Town of Mahone Bay

Edgewater Street Improvements

Issued for Construction

February 2025

Contract No. 241016.00

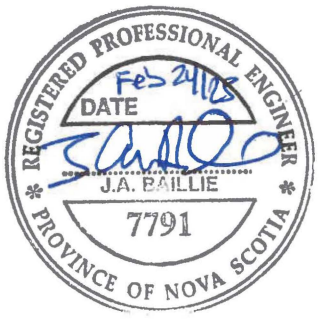
Town of Mahone Bay

Edgewater Street Improvements

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	Issued for Construction		Feb. 24/24	
	Issued for Tender		Dec. 04/24	
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CBCL

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CBCL Project No. 241016.00

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END OF SECTION

1. A complete Tender is comprised of the following:

   a) The Tender Form in its entirety, with all pages and spaces for entry of information by Tenderers filled in as instructed.

   b) Acknowledgment of Addenda received by the Tenderer during the tendering period.

   c) Tender Security (refer to clause 12 herein).

~~2. *Tenders shall be submitted exclusively by email to Bonfire up until 2:59:59 local time, on **Thursday January 9th, 2025. (Addendum No. 1)***~~

2. *Tenders shall be submitted exclusively by email to Bonfire up until 1:59:59PM local time, on **Monday January 13th, 2025 (Addendum No. 2)***

3. **Submission:**

   All tender submissions must be uploaded electronically to Bonfire. The closing date and time are included in the Bonfire opportunity posting.

   Hard copy submissions will not be accepted. All submissions and accompanying documentation will become the property of the Owner and may not be returned. Late proposals will not be accepted, nor will additional time be granted to any individual Tenderer. Any extensions to the closing date will be made only via addendum.

   You must register your company with Bonfire to access opportunities. Registration is free. If you have any challenges registering, you can contact Bonfire Support at support@gobonfire.com. For instructions on how to register go to Vendor Registration . When you are ready to register, please go to our eProcurement portal at https://ccsdnm.bonfirehub.com/portal/?tab=openOpportunities

   For a quick tutorial on how to upload a submittal, visit: Creating and Uploading a Submission to Bonfire

4. Before tendering, Tenderers shall have examined the site of the work and shall have satisfied themselves as to the working conditions, including labour conditions and labour rules, the nature and kind of work to be done, any special risks associated therewith and all other matters which may be necessary in order to form a proper conception under which the work will be required to be performed. Tenderers shall not be entitled to claim at any time after closing of tenders that there was any misunderstanding in regard to all such conditions.

5. When forming their estimates and preparing their tenders, Tenderers shall take full cognizance of the content of all the Contract Documents listed in Section 00 41 43.

6. Any ambiguities, inconsistencies, or uncertainties in the Contract Documents which may become apparent to Tenderers when tendering shall be advised by email to the C.J. McCardle at cjmccardle@cbcl.ca not less than three (3) working days before Tender Closing. Tenderers will be advised simultaneously of any decisions on such matters as necessary by means of addenda (which will be serially numbered) and all addenda issued shall be incorporated into the Contract Documents. All addenda will be uploaded to the Bonfire portal.

7. Tenderer shall fill in the Completion Time and is notified that the completion date based on this may be taken into account in considering the tenders.

8. All tenders shall be valid for acceptance for sixty (60) calendar days from the Closing Date.

9. The Agreement is included in the Contract Documents at the time of tendering is only for information and shall not be completed at the time of tendering.

10. The appending of any qualifying clauses to the tender or failure to comply with these instructions and with all other relevant provisions contained in the documents in the completing of any tender may render such tender liable to disqualification as determined by the Owner.

11. Contract Price to exclude HST. Harmonized sales tax shall be indicated as a separate amount and included in the Total Amount Payable.

12. Each tender shall be accompanied by Tender Security in the amount of ten percent (10%) of the Total Amount Payable in evidence of the bona fide nature of the tender.

13. Tender and Contract Security shall be in favour of the Owner and shall be in the form of a Certified Cheque, irrevocable Letter of Credit or a Bond which shall guarantee to the Owner that in the event of the successful Tenderer declining to enter into a formal agreement with the Owner as called for in the Contract Documents, or declining or neglecting to provide the Insurance or Contract Security required by the Contract Documents, then the Owner will be reimbursed the additional cost of accepting another tender or Tender Security amount, whichever is the lesser.
    .1 A scan of a hard copy bond, certified cheque, or irrevocable letter of credit is permitted provided the original is provided in the subsequent hard copy submission
    .2 The bonds shall be issued by a company whose guarantee bonds are acceptable to the Government of Canada. Use the latest edition of CCDC Form 220 for a Bid Bond, a CCDC Form 221 for a Performance Bond, and a Form 222 for a Labour and Material Bond.
    .3 Bonds may be submitted in an electronic or digital format provided it meets the following criteria:
        .1 The version submitted by the Tenderer must be verifiable by the Owner with respect to the totality and wholeness of the bond form, including: the content; all digital signatures; all digital seals; with the Surety Company, or an approved verification service provider of the Surety Company.
        .2 The version submitted must be viewable, printable, and storable in standard electronic file formats acceptable to the Owner, and in a single file. Allowable formats include pdf.
        .3 The verification may be conducted by the Owner immediately or at any time during the life of the bond and at the discretion of the Owner with no requirement for passwords or fees.
        .4 The results of the verification must provide a clear, immediate and printable indication of pass or fail regarding subsection 12.3.1 above.
        .5 Bonds failing the verification process will NOT be considered to be valid.
        .6 Bonds passing the verification process will be treated as original and authentic.

