Cut and remove the top layer of the wire basket and fold down remaining protruding wire sections without damaging root ball. Do not pull burlap or rope from under root ball. The wire basket should not be removed entirely as there is a likelihood of destroying the integrity of the root ball particularly if the tree was dug in sandy or dry soil.

.3 For container stock or root balls in non-degradable wrapping, water plants then

remove entire container or wrapping without damaging root ball. Under no circumstances should non-biodegradable burlap or cloth material be allowed to remain around the soil ball after planting.

.4 Plant vertically in locations indicated. Orient plant material to give best appearance in relation to structure, roads and walks.

.5 For trees and shrubs:
.1 Backfill planting mixture in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into planting mixture, backfill to finish grade. Ensure that the final grade of the soil ball and the tree trunk portion or root collar of the tree is at least 50 mm higher to allow for settlement. For trees that have been budded or grafted, the visible joint area of the collar should be 50 mm above the finished granular bed level.
.2 Form watering saucer as required.

.6 For groundcovers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.7 Water plant material thoroughly after planting operations are complete.

.8 After soil settlement has occurred, fill with soil to finish grade.

.9 Dispose of burlap, wire and container material off site.

3.5 Tree Supports

.1 Install tree supports unless indicated otherwise.

.2 For deciduous trees 50 mm and over:
.1 Use double tree support.
.2 Place one stake on the prevailing wind side of tree and second opposite or as directed by Engineer. Both stakes should be 800 mm minimum for trunk and should be placed on either side of root ball. Where trees are planted next to driveways or walkways, place one stake

between tree trunk and driveway or walkway.
.3 Drive stakes minimum 300 mm into undisturbed soil beneath root ball. Ensure stakes are secure, vertical and un-split.
.4 Install two guying collars above lowest branch crotch a minimum 1500 mm above grade.
.5 Thread guying wire through collar tube. Twist wire to form collar and secure firmly to stake. Cut off excess wire. Ensure collar is minimum 25 mm diameter larger than tree.
.6 For trees larger than 100 mm in caliper, support trees with three-way guy wires and stakes positioned in the ground equidistant around the perimeter of the tree. Some larger trees will require additional guy wires for added support. The use of turnbuckles to maintain taut support on the support wires is recommended.

.3 For evergreens, use three guy wires:
.1 Install guying collars above branch to prevent slipping at approximately 2/3 height for evergreens. Collar mounting height not to exceed 1000 mm above grade.
.2 Guying collars to be of sufficient length to encircle tree plus 500 mm space for trunk clearance. Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi-wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120 degrees.
.3 Install anchors at equal intervals about tree and away from trunk so that guy wire will form 45 degree angle with ground. Install anchor at angle to achieve maximum resistance for guy wire.
.4 Attach guy wire to anchors. Tension wire and secure by multi-wraps.
.5 Install wire tightner ensuring that guys are secure and leave room for slight movements of tree.
.6 Saw tops off anchors, which extend in excess of 100 mm above grade or as directed.

.4 After tree supports have been installed, prune and remove broken branches with clean, sharp tools.

3.6 Mulching

.1 Ensure soil settlement has been corrected prior to mulching.

.2 Water plant material thoroughly prior to spreading mulch as indicated.

.3 Spread mulch to a minimum 50 mm thickness or as specified in Project Documents. Do not cone or teepee the mulch as to bury the root collar or bud union of the tree trunk.

3.7 Maintenance During Establishment Period

.1 Perform following maintenance operations from time of planting to acceptance:
.1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
.2 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
.3 Remove weeds monthly.
.4 Replace or re-spread damaged, missing or disturbed mulch.
.5 Apply pesticides in accordance with federal, provincial and municipal regulations as and when required to control insects, fungus and disease.
.6 Prune and remove dead or broken branches from plant material using proper pruning cuts (techniques).
.7 Keep stakes and guy wires in proper repair and adjustment.
.8 Apply fertilizer in early spring at manufacturer's suggested rate and as required by planting material.
.9 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
.10 Where Municipal (By-laws) Regulations prohibit the use of Federally and/or Provincially approved pesticides, and the available (alternative) non-pesticide controls are not acceptable to the contractor; the (3.7.5) Apply pesticides to control insects, fungus and disease shall be deemed to be removed from 3.7 Maintenance During Establishment Period.

3.8 Acceptance

.1 Plant material will be accepted after planting operation is completed provided

that plant material exhibits healthy growing conditions and is free from disease, insects and fungal organisms.

.2 Plant material installed in fall will be accepted in following spring, one month after start of growing season, provided acceptance conditions outlined in 3.9.1 above are fulfilled. The acceptance date, for material planted in the fall and accepted in the spring, will be deemed to be the date of the completion of fall planting operations.

3.9 Maintenance During Warranty Period

.1 This maintenance will be the sole source of maintenance of the work during this period and is wholly the Contractor's responsibility. Should maintenance of the work be removed from the Contract, warranty will cease following final acceptance at project completion.

.2 From time of acceptance to end of warranty period, perform following maintenance operations:

.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

.2 For evergreen plant material: water thoroughly in late fall prior to freeze-up to saturate soil around root system.

.3 Re-form damaged watering saucers.

.4 Remove weeds monthly.

.5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.

.6 Apply pesticides where permitted in accordance with federal, provincial and municipal regulations as and when required to control insects, fungus and disease.

.7 Apply fertilizer in early spring at manufacturer's suggested rate and as required by plant material.

.8 Remove dead, broken or hazardous branches from plant material.

.9 Keep stakes and guy wires in proper repair and adjustment.

.10 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

.11 Notify Engineer when warranty

		period is completed to arrange inspection and transfer of maintenance responsibility to Owner. .12 Remove tree supports at end of warranty period if requested by the Engineer.
3.10 Clean Up	.1	Remove surplus materials at no additional cost to the contract.

END

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END

PART 1 - GENERAL

1.1 Work Included	.1	This section specifies requirements for working around existing trees during the course of construction. The work shall include protective zone requirements, fence protection, strapping of trunks, protection and pruning of roots, excavation and backfill requirements.
1.2 Related Sections	.1	Standard Details: Division 39
1.3 Definitions	.1	Maximum transplantable size: An existing tree shall be considered to be larger than the maximum transplantable size when its trunk is greater than 100 millimetres in diameter. This assumes conventional transplanting methods and equipment is being used. The definition precludes the use of larger specialized equipment used to move trees larger than 100 mm in diameter which may be affected by construction activities and a decision to relocate specific trees.

PART 2 - PRODUCTS

2.1 Strapping Material	.1	Strapping required for the protection of tree trunks of existing trees shall consist of wood slat snow fencing fastened securely around the tree trunk and wrapped with yellow or orange warning or marking tape. Alternately, use wooden planks with a minimum size of 25 x 150 x 2440 millimetres spaced at 75 to 100 mm around the trunk of the tree and securely fastened.
2.2 Fencing	.1	Fencing shall be a minimum height of 1.5 m and of heavy duty construction of either snow fencing or flexible rubber-coated chain link material supported by metal T-bar or a minimum of 50 mm x 50 mm wooden stakes at a minimum spacing

of 1.5 m apart to provide a rigid barrier around the tree or trees.

2.3 Mulch

.1 Natural Bark mulch or wood chips to be used where a protective cover is required over the roots to avoid compaction.

PART 3 - EXECUTION

3.1 Construction Methods

.1 Undertake all protective measures for trees and shrubs, beyond the maximum transplantable size, as indicated on the drawings and as specified herein. Trees less than the maximum transplantable size shall be protected similarly or relocated as required.

3.2 Identification and Removal

.1 Prior to the award of the contract, the Engineer will have identified all those trees that may be impacted by the construction activities.

3.3 Tree Protection and Protective Zone

.1 Where possible, establish a protective zone for all trees and shrubs to be preserved on site.

.2 Trees involved within the construction area shall have a 2.0 m radius protective zone calculated from the circumference at the base of the trunk which will remain free of excavation, trenching, grade changes, stock piling of materials and soil compaction throughout the duration of the project.

.3 Protective rigid fencing installed around these areas is required.

.4 Protect roots of trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

3.4 Strapping of Tree Trunks

.1 Where it is not possible to establish a minimum 2.0 m protection zone around a tree or group of trees that are to be preserved within and adjacent to proposed construction areas strapping will be required.

.2 This requires a double wrap of wood slat snow fencing, or other suitable wood planks (minimum 50 mm x 100 mm) spaced 75 to 100 mm around the trunk strapped to the trunk of the trees to protect the tree trunk from construction impact damages.

3.5 Excavation and Backfill at the Base of Trees

.1 Minimize stripping of topsoil and vegetation around the base of trees and shrubs to be preserved.

.2 Auguring under existing trees will be an acceptable method of underground installations.

.3 Open trenches at the base of trees is not acceptable. Removal of soil in the tree lawn areas shall be limited to the minimum.

.4 Any other excavation within the 2m radius protective zone must be approved by an Engineer.

.5 Where heavy traffic with construction equipment is anticipated, the Engineer may require a protective layer of mulch 100-150 mm in depth applied around the bases of the trees to avoid compaction of surface roots.

.6 Excavated trees, holes, shafts and trenches associated with construction efforts, and involving exposed roots from adjacent publicly owned trees, shall be kept moist in hot and dry weather to prevent root desiccation. Shading is acceptable where water use is unsafe. If required, moist burlap can be

used to cover exposed roots to avoid drying out.

.7 Backfilling within the 2 m radius protection zone to a depth of 300 mm of the finished grade shall be with a minimum type A soil mix as specified in Section 02645 to allow for proper root regeneration.

3.6 Root Pruning

.1 In the event of major reconstruction efforts, ensure that root pruning be done along the length of the work in an approved manner, such as with a trencher, chain saw, hand saw or pruners.

.2 Root disturbances shall be kept to a minimum during excavation.

.3 A clean severance of the root system is required. Minor root removal, when necessary, shall be done according to approved techniques.

.4 Where major roots come into conflict, the Engineer shall be contacted for input. Alternate construction methods shall be considered where possible to resolve major conflicts.

.5 Roots shall not be torn off with power equipment.

3.7 Limb and Branch Protection

.1 Trees and limbs overhanging the construction area shall not be damaged.

.2 If tree canopy height needs to be raised to allow for reasonable construction clearances, the work shall be performed by qualified persons using proper arboriculture practices.

.3 All tree pruning work must be performed according to the safety standards as prescribed under the Nova Scotia Department of Labour.

3.8 Remedial Repair Work to Trees	.1	During the course of construction, immediately notify the Engineer of any significant damage to a tree or trees.
3.9 Trees Damaged, Removed or Lost Due to Construction	.1	Trees removed without prior authority from the Engineer, shall be replaced at the contractor's expense.
	.2	In general, destroyed trees are to replaced at the rate of one tree for every tree lost with a minimum size of 60 mm calliper measured 15 cm from the base of the tree.
	.3	The location and species of replacement trees is to be determined by the Owner.
	.4	In the event that trees that are larger than the maximum transplantable size are destroyed or damaged, costs may be deducted from monies otherwise due.
3.10 Tree Mortality	.1	Mortality will incur removal and disposal costs which are to be determined by size, tree replacement costs, market price of the largest transplantable tree of the same species and may include the appraised value as determined by the current International Society of Arboriculture methods.
3.11 Quality Control & Final Inspection	.1	Final Inspection: .1 Prior to substantial performance of the contract where trees have been damaged, the Engineer shall arrange for a final inspection of all trees on the project with the contractor.
	.2	All repair/replacement monies due as a result of tree damage by the contractor, may be deducted from monies otherwise due.

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END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for preparation of subgrade, provision, placement, and fine grading of topsoil for seeded and sodded lawn areas, planting beds, and individual planting pits. Work includes supply and placement of materials, complete with all related components and accessories.

1.2 Related Sections

.1	Environmental Protection	Section 01 57 00
.2	Clearing and Grubbing	Section 31 10 00
.3	Earthwork	Section 31 20 00
.4	Planting of Trees, Shrubs and Groundcover	Section 32 90 00
.5	Protection of Existing Trees	Section 32 91 10
.6	Seeding and Sodding	Section 32 92 00

1.3 Reference Standards

.1 Canadian Nursery Landscape Association – Canadian Standards for Nursery Stock – latest edition.

.2 Soil and Compost Guidelines 1st Edition Landscape Nova Scotia 2003.

.3 Soil and Compost Guidelines 1st Edition Landscape Nova Scotia 2003.

1.4 Source Quality Control

.1 Inform Engineer of proposed source of topsoil to be supplied and provide access for sampling.

.2 Arrange to have testing of topsoil. Testing to be carried out by N.S. Dept. of Agriculture laboratory or other approved laboratory.

.3 Test topsoil from source prior to stripping and stockpiling for clay, sand and silt, coarse fragments, particle size, N, P, K, Mg, and organic matter.

.4 Perform pH test to determine required treatment to bring pH value of soil to 5.5 – 7.0 level. Test stockpiled soil after it has been spread in place.

.5 Submit two copies of soil analysis and recommendations for corrections to Engineer.

.6 Implement recommendations.

1.5 Delivery, Storage and Protection

.1 Schedule deliveries to minimize storage at job site without causing delays.

.2 Protect newly graded and filled areas from washouts and settlements caused by rain and water damage. Fill and grade settled or washed out areas to required levels and slopes as specified.

1.6 Scheduling

.1 Schedule topsoiling and finish grading operations to coincide with seeding, sodding, and planting operations.

1.7 Samples

.1 Submit samples in accordance with Section 01001 for items listed in Supplementary Specifications.

PART 2 - PRODUCTS

2.1 Landscape Fill

.1 Site excavated material, or selected material from excavation or other sources, unfrozen, free from rocks, roots larger than 75 maximum dimension, sods, debris, or other deleterious materials, as approved by Engineer.

2.2 Topsoil

.1 Imported, manufactured or site prepared from friable loam that is neither heavy clay nor of very light sandy in nature free from debris, vegetation, toxic materials and stones and roots over 50 mm maximum dimension and any other deleterious materials that might inhibit plant growth and development. The organic matter is to be limited to a maximum of 20% by volume.

.2 Topsoil to be rated to be classified to the USDA Soil Texture Triangle. Refer to soil rating chart in paragraph 2.2.3. A

"B" rated soil is recommended as a minimum for sodded areas and an "A" rated soil is recommended for seeded areas, or as specified in the Project Documents. Manufacture topsoil or topsoil derived from site sources is to be improved as necessary to meet topsoil qualifications above.

.3 Topsoil Suitability – Standard Topsoil Triangle:

.1 This rating indicates the kind and severity of limitations if the soil is used without corrective measures to grow "normal" landscaping stock (i.e., excluded rhododendrons, blueberries, and other plants with special soil requirements). It does not account for socio-economic factors such as markets or accessibility that make some materials desirable for development regardless of related development costs.

.2 The degree of limitation or soil suitability is determined by the most restrictive (least suitable) rating assigned to any of the listed soil properties. The cumulative effect of individual soil properties may act to further downgrade a soil.

	Rating			
Soil Factor	**A**	**B**	**C**	**D**
pH	6-7.5	5-7.5	4-7.5	4-7.5
Organic Matter	4.0-8.0	2.0-*8.0*	1.0-8.0	u/a
Coarse Fragments	<5%	<10%	<20	20-50%

Definitions:

pH: as measured in water.

Organic Matter: Walkley Black method or equivalent (% by weight)

Coarse Fragments: Particles over 2mm in diameter (% by volume)

2.3 Manure	.1	Well rotted, unleached cattle manure, not less than eight months or more than two years old, free of harmful chemicals and substances, containing no more than 25% straw, leaves or other materials unsuitable for planting use.
2.4 Peat Moss	.1	Derived from partially decomposed fibrous or cellular stems and leaves of species of sphagnum mosses.
	.2	Elastic and homogeneous; brown in colour.
	.3	Free of wood and deleterious material which could inhibit growth.
	.4	Shredded particle minimum size 5 mm.
2.5 Bone Meal	.1	Raw bone meal, finely ground with a minimum analysis of 2% nitrogen and 20% phosphoric acid.
2.6 Fertilizer	.1	Complete non-toxic, no-burning, slow release fertilizer.
	.2	Fertilizer analysis for hydroseeding areas, sodding areas and planting areas as determined from soil sample test.
2.7 Limestone	.1	Ground agricultural limestone containing minimum 85% of total carbonates.
	.2	Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
2.8 Planting Soil Mixture	.1	Mechanically mix: 9 parts topsoil with 1 part well-rotted manure, compost or peat moss. .1 Incorporate bone meal at rate of 3 kg bone meal per cu. m. .2 Incorporate fertilizer at rate determined by soil sample test.
2.9 Compost	.1	Mixture of soil and decomposing organic matter containing 40% or more organic matter as determined by the LOI test or its equivalent under the Walkley-Black test.

.2 Product must be sufficiently decomposed (i.e., stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50), and contain no toxic or growth inhibiting contaminates.

.3 Composed bio-solids must meet the requirements of the guidelines for Compost Quality, Category (A) (B) produced by the Canadian Council of the Ministers of the Environment (CCME), January 1996.

PART 3 - EXECUTION

3.1 General

.1 The Contractor shall be a member in good standing of Landscape Nova Scotia Horticultural Trades Association.

.2 Where required, raise subgrade to rough grade levels with landscape fill, deposit in layers not exceeding 200 mm. Consolidate each layer to minimum 93% Standard Proctor Density.

3.2 Preparation of Existing Grade for Seeding, Sodding and Planting

.1 Verify that subgrade elevations are correct.

.2 Grade soil. Eliminate uneven areas and low spots to ensure positive drainage. Remove soil contaminated with toxic materials from site as required by the N.S. Department of Environment.

.3 Cultivate entire area which is to receive topsoil to a depth of 100 mm where practical. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted the soil.

.4 Remove surface debris, roots, vegetation, branches, and stones in excess of 50 mm in diameter.

3.3 Preparation of Lawn Areas and Planting Beds

.1 Establish subgrade for lawn areas, planting beds and planting pits.

.2 Excavate or fill, and rough grade to the following depths below finished grades:
.1 100-150 mm for sodded areas after compaction.
.2 150 mm for seeded areas after compaction.
.3 500 mm minimum for planting beds.
.4 500 mm minimum deep and 1000 mm minimum diameter for individual tree planting pits to ensure minimum 300 mm planting soil around rootball as specified in Section 32 90 00.

3.4 Placing Topsoil

.1 Do not spread approved topsoil until subgrade has been approved by Engineer.

.2 Spread topsoil/planting soil mix with adequate moisture in uniform layers over approved, unfrozen subgrade where planting is indicated.

.3 Place topsoil to the depths indicated in 3.3.2.
.1 As per Section 32 90 00, Planting of Trees, Shrubs, and Groundcover for individual plant pits.

.4 Topsoil is to be lightly compacted. Keep topsoil 15 mm below finished grade for sodded areas. For seeded areas, bring topsoil to finished grade.

3.5 Soil Amendments

.1 Apply lime or other soil amendments at specified rate as determined by soil sample test.

.2 Mix soil amendment well into full depth of topsoil prior to fertilizer application.

3.6 Fertilizer

.1 Fertilizer type and rate of application to be determined from soil test and approved by Engineer.

.2 Spread fertilizer uniformly over entire area of topsoil.

3.7 Finish Grading

.1 Fine grade entire topsoil area to contours and elevations as indicated or directed. Eliminate rough spots and low areas to ensure positive drainage.

.2 Prepare loose friable bed by means of raking prior to sodding.

.3 Leave surface smooth, uniform, and firm against deep foot printing, with a fine loose texture using approved equipment.

3.8 Acceptance

.1 Engineer will inspect and test topsoil in place and determine acceptance of material, depth, and finish grading.

3.9 Clean Up

.1 Remove surplus materials at no additional cost to the contract.

END

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PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for seeding and sodding. Work includes supply and placement of sods, supply and application of seed, complete with all related components and accessories.

1.2 Related Sections

.1	Environmental Protection	Section 01 57 00
.2	Clearing and Grubbing	Section 31 10 00
.3	Earthwork	Section 31 20 00
.4	Planting of Trees, Shrubs and Groundcover	Section 32 90 00
.5	Protection of Existing Trees	Section 32 91 10
.6	Topsoiling and Finish Grading	Section 32 91 19

1.3 Reference Standards

.1 Canadian Nursery Landscape Association – Canadian Standards for Nursery Stock – latest edition.

1.4 Quality Control

.1 Obtain approval of sod and seed sources.

1.5 Delivery, Storage and Protection

.1 Schedule deliveries to minimize storage at job site without causing delays.

.2 Deliver and store grass seed in original containers showing:
.1 Analysis of seed mixture by percentage of mass for each ingredient.
.2 Net mass of the package.
.3 Grade and name of the mixture.
.4 Name and address of the distributor.
.5 Date and viability information of seed.

1.6 Scheduling

.1 Schedule seeding and sodding operations to coincide with topsoil operations.

1.7 Samples

.1 Submit samples in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

.2 Provide product data for seed, mulch, tackifier, and fertilizer.

1.8 Warranty

.1 Notwithstanding GC 12.3 – WARRANTY, provide warrant that the seeded and sodded areas will be maintained to remain healthy and free of defects for one full growth season from final acceptance date or other as specified in Project Documents.

PART 2 - PRODUCTS

2.1 Seed

.1 Canada No. 1 Grade to Government of Canada Seeds Act and Seeds regulations where applicable having a minimum germination of 80% and minimum purity of 85%. Seed mixture: turf type varieties: 40% Kentucky Blue Grass; 40% Fescue; 20% Rye Grass or as specified in the Project Documents.

2.2 Sod

.1 Number (#1) Kentucky Bluegrass – Sod grown from one or more Kentucky Bluegrass cultivars or Kentucky Bluegrass/Fine Fescue Sod – grown from a seed mixture containing 90-95% by weight of Kentucky Bluegrass cultivars and 5-10% by weight of creeping red chewing or hard fescue cultivars or as specified in the Project Documents.

.2 Broken, dry, discoloured pieces will be rejected.

2.3 Water

.1 Free of impurities that would inhibit plant growth.

2.4 Seed Fertilizer

.1 To Canada “Fertilizers Act” and “Fertilizers Regulations.”

.2 Complete synthetic, slow release with 35% of nitrogen content in water soluble form.

.3 Ratio spring seeding 1:2:2; ratio fall seeding 1:4:4 or as recommended by the Nova Scotia Agricultural College Soils Department or by an approved soils lab.

2.5 Sod Fertilizer

.1 Complete synthetic, slow release with maximum 35% water soluble nitrogen.

.2 Ratio for spring sodding: 1:2:2; fall sodding: 1:4:4.

.3 Ratio for year one maintenance applications: May 3:0:0, July 3:1:3, September 1:2:3, or as recommended by the Nova Scotia Agricultural College Soils Department or by an approved soils lab.

2.6 Seed Mulch

.1 Fibre: wood or wood-cellulose fibres free of germination or growth-inhibiting ingredients and forming blotter like ground cover allowing absorption and percolation of water.

.2 Capable of dispersing in water to form homogeneous slurry.

.3 Capable of forming an absorptive mat ground cover allowing water percolation.

2.7 Seed Tackifier

.1 Water diluted liquid dispersion containing polyvinyl acetate polymer emulsion.

2.8 Wooden Pegs

.1 17 x 17 x 150 mm or approved 150 mm long steel staples.

2.9 Wire Mesh

.1 40 mm, chicken wire, jute, synthetic, plastic.

2.10 Herbicide

.1 Type, rate, and method of application subject to approval by Engineer and applicable government agencies.

2.11 Equipment

.1 Truck (hydraulic):
.1 Slurry tank: approved commercial hydraulic equipment.
.2 Pumps capable of maintaining continuous non-fluctuating flow of solution.

.2 Seeder (mechanical):
.1 Use “Brillion” type landscape seeder that accurately places seed at specified depth and rate and rolls in single operation.
.2 Use acceptable equipment and method.

PART 3 - EXECUTION

3.1 General

.1 The Contractor shall be a member in good standing of Landscape Nova Scotia Horticultural Trades Association.

3.2 Field Conditions

.1 For seeding, do not perform work under adverse field conditions such as wind speeds over 20 km/h, frozen ground or ground covered with snow, ice or standing water, or temperatures which inhibit seed germination unless otherwise approved by the Engineer.

.2 For hydraulic seeding, take reasonable care to prevent spraying items such as structures, signs, guard rails, fences, plant material, and utilities.

.3 Where contamination occurs, remove seeding slurry to satisfaction of, and by means approved by, Engineer.

3.3 Preparation of Surfaces

.1 To Section 32 91 19 – Topsoiling and Finish Grading.

3.4 Mechanical Seeding

.1 Seed during local growing season when natural moisture is available and temperature is suitable to ensure germination and growth.

.2 Apply fertilizer as specified and according to soil test equipment prior to seeding and work lightly into soil bed.

.3 Use Brillion type mechanical seeder to place seed at specified depth and rate, and roll in single operation.

3.5 Sodding

.1 Topsoiling and finish grading to Section 32 91 19.

.2 Apply fertilizer at rate recommended by soil sample test.

.3 Lay sod as soon as possible after lifting to ensure proper establishment.

.4 Where new sodding abuts existing lawn, cut edge of existing sod with sharp tool in straight line. Lay new sod flush with level of existing lawn.

.5 Lay sod in rows, parallel with contours,

smooth and flush with adjoining areas, and with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Butt sections against curb flush with top of curb, ensure topsoil is well compacted behind curbing. Cut out irregular or thin sections with a sharp knife, edger or equivalent. Where sod abuts concrete curb, compact soil behind curb and lay top of sod flush with top of curb.

.6 Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

.7 Water sod immediately after laying as dictated by weather conditions to obtain moisture penetration through sod into 100 mm of topsoil.

.8 Roll sod with a roller having a mass of 50 kg/m of width. Repeated rolling to correct irregularities in grade is not permitted.

3.6 Sod Placement on Slopes and Pegging

.1 For slopes steeper than (1) horizontal or (2) vertical, install and secure with mesh, in area indicated, in accordance with the manufacturer’s instructions.

.2 Start laying sod at bottom of slopes.

.3 Peg sod on slopes steeper than (3) horizontal to (1) vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to the following pattern:

.1 100 mm below top edge at 200 mm on center for first sod sections along contours of slopes.

.2 Not less than 3-6 pegs per square metre.

.3 Not less than 6-9 pegs per square metre in drainage structures.

.4 Adjust pattern as directed by Engineer.

.5 Drive pegs to 20 mm above soil surface of sod section.

3.7 Hydraulic Seeding

.1 Seed during local growing season when natural moisture is available and temperature is suitable to ensure germination and growth.

.2 Measure all quantities of material by weight or by weight-calibrated volume measurement.

.3 Charge seeder with water, and while agitating, slowly add mulch, seed, fertilizer and lime until all components are thoroughly mixed.

.4 When required, add erosion control agent to seed and mix thoroughly to complete seeding slurry.

.5 Slurry application per 100 m^2:
.1 Seed - 2.0 kg or as recommended by seed supplier.
.2 Fertilizer – Not less than 1650 g of phosphorus per 100 m^2.
.3 Mulch - 10 kg
.4 Erosion control agent - as recommended by manufacturer
.5 Water - minimum 100 litres.
.6 Lime - as determined by soil analysis

.6 Apply slurry uniformly, blending into existing grassed areas. Slurry shall be thick enough to prevent grass seed from drying and blowing but not to impact germination and growth. Reshoot areas where application is not uniform.

.7 Remove slurry from items and areas not designated to be sprayed.

3.8 Maintenance During Establishment Period

.1 Perform the following maintenance operations from time of seeding and or sodding to acceptance:
.1 Repair dead or bare spots to allow establishment of seed and sod prior to acceptance.
.2 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing shrinkage or erosion.
.3 Cut grass to 50 mm, a minimum of twice, when it reaches a height of 70 mm. Remove clippings.

.4 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half the required amount of fertilizer in one direction and the remainder at right angles.

.5 Fertilize sodded areas one month after sodding. Spread evenly at manufacturer's suggested rate. Postpone fertilizing until next spring if application falls within four-week prior to expected end of growth season.

.6 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.

.7 Where continued maintenance is required after final acceptance, commence maintenance immediately following installation of work. Continue it for one year following final acceptance at Project completion.

.8 Notify Engineer upon completion of maintenance period to arrange inspection and transfer maintenance responsibility to Owner.

.9 Where Municipal (By-laws) Regulations prohibit the use of Federally or Provincially approved pesticides, and the available (alternative) non-pesticide controls are not acceptable to the Contractor, the application of pesticides to control weeds, insects, fungus and disease shall be deemed to be removed from Maintenance during Establishment Period.

3.9 Acceptance

.1 Grassed areas will be accepted upon completion of the second mowing provided that:

.1 Growth is properly established.

.2 Area is free of bare and dead spots and 98% weed free subject to section 3.8.9.

.3 Minimal surface soil is visible when grass has been cut to a height of 5O mm.

.2 Areas sodded or seeded in the fall will be accepted the following spring, one month after the start of growing season provided that acceptance conditions have been met.

.3 Continue maintenance and mowing until acceptance.

3.10 Clean Up

.1 Remove surplus materials at no additional cost to the contract.

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END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for reinstatement of surfaces, property, and structures damaged or disturbed by operations under this Contract. Work includes but is not limited to reinstatement of paved, gravelled and grassed surfaces; sidewalks, curbs and gutters; and ditches and culverts.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Metal Fabrications	Section 05 50 00
.3	Earthwork	Section 31 20 00
.4	Asphalt Concrete Paving	Section 32 12 16
.5	Walks, Curbs and Gutters	Section 32 16 00
.6	Trees, Shrubs and Groundcover:	Section 32 90 00
.7	Topsoiling and Finish Grading	Section 32 91 19
.8	Seeding and Sodding	Section 32 92 00
.9	Water Mains	Section 33 11 00
.10	Sanitary Sewers	Section 33 31 00
.11	Pressure Sewers	Section 33 34 00
.12	Precast Manholes, Catch Basins and Structures	Section 33 39 00
.13	Storm Sewers and Culverts	Section 33 40 00
.14	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 Province of Nova Scotia Department of Transportation and Infrastructure Renewal Specification - Highway Construction and Maintenance.

PART 2 - PRODUCTS

2.1 Materials

.1 Gravels: Type 1 to Section 31 20 00.

.2 Asphalt Concrete Materials: to Province of Nova Scotia Department of Transportation and Infrastructure Renewal Specification, Division 4, Section 4 - Highway Construction and Maintenance.

.3 Concrete Materials: to Section 03 30 00.

.4 Culverts: to Section 33 40 00.

.5 Topsoiling and Finish Grading: to Section 32 91 19.

.6 Seeding and Sodding: to Section 32 92 00.

.7 Trees, Shrubs and Groundcover: to Section 32 90 00.

2.2 Mixes

.1 Asphalt Concrete:
.1 Roads: to Section 32 12 16
.2 Walks and Curbs: to Section 32 16 00

.2 Portland cement concrete: to Section 03 30 00.