14. The Tender Security of the unsuccessful Tenderers will be returned to them after the Owner enters into a formal agreement with the successful Tenderer or the expiration of validity of their tenders, whichever occurs first.

15. On the written acceptance by the Owner of a tender, that tender becomes the Contract and the Tenderer who has submitted it becomes the Contractor. The Contractor will be required to enter into a formal agreement with the Owner following receipt of a written notice of acceptance from the Owner. The written notice of acceptance forms a Contract Agreement until the formal “Agreement” is executed.

16. Within seven (7) days of written acceptance of a tender that tender shall provide Contract Security in the amount and form as specified in SGC 14.1 as supplemented in Section 00 73 00, and Insurance as specified in GC 11.1.

17. Complete the Tender Form in ink and have corrections initialled by the individual signing the tender.

18. Where manufactured articles are described or specified in the Contract Documents by name, catalogue number of a manufacturer or supplier, Tenderers shall tender on the basis of using only such articles. Procedure concerning substitution of a specified article with another shall be in accordance with equivalents and alternates in Section 01 61 00.

19. The Owner will not defray any expenses whatsoever incurred by Tenderers in the preparation and submission of their tenders. The Owner reserves the right to waive any formality or technicality in any tender.

20. The Owner reserves the right to accept or to reject any or all tenders received, or to select a tender which is deemed by the Owner to be in its best interests. The Owner reserves the right to negotiate with the lowest compliant tenderer in the event that all tendered prices are higher than anticipated.

21. Tenders, which in the opinion of the Owner are considered to be informal or unbalanced, may be rejected.

22. Tenders may be amended or withdrawn without penalty, by accessing the Bonfire prior to Tender Closing.
    .1 The *Owner* will not be responsible for any failure attributable to the transmission or reception of the submission. The time stamp of the uploaded submission received by Bonfire will be used to determine if the submission was received in time – not the time it was emailed sent by the sender. Last minute submissions are not recommended.

23. Tenderers are encouraged to attend a non-mandatory site meeting, held at **the parking lot across from Tim Horton's at 9:30am on Tuesday December 10th, 2024**. Questions may be asked and description of the Work may be discussed during this meeting, however no minutes of the meeting will be distributed. Modifications made by way of addenda, to tendering requirements or the Contract Documents, shall be binding.

24. A Geotechnical Investigation has been carried out at the Site. Information from Geotechnical Investigation – Edgewater Street Improvements, Report No. 241016, dated November 4th, 2024, prepared by CBCL Limited is included as Appendix A. Any interpretations or extrapolation of its content are at the Tenderers own risk and neither the Consultant nor the Owner shall be held responsible for such interpretations or extrapolations.
    .1 The Geotechnical report has a typo where it refers to BH24-05 instead of BH24-04. There is no BH24-05 as indicated on Drawing SK01 of Appendix A included in the report. (Addendum No.3)

END OF SECTION

1. SALUTATION:

.1 To: Town of Mahone Bay
493 Main Street, Mahone Bay
B0J 2E0

.2 For: Edgewater Street Improvements
Tender No. 241016.00

.3 From: Harbour Construction Company Limited
40 Ilsley Ave. Dartmouth, NS
B3B 1L3

2. TENDERER DECLARES:

.1 That this tender was made without collusion or fraud.

.2 That the proposed work was carefully examined.

.3 To have personal knowledge of the location of the proposed Work and is informed as to the actual conditions and requirements, including labour conditions and labour rules and shall not claim at any time after execution of the Agreement that there was any misunderstanding in regard to such conditions and requirements.

.4 That Contract Documents and Addenda No. 1 to 3 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 multiplied by the estimated quantities in Subsection 4 hereunder.

.3 That this Tender is valid for acceptance for sixty (60) calendar days from the time of 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 Upon request to provide evidence of ability and experience within seven (7) calendar 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 fourteen (14) calendar 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 Declares to have carefully examined the documents and Addenda No. 1 to 3 referred to in the first paragraph of this Tender Form, and the Tenderer hereby accepts and agrees to the same as forming a part of the Contract.

.10 Understands that in the event that the tendered Contract Price is not within the project budget, the Owner has the right to negotiate the Contract with the low bidder or reject all tenders received.

.11 Agrees that the Warranty Period defined in the Contract Documents shall be for a period of one (1) year from the date of Ready-for-Takeover.

.12 Understands that Substantial Performance of the Work will be established in accordance with General Conditions of the Contract and applicable lien legislation.

.13 Understands that after the issuance of the certificate of Substantial Performance of the Work by the Consultant, provided that the Contractor has relieved the Owner from any and all claims, demands and lien claims for and in respect of the Contract, and has completed all outstanding items and corrected all deficiencies, the Contractor shall submit an application for Final Payment and the Consultant will thereafter prepare the Final Certificate for payment in accordance with the General Conditions of the Contract and applicable lien legislation.

.14 Understands that the payment of holdback will be in accordance with the General Conditions of the Contract and subject to the provisions of the lien legislation applicable to the Place of Work.

.15 Understands the occupational Health and Safety Legislation and any Workers or Workplace compensation legislation applicable to the Place of the Work and declares that they are in good standing and have all necessary certification as required by such legislation.

.16 Agrees that time shall be construed as being of the essence of the Contract.

.17 That the Contract Documents include:

.1 Tender Form
.2 Form of Agreement
.3 CCDC 18-2023 - General Conditions of the Civil Work Contract
.4 Supplementary General Conditions
.6 Technical Specifications listed in 00 01 11
.7 Drawings:

Dwg. No.	Title
00	Cover SHEET
CIVIL EXISTING CONDITIONS & REMOVALS	
C-000	OVERALL EXISTING SITE PLAN

C-001 EXISTING AND PROPOSED CONDITIONS PLAN SHEET 1 OF 6
C-002 EXISTING AND PROPOSED CONDITIONS PLAN SHEET 2 OF 6
C-003 EXISTING AND PROPOSED CONDITIONS PLAN SHEET 3 OF 6
C-004 EXISTING AND PROPOSED CONDITIONS PLAN SHEET 4 OF 6
C-005 EXISTING AND PROPOSED CONDITIONS PLAN SHEET 5 OF 6
C-006 EXISTING AND PROPOSED CONDITIONS PLAN SHEET 6 OF 6
C-007 EXISTING AND PROPOSED CONDITIONS – BRIDGE CROSSING

CIVIL MUNICIPAL SERVICING

C-100 PLAN & PROFILE-UNDERGROUND UTILITIES SHEET 1 OF 6
C-101 PLAN & PROFILE-UNDERGROUND UTILITIES SHEET 2 OF 6
C-102 PLAN & PROFILE-UNDERGROUND UTILITIES SHEET 3 OF 6
C-103 PLAN & PROFILE-UNDERGROUND UTILITIES SHEET 4 OF 6
C-104 PLAN & PROFILE-UNDERGROUND UTILITIES SHEET 5 OF 6
C-105 PLAN & PROFILE-UNDERGROUND UTILITIES SHEET 6 OF 6
C-106 PLAN & PROFILE-UNITED CHURCH DRAINAGE
C-107 PLAN & PROFILE-CIVIC 121, 191, 205 & 217
C-108 PLAN & PROFILE-MISCELLANEOUS PROFILES
C-109 STORM AND SANITARY STRUCTURE TABLES
C-110 SITE PLAN PUMP STATION #4
C-111 SITE PLAN-PUMP STATION #5
C-112 SERVICING DETAILS SHEET 1 OF 2
C-113 SERVICING DETAILS SHEET 2 OF 2
C-114 PUMP STATION DETAILS

CIVIL MULTI-USE TRAIL

C-200 PLAN & PROFILE-MULTI USE TRAIL SHEET 1 OF 6
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C-205 PLAN & PROFILE-MULTI USE TRAIL SHEET 6 OF 6
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C-209 PROPOSED CROSS SECTIONS-SHEET 2 OF 4
C-210 PROPOSED CROSS SECTIONS-SHEET 3 OF 4
C-211 PROPOSED CROSS SECTIONS-SHEET 4 OF 4
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COASTAL

C-300 LIVING SHORELINE PROPOSED SITE PLAN
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C-304 SITE SECTIONS 2 OF 6
C-305 SITE SECTIONS 3 OF 6
C-306 SITE SECTIONS 4 OF 6
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C-308 SITE SECTIONS 6 OF 6

STRUCTURAL

S01 PEDESTRIAN BRIDGE GENERAL ARRANGEMENT
S02 ABUTMENT SECTIONS AND DETAILS
S03 FILL AGAINST STRUCTURE & MISC. DETAILS

ELECTRICAL

E01 DESIGN CRITERIA
E10 PLAN VIEW PROPOSED CONDITIONS
E20 SCHEMATIC
E30 DUCTBANK DETAILS
E31 SINGLE PHASE PADMOUNT TRANSFORMER DETAILS
E32 THREE PHASE PADMOUNT TRANSFORMER DETAILS
E33 DISTRIBUTION EQUIPMENT DETAILS
E34 EQUIPMENT GROUNDING AND VEHICULAR PROTECTION DETAILS
E35 GROUNDING DETAILS
E36 RISER POLE DETAILS
E37 STREET LIGHTING DETAILS
E38 PARK DISTRIBUTION DETAILS
E50 SINGLE LINE DIAGRAMS AND ELECTRICAL DETAILS
E51 ELECTRICAL DETAILS

.8 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
1.	Mobilization	LS	1		
2.	Removals				
.1	Clearing and Grubbing	LS	1		
.2	Electrical				
.1	Streetlight Service Line	m	395		
.2	Light Standards	Ea	20		
.3	Roadway				
.1	Asphalt Milling	m^2	2170		
.2	Asphalt incl. gravels to subgrade	m^2	7200		
.3	Curb Islands	Ea	3		
.4	Concrete Sidewalks	m^2	90		
.5	Curb and Gutter	m	150		
.6	Timber Curb	m	230		
.4	Stormwater Systems				
~~.1~~	~~150mm dia. PVC~~	~~m~~	~~50~~		
.1	***150mm dia. PVC***	***m***	***40***		
.2	200mm dia. PVC	m	40		
.3	250mm dia. PVC	m	20		
.4	300mm dia. PVC	m	25		
.5	450mm dia. PVC	m	50		
.6	525mm dia PVC	m	55		
~~.7~~	~~Catchbasin and Manholes~~	~~Ea~~	~~13~~		
.7	***Catchbasin and Manholes***	***Ea***	***11***		
.5	Water Systems				
.1	150mm dia. CI	m	175		
.2	Fire Hydrants	Ea	2		
.6	Guiderail				
.1	Wooden	m	12		
.2	Post and Rope	m	50		
.7	Concrete Park Pad	m^2	25		
.8	450mm dia. Concrete Sanitary	m	30		
3.	Abandonments				
.1	450mm dia. Concrete Sanitary	m	150		
.2	150mm dia. CI Water	m	160		