PART 3 - EXECUTION

3.1 General

.1 Reinstate all surfaces to lines, elevations and dimensions which existed prior to construction and to match abutting surfaces.

.2 Make good all damage or disturbances to surfaces, survey markers, properties and structures disturbed during construction.

3.2 Gravel Surfaces

.1 Place, spread, and fine grade Type 1 gravel to minimum compacted thickness of 150 mm for shoulders and other gravel surfaces. Compact to 100% Standard Proctor Density.

3.3 Asphalt Concrete Surfaces	.1	Make vertical saw cut to full depth of asphalt concrete in straight lines. Cut back 300 mm minimum from edge of excavation or beyond to eliminate tension cracks.
	.2	Place or remove gravel to depth indicated.
	.3	Shape, fine grade and compact gravel surface to 100 percent Standard Proctor Density.
	.4	Clean contact surfaces and apply tack coat prior to placing asphalt concrete.
	.5	Place and compact hot-mix, hot-placed asphalt concrete to Section 32 12 16, and to following minimum thickness as indicated: .1 Sidewalk: 50 mm .2 Other Surfaces: 75 mm
3.4 Asphalt Concrete Curbs	.1	Cut back existing curb to full cross section, clean asphalt concrete contact surfaces and apply tack coat prior to placing asphalt concrete curb.
	.2	Place hot-mix, hot-placed asphalt concrete to Province of Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification - Highway Construction and Maintenance. Use curb machine having mould dimensions equal to those of the existing asphalt concrete curb. Hand placing not permitted unless approved.
3.5 Concrete Walks, Curbs and Gutters	.1	Construct concrete walks, curbs and gutters to Section 32 16 00.
	.2	Terminate reinstatement at nearest existing control joint or as directed.
3.6 Landscaped Surfaces	.1	Fine grade to smooth surface all areas to be reinstated.
	.2	Reinstate landscaped surfaces to Sections 32 91 19, 32 92 00 and 32 90 00.
3.7 Ditches	.1	Re-establish ditches to provide drainage that existed prior to construction.
3.8 Culverts	.1	Repair or replace all damaged culverts

with new culvert of same material and to lines, elevations, and dimensions as original unless otherwise indicated.

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3.8 Service Connections
3.9 Hydrostatic and Leakage Testing
3.10 Flushing and Disinfection
3.11 Connections to Existing Main

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing water mains and services. Work includes supply, installation and testing of pipe, fittings and service connections, and disinfection.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Metal Fabrications	Section 05 50 00
.3	Earthwork	Section 31 20 00
.4	Reinstatement	Section 32 98 00
.5	Precast Manholes, Catch Basins and Structures	Section 33 39 00
.6	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 ANSI/ASME B16.1-2005, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

.2 ANSI/AWWA C104/A21.4-08, Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water.

.3 ANSI/AWWA C105/A21.5-05, Polyethylene Encasement for Ductile-Iron Pipe Systems.

.4 ANSI/AWWA C110/A21.10-08, Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in., (75 mm Through 1200 mm) for Water and Other Liquids.

.5 ANSI/AWWA C111/A21.10-07, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

.6 ANSI/AWWA C151/A21.51-02, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.7 ANSI/AWWA C153/A21.53-06, Ductile-Iron Compact Fit-tings, 3 in. Through 24 in. (76 mm Through 610 mm) and 54 in. Through 64 in. (1400 mm Through 1600 mm) for Water Service.

.8 ANSI/AWWA C301-07 Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids.

.9 ANSI/AWWA C302-04, Reinforced Concrete Pressure Pipe, Non-cylinder Type.

.10 ANSI/AWWA C303-02 Reinforced Concrete Pressure Pipe, Steel Cylinder Type.

.11 ANSI/AWWA C502-05, Dry-Barrel Fire Hydrants.

.12 ANSI/AWWA C504-06, Rubber-Seated Butterfly Valves.

.13 ANSI/AWWA C509-01, Resilient-Seated Gate Valves for Water Supply Service.

.14 ANSI/AWWA C600-05, Installation of Ductile Water Mains and Their Appurtenances.

.15 ANSI/AWWA C606-04, Grooved and Shouldered Joints.

.16 ANSI/AWWA C651-05, Disinfecting Water Mains.

.17 ANSI/AWWA C800-05, Underground Service Line Valves and Fittings.

.18 ANSI/AWWA C900-07, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. (100 mm) Through 12 in.(300 mm), for Water Distribution.

.19 ANSI/AWWA C901-08, Polyethylene (PE) Pressure Pipe and Tubing, ½ in. (13 mm) Through 3 in. (76 mm), for Water Service.

.20 ANSI/AWWA C905-97, Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 in. Through 36 in. (350 mm Through 900 mm) for Water Transmission.

.22 ANSI/AWWA C906-07 Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) Through 63 in. (1,600 mm), for Water Distribution and Transmission.

.23 ASME B18.2.1-2005, Square and Hex Bolts and Screws, Inch Series.

.24 ASTM A183-03, Carbon Steel Track Bolts and Nuts.

.25 ASTM A276-08a, Stainless and Heat-Resisting Steel Bars and Shapes.

.26 ASTM B62-02, Composition Bronze or Ounce Metal Castings.

.27 ASTM B88-03, Seamless Copper Water Tube.

.28 AWWA B300-04, Hypochlorites.

.29 AWWA B301-04, Liquid Chlorine.

.30 CAN/ULC S701-05, Thermal Insulation, Polystyrene, Board and Pipe Coverings.

.31 CAN/CSA B137 Series-05, Thermoplastic Pressure Piping Compendium.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

.2 For concrete pressure pipe and fittings submit tabulated materials list and drawings indicating internal pressure rating, maximum external load, type of joints and identification mark numbers.

1.5 Certificates

.1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

1.6 Handling and Storage

.1 Handle and store pipe, valves and fittings, in such manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore. Do not damage coatings or linings.

.2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

.3 Store hydrants and valves to prevent retention of water and damage by freezing.

1.7 Scheduling of Work

.1 Coordinate and organize work to minimize interruptions to existing services.

.2 Notify Engineer and building occupants a minimum of 24 hours in advance of planned interruptions in service.

.3 Do not interrupt water service except between 10:00 a.m. and 4:00 p.m. local time, unless otherwise authorized.

.4 Notify Fire Department of any planned or accidental interruption to water service.

PART 2 - PRODUCTS

2.1 General

.1 Diameter, material and strength class of pipe and fittings: as indicated.

2.2 Ductile Iron Pipe and Fittings

.1 Pipe: to AWWA C151, cement mortar lined.

.2 Fittings: to AWWA C110 or C153, cement mortar lined, minimum pressure rating 1035 kPa for cast, 1720 for ductile iron.

.3 Cement Mortar Lining: to AWWA C104. Provide internal seal coat when required by Project Documents.

.4 Joints: mechanical or push-on to AWWA C111; flanged where indicated, to AWWA C110 with Class 125 flanged ends to ANSI/ASME B16.1.

2.3 Polyvinyl Chloride Pipe and Fittings

.1 Pipe and Joints: to CAN/CSA B137.3, AWWA C900 or AWWA C905 cast-iron outside diameter, gasketed bell-end joint.

.2 Fittings:
.1 PVC: to CAN/CSA B137.
.2 Gray or ductile-iron: to AWWA C110 and C153 cement mortar lined to AWWA C104, minimum pressure rating 1035 kPa for cast, 1720 kPa for ductile iron.

2.4 Concrete Pressure Pipe

.1 Pipe and Fittings:
.1 Steel cylinder type, pre-stressed,

and Fittings

concrete lined: to AWWA C301 (L).
.2 Steel cylinder type, pre-stressed, concrete embedded: to AWWA C301 (E).
.3 Non-cylinder type: to AWWA C302.
.4 Steel cylinder type, pre-tensioned, concrete lined: to AWWA C303.

.2 Joints: bell and spigot with confined O-ring gasket, protected with approved mortar.

2.5 Polyethylene Pipe and Fittings

.1 Pipe:
.1 13 to 76 mm diameter: to AWWA C901.
.2 100 mm diameter and larger: to AWWA C906.

.2 Joints:
.1 Thermal Butt Fusion.
.2 Electro-fusion coupling.
.3 Mechanical Connections: polyethylene flange end with metal back-up ring.

.3 Fittings:
.1 Polyethylene: to AWWA C901 and AWWA C906.
.2 Flanged cast-iron: to AWWA C110.

2.6 Hydrants

.1 Dry barrel type: to AWWA C502 and as follows:
.1 Depth of bury: as indicated.
.2 Barrel: two-piece with safety break-away flange and stem.
.3 Main valve: compression type, 134 mm minimum diameter.
.4 Inlet connection: mechanical joint, 150 mm diameter.
.5 Nozzles: two hose and one pumper, with threads to standard of Fire Authority having jurisdiction.
.6 Direction of opening: counter-clockwise or as indicated by the Project Documents.
.7 Operating nut: 32 mm square.
.8 Colour: to standard of Fire Authority having jurisdiction.

2.7 Gate Valves

.1 Buried: to AWWA C500, minimum pressure rating 1035 kPa or AWWA C509 up to 300 mm, minimum working pressure rating 1380 kPa and as follows:
.1 Body: cast-iron with mechanical joint ends.

.2 Mechanism (AWWA C509): wedge disc with resilient rubber seat ring and machined seating surface, non-rising spindle, and O-ring seals.
.3 Direction of opening: counter-clockwise.
.4 Operating nut: 50 mm square.
.5 Provide centering disc.

.2 In chamber: to AWWA C509 up to 300 mm, minimum working pressure rating 1380 kPa and as follows:
.1 Body: cast-iron with Class 125 flanged ends to ANSI/ASME B16.1.
.2 Mechanism (AWWA C509): wedge disc with resilient rubber seat ring and machined seating surface, O.S.& Y., rising stem and handwheel.
.3 Direction of opening: counter-clockwise.

2.8 Butterfly Valves

.1 Buried: to AWWA C504, short body, Class 150 B, minimum pressure rating 1035 kPa and as follows:
.1 Body: cast-iron with mechanical joint or flanged ends.
.2 Mechanism: cast-iron, cast steel, alloy cast iron or ductile iron disc, type 304 stainless steel shafts to ASTM A 276, rubber seated for positive shut-off at minimum 1035 kPa differential pressure, either direction.
.3 Direction of opening: counter-clockwise.
.4 Operating nut: 50 mm square.

.2 Chamber: to AWWA C504, short body, Class 150 B, minimum pressure rating 1035 kPa and as follows:
.1 Body: cast iron with flanged ends.
.2 Mechanism: cast-iron, cast steel, alloy cast iron or ductile iron disc, type 304 stainless steel shafts to ASTM A 276, rubber seated for positive shut-off at minimum 1035 kPa differential pressure, either direction. Provide handwheel operator.
.3 Direction of opening: counter-clockwise.

.3 Epoxy coat all butterfly valves with minimum 150 micron coating.

2.9 Valve Boxes

.1 Valve Boxes:
.1 Cast-iron, slide type, adjustable for depth of pipe below finished grade or composite valve box.
.2 Covers marked "Water".
.3 Lugged to prevent turning and rolling of cover, and cover notched to suit.

2.10 Service Pipe and Fittings

.1 Copper tubing: to ASTM B 88, type K annealed, minimum pressure rating 1035 kPa.

.2 Polyethylene pipe: to CAN/CSA B137, type PE, Series 160.

.3 Joints: compression type, minimum pressure rating 1035 kPa. For polyethylene pipe, to CAN/CSA B137, with stainless steel liner.

.4 Corporation stop: brass to ASTM B62, compression type, inlet threads to AWWA C800.

.5 Curb stop and drain: brass to ASTM B62, compression type joints and O-ring seal.

.6 Service clamp: bronze body, confined O-ring seal cemented in place, and straps suitable for connecting main. Outlet tapped and threaded to AWWA C800.

.7 Service box: adjustable type, cast-iron bottom section, cast-iron lid with recessed pentagon nut and internal stem to suit depth of bury. Service box to have appropriate foot piece.

2.11 Gaskets and Bolts for Flanges

.1 Gaskets: unless otherwise specified, full face one piece red virgin rubber gaskets of 3 mm thickness to be supplied for all flange joints.

.2 Bolts: unless otherwise specified, all steel bolts and nuts to be American Standard threads of the coarse thread series, conforming to ANSI B18.2.1. Bolts, heads and nuts to be hexagonal. Length of any bolt to be such that it will not project beyond nut more than 10 mm or less than 5 mm and no bolt shall be less than diameter of the hole in which

		it fits by more than 3 mm. Bolts to be utilized for all flanged joints unless otherwise indicated. Studs or "stub bolts" may be used for certain connections only when approved by the Engineer.
2.12 Couplings	.1	Mechanical joint sleeve type: to AWWA C110 for use on new ductile iron pipe. Provide spacer ring between pipe ends.
	.2	Grooved and shoulder type: to AWWA C606 with malleable iron housing, halogenated butyl gasket and heat treated, plated carbon steel bolts and nuts to ASTM A183.
	.3	Collar type: steel with minimum pressure rating 1035 kPa, appropriate to the type and size of pipe being joined, epoxy-coated with type 316 stainless steel bolts and nuts.
2.13 Thrust Restraint	.1	Thrust blocks and anchors: 20 MPa concrete and 15 M, Grade 400 reinforcing steel where indicated.
	.2	Mechanical joint restraint device: (100 mm to 600 mm) ductile iron follower gland to AWWA C153 and C111 with multiple wedge restraining mechanism, minimum pressure working rating 2410 kPa and minimum safety factor of 2:1. Lugs to have twist-off torque nuts.
2.14 Disinfectant	.1	Sodium hypochlorite or calcium hypochlorite: to AWWA B300.
	.2	Liquid Chlorine: to AWWA B301.
2.15 Reducing Agent	.1	Hydrogen Peroxide, 35% by mass commercial grade.
2.16 Insulation	.1	Insulation: to ULC S701, Type 4, extruded polystyrene.
2.17 Marker Stake	.1	Timber, 40 mm x 90 mm.
2.18 Geosynthetic	.1	Synthetic fibre, rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents. Non-woven construction, with minimum thickness of 2 mm and minimum density of 200 g/m^2.

2.19 Anode Packs	.1	Zinc anodes, as directed.
2.20 Polyethylene Encasement	.1	Encasement to be 200 micron polyethylene tube or sheet conforming to AWWA C105.
2.21 Protective Coating	.1	Anti-corrosion petrolatum paste, tape and mastic.

PART 3 - EXECUTION

3.1 Preparation	.1	Carefully inspect products for defects and remove defective products from site.
	.2	Ensure that pipe, fittings, valves and hydrants are clean before installation.
3.2 Trenching, Bedding and Backfilling	.1	Do trenching, bedding and backfilling to Section 31 20 00.
3.3 Pipe Installation	.1	Lay and join pipe, fittings, and valves as specified herein and according to manufacturer's published instructions.
	.2	Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances: Horizontal Alignment: 150 mm Vertical Alignment: 75 mm
	.3	Face bell ends in direction of laying. On grades of 5% or greater lay pipe up grade.
	.4	Do not exceed maximum joint deflection recommended by manufacturer.
	.5	Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipelaying is not in progress.
	.6	Do not use excessive force to join pipe sections.

.7 Install gaskets in accordance with manufacturers published instructions. Use only lubricant supplied by manufacturer. During cold weather store gaskets in heated area to assure that gaskets remain flexible.

.8 Align pipes carefully before joining.

.9 Support pipes as required to assure concentricity until joint is properly completed.

.10 Keep pipe joints free from mud, soil, gravel or other foreign materials.

.11 Avoid displacing gasket or contaminating with soil, petroleum products or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.

.12 Complete each joint before laying next length of pipe.

.13 Where deflection at joints is permitted, deflect only after spigot is fully inserted in bell.

.14 For concrete pressure pipe, install diapers and pour cement mortar into joint recess. Fill inside joint recess with stiff cement grout for pipe 600 mm and larger.

.15 At structures provide flexible joint not more than 1 m from outside face of structure. Support pipe between structure wall and first joint with 20 MPa concrete.

.16 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating and leave smooth beveled edge.

.17 Provide concrete thrust blocks to undisturbed ground on all tees, bends, plugs and caps or as indicated on Project Documents. Construct as indicated and keep joints and couplings free of concrete.

.18 Install mechanical joint restraint to AWWA C111 and tighten lug nuts until all wedges are in firm contact with pipe surface. Continue to tighten alternating between bolts until lug nuts twist off.

.19 Where corrosive soil conditions exist, install polyethylene tube or sheet on all ductile-iron pipe and fittings and install zinc anodes on all valves, hydrant bases, and copper service connections as indicated.

3.4 Undercrossing

.1 Provide shop drawings showing proposed method of installation for pipe in undercrossing.

.2 Excavate working pit according to reviewed shop drawings.

.3 Dewater area of excavation and undercrossing.

.4 Place jacking, boring or tunneling equipment in working pit to approved line and grade of the proposed pipe.

.5 Install encasing pipe to proposed line and grade as indicated.

.6 Use mechanical or welded type joints for encasing pipe.

.7 After encasing pipe has been installed, check line and grade for approval.

.8 Remove any soil that remains in the casing pipe.

.9 Insert pipe into encasement pipe, starting from the working pit.

.10 Place pipe one length at time outside encasement pipe. Maneuver pipe into position

.11 Use approved blocking method to guide pipe in true alignment.

3.5 Hydrant Installation

.1 Install hydrants at locations indicated or where directed.

.2 Install 150 mm gate valve and cast-iron valve box on hydrant anchor tee as indicated.

.3 Set hydrant plumb, with hose outlets parallel to roadway, pumper connection facing roadway and breakaway flange as indicated.

.4 Place concrete thrust blocks as indicated. Do not obstruct drain holes.

.5 Provide drainage not less than 0.5 m^3 in volume and backfill with clear stone to a level 150 mm above drain holes from hydrant to main.

.6 Place geosynthetic over clear stone from hydrant to main.

.7 Notify Engineer if water table is above drain holes. Plug drain holes and install permanent identification marker on hydrant.

3.6 Valve Chambers

.1 Construct valve chambers where and as indicated in accordance with applicable Sections. Do not allow valve chambers to rest upon pipe.

3.7 Valves and Valve Boxes

.1 Install valves at locations indicated. Joints and bedding as specified for pipe and fittings.

.2 On direct buried valves, install valve boxes plumb and centered over operating nut, using centering disc, and true to line and grade.

.3 Use thrust anchors for valves greater than 150 mm on PVC and polyethylene pipe.

3.8 Service Connections

.1 Install services at locations indicated.

.2 Do not tap closer than 1000 mm to adjacent service or pipe joint. Tap water main and install corporation stops at 2:00 o'clock or 10:00 o'clock positions using type of connection and tapping method appropriate for type, size and pressure of water main.

.3 Lay service pipe from water main to curb

stop in evenly graded trench with bedding as indicated.

.4 Install curb stops at street line, or where indicated. Ensure that curb stop is properly oriented.

.5 Leave corporation stop fully open. Operate curb stop to ensure flow, then close curb stop and leave closed.

.6 Install service box over curb stop, set plumb, with top flush with finished grade.

.7 Place temporary marker stake at end of each service lateral, extending from pipe end at pipe level to 600 mm above grade. Paint exposed portion of stake BLUE with designation WATER in black.

3.9 Hydrostatic and Leakage Testing

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests.

.3 Test after services and hydrants are installed.

.4 Backfill prior to testing.

.5 Notify Engineer at least 24 hours in advance of all proposed tests. Perform tests in presence of Engineer.

.6 Open all valves in test section.

.7 Expel air from main by slowly filling with potable water. Install corporation stops at high points where no air vacuum release valves are installed. After testing, remove corporation stops and install plugs.

.8 Fill concrete pipe 24 hours before testing to allow for absorption.

.9 Apply test pressure of 1035 kPa or pressure equal to 1.5 times working pressure, whichever is greater, measured at lowest point in test section. The test shall be conducted over a full two (2) hour period, maintaining a constant test pressure. No leakage is permitted by the test process.

.10 Locate and repair defects if test fails. Retest.

.11 Repair visible leaks regardless of test results.

3.10 Flushing and Disinfection

.1 Flush and disinfect water mains to AWWA C651 and as herein specified. Notify Engineer 24 hours in advance of flushing and disinfection.

.2 Flush water mains with potable water through available outlets with sufficient flow to produce minimum velocity in water main of 1.5 m/s, for 10 minutes. Flush until foreign materials have been removed and water is clear.

.3 Slowly open and close valves and hydrants to ensure thorough flushing.

.4 If satisfactory results cannot be achieved by flushing, swab pipes by approved methods and reflush.

.5 Disinfect water main upon completion of flushing using chlorine solution distributed throughout entire system.

.6 Inject 1% chlorine solution through a corporation cock in the top of newly laid pipe, at point close to where main is being filled and at rate proportional to filling rate. Prepare stock chlorine with concentration of 1% free chlorine by volume as follows:

Product	Amount of Compound	Quantity of Water
High test calcium hypochlorite (67-70% Cl)	1.0 kg	60 litres
Chlorinated lime (32-35% Cl)	1.0 kg	30 litres
Liquid bleach (5.25% Cl)	1.0 litre	3.5 litres
(10.5% Cl)	1.0 litre	7.0 litres

.7 Calcium hypochlorite and chlorinated lime are not to be used when water temperature is less than 5°C.

.8 The following table indicates the quantity of 1% chlorine stock solution required per 100 metre length of pipe.

Pipe Diameter (mm)	1% Chlorine Stock Solution (litres)
100	5
150	11
200	19
250	30
300	43
350	58
400	76
450	97
500	119
600	172
750	268

.9 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.10 Take water samples at all hydrants and termination points, in suitable sequence, to test chlorine residual.

.11 When tests indicate minimum chlorine residual of 50 mg/L, leave system charged with disinfectant solution for 24 hours and ensure minimum chlorine residual of 25 mg/L throughout system.

.12 Flush disinfectant solution from line after 24 hours. Add 1.0% Hydrogen Peroxide reducing agent to the disinfectant solution at point of discharge or within a retention facility such that the solution is disposed to the environment with a total chlorine residual no greater than 0.0 mg/L in accordance with the requirements of Nova Scotia Department of the Environment and Labour. Check chlorine residual before disposal and at regular intervals during disposal to ensure compliance. This dechlorination requirement can only be excluded with the written consent of the Nova Scotia Department of the Environment and Labour.

.13 Dispose of dechlorinated disinfectant solution. Where disposing to the environment, disposal of the dechlorinated solution must be at least 100 m from the nearest watercourse.

.14 Where disinfectant solution is dechlorinated at point of discharge, inject stock reducing agent at a rate proportional to discharge rate. Injection and discharge rates must be monitored continuously to ensure proper proportioning.

.15 Prepare stock reducing agent by volume with concentration of 1% Hydrogen Peroxide (H_2O_2) by mass, as follows:

Liquid Reducing Agent	Amount of Agent (litres)	Quantity of Water (litres)
Hydrogen Peroxide (35% H_2O_2 by mass)	1.0	34

.16 The following table indicates quantity of 1% Hydrogen Peroxide required to reduce total chlorine residual of disinfectant solution contained per 100 metre length of pipe, from 50 mg/L to 0.0 mg/L.

Pipe Diameter (mm)	1% Hydrogen Peroxide Stock Solution (litres)
100	5
150	10
200	18
250	28
300	41
350	55
400	72
450	91
500	113
600	163
750	254

.17 Where total chlorine residual of disinfectant solution exceeds 50 mg/L, quantity of stock reducing agent for dechlorination can be increased in direction proportion to the quantity indicated in the above table.

.18 After the disinfection solution has been flushed from the new water main, assist Engineer in obtaining water samples to confirm adequate disinfection has taken place. The required procedure is:

.1 After disinfection and flushing is complete, take chlorine residuals throughout the portion of the system being tested. Bacteriological samples shall not be collected until such time as total chlorine residual is less than 0.5 mg/l unless the water used for flushing is from the distribution system in which case the samples shall not be collected until such time as the total chlorine residual is equal or less than a value equal to the total chlorine residual in the water used for flushing plus 0.5 mg/l.

.2 After chlorine residuals have been reduced to the levels outlined in step 1, collect a minimum of two samples for bacteriological analysis from representative points throughout the portion of the system being tested. At least one sample should be collected every 366 m of new water main, plus one from the end and at least one from each branch. The sample points shall not include hydrants.

.3 At least 24 hours after collection of the first two samples, collect two additional samples for bacteriological analysis from representative points throughout the portion of the system being tested.

.4 The samples collected in steps 2 and 3 are to be analyzed for total coliform bacteria. The sample bottles will contain a chlorine neutralizing agent. Sampling collection and preservation shall follow the procedure contained in Appendix A of the Nova Scotia Department of Environment and Labour Guidelines for Monitoring Public Drinking Water Supplies. Sample analysis will be conducted by an independent laboratory acceptable to the Engineer following procedures defined in the latest edition of “Standard Methods for the Examination of Water and Wastewater”.

.5 Should the analysis results of any of the samples collected in steps 2 or 3 show the presence of total coliform bacteria, the disinfection procedure and sampling program will be repeated.

.6 Should any of the repeated samples outlined in step 5 show the presence of total coliform bacteria, an investigation to determine the cause of the contamination will be conducted and remediation steps taken to remove the source of contamination to the satisfaction of the Engineer prior to redisinfection and resampling.

.7 The portion of the system being tested will be considered to have been adequately disinfected when the samples taken on two consecutive days show the absence of total coliform

3.11 Connections to Existing Main

.1 Connect new mains to existing mains as indicated.

.2 Prior to cutting into existing main, verify outside diameter and type of pipe. Do not cut main unless all items required to complete connection are on hand.

.3 Valves on existing system will be operated only by the water utility.

.4 After bacteriological tests pass, place water main in service, as directed.

END

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END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing gravity sanitary sewers. Work includes supply, installation, and testing of pipe, fittings and service connections.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Earthwork	Section 31 20 00
.3	Reinstatement	Section 32 98 00
.4	Precast Manholes, Catch Basins and Structures	Section 33 39 00
.5	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 ASTM C14M-07, Concrete Sewer, Storm Drain,and Culvert Pipe (Metric).

.2 ASTM C76M-08a, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)

.3 CAN/CSA A257 Series-03, Standards for Concrete Pipe and Manhole Sections.

.4 CAN/CSA B1800-06, Thermoplastic Non-Pressure Piping Compendium.

1.4 Certificates

.1 Upon request, submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

1.5 Handling and Storage

.1 Handle and store pipe and fittings in such manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore.

.2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

PART 2 - PRODUCTS

2.1 General	.1	Diameter, material, and strength class of pipe and fittings: as indicated.
2.2 Concrete Pipe and Fittings	.1	Pipe and Fittings: .1 Non-reinforced: to ASTM C 14M or CAN/CSA A257.1 .2 Reinforced: to ASTM C 76M or CAN/CSA A257.2
	.2	Joints: bell and spigot with flexible rubber gaskets to CAN/CSA A257.3-M.
2.3 Plastic Pipe and Fittings	.1	Type PSM Polyvinyl Chloride. .1 For diameter 150 mm and under: CAN/CSA B1800. .2 For diameter 200 mm and over: CAN/CSA B1800.
	.2	Joints: bell and spigot with rubber gasket recommended by pipe manufacturer.
2.4 Service Saddles	.1	Concrete or asbestos-cement main: cast-iron or PVC with gasket, stainless steel strap or bolt on, and O-ring in branch end.
	.2	PVC main: PVC strap-on saddle, in-line tee or wye, with gasket, all stainless steel strap and O-ring in branch end.
2.5 Marker Stakes	.1	Timber, 40 mm x 90 mm.
2.6 Grout	.1	Non-shrink: to Section 03 30 00.

PART 3 - EXECUTION

3.1 Preparation	.1	Carefully inspect products for defects and remove defective products from site.
	.2	Ensure that pipe and fittings are clean before installation.
3.2 Trenching, Bedding and Backfilling	.1	Do trenching, bedding and backfilling to Section 31 20 00.
3.3 Pipe Installation	.1	Lay and join pipe and fittings as specified herein and according to manufacturer's published instructions.

.2 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:
Horizontal Alignment: 50 mm.
Vertical Alignment: the lesser of 13 mm or one half the rise per pipe length.

.3 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.

.4 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipelaying is not in progress.

.5 Install gaskets in accordance with manufacturer's published instructions. During cold weather store gaskets in heated area to assure flexibility.

.6 Install polyethylene pipe in accordance with CSA B1800.

.7 Align pipe carefully before joining. Do not use excessive force to join pipe sections.

.8 Support pipes as required to assure concentricity until joint is properly completed.

.9 Keep pipe joints free from mud, silt, gravel or other foreign material.

.10 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.

.11 Complete each joint before laying next length of pipe.

.12 Where deflection at joints is permitted, deflect only after joint is completed. Do not exceed maximum joint deflection recommended by manufacturer.

.13 At structures provide flexible joint not more than 1 metre from outside face of structure.

.14 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer.

.15 Make watertight connections to manholes. Use non-shrink grout when suitable gaskets are not available.

3.4 Undercrossing

.1 Provide shop drawings showing proposed method of installation for pipe in undercrossing.

.2 Excavate working pit according to reviewed shop drawings.

.3 Dewater area of excavation and undercrossing.

.4 Place jacking, boring or tunneling equipment in working pit to approved line and grade of the proposed pipe.

.5 Install encasing pipe to proposed line and grade as indicated.

.6 Use mechanical or welded type joints for encasing pipe.

.7 After encasing pipe has been installed, check line and grade for approval.

.8 Remove any soil that remains in the casing pipe.

.9 Insert pipe into encasement pipe, starting from the working pit.

.10 Place pipe one length at time outside encasement pipe. Maneuver pipe into position.

.11 Use approved blocking method to guide pipe in true alignment.

3.5 Service Connections

.1 Lay and join pipe and fittings to manufacturer's published instructions.

.2 Maintain minimum 2 percent grade or as required by authority having jurisdiction.

.3 Use tee or wye fittings or saddles for connections to sewer. For saddle connections cut hole using appropriate equipment and approved methods.

.4 Make up required horizontal and vertical bends from standard bends of 45 degrees or less, separated by straight section of pipe, having minimum length of four pipe diameters. Use long sweep bends where possible.

.5 Plug service laterals with watertight caps or plugs at termination points. Paint stub ends and caps RED.

.6 Place temporary marker stakes at end of each plugged or capped sewer service lateral, extending from pipe end at pipe level to 600 mm above grade. Paint exposed portion of stake RED with designation SAN in black.

3.6 Testing

.1 If water used for flushing or testing is obtained from a potable water supply, the potable water supply is to be continuously separated from the service being flushed or tested by an air gap or a level or protection equal to or greater than that provided by a double check valve backflow prevention device.

.2 Test each section of sewer. A section is the length of pipe between successive manholes or termination points, including service connections to the street line or termination point.