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
4.	Trenching for Pipework and Ductbanks (Provisional Items)				
.1	Trenching				
.1	Trench Rock Excavation (Provisional)	m^3	100		
.2	Removal of Unsuitable Material and Replacement with Type 2 (Provisional)	m^3	100		
.3	Import Common Fill (Provisional)	m^3	100		
5.	Sanitary Sewers Systems				
.1	100mm dia. PVC DR18 Forcemain	m	300		
.2	200mm dia. PVC DR18 Sanitary Main	m	655		
.3	450mm dia. PVC DR18 Sanitary Main	m	175		
.4	Concrete Manholes				
.1	1050mm dia. Precast	Ea	27		
.2	1200 Cast-in-Place	Ea	1		
.5	Connection to Existing System				
.1	At Main Street	Ea	1		
.2	At SMH006B	Ea	2		
.6	Sanitary Services				
.1	100mm dia. PVC DR35	m	190		
.2	150mm dia. PVC DR35	m	12		
.7	100mm Forcemain and 1200mm culvert crossing	LS	1		
6.	Water Systems				
.1	150mm dia. PVC DR18 Watermain	m	50		
.2	200mm dia. PVC DR18 Watermain	m	320		
.3	250mm dia. PVC DR18 Watermain	m	680		
.4	Gate Valves				
.1	150mm dia.	Ea	4		
.2	200mm dia.	Ea	3		
.3	250mm dia.	Ea	6		
.5	Fire Hydrants	Ea	8		

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
.6	Automatic Flushing System	Ea	1		
.7	Connection to Existing System				
.1	At Main Street	Ea	1		
.2	At Parish Street	Ea	1		
.8	Water Services to Property Line				
.1	19mm dia.	m	160		
.2	38mm dia.	m	12		
.9	250mm Watermain and Culvert Crossing	LS	1		
7.	Storm Systems				
.1	300mm dia. PVC DR35	m	180		
.2	375mm dia. PVC DR35	m	100		
.3	450mm dia. Concrete 65D Storm	m	70		
.4	525mm dia. Concrete 65D Storm	m	20		
.5	600mm dia. Concrete 65D Storm	m	110		
.6	750mm dia. Concrete 65D Storm	m	40		
.7	Backflow Preventors				
.1	300mm dia.	Ea	1		
.2	450mm dia.	Ea	1		
.3	600mm dia.	Ea	1		
.4	750mm dia.	Ea	2		
.8	Concrete Catchbasins				
.1	1050mm dia. Precast	Ea	18		
.2	1200mm dia. Precast	Ea	1		
.3	1500mm dia. Precast	Ea	4		
.9	Concrete Headwalls	Ea	3		
.10	Concrete Manholes				
.1	1050mm dia. Precast	Ea	1		
.2	1500mm dia. Precast	Ea	2		
8.	Private Property Servicing				
.1	Civic 121				
.1	Water and Sewer (Provisional)	LS	1		
.2	Civic 191				
.1	Water and Sewer (Provisional)	LS	1		
.2	Electrical	LS	1		

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
.3	Civic 205				
.1	Water and Sewer (Provisional)	LS	1		
.2	Electrical	LS	1		
.4	Civic 217				
.1	Water and Sewer (Provisional)	LS	1		
.2	Electrical	LS	1		
9.	Pumping Station #4	LS	1		
10	Pumping Station #5	LS	1		
11.	Roadway and Trails				
.1	50mm Asphalt Type C-HF	m^2	9000		
.2	100mm Asphalt Type B-HF	m^2	6850		
.3	150mm Type 1 Gravel	m^2	9000		
.4	450mm Type 2 Gravel	m^2	9000		
.5	Concrete Curb				
.1	Mountable	m	160		
.2	Curb and Gutter	m	790		
.3	High back Curb	m	200		
.6	Asphalt Driveways	m^2	80		
.7	Gravel Driveways	m^2	250		
.8	Driveway Ramps	m^2	50		
.9	Pedestrian Ramps	m^2	15		
~~.10~~	~~Multi-Use Trail~~	~~m^2~~	~~3000~~		
.10	***Multi-Use Trail***	***m^2***	***2950***		
~~.11~~	~~Select Backfill~~	~~m^3~~	~~2850~~		
.11	***Select Backfill***	***m^3***	***2625***		
.12	Traffic Signs (Provisional)				
.1	Relocate Signs	Ea	10		
.2	New Signs	Ea	10		
.13	Relocate Benches	Ea	2		
.14	Relocate Monuments	Ea	1		
.15	Relocate and Store Welcome Sign	Ea	2		
.16	Relocate Tables	Ea	3		
.17	Relocate Garbage Bins	Ea	1		
.18	Concrete Pads for Park Features	Ea	6		
~~.19~~	~~Pedestrian Footbridge (Provisional)~~	~~LS~~	~~1~~		

Item No.	Description	Unit of Measurement	Estimated Quantity	Unit Price	Total Price
.20	Guiderails				
	~~.1 Black Ornamental~~	~~m~~	~~150~~		
	.1 Black Ornamental	***m***	***65***		
	~~.2 Wooden~~	~~m~~	~~520~~		
	.2 Wooden	***m***	***645***		
	.3 Post and Rope	m	235		
.21	Retaining Walls				
	~~.1 Trail Retaining Wall~~	~~m^2~~	~~170~~		
	.2 Parking Lot Retaining Wall	m^2	65		
.22	Concrete Sidewalk and Ramp	m^2	160		
~~.23~~	~~Topsoil and Sod~~	~~m^2~~	~~2080~~		
.23	**Topsoil and Sod**	**m^2**	**2000**		
.24	Line Painting	LS	1		
~~.25~~	~~Parking Lot A Regrading~~	~~LS~~	~~1~~		
12.	Electrical				
.1	Decorative Street Lights	Ea	19		
.2	Ductbanks and Conduits				
	.1 Direct Buried DB7				
	.1 1x53mm	m	370		
	.2 2x53mm	m	15		
	.3 1x78mm	m	20		
	.4 2x78mm	m	20		
.3	Concrete Encased				
	.1 DB1 Primary - 2x129mm	m	125		
	.2 DB2 Primary - 4x103mm + Secondary 6x103mm	m	15		
	.3 DB3 Secondary				
	.1 2x103mm	m	90		
	.2 4x103mm	m	20		
	.4 DB4 Primary - 8x103mm	m	260		
	.5 DB5 Primary - 4x103mm	m	320		
	.6 DB8 Primary	m	25		
.4	Primary Riser Pole Base	Ea	2		
.5	Secondary Riser Pole Base				
	.1 with concrete	Ea	1		
	.2 without concrete	Ea	2		
.6	EV Charging Station Pedestals	Ea	2		
.7	Pad Mounted Transformers				
	.1 Single-Phase 75kVA	Ea	1		

No.	Item Description	Measurement	Unit of Quantity	Estimated Price	Unit Price	Total
	.2 Single-Phase 167kVA	Ea	1			
	.3 Single-Phase 100kVA	Ea	1			
	.4 Three-Phase 45kVA	Ea	1			
.8	Pull Pits	Ea	1			
.9	Sectionalizing Cabinets	Ea	4			
.10	Bollards	Ea	44			
.11	URD Box	Ea	3			
.12	Park Area Distribution	LS	1			
13.	Allowances					
.1	Power Utility	LS	1			
.2	Coastal Planting	LS	1			
14.	Coastal					
.1	Tree Planting					
	.1 Eastern White Pine	Ea	15			
	.2 Northern Red Oak	Ea	15			
	.3 Paper Birch	Ea	15			
	.4 White Ash	Ea	15			
.2	Gravels and Stone					
	.1 Coarse Sand	m^2	1500			
	.2 Surge Rock	T	2000			
	.3 Armour Stone					
	.1 300-1000kg	T	1500			
	.2 500 to 1500 kg	T	2000			
	.4 R2 Rip Rap	T	4700			
	.5 Filter Stone	T	200			
	.6 Type 2 Gravel	m^3	1700			
	.7 Clearstone	m^3	1300			
.3	Nonwoven Geotextile	LS	1			
.4	Erosion Blanket	LS	1			
.5	Growing Medium	T	500			

TENDER SUMMARY

ESTIMATED CONTRACT PRICE (Excluding HST) **$**_____

Add HST (15% of the Estimated Contract Price) $_____

TOTAL AMOUNT PAYABLE **$**_____

TENDERER'S HST REGISTRATION NO. 102271699

5. COMPLETION TIME

1. Tenderer agrees to achieve Ready-for-Takeover within 42 weeks from written notification of Award but in no case later than **December 31st, 2025**.

6. SIGNATURE *

DATED THIS _____ DAY OF_____ , 202___.

[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 OF SECTION

CCDC
Canadian Construction Documents Committee

Civil Works Contract

CCDC 18 — 2023

Name of the Work

Apply a CCDC 18 copyright seal here.
The application of the seal demonstrates the intention of the party proposing the use of this document that it be an accurate and unamended form of CCDC 18 — 2023 except to the extent that any alterations, additions or modifications are set forth in supplementary conditions.

CCDC 18 CIVIL WORKS CONTRACT

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FORM OF AGREEMENT - CIVIL WORKS CONTRACT
CCDC 18-2023

AGREEMENT BETWEEN OWNER AND CONTRACTOR

This Agreement made on day of in the year .
by and between the parties

hereinafter called the "*Owner*"

and

hereinafter called the *"Contractor"*

The *Owner* and the *Contractor* agree as follows:

ARTICLE A-1 THE WORK

The *Contractor* shall:

1.1 perform the *Work* required by the *Contract Documents* for *(insert below the description or title of the Work)*

located at *(insert below the Place of the Work)*

for which the Agreement has been signed by the parties, and for which *(insert below the name of the Consultant)*

is acting as and is hereinafter called the "*Consultant*" and

1.2 do and fulfill everything indicated by the *Contract Documents*, and

1.3 commence the *Work* by the day of in the year and, subject to adjustment in *Contract Time* as provided for in the *Contract Documents*, attain *Ready-for-Takeover*, by the day of in the year .