.3 Provide labour, equipment and materials required to perform testing.

.4 Notify Engineer at least 24 hours in advance of all proposed tests. Perform tests in presence of Engineer.

.5 Flush sewers and related appurtenances to remove foreign materials.

.6 Exfiltration test:
.1 Fill section with water to displace air from main and service connections. Fill and maintain nominal head on concrete and asbestos cement pipe 24

hours before testing to allow absorption of water by pipe material.
.2 Add water to establish test head of 3 metres over either crown of pipe, measured at highest point of section, or level of static ground water, whichever is greater. Do not exceed net internal head of 8 metres.
.3 Maintain test head for 1 hour.
.4 Measure and record volume of water required to maintain head during test period.

.7 Infiltration test:
.1 Conduct infiltration test in place of exfiltration test where level of static ground water is 750 mm or more above crown of pipe measured at highest point of section. No increase in infiltration rate will be allowed if head exceeds 750mm.
.2 Install watertight plug at upstream end of section.
.3 Discontinue dewatering minimum of 3 days before taking test measurements.
.4 Place 90 degree V-notch weir, in invert of main at downstream end of section. Add water until flow is observed through notch.
.5 Measure and record total volume of flow for one hour.

.8 Allowable leakage: determined by the following formula:

$$L = F \times D \times \frac{S}{100}$$

where:

L = allowable leakage in litres per hour
D = Diameter in mm
S = Length of section, in metres
F = leakage factor, (litres per hour per mm of diameter per 100 metres of sewer):

EXFILTRATION TEST:

Porous Pipe F = 0.12 litre
Non-Porous Pipe F = 0.02 litre

INFILTRATION TEST:

Porous Pipe F = 0.10 litre
Non-Porous Pipe F = 0.02 litre

.9 Low Pressure Air Testing

CAUTION:
FOR SAFETY OF PERSONNEL AND PUBLIC, OBSERVE PROPER PRECAUTIONS DURING AIR TESTING. USE TEST EQUIPMENT DESIGNED TO OPERATE ABOVE GROUND. DO NOT PERMIT PERSONNEL IN TRENCH DURING TESTING. DO NOT AIR TEST PIPE WITH DIAMETER GREATER THAN 600 MM.

.1 Provide air testing equipment meeting the following requirements:

.1 Air Blower: 14 litres/sec, maximum pressure 70 kPa continuous.

.2 Pressure Relief Valve: Sized to relieve full blower capacity at maximum blower pressure. Range 20 - 70 kPa, adjustable.

.3 Pressure Gauges: Range 0 to 70 kPa with accuracy +/- 0.25 kPa.

.2 Provide plugs at each end of section, with one plug equipped for air inlet connection.

.3 Fill test section slowly until a constant pressure of 28 kPa is reached. If ground water is above section being tested, Engineer may recommend increase in air pressure.

.4 Allow minimum 2 minutes for air temperature to stabilize, adding only amount of air required to maintain pressure.

.5 After 2 minute period, shut off air supply.

.6 Decrease pressure to 24 kPa. Measure time required for pressure to reach 17kPa. Minimum time allowed for pressure drop is as follows:

Pipe Diameter (mm)	Minimum Time Min:Sec
100	1:53
150	2:50
200	3:47
250	4:43
300	5:40
375	7:05

		450	8:30
		525	9:55
		600	11:20

.7 Locate and repair defects if test fails. Retest.
.8 Repair visible leaks regardless of test results.

3.7 Deflection Testing

.1 Measure deflection by pulling a deflection gauge through each pipe from manhole to manhole after backfilling.

.2 Provide deflection gauges to measure a 5% and 7 1/2% deflection. Gauges to be a "Go-No-Go" device similar to Standard Detail 02517-D2.

.3 Within thirty days after installation, pull a deflection gauge measuring 5% deflection through the installed section of pipeline. If this test fails proceed with 7 1/2% deflection test. If 7 1/2% deflection test fails, locate defect and repair. Retest using same methodology.

.4 Thirty days prior to completion of warranty period, pull a deflection gauge measuring 7 1/2% deflection through the installed section of pipeline. If 7 1/2% deflection test fails, locate defect and repair. Retest using same methodology.

3.8 Inspection

.1 Engineer may require inspection of installed sewers by television camera, photographic camera or by other visual method.

.2 Provide television camera inspection when required by Project Document.

3.9 Closed Circuit Television Inspection

.1 Conduct closed circuit television inspection procedures to meet North American Association of Pipeline Inspectors (NAAPI) and the WRc Standard.

.2 Equipment:
.1 Provide equipment meeting following requirements:
.1 Self-contained, self-leveling monitoring unit and pan-tilt camera with remotely controlled lighting

system capable of varying the illumination.
.2 Picture quality shall produce continuous 600-line resolution picture, showing entire periphery of pipe.
.3 A meter device with readings above ground or marking on cable to clearly identify exact location of camera.

.3 Inspection:
.1 Perform inspection of pipe from manhole to manhole by passing TV camera through sewer in direction of flow.
.2 Classify results in accordance with North American Pipeline Inspectors (NAAPI) and WRc Standard.

.4 Records:
.1 Maintain inspection record in log form, during television inspection.
.2 Log to include location of each fault and service lateral distance measured from centreline of reference manhole and position referenced to axis of pipe.
.3 Photograph fault from the television screen. All photographs to be clear and precise with distinct definition of fault.
.4 Include detailed technical description with photographs as supporting data for each fault.
.5 Provide minimum of two photographs for each sewer main section televised, detailing typical joint, and typical building service lateral.
.6 All photos and videos to be in colour.

.5 Reports:
.1 Provide a composite report of TV inspection. Enclose report in binder on letter size paper. Include following pages and information.
.1 Title page identifying project, camera operator and dates of inspection.
.2 Index page identifying street name, section from manhole to manhole, page number or numbers

where information for section is contained.

.2 Organize inspection records in sequence from upstream manhole to downstream manhole.

.3 Report on each sewer main section to contain:

.1 Heading:

.1 Street name.

.2 Manhole numbers applicable to section.

.3 Reference drawing number, if applicable.

.4 Weather on the day of inspection.

.5 Statement of soil condition in area of inspection, i.e., dry, damp, wet, frozen.

.6 Date of inspection.

.2 Key Plan, showing corresponding manhole numbers, magnetic north, horizontal distance, pipe and material between manholes, and direction of flow.

.3 Inspection findings for each sewer main section to include:

.1 Location of all faults.

.2 Photographs of all faults.

.3 Location of all service laterals.

.4 One photograph each of typical joint and typical when service laterals faults are not found.

.4 Mount photographs on left-hand page and place corresponding description on right-hand page. Number all photographs in order. Number beside photograph to correspond with description number.

.5 Enclose all pages of report in transparent sheet protector.

.6 Accuracy:

.1 Maximum permissible error in accuracy to be within following limits of fault location:

.1 Up to 375 mm pipe: ± 75 mm per 100 m of length.

.2 450 mm - 600 mm pipe: ± 150 mm per 100 m of length.

.3 750 mm - 900 mm pipe: ± 225 mm per 100 m of length.

.7 Video Record:
.1 Supply a complete record of all inspections in digital format.
.2 Index all tapes, listing sections of inspections.
.3 Submit video tapes or DVD with written reports to Engineer.

.8 Repeat Inspection:
.1 Repair faults detected during television inspection. Repeat television inspection at no cost to Owner.

END

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END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing suction lift pumping stations. Work generally includes supply and installation of pumping equipment, pump controller, valves, metal fabrications, and related pipe work.

1.2 Related Sections

.1 Concrete: Section 03 30 00

.2 Earthwork: Section 31 20 00

.3 Sanitary Sewers: Section 33 31 00

.4 Pressure Sewers: Section 33 34 00

.5 Pre-cast Manholes, Catch Basins and Structures: Section 33 39 00

1.3 Reference Standards

.1 ANSI/ASME B-16.1-2005, Class 125, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ANSI/AWWA C104/A21.4-08, Cement Mortar Lining for Ductile-Iron Pipe and Fittings.

.3 ANSI/AWWA C110/A21.10-08, Ductile-Iron and Gray Iron Fittings for Water.

.4 ANSI/AWWA C151/A21.51-02, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.5 CAN/CSA C22.2 No. 100-2004, Motors and Generators.

.6 Canadian Electrical Code.

.7 CSA Bulletin S2619-1998, Information and Documentation

.8 IEEE-112-2004, Standard Test Procedures for Polyphase Induction Motors and Generators.

.9 National Fire Protection Association.

.10 NEMA MG-1-2006, Motors and Generators.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Indicate details of piping, valves, supports, pumps, metal fabrications, enclosure, and appurtenances.

1.5 Operating and Maintenance Data

.1 Provide operating and maintenance data in accordance with Section 01 10 00 and as follows:
.1 System description.
.2 Design parameters, system hydraulics, design calculations, and system curves.
.3 Performance curves for the pumps, layout, and wiring diagrams, control system schematic, level control system schematic.
.4 Related civil, mechanical, and electrical drawings.
.5 Manufacturer's operation instructions.
.6 Name, address, and telephone number of equipment suppliers.
.7 Information on guarantees and warranties.

1.6 Handling and Storage

.1 Handle and store pumps, pipe, valves, and fittings in such a manner as to avoid shock and damage. Do not use chains or cables passed through pipe or equipment. Do not damage coatings ~~of~~ *or* linings.

1.7 Maintenance Material

.1 Manufacturer to maintain, in local inventory, standard maintenance material. Parts to be available for shipment within 24 hours notice.

PART 2 - PRODUCTS

2.1 General

.1 Pump characteristics, flow, head, material selection: as indicated in Project Document.

2.2 Pumps

.1 Complete factory-built and assembled base mounted duplex pump station for above ground installation. The pumps shall be horizontal, self-priming, solids handling sewage pump sets complete as follows:
.1 Pump and baseplate.
.2 V-belt drive and drive enclosure.
.3 TEFC high efficiency electric motor as specified by Engineer.

.4 air release valve and gastight vent pipe.
.5 PVC Volute drain, ball valve and clear hose connector.
.6 112 mm liquid gauge suction vacuum and discharge pressure gauge set with ballcock connectors and mounting panel.
.7 Discharge pipe and fittings comprised of check valves, elbows, nipples and 3-way plug valve.
.8 Volute contents temperature sensor.

.2 Casing and volute in contact with sewage shall be cast iron, Class 30 or higher grade.

.3 Impeller ductile iron, dynamically balanced, non-clog, two-vaned, semi-open with integral pump-out vanes on the back shroud. Threaded on to pump shaft and secured by lock screw.
.1 Impeller to be capable of handling solids, fibrous material, heavy sludge and other matter found in normal sewage applications.

.4 Rotating assembly, including bearings, shaft mechanical seal and impeller shall be removable as a unit without removing pump volute or piping.

.5 Mechanical seals shall have tungsten titanium carbide rotating and stationary faces lubricated by a separate oil-filled reservoir.

.6 Inspection coverplate to be removable and support a replaceable wear plate.

.7 Bearing housing shall contain the bearing cavity, complete with oil level sight gauge, fill/vent plug, double lip seals, shaft and bearings.

.8 Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir.

.9 Power:

.1 Power to pumps transmitted V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

.2 Pump drives to be enclosed on all sides by a guard constructed of fabricated steel or combination of materials, including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed ½ inch.

.10 Electric motors:

.1 The motors shall be furnished by the pump manufacturer for complete compatability.

.2 Motor shall be horizontal mounted, TEFC and—connection to the pumps at the factory. Motor shall be a totally enclosed, fan cooled, squire cage type induction motor, NEMA design B, CSA approved, with minimum Class F motor winding insulation and designed for a 40°C ambient. Motor shall be appropriately matched to the speed and torque requirements of the proposed pump and shall be capable of continuous duty. The horsepower rating and start characteristics shall be matched to the pump. The horsepower stated above shall not overload the motor service factor rating at any point along the impeller curve above the static head. Motor to be capable of sustaining the minimum number of starts per hour as specified in the project documents.

.3 Motors shall comply with the latest edition of NEMA standard MG-1 and CSA C22.2 No. 100.

.4 Motor nameplate and shop drawings shall indicate nominal efficiency in accordance with NEMA MGI-12.53 (a) and (b), based on IEEE-112, Method B. Motors shall be high efficiency in accordance with these standards.

.5 Motor shall have a 1.15 service factor and shall be operable at the service factor load continuously without exceeding the insulation rated temperature rise at 40°C ambient.

.6 Motor bearings shall be of the grease lubricated type and shall be constructed and mounted to exclude dirt and moisture and to prevent lubricant from reaching the motor internals. Anti-friction bearings shall have a minimum L-10 rating life of 100,000 hours under AFBMA standards.

.7 Motors shall have rugged cast iron frames with mounting supports, end brackets, bearing housings, fan covers and conduit junction box. Lifting eyes and drain holes fitted with pipe plugs shall be supplied.

2.3 Ventilation Fan

.1 In-line air intake type, with flanged connections to vent piping using stainless steel flange bolts.

.2 Ventilation piping: *to* NFPA.

.3 Fan type systems to meet Electrical Code requirements.

2.4 Piping, Fittings and Valves

.1 Ductile iron pipe: AWWA C151, Special Class 5~~2~~*4*, cement mortar-lined to AWWA C104 and coated outside with standard coating.

.1 Joints:

.1 Mechanical, high strength heat-treated cast iron or alloy steel T-head bolts with hex nuts.

.2 Grooved-type coupling joint with malleable iron couplings and gaskets.

.3 Flanged-end joint, cast iron to ANSI B16.1, with cloth-inserted rubber gasket.

.2 Fittings: to AWWA C110, cement mortar-lined to AWWA C104*, complete with an internal seal coat*.

.3 Coatings: all pipe and fittings to be coated with manufacturer’s standard coating.

.4 Isolation valve*s* and check valves located in discharge lines to be supplied by pumping equipment manufacturers.

.5 Discharge line for each pump: ductile iron Special Class 54, stainless steel or

as specified in the project documents. Install check valves and valves as specified in each pump discharge line. Each valve to have a throughway size equal to the pump discharge pipe size to ensure full, free-flow operation.

2.5 Station Enclosure

.1 The station enclosure shall contain and *protect* all pumps, interior piping, valves and associated controls. Enclosure to provide adequate access for any anticipated maintenance. Enclosure to be vented to allow for adequate air flow.

2.6 Pumping Station Accessories

.1 Pre-cast concrete sections and cover. As specified in Section 33 39 00 and as indicated on the Drawings with opening to suite access cover and pipe work.

2.7 Access Frame and Cover

.1 Aluminum access frame to be fabricated using an extrusion of 6351 aluminum. Cover to be fabricated using a plate of 5086 aluminum designed to withstand shear and deflect not more than 1/79 of the maximum span for minimum specified loads of 7.2 kPa uniform load or 1100 kg point load. The cover is to rest on a rubber gasket to be hinged along one side with a heavy duty aluminum hinge.

.2 Top of the access frame to be flush, the handle recessed. Install padlock within the recess to lock the cover in the closed position.

.3 Provide cover stay to allow the cover to be locked in the open position.

.4 Each access frame to be capable of supporting the full weight of any of the station equipment and maintenance personnel.

.5 Design access frames for embedding into the concrete top of a sewer station, extrusion to be shaped such as to provide good anchoring to the concrete. All surfaces in contact with the concrete to be bitumastic coated.

.6 Frames to be capable of being installed side-by-side by bolting them together using standardized bolting kits.

.7 Provide aluminum rail nuts within the extrusions, permitting a level regulator hanger and a chain hook to be attached without any modifications required to the frame.

.8 A bilingual confined space warning label to be clearly displayed on the underside of the cover.

.9 Provide a safety grate for fail through protection. When installed in pairs, safety grates should open outward unless specified otherwise in the contract documents.

2.8 Liquid Control

.1 Provide liquid level regulation to control the operation of the pumps in accordance with variations of sewage levels in the pump chamber.

.2 Level control by mechanical switches (floats) ultrasonic sensor, air bubbler, or pressure transducer. Mercury liquid level switches are not permitted.

.3 Provide mechanical switches for backup control as specified in the project documents.

2.9 Pump Control Panel

.1 Pump manufacturer to supply a completely assembled control panel to provide alternating operation of the pump system and pump running time recorder.

.2 Electro-mechanical, micro-processor control and SCADA control as indicated in project documents.

.3 Provide soft starters for pumps where required by agencies having jurisdiction.

.4 Controls to be CSA approved.

2.10 Electrical Wiring

.1 Install only equipment essential for the operation of the pump station inside the wet well.

.2 Locate, where possible, all fans, heaters, switches and junction boxes, etc., outside the wet well to avoid corrosion or flood damage.

.3 All electrical wiring of the pump station to be designed and supplied by the manufacturer in accordance with the Canadian Electrical Code and CSA bulletin S 2619.

.4 Provide pump power and level regulator cables in sufficient length to run directly to the control panel via an external conduit. Provide conduit fittings and strain relief connectors in sufficient number and size to permit installation of the conduit to the pumping station. All external conduits to enter the control panel enclosure only through the bottom. Seal conduits with an approved gastight barrier, preventing entry of vapour or gas from the wet well. Locate seal to enable removal complete with electrical disconnect without disturbing the seal. Where EYS seals are used, a rated junction box is to be employed to allow for pump removal.

.5 Code all wiring in the pump station either by colour or a numbering system.

.6 Provide pump power and level regulator (and automatic flush valve-optional) cables with sufficient length to run directly to the control panel (except where otherwise specified), and pull through external conduits.

.7 All conductors in power wiring to be no less than No. 14 AWG. Control wiring conductors may be smaller in size, in accordance with the current requirements of the circuit involved and all applicable standards.

.8 Provide separate conduit(s) for intrinsically safe devices.

2.11 Labels

.1 Suitable nameplates to be permanently affixed onto the pumps, control enclosure components, and other operating components to indicate the purpose of the component or operating routine and parameters applying to the component. The suction lift pumps and control equipment are CSA approved and the CSA logo appears on the nameplates of these

components. The suction lift pumps and control equipment shall be CSA approved and the CSA logo shall appear on the nameplates of these components.

PART 3 – EXECUTION

3.1 Installation

.1 Verify all layouts, dimensions, elevations and other pertinent data prior to proceeding with the work.

.2 Back prime all metal surfaces being mounted directly against concrete surfaces with bitumastic paint with the exception of surfaces that will grouted in.

.3 Examine all components to be incorporated into the Work for cracks, pits, blow holes, finishes, and any other defects. Do not incorporate any defective materials into the Work. Remove any defective materials from the site immediately and replace defective materials with new materials. Inspect all materials and remove all dirt and other debris.

.4 Install all components in strict accordance with each manufacturer’s instructions, recommendations and the approved shop drawings for the various materials to be incorporated in the Work.

.5 Install pumps, pipe, fittings, valves, accessories and appurtenances using skilled workers experienced in the tasks required.

.6 Handle all components carefully taking care not to damage the surface finish on these components. Make good any damage or supply new components as appropriate.

.7 Install isolation bushings between stainless steel anchors and other dissimilar materials.

.8 Equipment bases: concrete to suit pumping equipment and pipe work provided by pumping equipment manufacturer.

.9 Arrange for start-up, testing and commissioning by the equipment manufacturers' representatives in presence of the Owner's representatives after the installation has been completed and is ready for start-up and commissioning.

.10 All electrical installations to be completed to meet or exceed all applicable codes.

.11 Anchor bolts: the correct and full number, size and length of anchor bolt or other connecting bolts shall be used, as required by the equipment manufacturer or as shown on the Drawings. Anchor bolts shall be preset in the concrete.

3.2 Pipe Installation

.1 Carefully examine pipes and appurtenances for cracks or other defects, and clean of all dirt and debris before installation.

.2 Temporarily support all pipe during assembly and install fittings in a manner such that the pipe is not stained during the joining procedure.

.3 Flanged joints: prior to assembling the joints, thoroughly clean all flanges with a wire brush worked in a direction parallel to the serrations. Use gasket lubricant to ease gasket installation. During assembly, tighten diametrically opposing pairs of bolts simultaneously. Gaskets shall be standard full-face type, best quality rubber sheeting 3 mm thick cloth inserted.

.4 Connecting pipe work: supply and install all small connecting pipe work, fittings and valves, whether shown on the Drawings or not but required for the proper functioning and servicing of the equipment. All such work shall be done in accordance with the manufacturer's instructions at no additional cost to the Contract. Where pipe is to be connected to equipment, the placement of the piping shall be done in a manner such that neither pipe nor equipment is strained during the joining procedure.

3.3 Valves and Appurtenances

.1 All valves and appurtenances shall be installed where shown on the Drawings and checked and adjusted to ensure smooth operation. Ensure that the valves are installed in the proper orientation with respect to flow direction.

.2 Install and connect all the equipment and to make all necessary arrangements for a representative of the company supplying the equipment to check the complete installation before start-up or commissioning of the works.

3.4 Supervision

.1 Install and build-in all the equipment, and shall provide, where necessary, for skilled supervision during the installation. Allow in tendered price for the services of a skilled representative of the manufacturer’s of each item of equipment to be present during the installation and testing and to be present on as many further occasions as are required to put each item of equipment in working order.

.2 Allow in tendered price for the services of skilled representatives of the equipment suppliers to adequately acquaint the permanent plant operators with the proper operation and maintenance of all equipment specified.

3.5 Lubrication

.1 Lubricate all equipment in accordance with the equipment manufacturer’s recommendations.

3.6 Responsibility of Temporary Trial Usage

.1 Obtain written permission from the Owner to use and test permanent equipment and systems prior to acceptance by the Owner.

.2 The guarantee period shall not be affected by temporary trial use of the equipment.

.3 Clean and renew equipment and systems used prior to acceptance. Restore to original or new working condition.

.4 Protect equipment and systems openings from dirt, dust, and other foreign materials during temporary usage.

3.7 Inspection Testing and Start-up

.1 Provide the services of competent servicemen, mechanics or other trained personnel of the equipment suppliers or manufacturers to check the complete installation and be present for start-up of the equipment. A written report signed by the equipment manufacturer's representative shall be submitted to the Owner starting the following:
.1 That a satisfactory installation of equipment has been performed and/or outlining any modifications that have been made as a result of the commissioning or testing of the equipment.
.2 That the equipment is now ready for permanent operation.
.3 That operation, lubrication and maintenance instructions for the equipment have been presented to the Owner.
.4 That the equipment has been properly lubricated with the correct lubricants.

.2 Advise the Owner in writing at least one week in advance of the proposed date for testing and start-up. Provide all necessary tools, materials and equipment for carrying out tests. All tests shall be conducted in the presence of the Owner.

.3 Defective material or equipment shall be replaced with new material or equipment. Bear all cost including re-testing and making good.

.4 Test interior pipework: water inside pipework to be gradually increased until it reaches a minimum of 690 kPa and maintain test pressure for one hour. No leakage will be allowed.

.5 The re-prime of a completely empty suction line to full pumping shall take a maximum of five (5) minutes operating at the selected speed and impeller diameter with the re-prime lift of the installation condition.

END

.6 The re-prime lift shall be published dated and is to be certified by the pump manufacturer upon request.

END

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PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing submersible pumping stations. Work generally includes supply and installation of pumping equipment, pump controller, valves, metal fabrications, and related pipe work.

1.2 Related Sections

.1 Concrete: Section 03 30 00

.2 Earthwork: Section 31 20 00

.3 Sanitary Sewers: Section 33 31 00

.4 Pressure Sewers: Section 33 34 00

.5 Pre-cast Manholes, Catch Basins and Structures: Section 33 39 00

1.3 Reference Standards

.1 ANSI/ASME B-16.1-2005, Class 125, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ANSI/AWWA C104/A21.4-08, Cement Mortar Lining for Ductile-Iron Pipe and Fittings.

.3 ANSI/AWWA C110/A21.10-08, Ductile-Iron and Gray Iron Fittings for Water.

.4 ANSI/AWWA C151/A21.51-02, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.3 ASTM A36M-08, Carbon Structural Steel.

.4 ASTM A181M-06, Carbon Steel Forgings for General-Purpose Piping.

.5 CAN/CSA-C22.1-06, Canadian Electrical Code.

.6 CAN/CSA-C22.2 No. 108-01, Liquid Pumps.

.7 CSA Bulletin S2619-1998, Information and Documentation.

.8 National Fire Protection Association.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Indicate details of piping, valves, supports, pumps, metal fabrications, access hatches, and appurtenances.

1.5 Operating and Maintenance Data

.1 Provide operating and maintenance data in accordance with Section 01 10 00 and as follows:
.1 System description.
.2 Design parameters, system hydraulics, design calculations, and system curves.
.3 Performance curves for the pumps, layout, and wiring diagrams, control system schematic, level control system schematic.
.4 Related civil, mechanical, and electrical drawings.
.5 Manufacturer's operation instructions.
.6 Name, address, and telephone number of equipment suppliers.
.7 Information on guarantees and warranties.

1.6 Handling and Storage

.1 Handle and store pumps, pipe, valves, and fittings in such a manner as to avoid shock and damage. Do not use chains or cables passed through pipe or equipment. Do not damage coatings ~~of~~ *or* linings.

1.7 Maintenance Material

.1 Manufacturer to maintain, in local inventory, standard maintenance material. Parts to be available for shipment within 24 hours notice.

PART 2 - PRODUCTS

2.1 General

.1 Pump characteristics, flow, head, material selection: as indicated in Project Document.

2.2 Pumps

.1 Submersible, non-clog or grinder pumps.
.1 Equip each pump with submersible, electric motor and power supply and monitoring cable(s).

.2 Pump unit to be capable of delivering flow and TDH, as indicated.

.3 Supply each unit complete with a mating, cast iron discharge connection and galvanized lifting chain or cable, approved for overhead lifting and of adequate strength to permit raising and lowering of the pump. Lifting system shall be compatible with existing municipal lifting equipment.

.4 Pump and motor close-coupled, integral design capable of handling raw, unscreened sewage. Discharge connection elbow to be permanently installed in wet well, together with the discharge piping.

.5 Pump to be automatically connected to discharge connection elbow when lowered into place, and easily removed for inspection and service.

.6 Major pump components: grey cast iron, with smooth surfaces, devoid of blowholes and other irregularities.

.7 All exposed nuts and bolts to be 316 series stainless steel construction.

.8 Protect all surfaces coming into contact with sewage, other than stainless steel or brass, by an approved, sewage-resistant coating.

.9 Machine all mating surfaces where watertight sealing is required and fitted with nitrile or neoprene rubber O-rings. Accomplish sealing by metal-to-metal contact between machined surfaces.

.10 Control compression of nitrile rubber or neoprene O-rings without the requirement of a specific torque limit. Do not use secondary sealing components, rectangular gaskets, elliptical O-rings, grease or other devices or materials.

.11 Volute: single port, non-concentric design with smooth fluid passages, large enough at all points on the volute to pass any size solids which can pass through impeller.

.12 Impeller ductile iron or grey cast iron, Class 30 or better, dynamically balanced,

non-clog or recessed design having a long throughlet without acute turns.
.1 Impeller to be capable of handling solids, fibrous material, heavy sludge, and other matter found in normal sewage applications.
.2 Impeller vane design and passing sphere capability to be as indicated in Project Documents.

.13 Wear ring or plate system to provide efficient sealing between volute and impeller, and consist of a stationary hard metal wear system, which is fitted to volute inlet.

.14 Grinder pumps to have hardened stainless shredding ring and grinder to reduce sewage to a small size for discharge through small diameter piping.

.15 Pumps to be rated for operation in Class 1, Zone 1 or 2 areas as specified in the product documents.

2.3 Cable

.1 Power and/or control (monitoring) cable(s): neoprene-jacketed type SOW *composite* cable sized to *meet* or exceed electrical code requirements. Cable to be suitable for submerged use and CSA approved.

2.4 Cable Entry

.1 Cable entry design shall ensure an impermeable seal.

.2 Cable entry to be comprised of a cylindrical elastomer grommet system or an epoxy sealed cable entry system.

.3 Cable entry design shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 20 m.

2.5 Guide Bars and Cables

.1 Provide corrosion resistant vertical guide bar(s) or cables with each pump to ensure correct alignment of pump with automatic discharge connection.

.2 For each pump, guide bar(s) or cables to be as specified in the Project Documents, securely fixed at lower end to the

discharge connection by means of corrosion proof bosses, provided.

.3 Extend guide bar(s) or cables from discharge connection toward ground level to be securely fixed by a corrosion proof bracket (upper guide bar holder), anchored to the station roof.

.4 Provide bracket with special inserts to position the guide bars rigidly, where applicable.

2.6 Discharge Connections

.1 Provide cast iron, automatic discharge connection for each pump to connect pump to discharge piping.

.2 Discharge connection to be permanently fixed in position by anchor bolts attached to the bottom of the pump chamber.

.3 Discharge connections to permit rapid and precise installation or removal of the pumps without entering pump chamber.

.4 Connection to ensure zero leakage between the pump and its discharge connection.

.5 No part of the pump shall bear directly on the floor of the wet well.

2.7 Ventilation Fan

.1 In-line air intake type, with flanged connections to vent piping using stainless steel flange bolts.

.2 Ventilation piping: to NFPA.

.3 Fan type systems to meet Electrical Code requirements.

2.8 Piping, Fittings *and Valves*

.1 Pipe: all interior station piping to be ductile iron Special Class 54*, stainless steel* or as specified in the Project Documents.

.2 Welded fittings: to ASTM A181.

.3 Flanges to ANSI/ASME B-16.1, Class 125.

.4 Wall pieces: wall pieces to have slip-on flanges, welded to pipe and located in centre of the wall or as specified in the project documents. Exterior wall pieces

to be cement-lined ductile iron, flanged inside and plain end outside. Exterior connections to forcemain to be by suitable coupling with joint restraint.

.5 Discharge line for each pump: ductile iron Special Class 54, stainless steel or as specified in the project documents. Install check valves and plug valves as specified in each pump discharge line. Each valve to have a throughway size equal to the pump discharge pipe size to ensure full, free-flow operation.

2.9 Miscellaneous Items

.1 Splash plate: fabricated from stainless steel ASTM A36.

2.10 Motor

.1 The pump motor: squirrel-cage induction type design, housed in a watertight chamber of maximum efficiency and durability. Design motor for continuous duty capable of sustaining a minimum of fifteen (15) starts per hour. Motor speed and electrical characteristics as indicated in Project Documents.

.2 Motor stator: directly shrink-fitted into the stator housing. Insulate stator winding and leads with moisture-resistant varnish capable of withstanding a temperature of 155°C or the motors maximum temperature rise, whichever is greater. Insulation rating *to* Class F.

.3 Rotor bars and short-circuit rings to be made of aluminum. Use thermal sensors to monitor stator temperatures on all pumps. Equip stator with not less than two (2) thermal switches embedded in the end coils of the stator windings (one switch per phase to protect the motor against surcharges and high temperature). Use these in conjunction with, and supplemental to, external motor overload protection, and wired to the control panel.