ARTICLE A-2 AGREEMENTS AND AMENDMENTS

2.1 The *Contract* supersedes all prior negotiations, representations or agreements, either written or oral, relating in any manner to the *Work*, including the bid documents that are not expressly listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS.

2.2 The *Contract* may be amended only as provided in the *Contract Documents*.

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ARTICLE A-3 CONTRACT DOCUMENTS

3.1 The following are the *Contract Documents* referred to in Article A-1 of the Agreement – THE WORK:

- Agreement between *Owner* and *Contractor*
- Definitions
- General Conditions
- *

* *(Insert here, attaching additional pages if required, a list identifying all other Contract Documents e.g. supplementary conditions; Schedule of Prices; Division 01 of the Specifications – GENERAL REQUIREMENTS; Project information that the Contractor may rely upon; technical Specifications, giving a list of contents with section numbers and titles, number of pages and date; material finishing schedules; Drawings, giving drawing number, title, date, revision date or mark; addenda, giving title, number, date; time schedule)*

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ARTICLE A-4 CONTRACT PRICE

4.1 * *Unit Prices* form the basis for payment of the *Contract Price*. Quantities in the *Schedule of Prices* are estimated. The estimated *Contract Price*, which is the total extended amount indicated in the *Schedule of Prices*, is:

OR

* A lump sum stipulated price forms the basis for payment of the *Contract Price*. The *Contract Price* is:

/100 dollars $

* *Strike out inapplicable paragraph.*

4.2 These amounts shall be subject to adjustments as provided in the *Contract Documents*.

4.3 All amounts are in Canadian funds and exclude *Value Added Taxes*.

ARTICLE A-5 PAYMENT

5.1 Subject to the provisions of the *Contract Documents* and *Payment Legislation*, and in accordance with legislation and statutory regulations respecting holdback percentages, the *Owner* shall:

.1 make progress payments to the *Contractor* on account of the *Contract Price* when due in the amount certified by the *Consultant* unless otherwise prescribed by *Payment Legislation* together with such *Value Added Taxes* as may be applicable to such payments,

.2 upon *Substantial Performance of the Work*, pay to the *Contractor* the unpaid balance of the holdback amount when due together with such *Value Added Taxes* as may be applicable to such payment, and

.3 upon the issuance of the final certificate for payment, pay to the *Contractor* the unpaid balance of the *Contract Price* when due together with such *Value Added Taxes* as may be applicable to such payment.

5.2 Interest

.1 Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by adjudication, arbitration or court, interest at the following rates on such unpaid amounts shall also become due and payable until payment:

(1) 2% per annum above the prime rate for the first 60 days.

(2) 4% per annum above the prime rate after the first 60 days.

Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by

(Insert name of chartered lending institution whose prime rate is to be used)

for prime business loans as it may change from time to time.

.2 Interest shall apply at the rate and in the manner prescribed by paragraph 5.2.1 of this Article on the settlement amount of any claim in dispute that is resolved either pursuant to Part 8 of the General Conditions – DISPUTE RESOLUTION or otherwise, from the date the amount would have been due and payable under the *Contract*, had it not been in dispute, until the date it is paid.

ARTICLE A-6 RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING

6.1 *Notices in Writing* will be addressed to the recipient at the address set out below.

6.2 The delivery of a *Notice in Writing* will be by hand, by courier, by prepaid first class mail, or by other form of electronic communication during the transmission of which no indication of failure of receipt is communicated to the sender.

6.3 A *Notice in Writing* delivered by one party in accordance with this *Contract* will be deemed to have been received by the other party on the date of delivery if delivered by hand or courier, or if sent by mail it will be deemed to have been received five calendar days after the date on which it was mailed, provided that if either such day is not a *Working Day*, then the *Notice in Writing* will be deemed to have been received on the *Working Day* next following such day.

6.4 A *Notice in Writing* sent by any form of electronic communication will be deemed to have been received on the date of its transmission provided that if such day is not a *Working Day* or if it is received after the end of normal business hours on the date of its transmission at the place of receipt, then it will be deemed to have been received at the opening of business at the place of receipt on the first *Working Day* next following the transmission thereof.

6.5 An address for a party may be changed by *Notice in Writing* to the other party setting out the new address in accordance with this Article.

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Owner

*name of Owner**

address

email address

Contractor

*name of Contractor**

address

email address

Consultant

*name of Consultant**

address

email address

** If it is intended that a specific individual must receive the notice, that individual's name shall be indicated.*

ARTICLE A-7 LANGUAGE OF THE CONTRACT

7.1 When the *Contract Documents* are prepared in both the English and French languages, it is agreed that in the event of any apparent discrepancy between the English and French versions, the English / French # language shall prevail.
Complete this statement by striking out inapplicable term.

7.2 This Agreement is drawn in English at the request of the parties hereto. La présente convention est rédigée en anglais à la demande des parties.