.4 Seal junction box chamber containing the terminal board from the motor by an elastomer compression grommet for pumps of 3 kW (4 hp) or more. Alternately, use of triple-sealed cable entry system does not require a seal junction box chamber.

.5 Equip motor housing with a moisture detector to detect any leakage of water or pumpage, into the stator housing. The signals from the thermal switches and the moisture detector to be wired to the control panel.

.6 Accomplish control of the moisture detector and the winding thermal switches by using a control/indicator relay(s) which will be installed and wired inside the control panel to stop the pump unit upon a fault signal.

.7 Motors to be air cooled or oil cooled to manufacturer’s standard.

.8 Motor shall be able to operate dry without damage while pumping under load.

2.11 Shaft and Seals

.1 Pump shaft: AISI 400 series stainless steel. Provide each pump with a tandem mechanical shaft seal system.

.2 The upper of the tandem set of seals operates in cooling medium. This set contains one stationary tungsten-carbide ring and one positively driven rotating carbon ring. The seals function as an independent secondary barrier between the pumped liquid and the stator housing.

.3 The lower of the tandem set of seals shall function as the primary barrier between the pumpage and the stator housing. This set shall consist of a stationary ring and a positively driven rotating ring, both to be solid tungsten carbide, silicone carbide or carbon ceramic.

2.12 Access Frame and Cover

.1 Aluminum access frame to be fabricated using an extrusion of 6351 aluminum. Cover to be fabricated using a plate of 5086 aluminum designed to withstand shear and deflect not more than 1/79 of the maximum span for minimum specified loads of 7.2 kPa uniform load or 1100 kg point load. The cover is to rest on a rubber gasket to be hinged along one side with a heavy duty aluminum hinge.

.2 Top of the access frame to be flush, the

handle recessed. Install padlock within the recess to lock the cover in the closed position.

.3 Provide cover stay to allows the cover to be locked in the open position.

.4 Each access frame to be capable of supporting the full weight of any submersible pump which can be installed through its opening.

.5 Design access frames for embedding into the concrete top of a sewer station, extrusion to be shaped such as to provide good anchoring to the concrete. All surfaces in contact with the concrete to be bitumastic coated.

.6 Frames to be capable of being installed side-by-side by bolting them together using standardized bolting kits.

.7 Provide aluminum rail nuts within the extrusions, permitting an upper guide holder, a level regulator hanger and a chain hook to be attached without any modifications required to the frame.

.8 A bilingual confined space warning label to be clearly displayed on the underside of the cover.

.9 Provide a safety grate for fail through protection. When installed in pairs, safety grates should open outward unless specified otherwise in the contract documents.

2.13 Liquid Control

.1 Provide liquid level regulation to control the operation of the pumps in accordance with variations of sewage levels in the pump chamber.

.2 Level control by mechanical switches (floats) ultrasonic sensor, air bubbler, or pressure transducer. Mercury liquid level switches are not permitted.

.3 Provide mechanical switches for backup control as specified in the project documents.

2.14 Pump Control Panel

.1 Pump manufacturer to supply a completely assembled control panel to provide alternating operation of the pump system and pump running time recorder.

.2 Electro-mechanical, micro-processor control and SCADA control as indicated in project documents.

.3 Provide soft starters for pumps where required by agencies having jurisdiction.

.4 Controls to be CSA approved.

2.15 Electrical Wiring

.1 Install only equipment essential for the operation of the pump station inside the wet well.

.2 Locate, where possible, all fans, heaters, switches and junction boxes, etc., outside the wet well to avoid corrosion or flood damage.

.3 All electrical wiring of the pump station to be designed and supplied by the manufacturer in accordance with the Canadian Electrical Code and CSA bulletin S2619.

.4 Provide pump power and level regulator cables in sufficient length to run directly to the control panel via an external conduit. Provide conduit fittings and strain relief connectors in sufficient number and size to permit installation of the conduit to the pumping station. All external conduits to enter the control panel enclosure only through the bottom. Seal conduits with a*n* approved gastight barrier, preventing entry of vapour or gas from the wet well. Locate seal to enable motor removal complete with electrical disconnect without disturbing the seal. Where EYS seals are used, a rated junction box is to be employed to allow for pump removal.

.5 Code all wiring in the pump station either by colour or a numbering system.

.6 Provide pump power and level regulator (and automatic flush valve-optional) cables with sufficient length to run

directly to the control panel (except where otherwise specified), and pull through external conduits.

.7 All conductors in power wiring to be no less than No. 14 AWG. Control wiring conductors may be smaller in size, in accordance with the current requirements of the circuit involved and all applicable standards.

.8 Provide separate conduit(s) for intrinsically safe devices.

2.16 Inspection, Testing and Shipment

.1 Inspection and Testing

.1 Test pump proper operation at rated power supply values and for electrical and mechanical integrity prior to shipment. Pump supplier to have adequate test facilities to at least provide a single-point performance test or a complete performance curve at an accuracy of ± 1%. Check level regulators for correct operation.

.2 Pump/motor assembly to be CSA approved as one, integral unit, as per CSA standard CAN/CSA-C22.2.108. Proof of this approval to be submitted by the pump manufacturer together with the approval drawings. An approval of the motor unit only shall not be acceptable. Cable to be CSA approved, SOW type, neoprene-jacketed, with a 90°C rating.

.3 The supplier grants the right of inspection of the pumping station to any authorized representative of the purchaser or Owner’s representative before shipment from factory. If inspection is requested give 48 hours notice in advance of the time when the equipment will be ready for inspection at the factory.

.4 Any equipment in the pumping station that may have been provided by another supplier shall have been tested by the original supplier.

.5 Pump manufacturer to perform the following inspections and tests on each pump before shipment:

.1 Check impeller, motor rating, and electrical connections for compliance to the customer’s purchase order.

.2 A motor and cable insulation test for moisture content and/or insulation defects.
.3 Prior to submergence, run the pump dry to establish mechanical integrity and free rotation.
.4 Run pump for 30 minutes, submerged 2 m minimum depth.
.5 Repeat after operational test number 4, the insulation test, number 2.
.6 Check oil housing for any leakage of water by the lower seal.
.7 Inspect motor housing and junction box for any water leakage.
.8 Supply upon request, a written report stating that the above tests have been performed with each pump at the time of shipment.
.9 Seal pump cable end with a high quality protective covering to make it impervious to moisture and/or water seepage, prior to shipping to job site and electrical installation.

.6 Provide successful test results prior to shipment.

.2 Shipment
.1 Ship station assembled to the greatest extent possible to reduce installation and start-up costs. Shipped separately from the tank to be the pumps, the controls including the regulators, and a container of miscellaneous connecting hardware, etc.

2.17 Labels

.1 Suitable nameplates to be permanently affixed onto the pumps, control enclosure components, and other operating components to indicate the purpose of the component or operating routine and parameters applying to the component. The lift station pumps and control equipment are CSA approved and the CSA logo appears on the nameplates of these components.

PART 3 – EXECUTION

3.1 General

.1 Verify all layouts, dimensions, elevations and other pertinent data prior

to proceeding with the work.

.2 Back prime all metal surfaces being mounted directly against concrete surfaces with bitumastic paint with the exception of surfaces that will grouted in.

.3 Examine all components to be incorporated into the Work for cracks, pits, blow holes, finishes, and any other defects. Do not incorporate any defective materials into the Work. Remove any defective materials from the site immediately and replace defective materials with new materials. Inspect all materials and remove all dirt and other debris.

.4 Install all components in strict accordance with each manufacturer’s instructions, recommendations and the approved shop drawings for the various materials to be incorporated in the Work.

.5 Install pumps, pipe, fittings, valves, accessories and appurtenances using skilled workers experienced in the tasks required.

.6 Handle all components carefully taking care not to damage the surface finish on these components. Make good any damage or supply new components as appropriate.

.7 Install isolation bushings between stainless steel anchors and other dissimilar materials.

.8 Install stainless steel washers when installing anchors for pump discharge base elbows. Washers to have a stick-on plastic film on the side contacting the base elbows. Use stainless steel shims similarly protected when shimming base elbows.

.9 Arrange for start-up, testing and commissioning by the equipment manufacturers' representatives in presence of the Owner's representatives after the installation has been completed and is ready for start-up and commissioning.

.10 All electrical installations to be completed to meet or exceed all applicable codes.

3.2 Piping

.1 Cut piping to length using equipment designed for the cutting of pipe within the maximum allowable tolerance from square cut ends in accordance with type.

.2 Lubricate pipe and gaskets with lubricant before installing gaskets on pipe and completing joint.

.3 Install piping straight, parallel to walls and in such a manner so as to prevent straining during jointing procedures. Install galvanized pipe supports where shown or required.

.4 Prior to assembling flanged joints, thoroughly clean flanges. Use a gasket lubricant to ease gasket installation. Tighten diametrically opposed bolts simultaneously.

.5 Do not correct misalignment using fasteners or other means to pull flanges into alignment. Correct so that no eccentric loads are placed on flanges.

3.3 Valves

.1 Ensure that the valves are installed in the proper orientation with respect to flow direction. Install isolation valves with the seat side down.

.2 Ensure that all valves are installed in waterproof chambers with access for maintenance or as specified in the project documents.

3.4 Pumps and Appurtenances

.1 Locate, align, level, adjust and install pump discharge base elbows. The pumps and discharge base elbows to be located so that the pumps can be easily removed through the openings in the lift station without requiring the removal of any station equipment. Ensure that sufficient clearance is present to permit easy pump removal when a flush valve is installed on the designated pump.

.2 Install upper guide bar or cable holders and guide bar(s) or cables in accordance with the pump and anchor manufacturer's instructions, so that the guide bars are true, plumb and in the proper location and alignment so that the pumps can be easily removed through the openings in the lift station cover.

.3 Take particular care to protect the finish on the pumps, pipe, fittings, valves and appurtenances from scratches and other damage. Repair any damage to the surface finishes.

3.5 Accessories

.1 Back-prime the level regulator hanger with bitumastic paint and mount in the position indicated or as directed or if not shown, mount in a location where they will not be affected by flow from the inlet piping or prevent removal of the pumps, including a pump if fitted with flush valve, all in accordance with the pump and anchor manufacturer's instructions.

.2 Back-prime and mount each galvanized chain hook or cable in the area shown and located so that the chain can be reached conveniently and such that the hook does not interfere with pump removal from the lift station. Install isolation bushings between galvanized steel and 316 stainless steel anchors. Install hooks in accordance with pump and anchor manufacturer's instructions.

.3 Supply and install back-primed galvanized

pipe supports and install with medium duty, 316 stainless steel, wedge anchors using isolation bushings all in accordance with the anchor manufacturer's instructions.

.4 Following installation of the stainless steel anchors that use studs instead of bolts, cut the studs off level with the top of the nut.

3.6 Testing

.1 Prior to starting the pumps, remove the plug or cap from the forcemain in the manhole.

.2 After pumps and piping have been installed, test pumps with the material they are to pump, or with water, operate and pump for a duration of time sufficient to satisfy that the complete installation has been properly installed and aligned and that the pumps run free from heating, rubbing or vibration and meet the requirements of these Specifications, and that the pumps and piping are free and clear of debris and obstructions.

.3 Demonstrate that each pump can be easily removed from the lift station without obstruction or removal of any station equipment. Make any adjustments necessary to carry out pump removal in this manner.

.4 Demonstrate the operation of all valves and make any adjustments necessary to permit the valves to be operated smoothly without obstruction and allow the pumps to be removed with the valves in an open or closed position.

.5 Demonstrate integrity of pump discharge connection seal to pump by pumping down wet well sufficiently to detect leakage.

.6 Observe wet well and valve chamber for piping leaks during pump operation for leaks and/or loose connections. Repair any leaks identified.

END

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END

PART 1 – GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing pressure sewers and appurtenances. Work includes supply, installation and testing of pipe, fittings and service connections.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Metal Fabrications	Section 05 50 00
.3	Earthwork	Section 31 20 00
.4	Reinstatement	Section 32 98 00
.5	Precast Manholes, Catch Basins and Structures	Section 33 39 00
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1.3 Reference Standards

.1 ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

.2 ANSI/AWWA C104/A21.4-08, Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water.

.3 ANSI/AWWA C110/A21.10-08, Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in., (75 mm Through 1200 mm) for Water and Other Liquids.

.4 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.5 ANSI/AWWA C151/A21.51-02, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.6 ANSI/AWWA C153/A21.53-06, Ductile Iron Compact Fittings, 3 Inch Through 16 Inch, for Water and Other Liquids.

.7 ANSI/AWWA C301-07, Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids.

.8 ANSI/AWWA C303-02, Reinforced Concrete Pressure Pipe, Steel Cylinder Type, Pretensioned, for Water and Other Liquids.

.9 ANSI/AWWA C509-01, Resilient-Seated Gate Valves for Water and Sewerage Systems.

.10 ANSI/AWWA C900-07, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution

.11 ANSI/AWWA C901-08, Polyethylene (PE) Pressure Pipe and Tubing, ½ in. (13 mm) Through 3 in. (76 mm), for Water Service.

.12 ANSI/AWWA C906-07, Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) Through 63 in. (1,600 mm), for Water Distribution and Transmission.

.13 CAN/CSA B137 Series-05, Thermoplastic Pressure Piping Compendium.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

.2 For concrete pressure pipe and fittings submit tabulated materials list and drawings indicating internal pressure rating, maximum external load, type of joints and identification mark numbers.

1.5 Certificates

.1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

.2 For fusion butt jointing for polyethylene pipe provide certification that personnel are trained by manufacturer in current methods and use of equipment.

1.6 Handling and Storage

.1 Handle and store pipe, valves, fittings, in such manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore. Do not damage coatings or linings.

.2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

PART 2 - PRODUCTS

2.1 General

.1 Diameter, material and strength class of pipe and fittings: as indicated.

2.2 Ductile-Iron Pipe and Fittings

.1 Pipe: to AWWA C151, cement mortar lined.

.2 Fittings: to AWWA C110 or C153, cement mortar lined, minimum pressure rating 1035 kPa for cast, 1720 kPa for ductile iron.

.3 Cement Mortar Lining: to AWWA C104.

.4 Joints: mechanical or push-on to AWWA C111; flanged to AWWA C110 with Class 125 flanged ends to ANSI/ASME B16.1.

2.3 Polyvinyl Chloride Pipe and Fittings

.1 Pipe and Joints: to, AWWA C900 or AWWA C905, CAN/CSA B137, cast-iron outside diameter, gasketed bell-end Joint.

.2 Fittings:
.1 PVC: to CAN/CSA B137.
.2 Gray or ductile-iron: to AWWA C110 and C153, cement mortar lined, minimum pressure rating 1035 kPa for cast, 1720 kPa for ductile iron.
.3 Cement mortar lining: to AWWA C104. Provide internal seal coat when required by Project Documents.
.4 Joints, mechanical or push-on: to AWWA C153.

2.4 Polyethylene Pipe and Fittings

.1 Pipe:
.1 13 to 76 mm diameter: to AWWA C901.
.2 100 mm diameter and larger: to AWWA C906.

.2 Joints:
.1 Thermal Butt Fusion
.2 Mechanical Connections: polyethylene flange end with metal back-up ring.

.3 Fittings:
.1 Polyethylene: to AWWA C901 and AWWA

C906.
.2 Flanged cast-iron: to AWWA C110.

2.5 Concrete Pressure Pipe and Fittings

.1 Pipe and Fittings:
.1 Steel cylinder type, pre-stressed, concrete lined: to AWWA C301 (L).
.2 Steel cylinder type, pre-stressed, concrete embedded: to AWWA C301 (E).
.3 Non-cylinder type: to AWWA C302.
.4 Steel cylinder type, pre-tensioned, concrete lined: to AWWA C303.

.2 Joints: bell and spigot with confined O-ring gasket, protected with approved mortar.

2.6 Gate Valves

.1 Buried: to AWWA C509 up to 300 mm, minimum pressure rating 1380 kPa and as follows:
.1 Body: cast-iron with mechanical joint ends.
.2 Mechanism (AWWA C509): wedge disk with resilient rubber seat ring and machined seating surface, non-rising spindle, and O-ring seals.
.3 Direction of opening: counterclockwise.
.4 Operating Nut: 50 mm square.
.5 Provide centering disc.

.2 In chamber: to AWWA C509 up to 300 mm, minimum pressure rating 1380 kPa and as follows:
.1 Body: cast-iron with Class 125 flanged ends to ANSI B16.1.
.2 Mechanism (AWWA C509): wedge disc with resilient rubber seat ring and machined seating surface, O.S.& Y., rising stem and handwheel.

2.7 Valve Boxes

.1 Valve boxes:
.1 Cast-iron, slide type, adjustable for depth of pipe below finished grade or composite valve box.
.2 Covers marked "Sewer".
.3 Lugged to prevent turning and rolling of cover, and cover notched to suit.

2.8 Thrust Restraint

.1 Thrust blocks and anchors: 20 MPa Portland cement concrete and 15 M, Grade 400 reinforcing steel where indicated.

.2 Mechanical joint restraint device: (100 mm to 600 mm) ductile iron follower gland to AWWA C153 and C111 with multiple wedge restraining mechanism, minimum pressure working rating 2410 kPA and minimum safety factor of 2:1 Lugs to have twist-off torque nuts.

2.9 Insulation

.1 Insulation: to UL 701, Type 4, extruded polystyrene.

PART 3 - EXECUTION

3.1 Preparation

.1 Carefully inspect material for defects and remove defective materials from site.

.2 Immediately before installation, remove any water, debris, and foreign material from interior of pipe, fittings and valves.

3.2 Trenching, Bedding and Backfilling

.1 Do trenching, bedding and backfilling to Section 31 20 00.

3.3 Pipe Installation

.1 Lay and join pipe, fittings, and valves as specified herein and according to manufacturer's published instructions.

.2 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:
Horizontal Alignment: 150 mm
Vertical Alignment: 75 mm

.3 Face bell ends in direction of laying. On grades of 5% or greater lay pipe up grade.

.4 Do not exceed maximum joint deflection recommended by manufacturer.

.5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.

.6 Join pipes in accordance with

manufacturer's published instructions. Do not use excessive force to join pipe sections.

.7 Install gaskets in accordance with manufacturers published instructions. Use only lubricant supplied by manufacturer. During cold weather store gaskets in heated area to assure that gaskets remain flexible.

.8 Align pipes carefully before joining.

.9 Support pipes as required to assure concentricity until joint is properly completed.

.10 Keep pipe joints free from soil or other foreign materials.

.11 Avoid displacing gasket or contaminating with dirt, petroleum products or other foreign material. Remove, clean, re-install and lubricate gaskets so disturbed.

.12 Complete each joint before laying next length of pipe.

.13 For concrete pressure pipe, install diapers and pour cement mortar into joint recess. Fill inside joint recess with stiff cement grout.

.14 Join polyethylene pipe in accordance with manufacturer's published instructions.

.15 Where deflection at joints is permitted, deflect only after joint is completed.

.16 At structures provide flexible joint not more than 1 metre from outside face of structure.

.17 Cut pipe as required for specials, fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating and leave smooth bevelled edge.

.18 Provide concrete thrust blocks to undisturbed ground on all tees, bends,

plugs and caps. Construct as indicated and keep joints and couplings free of concrete.

.19 Install mechanical joint restraint to AWWA C111 and tighten lug nuts until all wedges are in firm contact with pipe surface. Continue to tighten alternating between bolts until lug nuts twist off.

3.4 Undercrossing

.1 Provide shop drawings showing proposed method of installation for pipe in undercrossing

.2 Excavate working pit according to reviewed shop drawings.

.3 Dewater areas of excavation and undercrossing.

.4 Place jacking, boring or tunneling equipment in working pit to approved line and grade of the proposed pipe.

.5 Install encasing pipe to proposed line and grade as indicated.

.6 Use mechanical or welded type joints for encasing pipe.

.7 After encasing pipe has been installed, check line and grade for approval.

.8 Remove any soil that remains in the casing pipe.

.9 Insert pipe into encasement pipe starting from the working pit.

.10 Place pipe one length at time outside encasement pipe. Maneuver pipe into position

.11 Use approved blocking method to guide pipe in true alignment.

3.5 Valve Chambers

.1 Construct valve chambers where indicated. Do not allow valve chambers to rest upon pipe.

.2 Construct valve chambers as indicated and in accordance with applicable sections.

3.6 Valves and Valve Boxes

.1 Install valves at locations indicated. Joints and bedding as for pipe and fittings.

.2 On direct buried valves, install valve boxes plumb and centered over operating nut, using centering disc, and true to line and grade.

.3 Use thrust anchors for valves greater than 150 mm on PVC and polyethylene pipe.

3.7 Hydrostatic and Leakage Testing

.1 If water used for flushing or testing is obtained from a potable water supply, the supply is to be continuously separated from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double check valve backflow prevention device.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests.

.3 Backfill prior to testing.

.4 Notify Engineer at least 24 hours in advance of all proposed tests. Perform tests in presence of Engineer.

.5 Open all valves in test section.

.6 Expel air from main by slowly filling with water. Install corporation stops at high points where no air-vacuum release valves are installed. After testing, remove corporation stops and install plugs.

.7 Fill concrete pipe 24 hours before testing to allow for absorption of water.

.8 Apply test pressure of 1035 kPa or pressure equal to 1.5 times working pressure, whichever is greater, measured at lowest point in test section. The test shall be conducted over a full two (2) hour period, maintaining a constant test pressure. No leakage is permitted by the test process.

.9 Locate and repair defects if test fails.

Retest.

3.8 Flushing

.1 If water used for flushing or testing is obtained from a potable water supply, the supply is to be continuously separated from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double check valve backflow prevention device.

.2 Notify Engineer 24 hours in advance of flushing.

.3 Flush mains with water through available outlets with sufficient flow to produce minimum velocity in main of 1.5 m/s, for 10 minutes. Flush until foreign materials have been removed and water is clear.

.4 Slowly open and close valves to ensure thorough flushing.

END

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END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing precast concrete manholes, catchbasins and structures. Work includes supply and installation of concrete bases, precast sections, metal castings and testing.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Metal Fabrications	Section 05 50 00
.3	Earthwork	Section 31 20 00
.4	Water Mains	Section 33 11 00
.5	Sanitary Sewers	Section 33 31 00
.6	Pressure Sewers	Section 33 34 00
.7	Storm Sewers and Culverts	Section 33 40 00
.8	Standard Details	Section 39 00 00

1.3 Reference Standards

.1 ASTM A48/A48M-03(R2008), Gray Iron Castings

.2 ASTM C478M-08, Precast Reinforced Concrete Manhole Sections (Metric)

.3 CAN/CSA A257 Series-03, Standards for Concrete Pipe and Manhole Sections.

.4 CAN/ULC S701-05, Thermal Insulation, Polystyrene Boards and Pipe Covering

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

1.5 Handling and Storage

.1 Prevent damage to materials during storage and handling.

.2 Store gaskets in cool location out of direct sunlight, and away from petroleum products.

PART 2 - PRODUCTS

2.1 General	.1	Diameter and type: as indicated.
2.2 Precast Bases and Sections	.1	Precast Concrete Bases and Sections: to ASTM C478M or CSA A257.
2.3 Gaskets	.1	O-Rings: to manufacturer's standard.
	.2	Bituminous Compound: precast manufacturer's recommended compound.
2.4 Metal Castings	.1	Frames, covers and gratings: to ASTM A48, gray cast iron, factory coated.
2.5 Waterproofing	.1	Waterproofing: type specified in Supplementary Specification.
2.6 Insulation	.1	Rigid Insulation: to CAN/ULC S701, Type 4, polystyrene.
2.7 Concrete	.1	Cast-in-place base and grade adjustment: to Section 03300, min. 35 MPa at 28 days, air entrained, 50 mm slump, Water/cement ratio: 0.45 maximum.
	.2	Grade Adjustment: manufactured type or cast-in-place type as indicated.
2.8 Non-Shrink Grout	.1	Pre-mixed, dry pack or pourable type containing non-metallic aggregate, plasticizing agents and cement, minimum compressive strength of 45 MPa at 28 days.
2.9 Ladders	.1	Galvanized Steel: to section 05 50 00.

PART 3 - EXECUTION

3.1 Preparation	.1	Carefully inspect products for defects and remove defective products from site.
3.2 Excavation and Backfill	.1	Do excavating and backfilling to Section 31 20 00.
3.3 Installation	.1	Construct units as indicated.
	.2	Complete units as pipe laying progresses.

.3 Cast or set base on 150 mm thick pipe bedding or material as indicated in the Project Documents compacted to 95% Standard Proctor Density or as indicated. Top of base to be level.

.4 Place stubs at elevations and in positions indicated. Provide flexible pipe joints within 1 metre of outside face of poured-in-place and precast structure where there is no in-wall gasket for pipe sizes up to and including 750 mm diameter.

.5 Form manhole bases to provide smooth U-shaped channels with depth equal to diameter of pipes or as indicated. Curve channels smoothly and slope uniformly from inlet to outlet. Benching to drain towards channel, 4% maximum slope.

.6 Install base section of precast shafting on cast-in-place base as indicated and assure watertight joint.

.7 Install gaskets in accordance with manufacturer's published instructions.

.8 Install precast sections plumb and true with opening centered over upstream pipe.

.9 Make all joints watertight in sanitary sewer manholes and valve chambers.

.10 Install ladder if required by Project Documents.

.11 Set frame and cover or grating to elevation and slope indicated. Use cast-in-place concrete for adjustment and secure frame in place with cement grout or use manufactured type.

.12 Clean debris and foreign material from unit. Remove fins and sharp projections. Prevent debris from entering system.

3.4 Installation in Existing System

.1 Installing units in existing systems:
.1 Where new unit is to be installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as

specified.
.2 Make joints watertight between new unit and existing pipe.
.3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

3.5 Adjusting Tops Of Existing Units

.1 Remove existing gratings, frames and store for re-use at locations designated by Engineer.

.2 Sectional units:
.1 Raise or lower straight walled sectional units by adding or removing precast sections as required.
.2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section. When amount of raise is less than 600 mm use standard moduloc or grade rings.

.3 Monolithic units:
.1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation.
.2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.
.3 When monolithic units with tapered upper section are to be lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.
.4 Install additional manhole ladder rungs in adjusted portion of units as required.
.5 Re-use existing gratings, frames as directed by the Engineer.
.6 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

3.6 Sealing over Existing Units

.1 Fill with cast-in-place concrete approved by Engineer.

3.7 Testing

.1 Test sanitary sewer manholes and structures.

.2 Provide labour, equipment and materials required to perform testing.

.3 Backfill prior to testing.

.4 Notify Engineer 24 hours in advance of proposed test. Do test in presence of Engineer.

.5 Test method: as indicated and in accordance with the authority having jurisdiction.

.6 Water testing: perform test as follows:
.1 If water used for flushing or testing is obtained from a potable water supply, the potable water supply is to be continuously separated from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double check valve backflow prevention device.
.2 Plug all inlet and outlet pipes with watertight plugs.
.3 Fill with water to top of precast sections.
.4 Allow time for initial absorption.
.5 Measure and record volume of water required to maintain level for one hour.
.6 Leakage not to exceed 5.0 litres per hour per 1000 mm diameter per 1000 mm of height above groundwater.
.7 Locate and repair defects if test fails. Retest using same methodology.
.8 Repair leaks regardless of test results.

.7 Vacuum testing: perform test as follows:
.1 Plug all inlet and outlet pipes. Restrain plugs.
.2 Place and seal vacuum tester head on the manhole frame.
.3 Draw vacuum of 250 mm Hg on the manhole and measure the time for the vacuum to drop to 225 mm Hg.
.4 Time to be not less than 45, 50, 65, and 80 seconds for manhole diameters of 1050 mm, 1200 mm, 1500 mm, and 1800 mm respectively.
.5 For manholes deeper than 6 meters, increase test times by 2 seconds per 300

mm of additional manhole depth.

.6 Locate and repair defects if test fails. Retest using same methodology.

.7 Repair leaks regardless of test results.

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END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for constructing storm sewers and culverts. Work includes supply and installation of pipe, fittings and service connections.

1.2 Related Sections

.1	Concrete	Section 03 30 00
.2	Metal Fabrications	Section 05 50 00
.3	Earthwork	Section 31 20 00
.4	Reinstatement	Section 32 98 00
.5	Precast Manholes, Catch Basins and Structures	Section 33 39 00
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1.3 Reference Standards

.1 ASTM C14M-07, Concrete Sewer, Storm Drain, and Culvert Pipe (Metric).

.2 ASTM C76M-08a, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).

.3 ASTM D1056-07, Flexible Cellular Materials - Sponge or Expanded Rubber.

.4 CSA-G401-M-07, Corrugated Steel Pipe Products.

.5 CAN/CSA A257 Series-03, Standards for Concrete Pipe and Manhole Sections.

.6 CAN/CSA B1800 Series-06, Thermoplastic Non-Pressure Piping Compendium.

1.4 Certificates

.1 Upon request, submit manufacturers' test data and certification that products and materials meet requirements of this Section in accordance with Section 01001 for items listed in Supplementary Specifications.

1.5 Handling and Storage

.1 Handle and store pipe and fittings in such manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore.

.2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

PART 2 - PRODUCTS

2.1 General

.1 Diameter, material, strength class and dimensional ratio of pipe and fittings: as indicated.

2.2 Concrete Pipe and Fittings

.1 Pipe and Fittings:
.1 Non-reinforced: to ASTM C 14M or CAN/CSA A257.1.
.2 Reinforced: to ASTM C 76M or CAN/CSA A257.2.

.2 Joints: bell and spigot with flexible rubber gaskets to CAN/CSA A257.3-M.

2.3 Plastic Pipe and Fittings

.1 Type PSM Polyvinyl Chloride:
.1 For diameter 150 mm and under: CAN/CSA B182.1.
.2 For diameter 200 mm and over: CAN/CSA B182.2-M.

.2 Profile PVC sewer pipe and fittings: to CAN/CSA B182.4, profile as indicated in Project Documents.

.3 Joints: bell and spigot with locked-in rubber gasket.

2.4 HDPE Pipe and Fittings

.1 Double walled HDPE: to CSA B182.6 with smooth interior surfaces.

.2 Fittings: welded or bell and gasket as indicated.

2.5 Corrugated Steel Pipe and Couplers

.1 Pipe and Couplers: to CAN3-G401-M galvanized.
.1 Gaskets: to ASTM D1056.

2.6 Service Saddles

.1 Concrete main: cast-iron or PVC with gasket, all stainless steel strap, or bolt on, and O-ring in branch end.

.2 PVC main: in-line tee or wye or PVC strap-on saddle, with gasket, all stainless steel clamps and O-ring in branch end.

.3 Corrugated steel pipe: prefabricated corrugated steel saddle as specified for corrugated steel pipe.

2.7 Marker Stakes

.1 Timber, 40 mm x 90 mm.