ARTICLE A-8 SUCCESSION

8.1 The *Contract* shall enure to the benefit of and be binding upon the parties hereto, their respective heirs, legal representatives, successors, and assigns.

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In witness whereof the parties hereto have executed this Agreement by the hands of their duly authorized representatives.

SIGNED AND DELIVERED
in the presence of:

WITNESS

signature

name of person signing

OWNER

name of Owner

signature

name and title of person signing

WITNESS

signature

name of person signing

CONTRACTOR

name of Contractor

signature

name and title of person signing

N.B. Where legal jurisdiction, local practice or Owner or Contractor requirement 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.

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DEFINITIONS
CCDC 18 – 2023

DEFINITIONS

The following Definitions shall apply to all *Contract Documents*.

Change Directive

A *Change Directive* is a written instruction prepared by the *Consultant* and signed by the *Owner* directing the *Contractor* to proceed with a change in the *Work* within the general scope of the *Contract Documents* prior to the *Owner* and the *Contractor* agreeing upon adjustments in the *Contract Price* and the *Contract Time*.

Change Order

A *Change Order* is a written amendment to the *Contract* prepared by the *Consultant* and signed by the *Owner* and the *Contractor* 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.

Construction Equipment

Construction Equipment means all machinery and equipment, either operated or not operated, that is required for preparing, fabricating, conveying, erecting, or otherwise performing the *Work* but is not incorporated into the *Work*.

Consultant

The *Consultant* is the person or entity engaged by the *Owner* and identified as such in the Agreement. The *Consultant* is the Architect, the Engineer or entity licensed to practise in the province or territory of the *Place of the Work*.

Contract

The *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.

Contract Documents

The *Contract Documents* consist of those documents listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS and amendments agreed upon between the parties.

Contract Price

When *Unit Prices* form the basis of payment, the *Contract Price* is the sum of the products of the actual final quantities that are incorporated in or made necessary by the *Work*, multiplied by the appropriate *Unit Prices* stated in the *Schedule of Prices*, plus lump sums and allowances, if any. When a lump sum stipulated price forms the basis of payment, the *Contract Price* is the amount stipulated in Article A-4 of the Agreement – CONTRACT PRICE.

Contract Time

The *Contract Time* is the time from commencement of the *Work* to the date of *Ready-for-Takeover* as stipulated in paragraph 1.3 of Article A-1 of the Agreement – THE WORK .

Contractor

The *Contractor* is the person or entity identified as such in the Agreement.

Drawings

The *Drawings* are the graphic and pictorial portions of the *Contract Documents*, wherever located and whenever issued, showing the design, location and dimensions of the *Work*, generally including plans, schedules, elevations, sections, details, and diagrams.

Notice in Writing

A *Notice in Writing*, where identified in the *Contract Documents*, is a written communication between the parties or between them and the *Consultant* that is transmitted in accordance with the provisions of Article A-6 of the Agreement – RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING.

Owner

The *Owner* is the person or entity identified as such in the Agreement.

Other Contractor

Other Contractor means a contractor, other than the *Contractor* or a *Subcontractor*, engaged by the *Owner* for the *Project*.

Payment Legislation

Payment Legislation means such legislation, if any, in effect at the *Place of the Work* which governs payment under construction contracts.

Place of the Work

The *Place of the Work* is the designated site or location of the *Work* identified in the *Contract Documents*.

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Product

Product or *Products* means material, machinery, equipment, and fixtures forming part of the *Work*, but does not include *Construction Equipment.*

Project

The *Project* means the total construction contemplated of which the *Work* may be the whole or a part.

Ready-for-Takeover

Ready-for-Takeover shall have been attained when the conditions set out in paragraph 12.1.1 of GC 12.1 – READY-FOR-TAKEOVER have been met, as verified by the *Consultant* pursuant to paragraph 12.1.4.2 of GC 12.1 – READY-FOR-TAKEOVER.

Schedule of Prices

The *Schedule of Prices* is the schedule listed in Article A-3 – CONTRACT DOCUMENTS identifying items of work, units of measure, estimated quantities, and *Unit Prices*.

Shop Drawings

Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, *Product* data, and other data which the *Contractor* provides to illustrate details of portions of the *Work*.

Specifications

The *Specifications* are that portion of the *Contract Documents*, wherever located and whenever issued, consisting of the written requirements and standards for *Products*, systems, workmanship, quality, and the services necessary for the performance of the *Work*.

Subcontractor

A *Subcontractor* is a person or entity having a direct contract with the *Contractor* to perform a part or parts of the *Work* at the *Place of the Work*.

Substantial Performance of the Work

Substantial Performance of the Work is as defined in the lien legislation applicable to the *Place of the Work*.

Supplemental Instruction

A *Supplemental Instruction* is an instruction, not involving adjustment in the *Contract Price* or *Contract Time*, in the form of *Specifications*, *Drawings*, schedules, samples, models, or written instructions, consistent with the intent of the *Contract Documents*. It is to be issued by the *Consultant* to supplement the *Contract Documents* as required for the performance of the *Work*.

Supplier

A *Supplier* is a person or entity having a direct contract with the *Contractor* to supply *Products*.

Temporary Work

Temporary Work means temporary supports, structures, facilities, services, and other temporary items, excluding *Construction Equipment*, required for the execution of the *Work* but not incorporated into the *Work*.