2.8 Grout

.1 Non-shrink: to Section 03300.

PART 3 - EXECUTION

3.1 Preparation

.1 Carefully inspect products for defects and remove defective products from site.

.2 Ensure that pipe and fittings are clean before installation.

3.2 Trenching, Bedding and Backfilling

.1 Do trenching, bedding and backfilling to Section 31 20 00.

3.3 Pipe Installation

.1 Lay and joint pipe and fittings as specified herein and according to manufacturer's published instructions.

.2 Lay pipe and fittings on prepared bed, true to line and grade indicated within following tolerances:
Horizontal Alignment: 50 mm.
Vertical Alignment: the lesser of 13 mm or one half the rise per pipe length.

.3 Commence laying at outlet and proceed in upstream direction with bell ends facing upgrade.

.4 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipelaying is not in progress.

.5 Install gaskets in accordance with manufacturer's published instructions. During cold weather, store gaskets in heated area to assure flexibility.

.6 Align pipe carefully before joining. Do not use excessive force to join pipe sections.

.7 Support pipes as required to assure concentricity until joint is properly completed.

.8 Keep pipe joints free from mud, silt, gravel or other foreign material.

.9 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.

.10 Complete each joint before laying next length of pipe.

.11 Where deflection at joints is permitted, deflect only after the joint is completed. Do not exceed maximum joint deflection recommended by pipe manufacturer.

.12 At structures provide flexible joint not more than 1 metre from outside face of structure.

.13 For corrugated steel pipe match corrugations or indentation of coupler band with pipe sections before tightening. Tap coupler firmly while tightening to take up slack and ensure snug fit. Ensure all bolts are inserted and tightened.

.14 Install polyethylene pipe in accordance with CSA B182.6.

.15 Cut pipe as required for fittings or closure pieces, square to centreline, and as recommended by manufacturer.

.16 Make watertight connections to manholes and catchbasins. Use non-shrink grout when suitable gaskets are not available.

3.4 Undercrossing

.1 Provide shop drawings showing proposed method of installation for pipe in undercrossing.

.2 Excavate working pit according to reviewed shop drawings.

.3 Dewater area of excavation and undercrossing.

.4 Place jacking, boring or tunneling equipment in working pit to approved line and grade of the proposed pipe.

.5 Install encasing pipe to proposed line and grade as indicated.

.6 Use mechanical or welded type joints for encasing pipe.

.7 After encasing pipe has been installed, check line and grade for approval.

.8 Remove any soil that remains in the casing pipe.

.9 Insert pipe into encasement pipe, starting from the working pit.

.10 Place pipe one length at time outside encasement pipe. Maneuver pipe into position.

.11 Use approved blocking method to guide pipe in true alignment.

3.5 Service Connections

.1 Lay and join pipe and fittings to manufacturer's published instructions.

.2 Maintain minimum 2 percent grade or as required by authorities having jurisdiction.

.3 Use tee, wye fittings, saddles or core-in type sewer connectors for connections to sewer. For all connections cut hole using appropriate equipment and approved methods.

.4 Use long sweep bends where possible. Make up required horizontal and vertical bends from standard bends of 45 degrees or less, separated by straight section of pipe having minimum length of four pipe diameters.

.5 Plug service laterals with watertight caps or plugs at termination points. Paint cap and stub end of pipe GREEN.

.6 Place temporary marker stake at end of each plugged or capped service lateral, extending from pipe end at pipe level to

600 mm above grade. Paint exposed portion of stake GREEN with designation STORM in black.

3.6 Inspection

.1 Engineer may require inspection of installed sewers by television camera, photographic camera or by other visual method.

.2 Provide television camera inspection when required by project document.

3.7 Deflection Testing – Plastic Pipe

.1 Measure deflection by pulling deflection gauge through each pipe from manhole to manhole after backfilling.

.2 Provide deflection gauges to measure a 5% and 7-1/2% deflection. Gauges to be a "Go-No-Go" device similar to Standard Detail 02517-D2.

.3 Within thirty days after installation, pull a deflection gauge measuring 5% deflection through the installed section of pipeline. If this test fails proceed with 7-1/2% deflection test. If 7-1/2% deflection test fails, locate defect and repair. Retest using same methodology.

.4 Thirty days prior to completion of warranty period, pull a deflection gauge measuring 7-1/2% deflection through the installed section of pipeline. If 7 1/2% deflection test fails, locate defect and repair. Retest using same methodology.

3.8 Closed Circuit Television Inspection

.1 Conduct closed circuit television inspection procedures to meet North American Association of Pipeline Inspectors (NAAPI) and the WRc Standard.

.2 Equipment:

.1 Provide equipment meeting following requirements:

.1 Self-contained, self-leveling monitoring unit and pan-tilt camera with remotely controlled lighting system capable of varying the illumination.

.2 Picture quality shall produce continuous 600-line resolution picture, showing entire periphery of pipe.

.3 A meter device with readings above ground or marking on cable to clearly identify exact location of camera.

.3 Inspection:

.1 Perform inspection of pipe from manhole to manhole by passing TV camera through sewer in direction of flow.

.2 Classify results in accordance with North American Pipeline Inspectors (NAAPI) and WRc Standard.

.4 Records:

.1 Maintain inspection record in log form, during television inspection.

.2 Log to include location of each fault and service lateral distance measured from centreline of reference manhole and position referenced to axis of pipe.

.3 Photograph fault from the television screen. All photographs to be clear and precise with distinct definition of fault.

.4 Include detailed technical description with photographs as supporting data for each fault.

.5 Provide minimum of two photographs for each sewer main section televised, detailing typical joint, and typical building service lateral.

.6 All photos and videos to be in colour.

.5 Reports:

.1 Provide a composite report of TV inspection. Enclose report in binder on letter size paper. Include following pages and information.

.1 Title page identifying project, camera operator and dates of inspection.

.2 Index page identifying street name, section from manhole to manhole, page number or numbers where information for section is contained.

.2 Organize inspection records in sequence from upstream manhole to downstream manhole.

.3 Report on each sewer main section to contain:

.1 Heading:
.1 Street name.
.2 Manhole numbers applicable to section.
.3 Reference drawing number, if applicable.
.4 Weather on the day of inspection.
.5 Statement of soil condition in area of inspection, i.e., dry, damp, wet, frozen.
.6 Date of inspection.
.2 Key Plan, showing corresponding manhole numbers, magnetic north, horizontal distance, pipe and material between manholes, and direction of flow.
.3 Inspection findings for each sewer main section to include:
.1 Location of all faults.
.2 Photographs of all faults.
.3 Location of all service laterals.
.4 One photograph each of typical joint and typical when service laterals faults are not found.
.4 Mount photographs on left-hand page and place corresponding description on right-hand page. Number all photographs in order. Number beside photograph to correspond with description number.
.5 Enclose all pages of report in transparent sheet protector.

.6 Accuracy:
.1 Maximum permissible error in accuracy to be within following limits of fault location:
.1 Up to 375 mm pipe: ± 75 mm per 100 m of length.
.2 450 mm - 600 mm pipe: ± 150 mm per 100 m of length.
.3 750 mm - 900 mm pipe: ± 225 mm per 100 m of length.

.7 Video Record:
.1 Supply a complete record of all inspections in digital format.
.2 Index all tapes, listing sections of inspections.
.3 Submit video tapes or CD’s with written reports to Engineer.

.8 Repeat Inspection:
.1 Repair faults detected during television inspection. Repeat television inspection at no cost to Owner.

END

INDEX TO CLAUSES

PART 1 - GENERAL

1.1 Work Included
1.2 Related Sections
1.3 Reference Standards

PART 2 - PRODUCTS

2.1 Materials

PART 3 - EXECUTION

3.1 General
3.2 Trench Preparation
3.3 Pipe Laying
3.4 Backfill
3.5 Reinstatement
3.6 Testing
3.7 Inspection
3.8 Records

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for installing owner supplied natural gas distribution polyethylene pipelines. Work includes trench preparation, pipe laying, backfill, testing and reinstatement.

1.2 Related Sections

.1	Concrete:	Section 03 30 00
.2	Earthwork:	Section 31 20 00
.3	Asphalt Concrete Paving:	Section 32 12 16
.4	Walks, Curbs and Gutters	Section 32 16 00
.5	Seeding and Sodding:	Section 32 92 00
.6	Reinstatement:	Section 32 98 00

1.3 Reference Standards

.1 CSA Z662-07 Package, Oil and Gas Pipeline System, Current Edition.

.2 Pipeline regulations, Nova Scotia.

.3 When a pipeline is installed within a public right-of-way, the installation shall also meet the requirements of the authority having jurisdiction.

PART 2 - PRODUCTS

2.1 Material

.1 Pipeline materials and fittings will be to CSA Z662 and natural gas distribution company standards.

.2 Backfill and reinstatement materials will be in accordance with related sections of Standard Specifications for Municipal Services and as specified in the Project Documents.

PART 3 – EXECUTION

3.1 General

.1 Use workers skilled in natural gas pipeline installation.

3.2 Trench Preparation	.1	Trench excavation, bedding and compaction will be in accordance with natural gas distribution company standards.
3.3 Pipe Laying	.1	Lay pipe and fittings on prepared trench bottom with minimum depth of cover as specified by CSA Z662.
	.2	Pipe joining shall be completed by personnel certified by natural gas distribution company using fusion equipment in accordance with manufacturer’s recommendation and natural gas distribution company standards.
3.4 Backfill	.1	Bedding or select native backfill will be backfilled in accordance with natural gas distribution company standards.
	.2	Coordinate work activities to ensure heavy equipment is not driven over the pipeline nor compaction activities take place until 600 mm of backfill has been placed over the pipeline.
3.5 Reinstatement	.1	Restoration of disturbed areas shall be to previous conditions or better in accordance with applicable related section of Standard Specifications for Municipal Services and as specified in the Project Documents.
3.6 Testing	.1	Be responsible for maintaining gas pipeline integrity after backfill has been completed and test pipeline to natural gas distribution company standards prior to activation and as part of substantial performance requirements.
3.7 Inspection	.1	Accommodate the inspection requirements of the natural gas distribution company and of any other regulatory authority.
3.8 Records	.1	Provide record drawings and test results to natural gas distribution company as part of substantial performance requirements.

END

INDEX TO CLAUSES

PART 1 - GENERAL

1.1 Work Included
1.2 Related Sections
1.3 Reference Standards
1.4 Submittals

PART 2 - PRODUCTS

2.1 Materials

PART 3 - EXECUTION

3.1 Erection
3.2 Painting Touch Up

END

PART 1 - GENERAL

1.1 Work Included

.1 This section specifies requirements for supplying and installing steel guardrail and wooden guide posts.

1.2 Related Sections

.1 Earthwork Section 31 20 00

1.3 Reference Standards

.1 ASTM A307-07b, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.2 CSA O80 Series-08, Wood Preservation.

.3 AASHTO M180-00(2004), Corrugated Sheet Steel Beams for Highway Guard-rails.

.5 CAN/CGSB 1.181-99, Ready Mixed Organic Zinc-Rich Coating.

1.4 Submittals

.1 Submit shop drawings in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

PART 2 - PRODUCTS

2.1 Materials

.1 Steel W-beam guardrail:
- .1 Steel rail and terminal sections: to AASHTO M180, Class A.
- .2 Coatings:
  - .1 Type 1, zinc coated.
  - .2 Organic zinc-rich coating: to CAN/CGSB-1.181.
- .3 Bolts, nuts and washers: to ASTM A307, hot dip galvanized to CSA G164.

.2 Timber posts:
- .1 Well seasoned, straight and sound, free from knots or other defects. Acceptable species for posts shall be Eastern hemlock, red pine or mixed hardwood (birch, maple, oak or ash).
- .2 Treatment (Pressure):
  - .1 Cromated copper arsenate (CCA) or ammoniacal copper arsenate (ACA) to CAN/CSA 080 minimum retention of preservative: 6.4 kg/m^3.

PART 3 - EXECUTION

3.1 Erection

.1 Set posts by instrument for alignment and locations and to depths as indicated or as directed.

.2 Excavate post holes and compact bottom to provide firm foundation. Set posts plumb and square in holes.

.3 Backfill around posts using selected excavated material and place in uniform layers not exceeding 300 mm thickness; compact to 95% Standard Proctor Density.

.4 Cut tops of posts as indicated, with tops parallel to grade of pavement edge.

.5 Treat cut tops with two coats of same type of wood preservative used to pressure treat posts.

.6 Erect steel W-beam components to details indicated. Lap joints in direction of traffic. Tighten nuts to 100 N.m torque. Maximum protrusion of bolt 12 mm beyond nut.

3.2 Painting Touch Up

.1 Galvanized steel-touch up:
.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Pre-treat damaged surfaces according to manufacturer's instructions for zinc-rich paint. Apply two coats of organic zinc-rich paint to damaged areas.

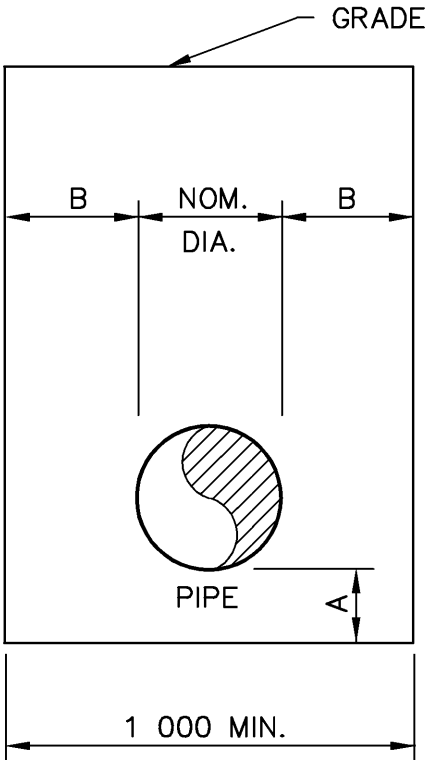
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Trench Payment Details for Additional Items	01 22 00-01
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Concrete Curb Section	32 16 00-02
Mountable Curb and Gutter Section	32 16 00-03
Guyed Tree Planting Detail	32 90 00-01
Staked Tree Planting Detail	32 90 00-02
Shrub Planting Detail	32 90 00-03
Soil Texture Classes, Canadian System of Soil Classification	32 90 00-04
Standard Tree Protection for Single Trees	32 90 00-05
Standard Tree Trunk Protection for Single Trees When Protective Fencing cannot be Installed	32 90 00-06
Fire Hydrant	33 11 00-01
Gate Valve and Valve Box	33 11 00-02
Water Service Connection	33 11 00-03
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Typical Zinc Anode Installation on Valves and Copper Services	33 11 00-06
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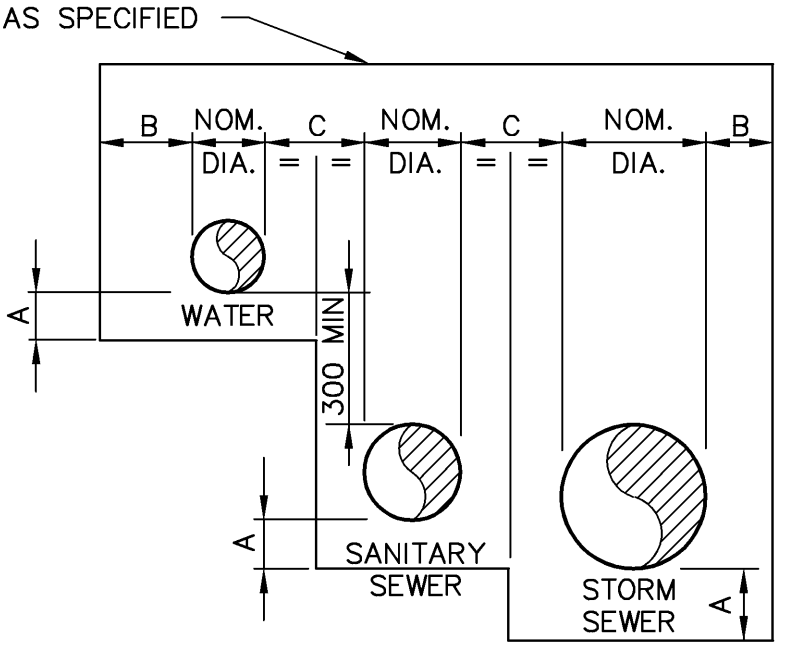
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STANDARD SPECIFICATION FOR MUNICIPAL SERVICES | STANDARD DETAILS | SECTION 39 00 00 JAN 2009



TYPICAL SINGLE PIPE TRENCH

(FIG. 1)



TYPICAL MULTIPLE PIPE TRENCH

(FIG. 2)

NOTES:

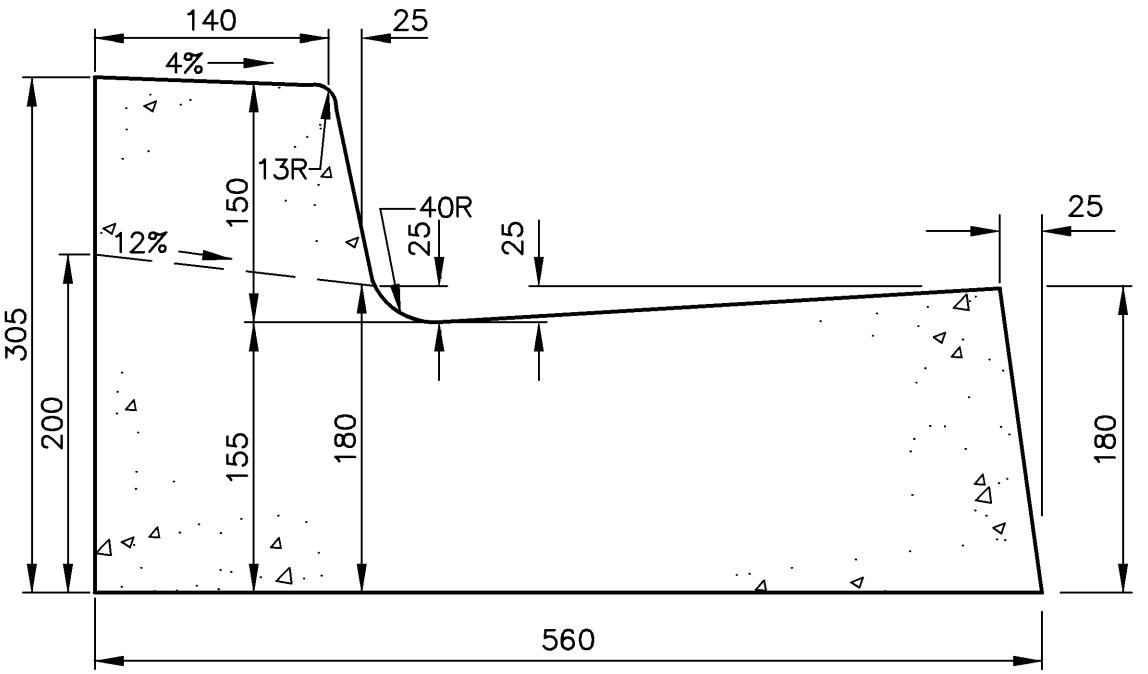
1. DIMENSIONS ARE GOVERNED BY THE LARGER ADJACENT PIPE. (FIG. 2)
2. ACTUAL ELEVATIONS OF ALL PIPES TO BE AS SHOWN ON PROFILES.
3. DIMENSION 'A' EQUALS 25% OF THE NOMINAL DIAMETER OR 150mm WHICHEVER IS GREATER.
4. LATERAL TRENCH PAY WIDTH ONE METRE FOR MAXIMUM COMBINED PIPE DIAMETERS UP TO 300mm.
5. PAYMENT WIDTH FOR STRUCTURES TO BE 300mm OUTSIDE THE OUTER WALL OF STRUCTURES.
6. DIMENSIONS GIVEN ARE FOR PAYMENT PURPOSES ONLY. ACTUAL CONSTRUCTION WIDTHS SHALL BE IN ACCORDANCE WITH THE REGULATIONS AND THE REQUIREMENTS OF THE DEPARTMENTS OF ENVIRONMENT AND LABOUR.

PIPE SIZE NOM. DIA.	DIMENSIONS	
	B	C
UP TO 375	300	500
376 TO 500	300	600
501 TO 750	400	600
751 TO 1200	400	750
OVER 1200	SEE PROJECT DRAWINGS	

TRENCH PAYMENT DETAILS FOR ADDITIONAL ITEMS

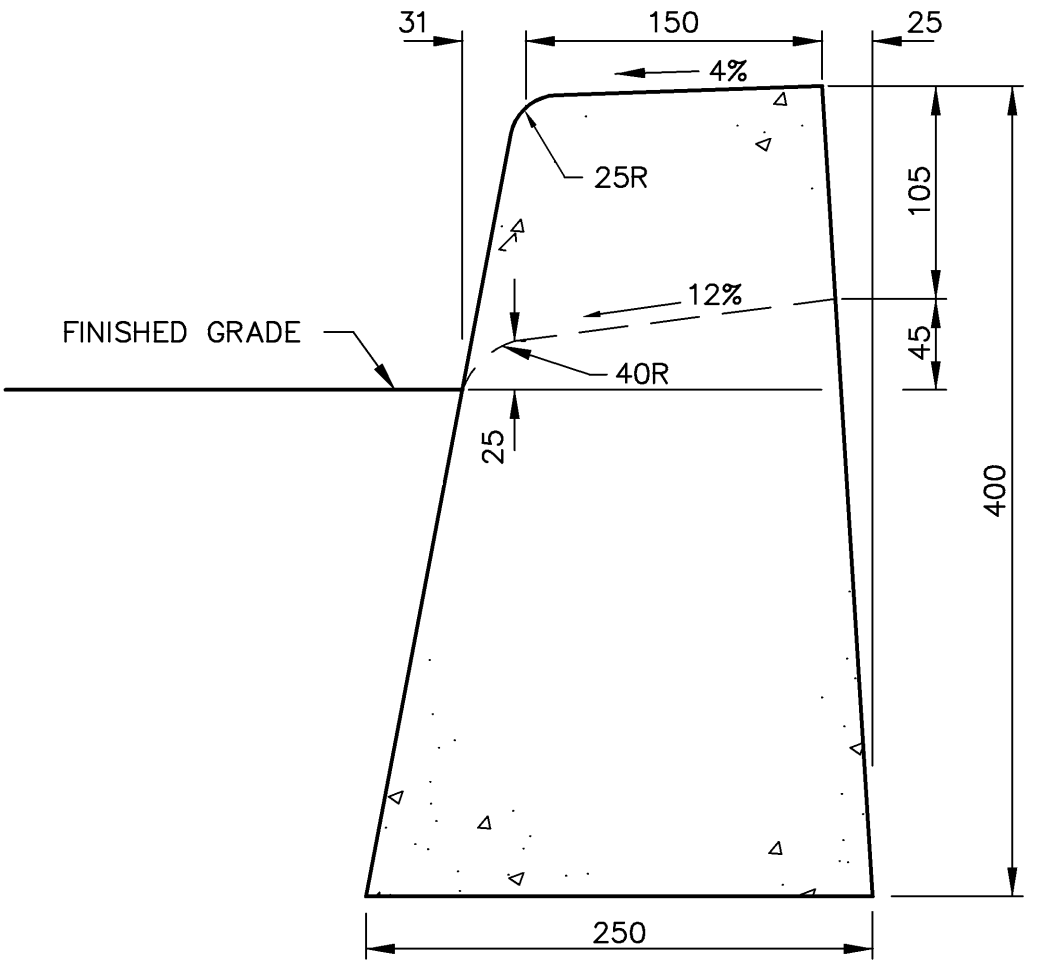
DETAIL NO. 01 22 00–01

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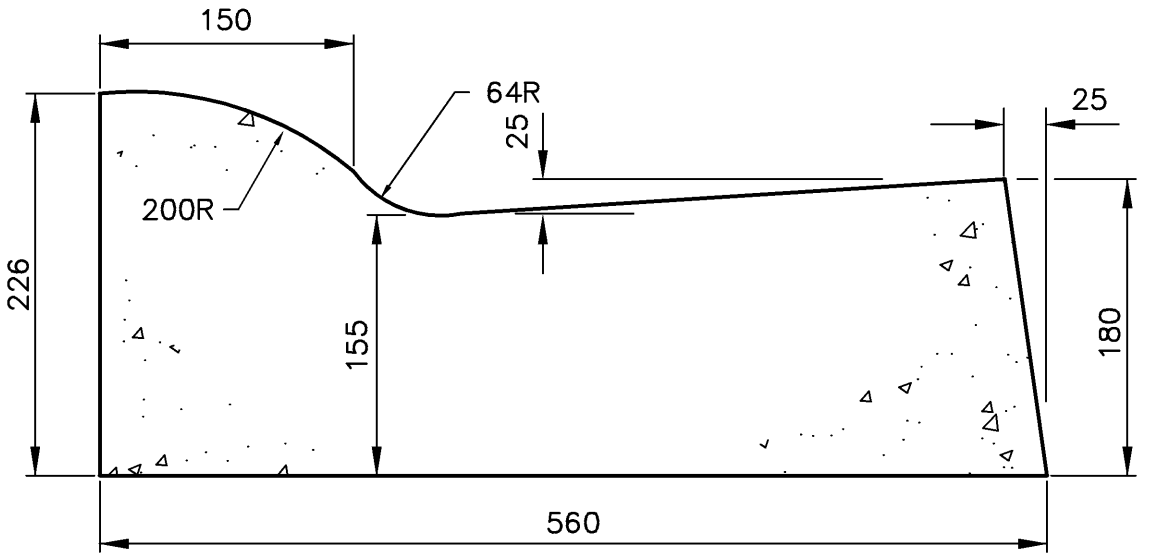
CONCRETE CURB AND GUTTER SECTION	
DETAIL NO.	32 16 00–01

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009



CONCRETE CURB SECTION	
DETAIL NO.	32 16 00–02

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009

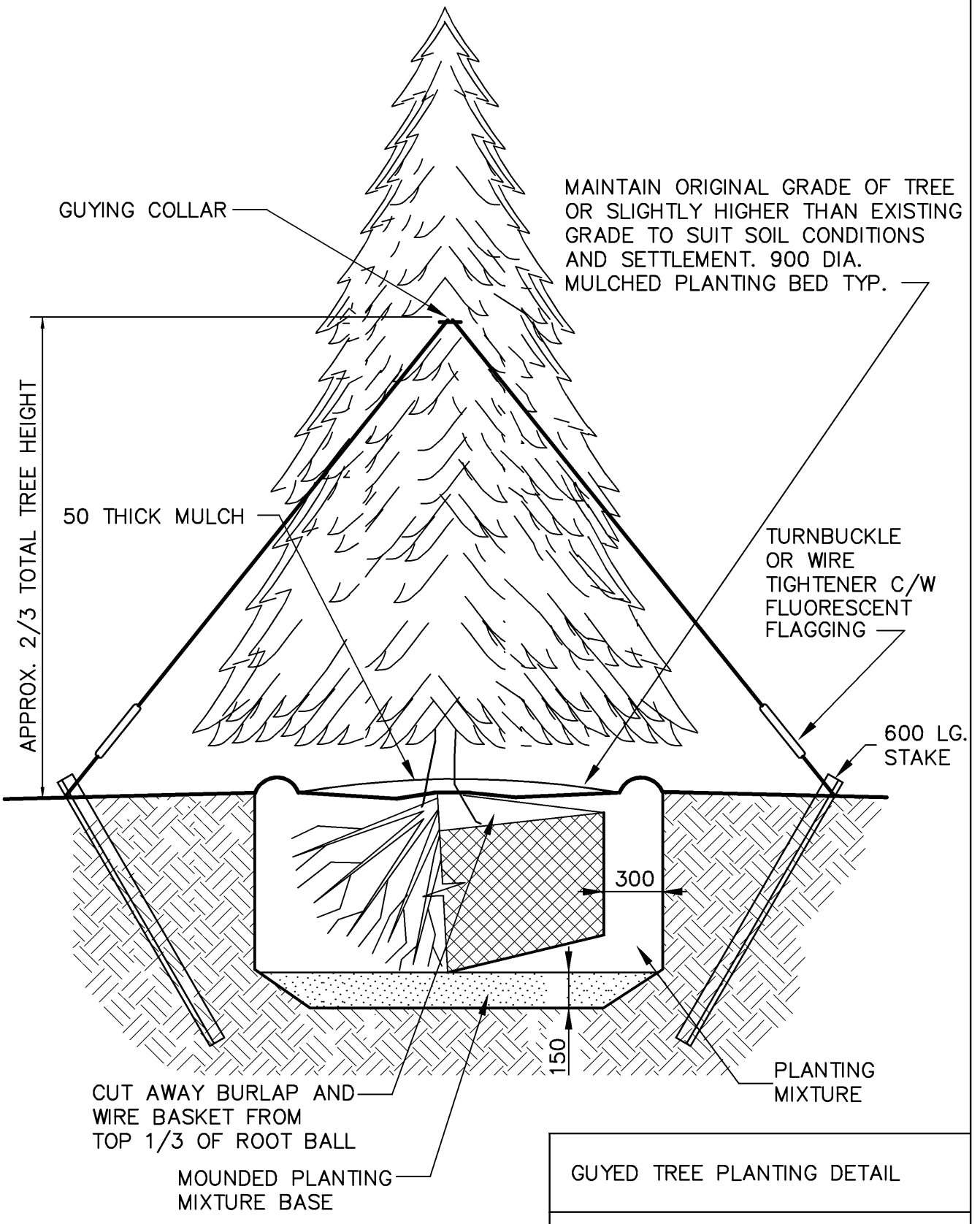


MOUNTABLE CURB AND GUTTER SECTION	
DETAIL NO.	32 16 00–03

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GUYED TREE PLANTING DETAIL

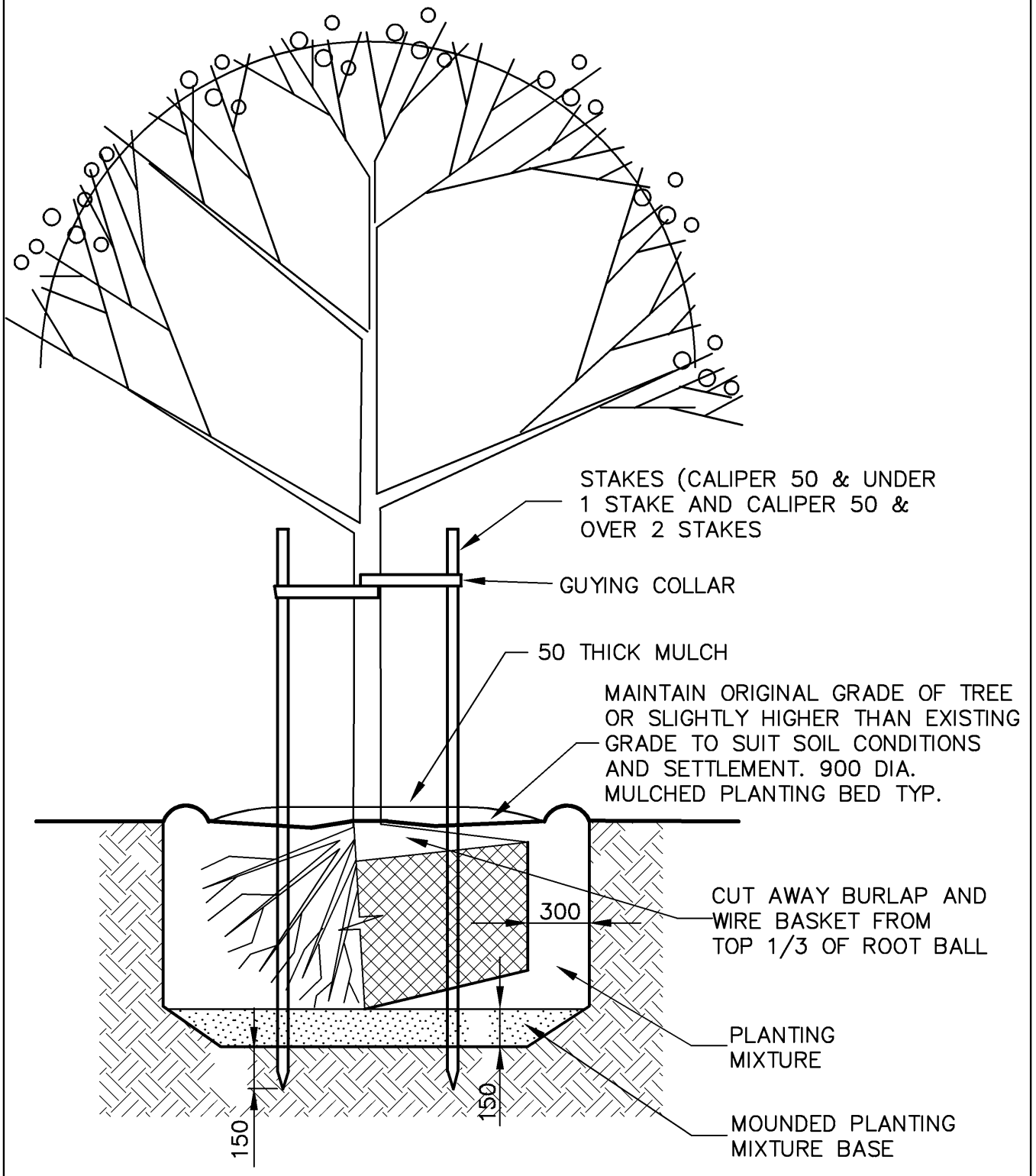
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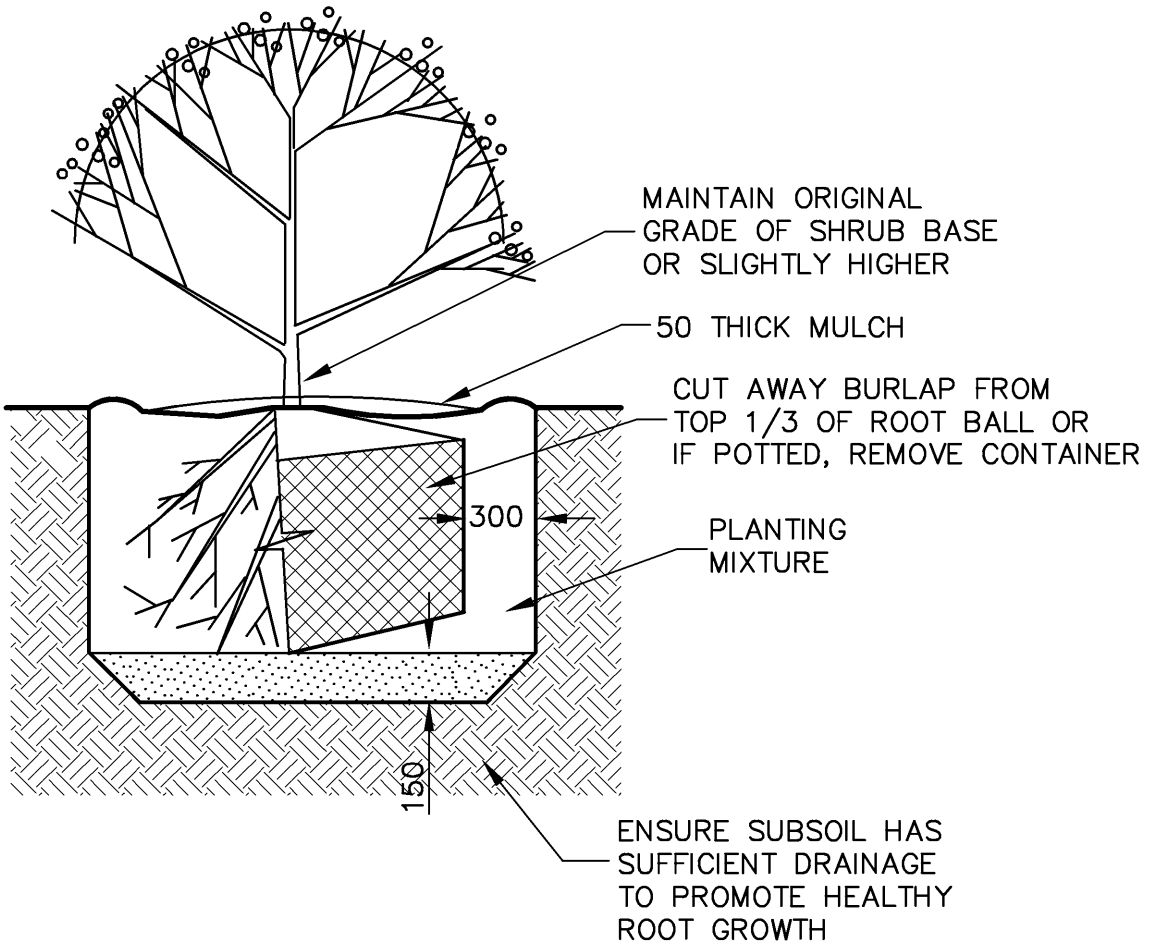
JAN 2009



STAKED TREE PLANTING DETAIL

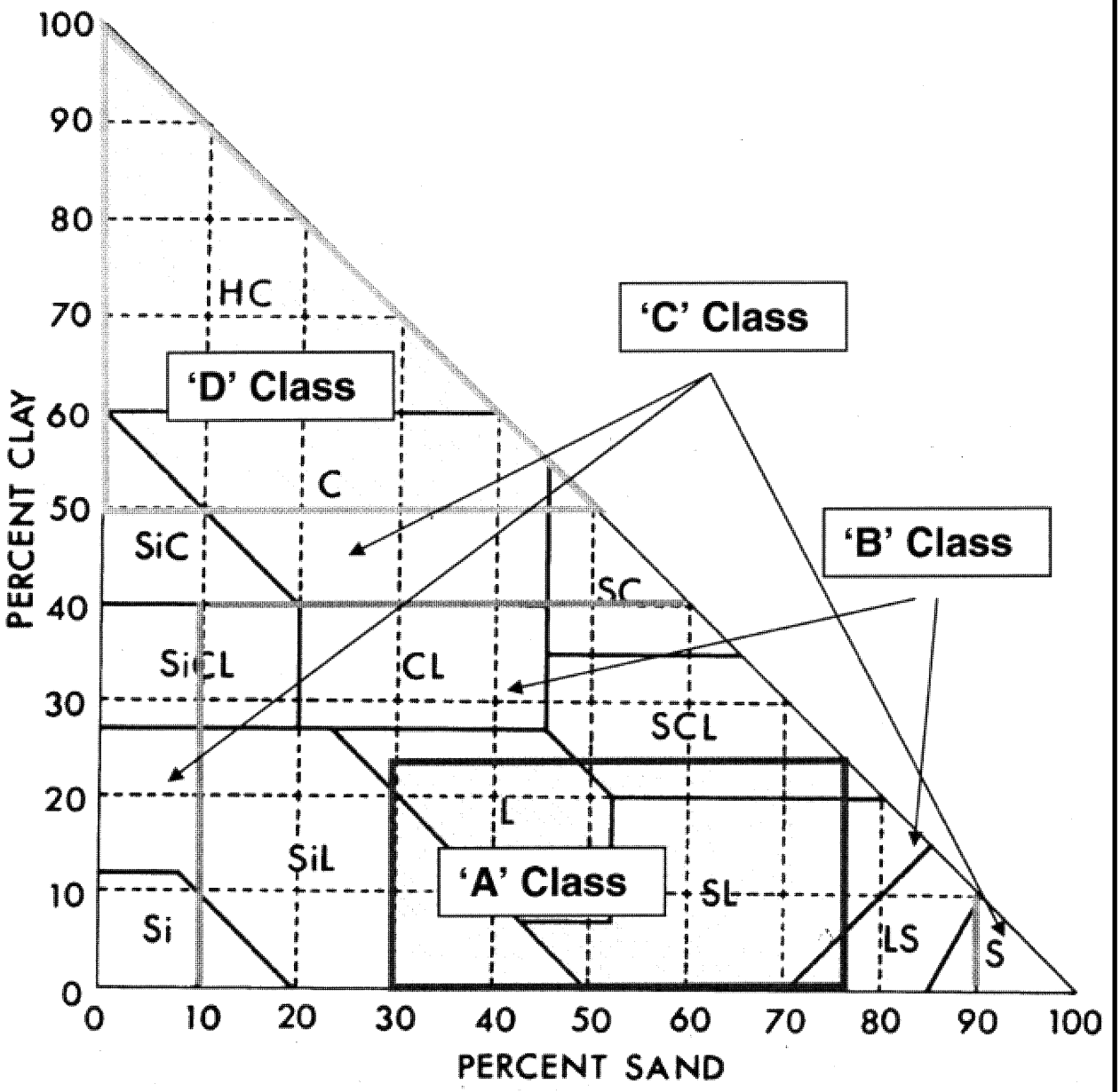
DETAIL NO. 32 90 00–02

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009



SHRUB PLANTING DETAIL	
DETAIL NO.	32 90 00–03

Proposed Soil Groupings



Soil texture classes. Percentages of clay and sand in the main textural classes of soil; the remainder of each class is silt.

SOIL TEXTURE CLASSES,
CANADIAN SYSTEM OF
SOIL CLASSIFICATION

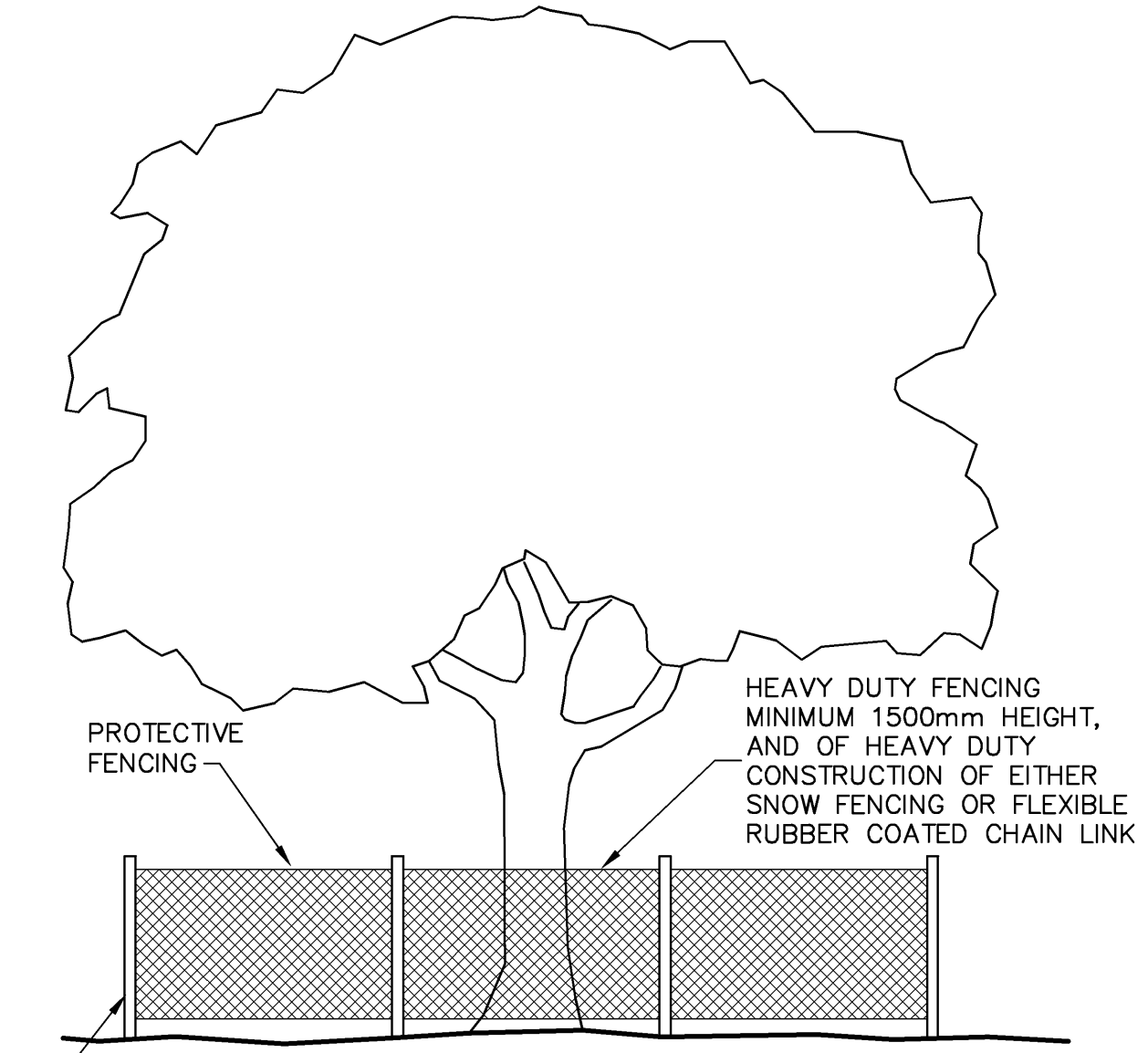
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STANDARD SPECIFICATION
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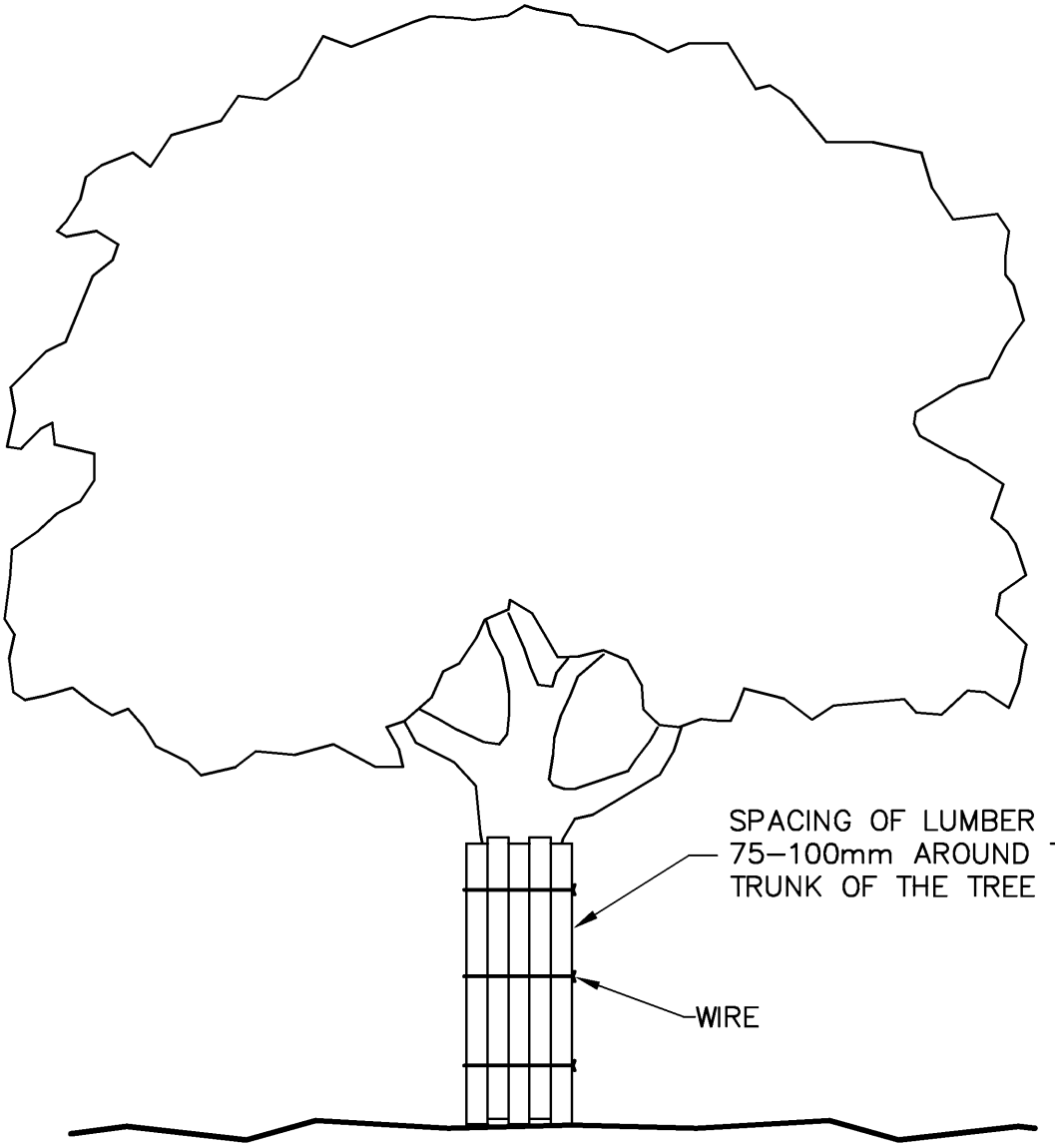
JAN 2009



STANDARD TREE PROTECTION
FOR SINGLE TREES

DETAIL NO. 32 90 00-05

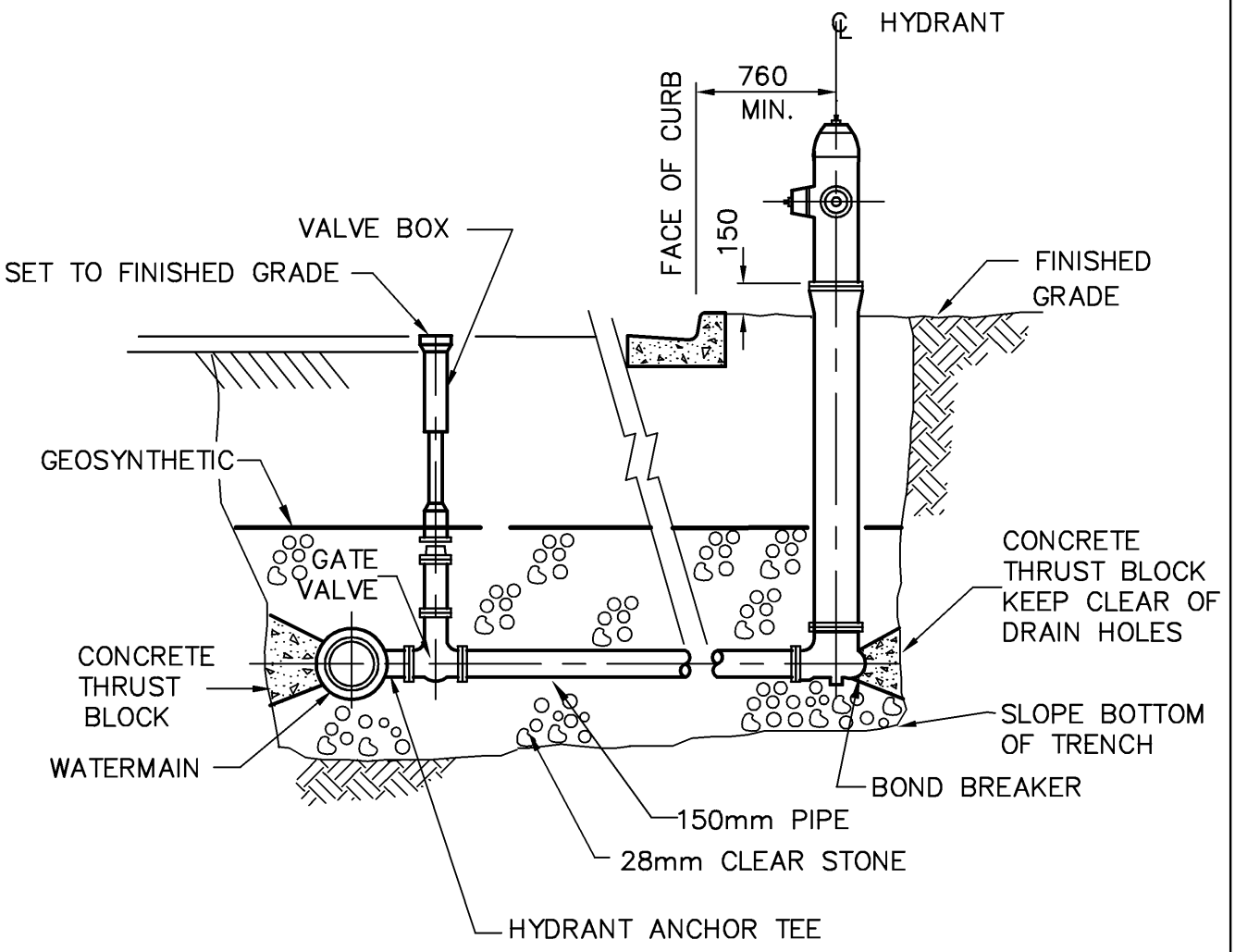
STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009



STANDARD TREE TRUNK PROTECTION FOR SINGLE TREES WHERE PROTECTIVE FENCING CANNOT BE INSTALLED

DETAIL NO. 32 90 00–06

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009

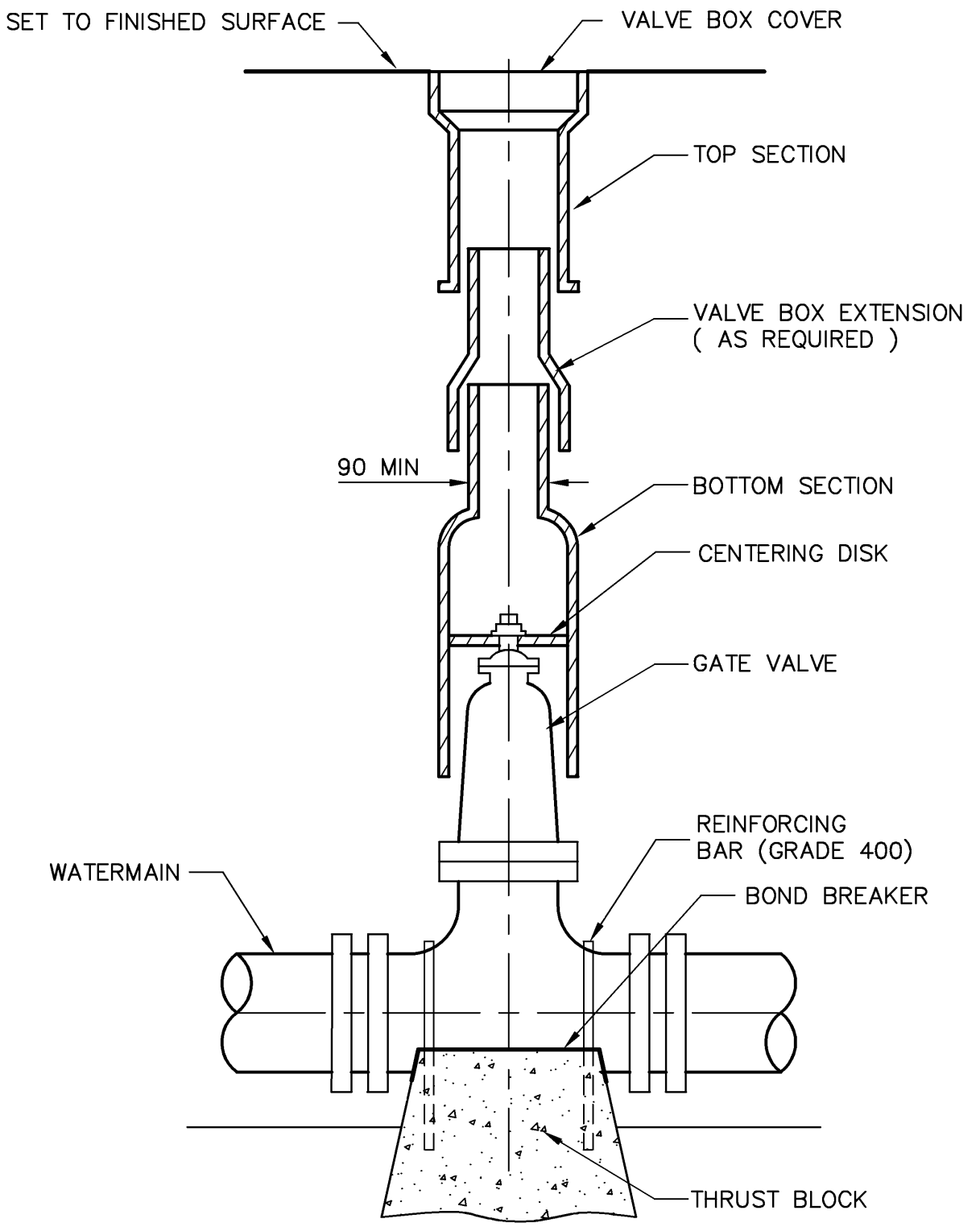


NOTE:

1. SEE 33 11 00–04 AND 33 11 00–05 FOR THRUST BLOCKS.

FIRE HYDRANT	
DETAIL NO.	33 11 00–01

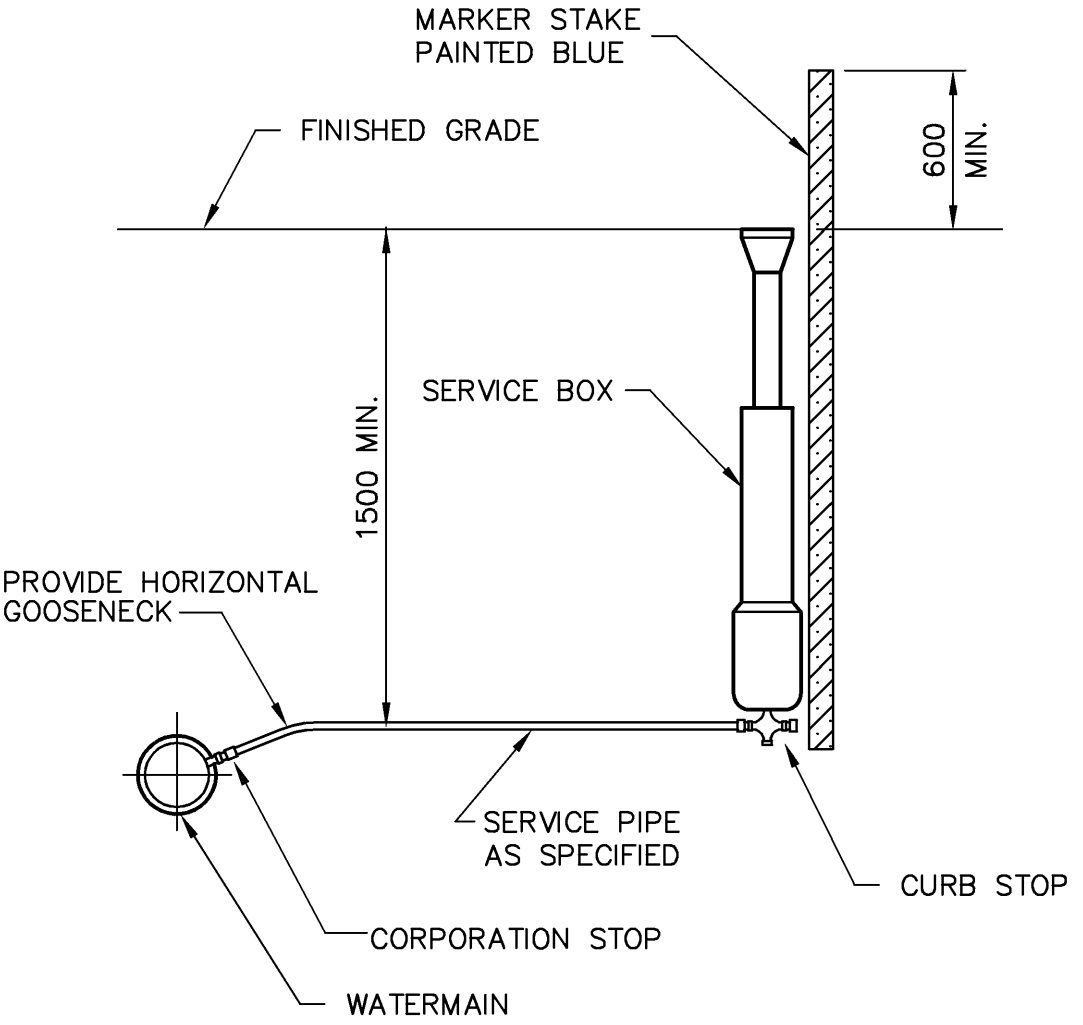
STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009



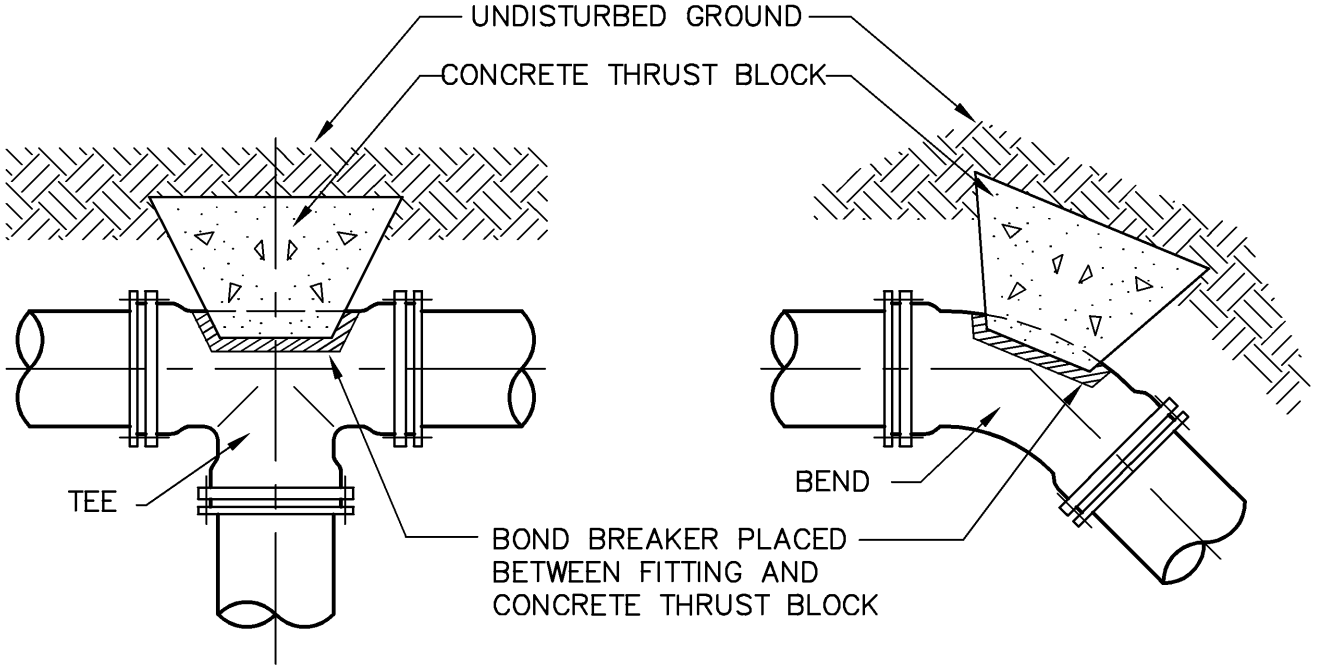
NOTE:
THRUST ANCHOR ONLY REQUIRED FOR POLYETHYLENE AND PVC PIPE GREATER THAN 150 mm.

GATE VALVE AND VALVE BOX	
DETAIL NO.	33 11 00–02

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009

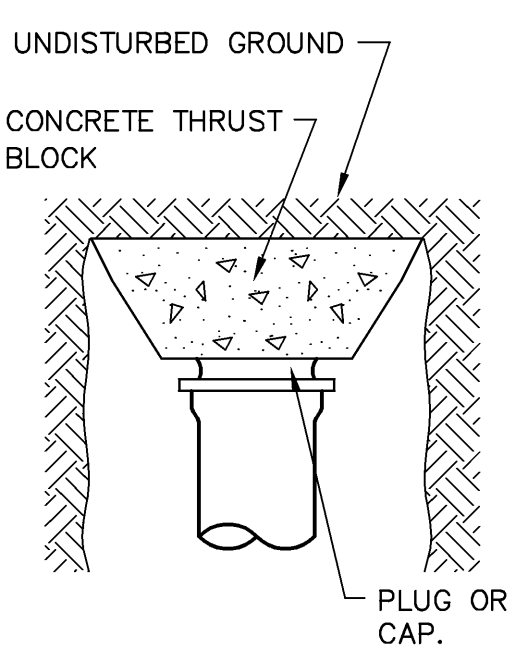


WATER SERVICE CONNECTION	
DETAIL NO.	33 11 00–03

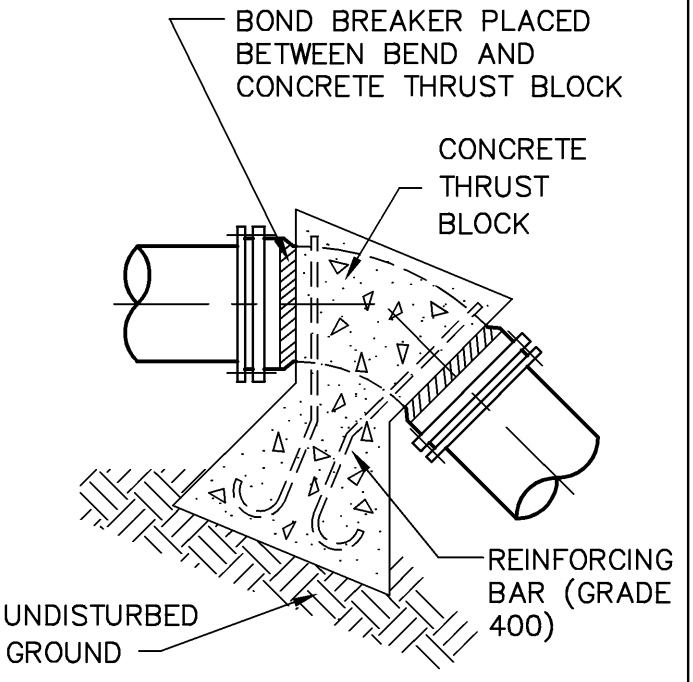


TEE

HORIZONTAL BENDS



BLANK END



VERTICAL BENDS

NOTE: SEE 33 11 00–05 FOR THRUST BLOCK REQUIREMENTS

THRUST BLOCK DETAILS	
DETAIL NO.	33 11 00–04

MINIMUM CONTACT AREAS FOR CONCRETE THRUST BLOCKS

PIPE DIA.	AREA, M^2 FOR SOIL SUPPORTING CAPACITY OF 100 kPa					
mm	CAP/PLUG	TEE	90° BEND	45° BEND	22.5° BEND	11.25° BEND
100	0.25	0.25	0.32	0.20	0.16	0.16
150	0.48	0.48	0.64	0.40	0.24	0.16
200	0.80	0.80	1.12	0.64	0.32	0.16
250	1.28	1.28	1.76	0.96	0.48	0.24
300	1.76	1.76	2.56	1.44	0.72	0.40

MINIMUM DISTANCE FROM FITTING TO UNDISTURBED GROUND

PIPE DIAMETER, mm	mm
100	450
150	450
200	450
250	600
300	750

VERTICAL THRUST BLOCKS
THRUST COMPENSATED FOR BY MASS OF CONCRETE (m^3)

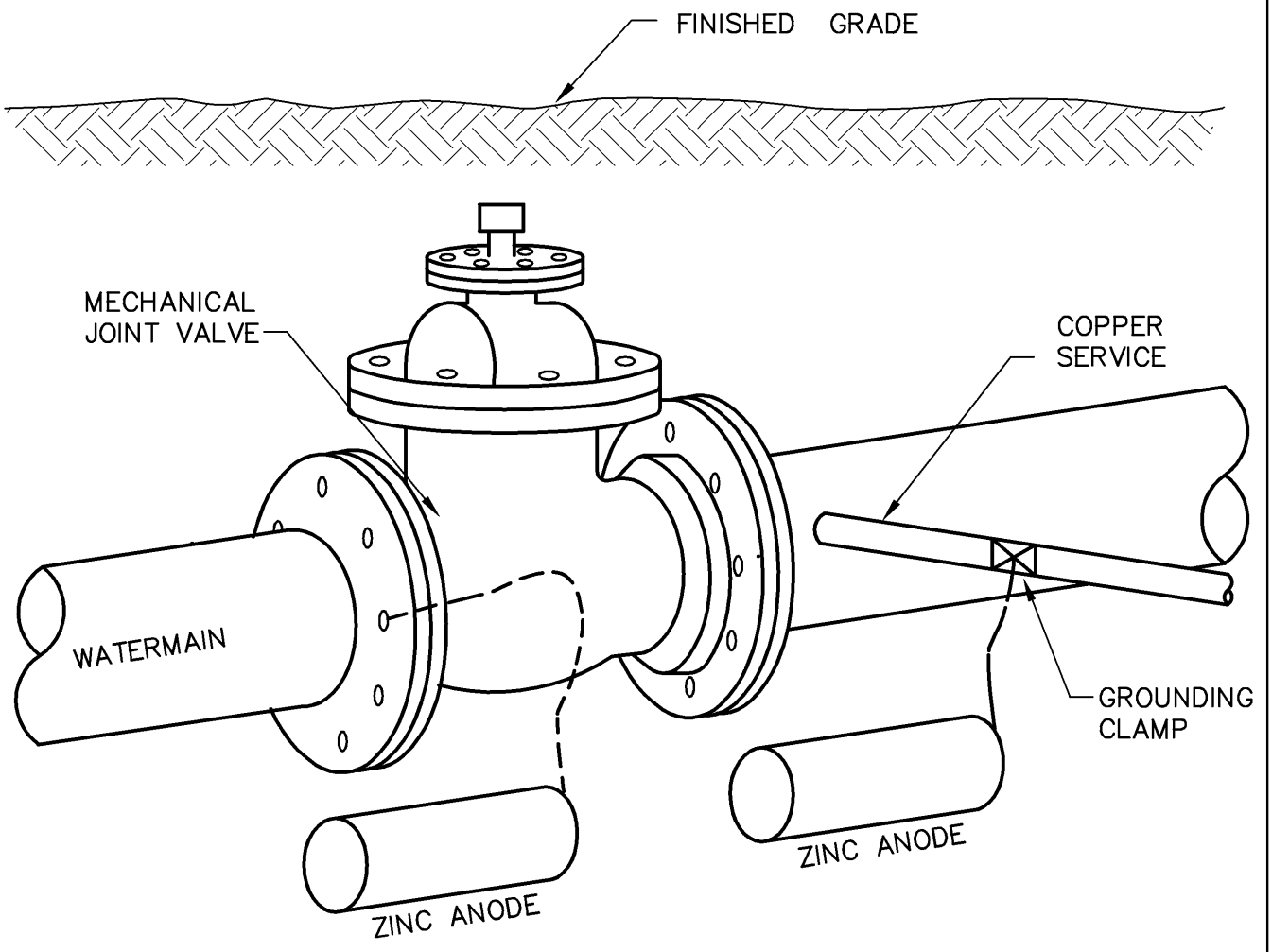
PIPE DIA. mm	45° BEND	22.5° BEND	11.25° BEND
100	0.40	0.20	0.20
150	0.80	0.40	0.40
200	1.40	0.70	0.70
250	2.10	1.10	1.10
300	3.00	1.50	1.50

NOTES:

1. SEE 33 11 00–04 FOR THRUST BLOCK CONFIGURATIONS.

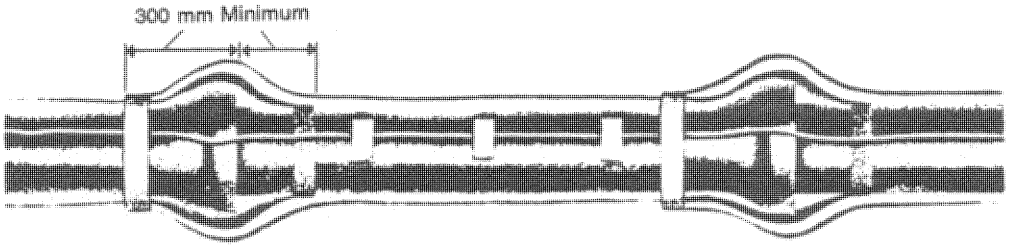
2. THESE TABLES ARE BASED ON SOIL SUPPORTING CAPACITIES OF 100kPa AND AN INTERNAL PIPE PRESSURE OF 1035 kPa. WHERE DIFFERENT SUPPORTING CAPACITIES OR INTERNAL PRESSURES ARE ENCOUNTERED, CONTACT AREAS SHOULD BE CALCULATED ACCORDINGLY. SAFE SUPPORTING CAPACITY SHOULD BE DETERMINED BY THE DESIGN ENGINEER, AND SHOULD INCLUDE AN APPROPRIATE FACTOR OF SAFETY.

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009

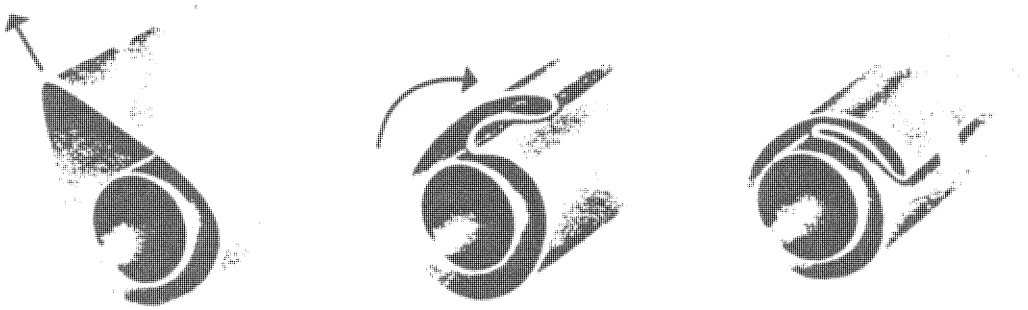


1. SEPARATE ANODE AND VALVE / SERVICE USING 50mm THICK RIGID INSULATION IF ANODE IS INSTALLED DIRECTLY ADJACENT TO VALVE OR SERVICE.
2. WRAP ANODE WIRE AROUND A BOLT SEVERAL TIMES WHEN ANODES ARE ATTACHED TO MECHANICAL JOINT VALVES.
3. IF PUSH–ON JOINT VALVES ARE INSTALLED, ANODE WIRE MUST BE ATTACHED TO VALVE WITH WIRE CONNECTOR OR CADWELD. APPLY BITUMINOUS COATING TO WIRE CONNECTOR OR CADWELD.

TYPICAL ZINC ANODE INSTALLATION ON VALVES AND COPPER SERVICES	
DETAIL NO.	33 11 00–06



One length of polyethylene tube for each length of pipe, overlapped at joint.



Take up slack in tube to make snug, but not tight, fit. Fold excess back over top of pipe, securing the fold at quarter points along the length of the pipe.

1. DUCTILE PIPE AND FITTINGS TO BE ENCASED IN 200 MICRON POLYETHYLENE TUBE OR SHEET.
2. DURING INCLEMENT WEATHER OR WET TRENCH CONDITIONS, USE PLASTIC STRIP TIES TO SECURE POLYETHYLENE.

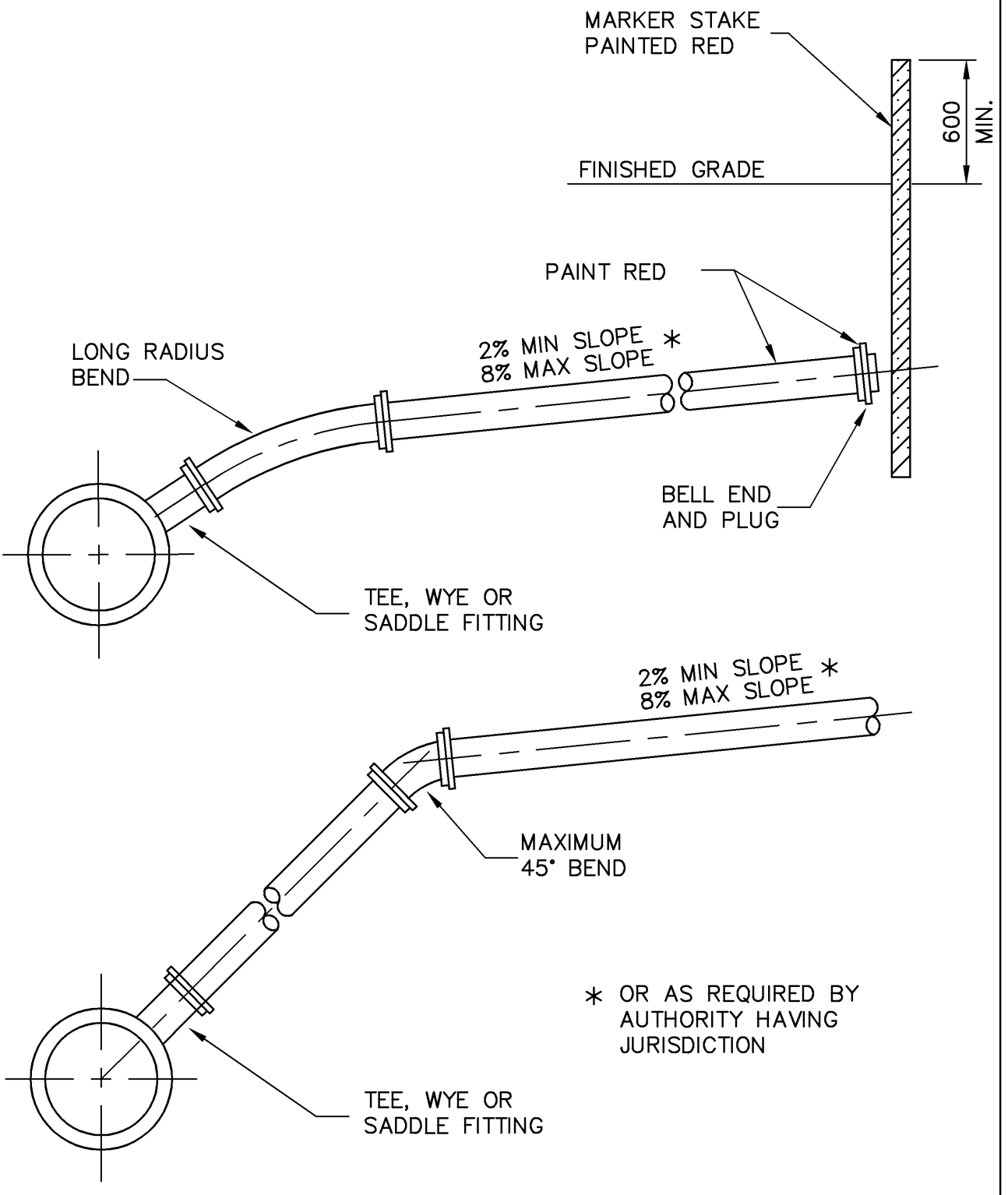
POLYETHYLENE ENCASEMENT
ON DUCTILE IRON WATER PIPES

DETAIL NO. 33 11 00–07

STANDARD SPECIFICATION
FOR
MUNICIPAL SERVICES

STANDARD DETAILS

SECTION 39 00 00
JAN 2009



CONNECTION TO DEEP SEWER

SANITARY SEWER
SERVICE CONNECTION

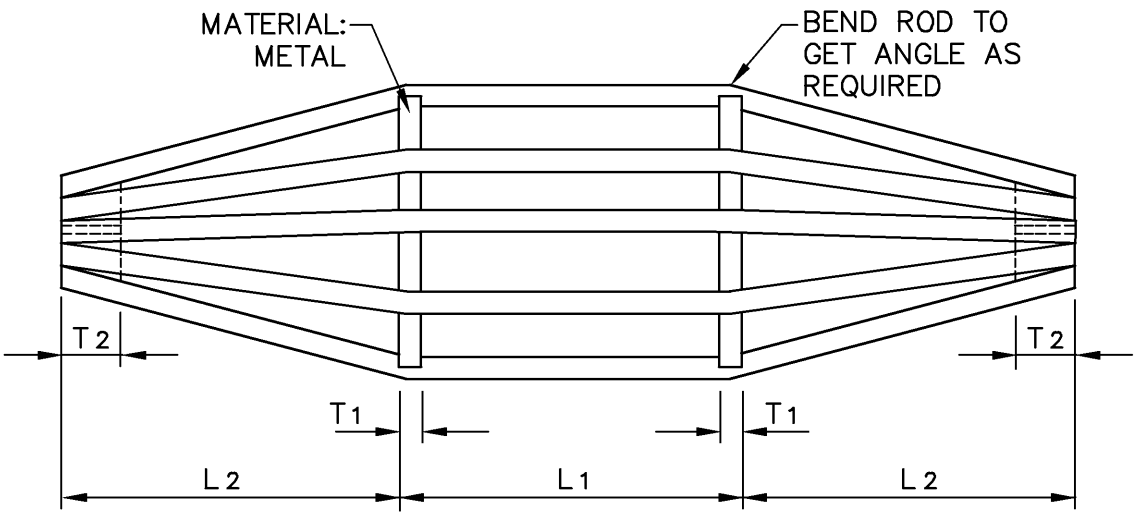
DETAIL NO. 33 31 00–01

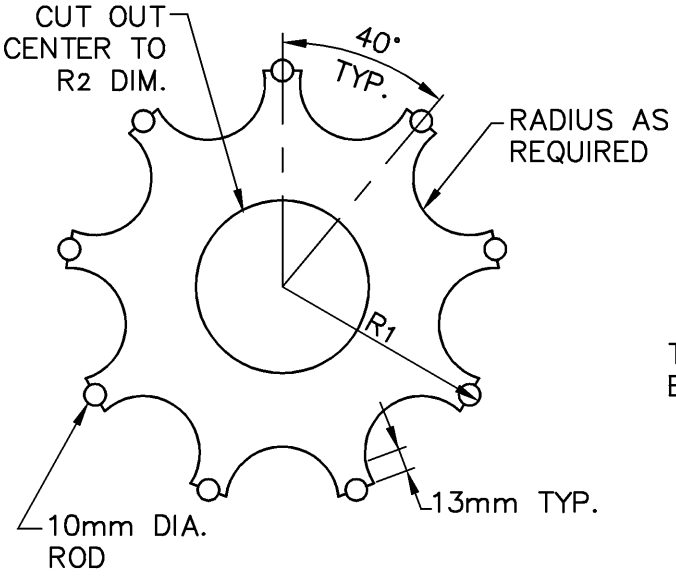
STANDARD SPECIFICATION FOR MUNICIPAL SERVICES

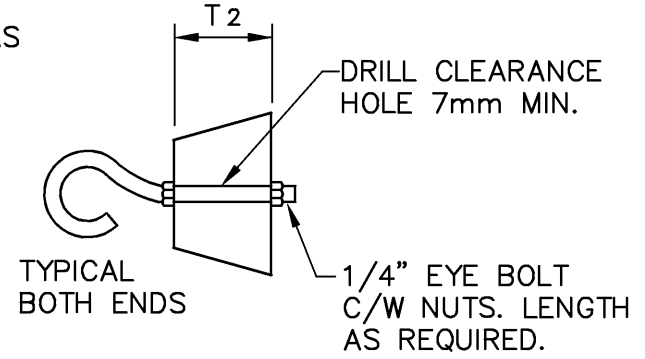
STANDARD DETAILS

SECTION 39 00 00

JAN 2009





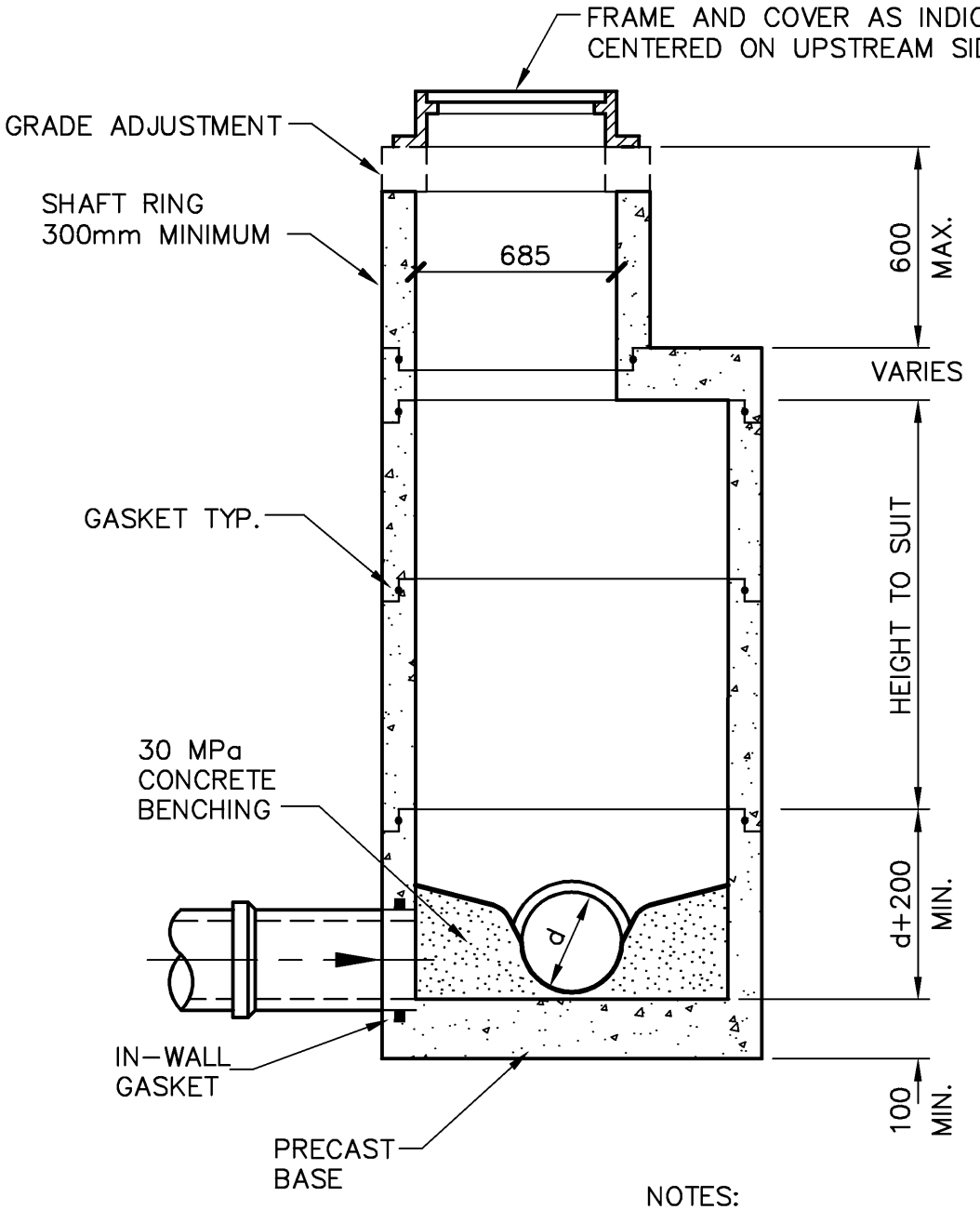


NOTE:
WELD ALL RODS TO FRAME

PIPE SIZE	BASE ID.	L1 L2	ROD DIA.	T1	T2	R2	5% R1	7 1/2% R1
150	148.66	150	10	10	25	20	70.6	68.8
200	199.46	150	10	10	25	35	94.7	92.2
250	249.20	200	10	10	25	40	118.4	115.3
300	296.78	200	10	10	25	45	141.0	137.3
375	363.10	230	10	10	25	50	172.5	167.9

DEFLECTION GAUGE

DETAIL NO. 33 31 00–02

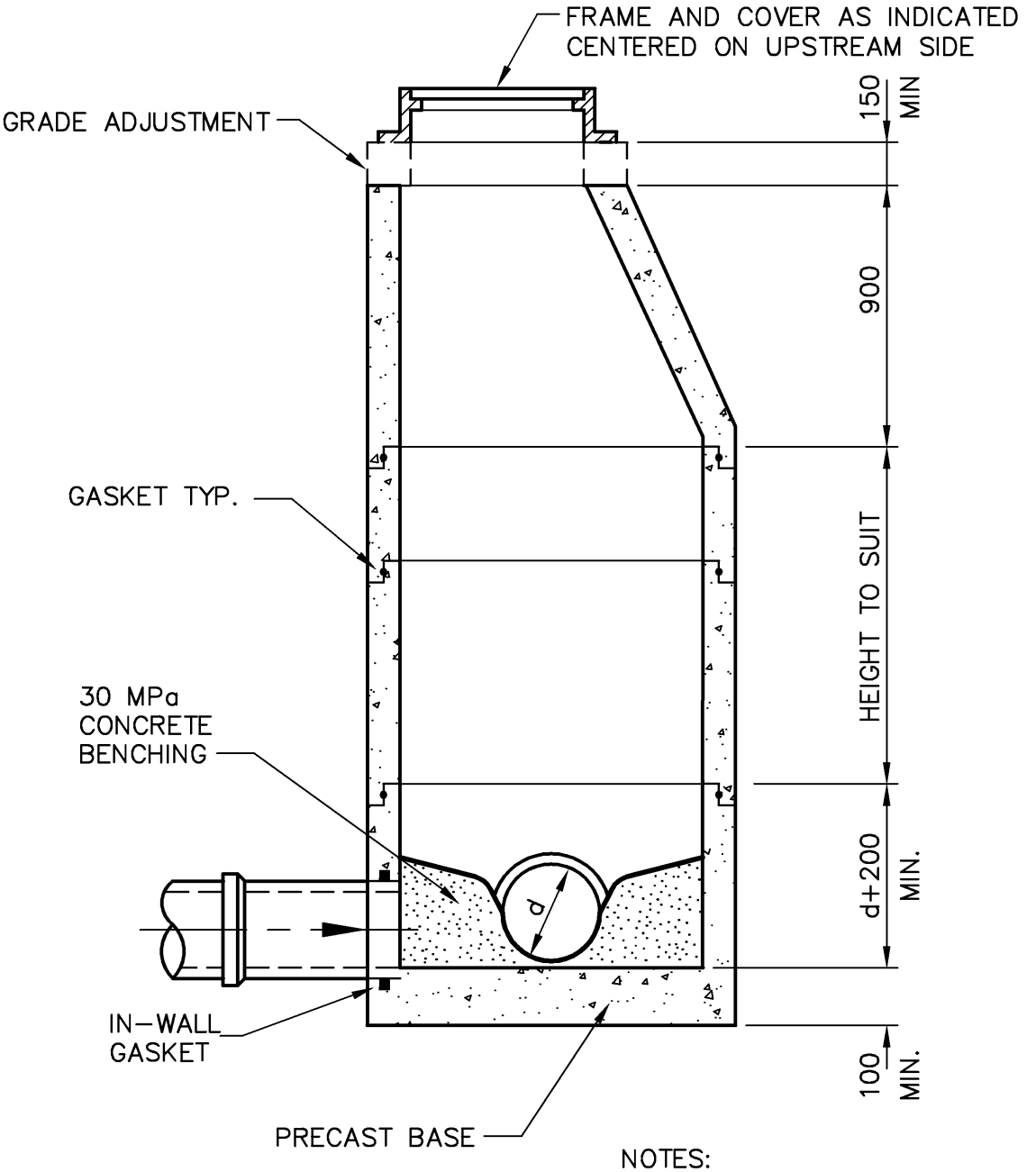


NOTES:

1. SEE 33 39 00–04 FOR DETAILS OF CAST–IN–PLACE BASE.

PRECAST MANHOLE WITH FLAT TOP	
DETAIL NO.	33 39 00–01

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009

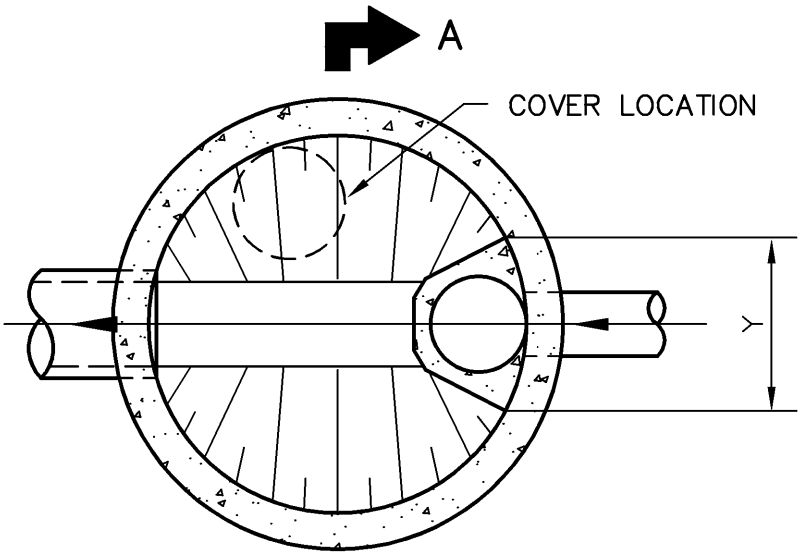


NOTES:

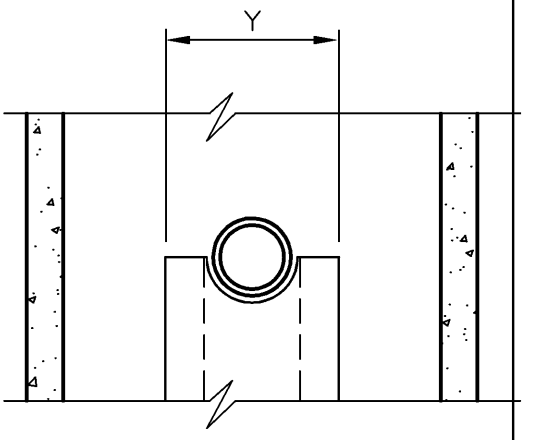
1. SEE 33 39 00–04 FOR DETAILS OF CAST–IN–PLACE BASE.

1050 DIA. PRECAST MANHOLE WITH CONE SECTION	
DETAIL NO.	33 39 00–02

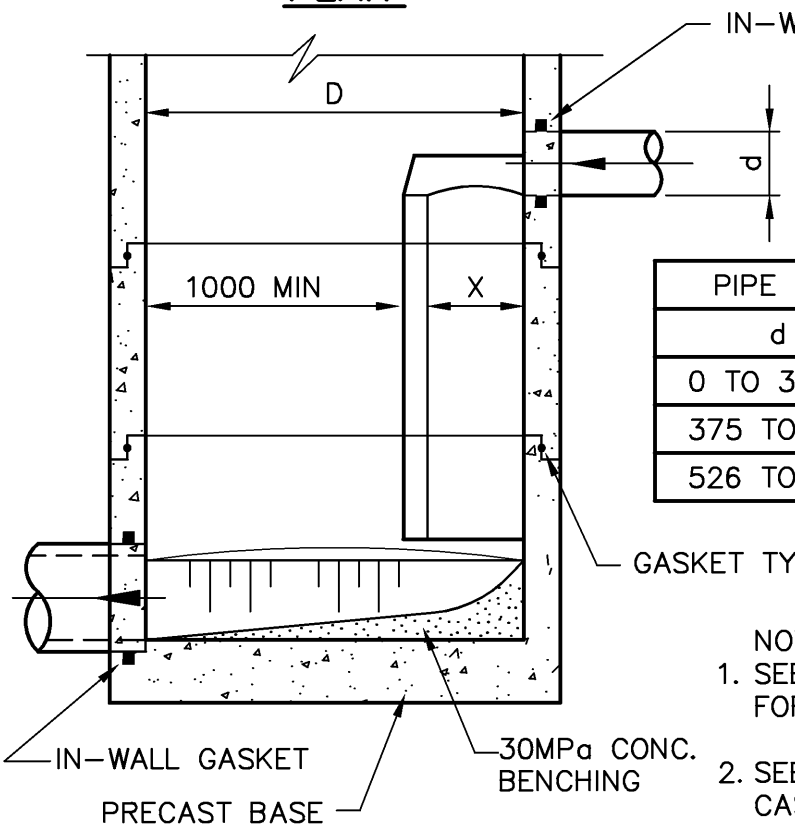
STANDARD SPECIFICATION FOR MUNICIPAL SERVICES | STANDARD DETAILS | SECTION 39 00 00 JAN 2009



PLAN



SECTION A–A



ELEVATION

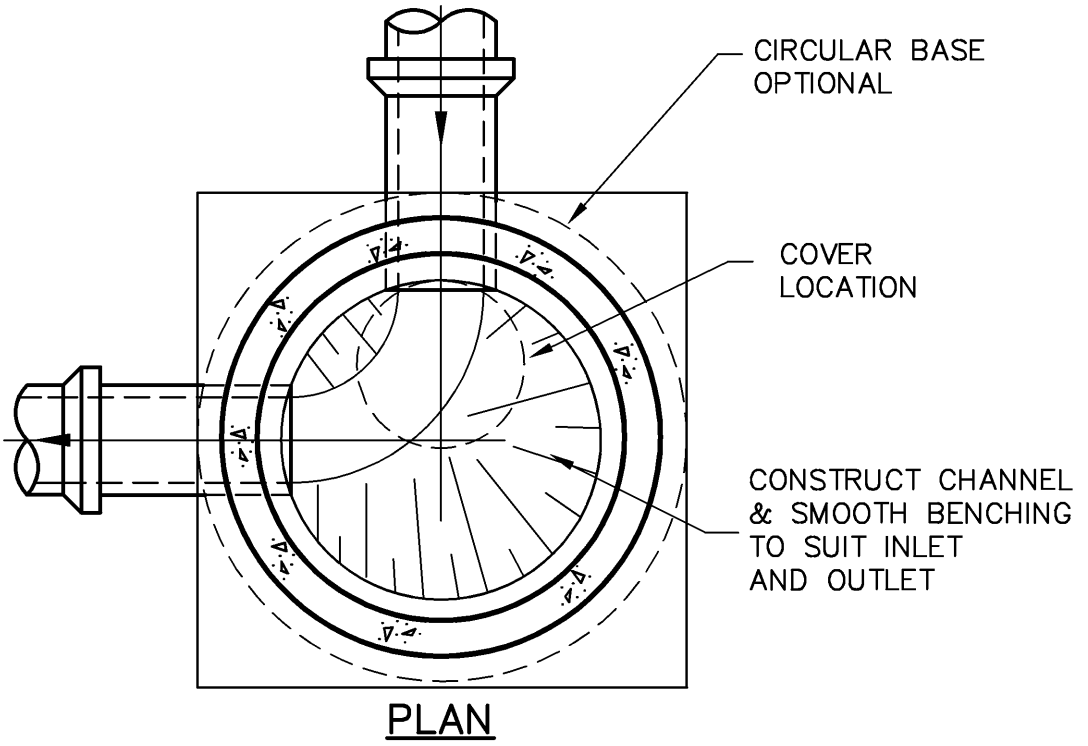
PIPE SIZE	MIN. DIMENSIONS		
d	D	X	Y
0 TO 374	1375	300	700
375 TO 525	1500	375	900
526 TO 750	1800	500	1100

NOTES:
1. SEE 33 39 00–01 AND 33 39 00–02 FOR ADDITIONAL DETAILS
2. SEE 33 39 00–03 FOR CAST–IN–PLACE BASE

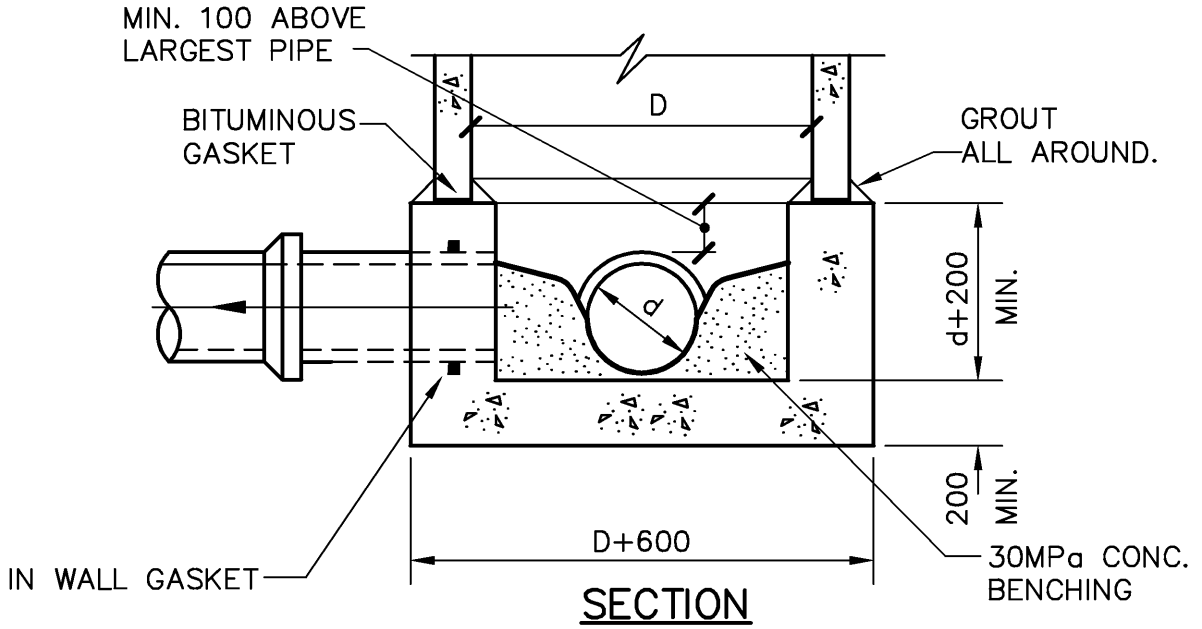
PRECAST MANHOLE WITH INTERNAL DROP

DETAIL NO. 33 39 00–03

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009



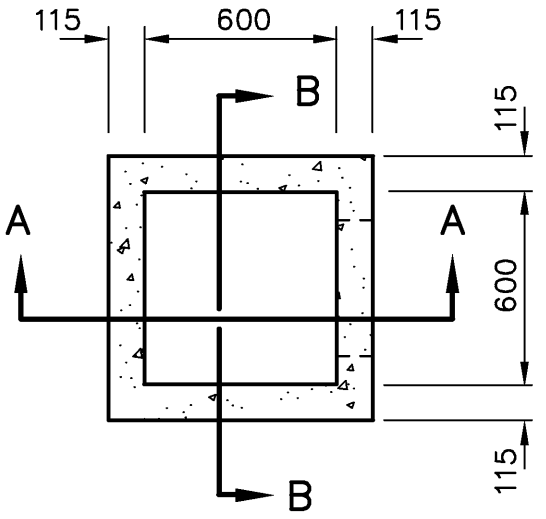
PLAN



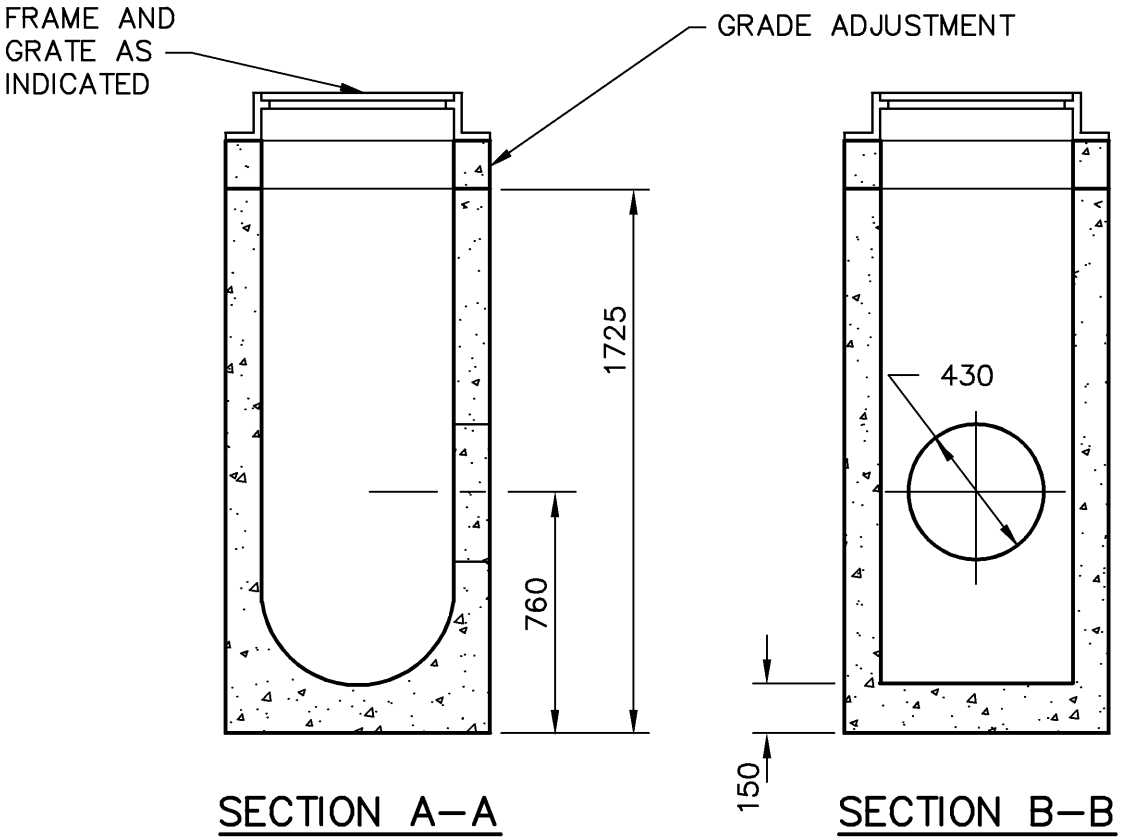
SECTION

CAST–IN–PLACE BASE FOR PRECAST MANHOLE	
DETAIL NO.	33 39 00–04

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009



PLAN

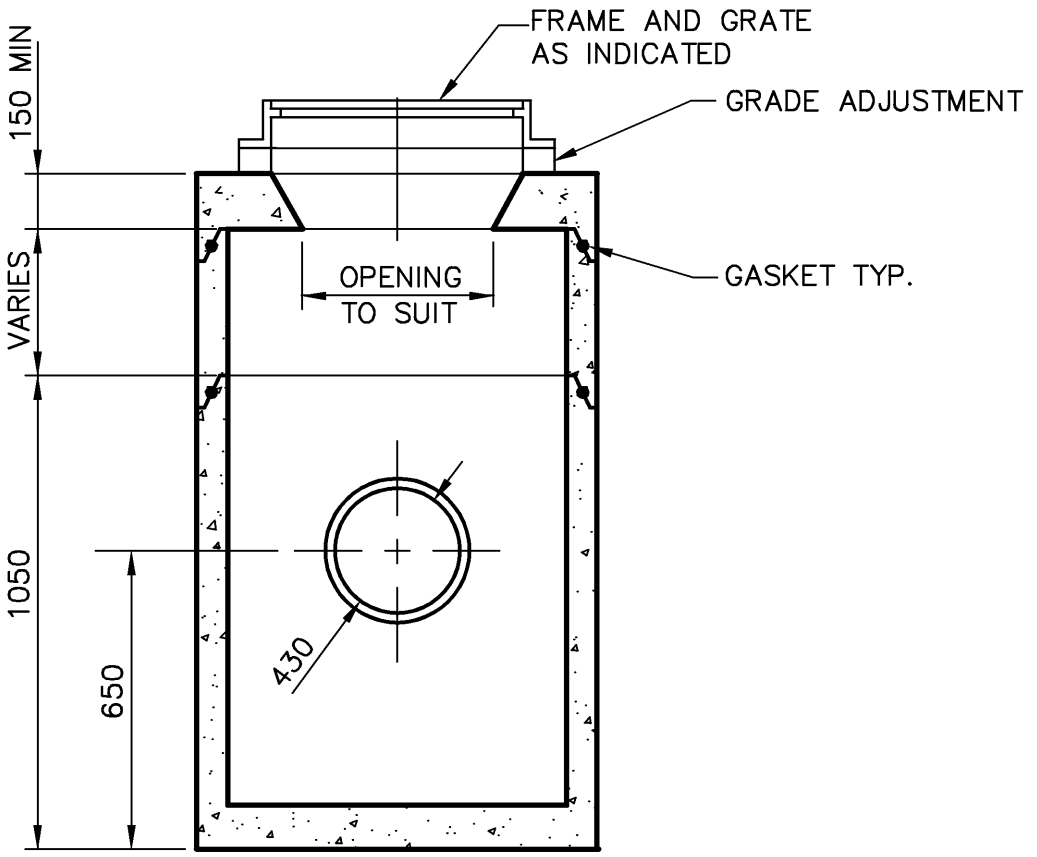


SECTION A–A

SECTION B–B

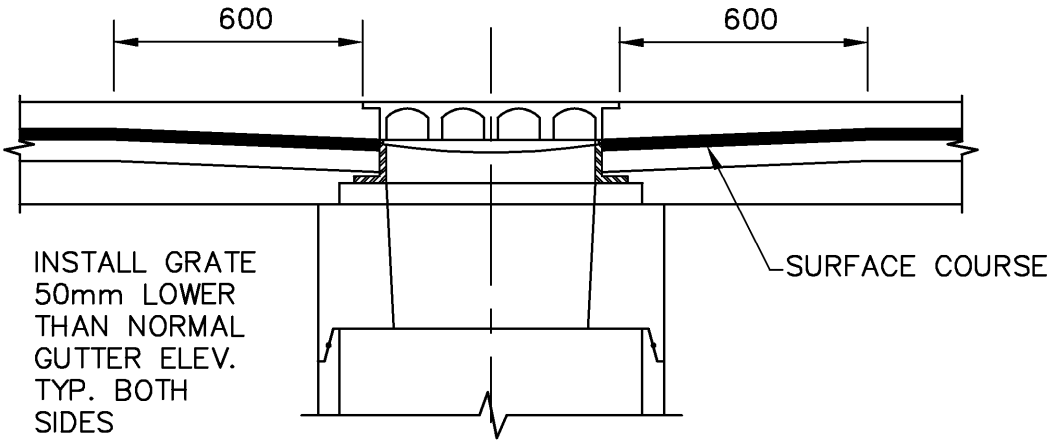
600 SQ. PRECAST CATCHBASIN	
DETAIL NO.	33 39 00–05

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009

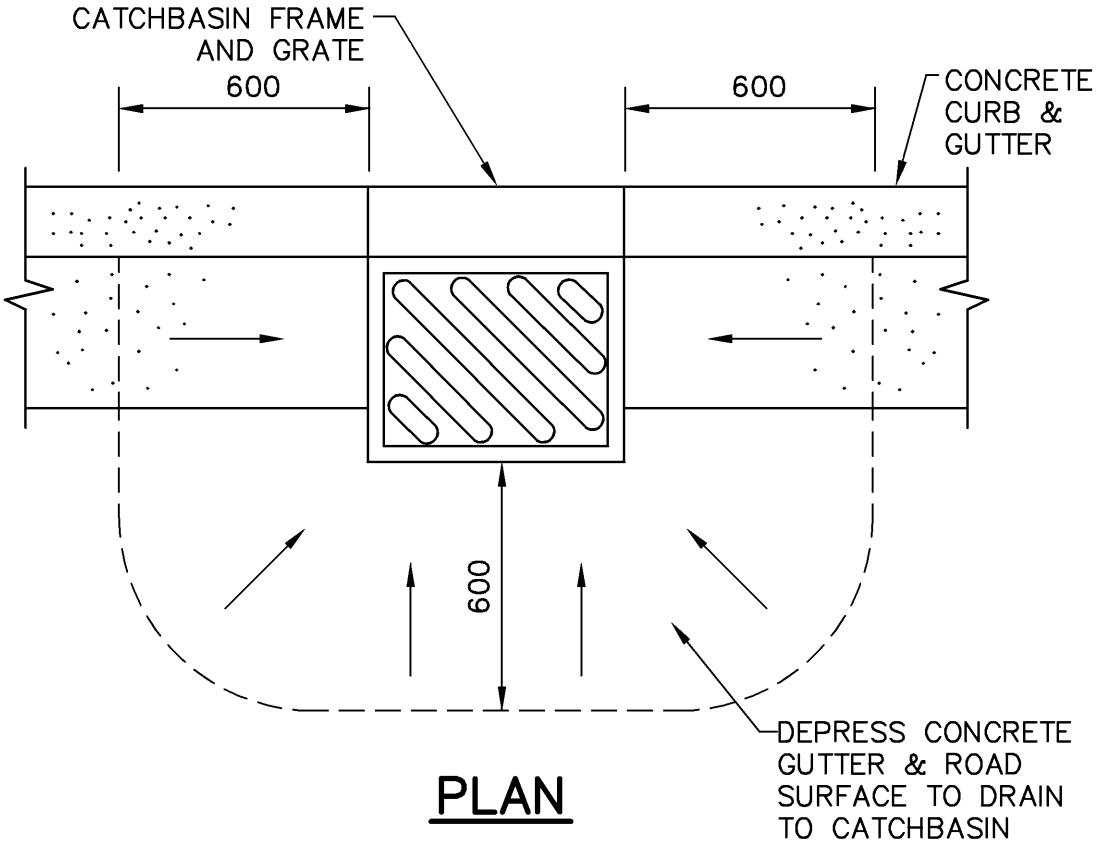


1050 DIA. PRECAST CATCHBASIN	
DETAIL NO.	33 39 00–06

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009



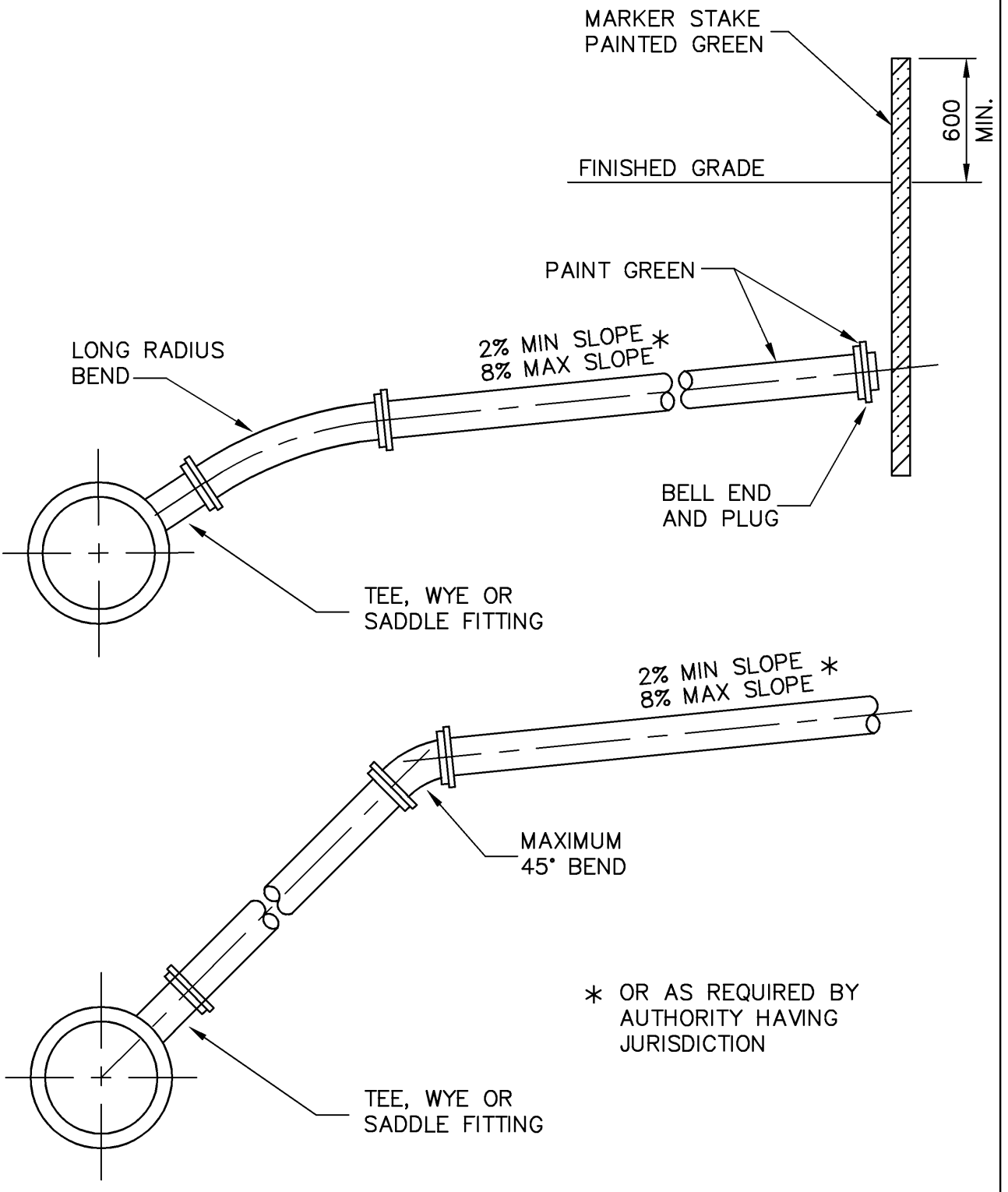
SECTION



PLAN

ASPHALT DEPRESSION AT CATCHBASIN	
DETAIL NO.	33 39 00–07

STANDARD SPECIFICATION FOR MUNICIPAL SERVICES	STANDARD DETAILS	SECTION 39 00 00 JAN 2009



CONNECTION TO DEEP SEWER

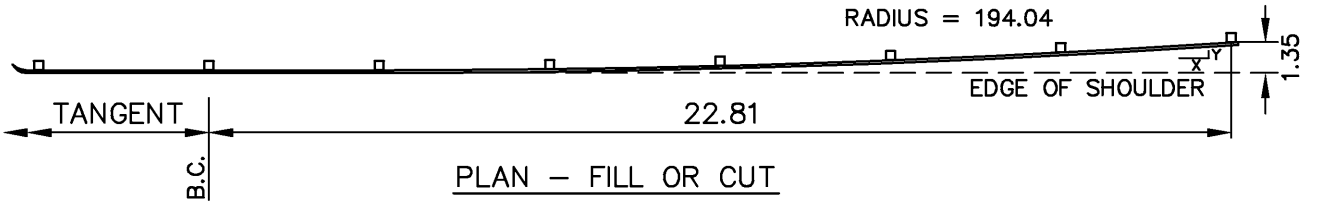
STORM SEWER SERVICE CONNECTION	
DETAIL NO.	33 40 00–01

STANDARD SPECIFICATION
FOR
MUNICIPAL SERVICES

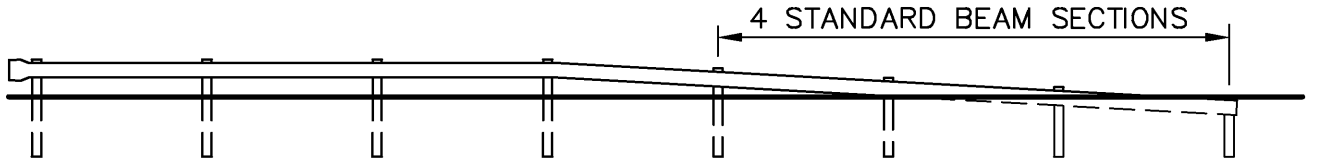
STANDARD DETAILS

SECTION 39 00 00

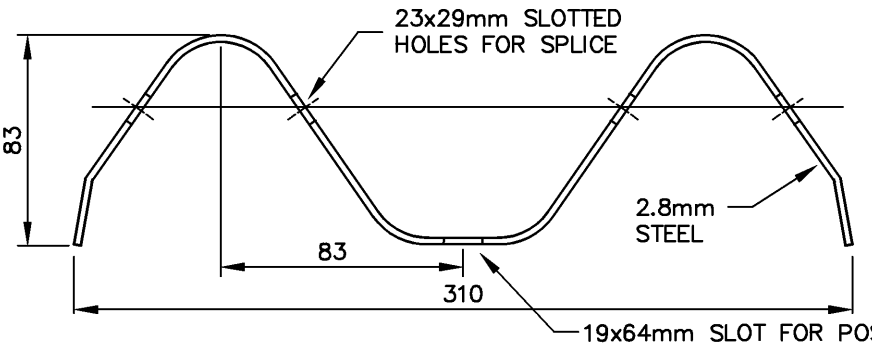
JAN 2009



PLAN – FILL OR CUT

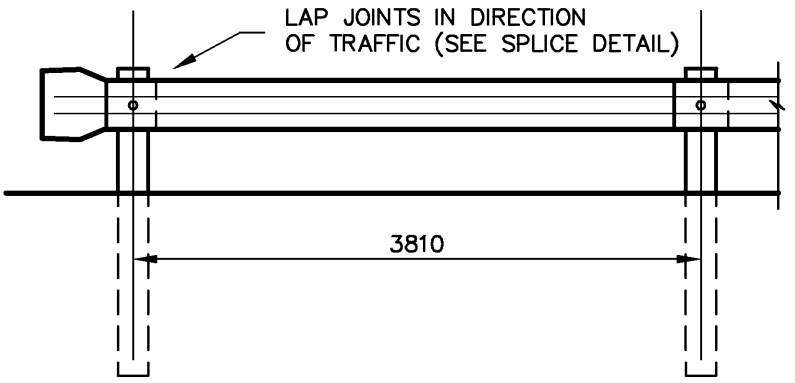


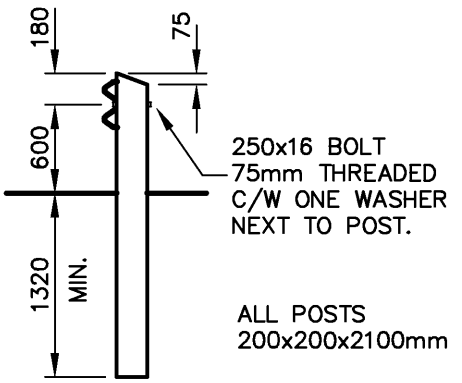
ELEVATION

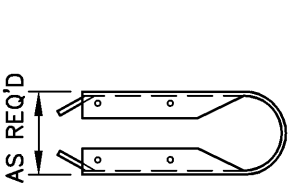


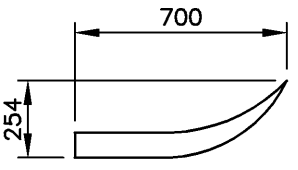
TYPICAL SECTION OF BEAM

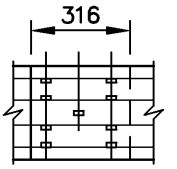
POST OFFSET TABLE	
FILL OR CUT	
X	Y
3.81	0.04
7.62	0.15
11.42	0.34
15.22	0.60
19.02	0.94
22.81	1.35

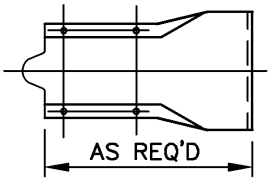




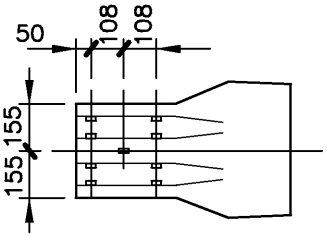








BUFFER END



TERMINAL SECTION

SPLICE DETAIL

GUARDRAIL DETAIL

DETAIL NO. 37 71 13–01