Unit Price

A *Unit Price* is the amount payable for a single unit of *Work* as stated in the *Schedule of Prices*.

Value Added Taxes

Value Added Taxes means such sum as shall be levied upon the *Contract Price* by the Federal or any Provincial or Territorial Government and is computed as a percentage of the *Contract Price* and includes the Goods and Services Tax, the Quebec Sales Tax, the Harmonized Sales Tax, and any similar tax, the collection and payment of which have been imposed on the *Contractor* by tax legislation.

Work

The *Work* means the total construction and related services required by the *Contract Documents*.

Working Day

Working Day means a day other than a Saturday, Sunday, statutory holiday, or statutory vacation day that is observed by the construction industry in the area of the *Place of the Work*.

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GENERAL CONDITIONS OF THE CIVIL WORKS CONTRACT CCDC 18 – 2023

GENERAL CONDITIONS

PART 1 GENERAL PROVISIONS

GC 1.1 CONTRACT DOCUMENTS

1.1.1 The intent of the *Contract Documents* is to include the labour, *Products* and services necessary for the performance of the *Work* by the *Contractor* in accordance with these documents. It is not intended, however, that the *Contractor* shall supply products or perform work not consistent with, not covered by, or not properly inferable from the *Contract Documents*.

1.1.2 The *Contract Documents* are complementary, and what is required by one shall be as binding as if required by all. Performance by the *Contractor* shall be required only to the extent consistent with the *Contract Documents*.

1.1.3 The *Contractor* shall review the *Contract Documents* for the purpose of facilitating co-ordination and execution of the *Work* by the *Contractor*.

1.1.4 The *Contractor* is not responsible for errors, omissions or inconsistencies in the *Contract Documents*. If there are perceived errors, omissions or inconsistencies discovered by or made known to the *Contractor*, the *Contractor* shall promptly report to the *Consultant* and shall not proceed with the work affected until the *Contractor* has received corrected or additional information from the *Consultant*.

1.1.5 If there is a conflict within the *Contract Documents*:

.1 the order of priority of documents, from highest to lowest, shall be

- the Agreement between *Owner* and *Contractor*,
- the Definitions,
- Supplementary Conditions,
- the General Conditions,
- Division 01 of the *Specifications*,
- technical *Specifications*,
- material and finishing schedules,
- the *Drawings*.

.2 *Drawings* of larger scale shall govern over those of smaller scale of the same date.

.3 dimensions shown on *Drawings* shall govern over dimensions scaled from *Drawings*.

.4 amended or later dated documents shall govern over earlier documents of the same type.

.5 noted materials and annotations shall govern over graphic indications.

1.1.6 Nothing contained in the *Contract Documents* shall create any contractual relationship between:

.1 the *Owner* and a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any portion of the *Work*.

.2 the *Consultant* and the *Contractor*, a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any portion of the *Work*.

1.1.7 Words and abbreviations which have well known technical or trade meanings are used in the *Contract Documents* in accordance with such recognized meanings.

1.1.8 References in the *Contract Documents* to the singular shall be considered to include the plural as the context requires.

1.1.9 Neither the organization of the *Specifications* nor the arrangement of *Drawings* shall control the *Contractor* in dividing the work among *Subcontractors* and *Suppliers*.

1.1.10 *Specifications*, *Drawings*, models, and copies thereof furnished by the *Consultant* are and shall remain the *Consultant*'s property, with the exception of the signed *Contract* sets, which shall belong to each party to the *Contract*. All *Specifications*, *Drawings* and models furnished by the *Consultant* are to be used only with respect to the *Work* and are not to be used on other work. These *Specifications*, *Drawings* and models are not to be copied or altered in any manner without the written authorization of the *Consultant*.

1.1.11 Physical models furnished by the *Contractor* at the *Owner*'s expense are the property of the *Owner*.

GC 1.2 LAW OF THE CONTRACT

1.2.1 The law of the *Place of the Work* shall govern the interpretation of the *Contract*.

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GC 1.3 RIGHTS AND REMEDIES

1.3.1 Except as expressly provided in the *Contract Documents*, the duties and obligations imposed by the *Contract Documents* and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights, and remedies otherwise imposed or available by law.

1.3.2 No action or failure to act by the *Owner*, the *Consultant* or the *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.

GC 1.4 ASSIGNMENT

1.4.1 Neither party to the *Contract* shall assign the *Contract* or a portion thereof without the written consent of the other, which consent shall not be unreasonably withheld.

PART 2 ADMINISTRATION OF THE CONTRACT

GC 2.1 AUTHORITY OF THE CONSULTANT

2.1.1 The *Consultant* will have authority to act on behalf of the *Owner* only to the extent provided in the *Contract Documents*, unless otherwise modified by written agreement as provided in paragraph 2.1.2.

2.1.2 The duties, responsibilities and limitations of authority of the *Consultant* as set forth in the *Contract Documents* shall be modified or extended only with the written consent of the *Owner*, the *Consultant* and the *Contractor*.

GC 2.2 ROLE OF THE CONSULTANT

2.2.1 The *Consultant* will provide administration of the *Contract* as described in the *Contract Documents*.

2.2.2 The *Consultant* will visit the *Place of the Work* at intervals appropriate to the progress of construction to:

.1 become familiar with the progress and quality of the *Work*,
.2 determine if the *Work* is proceeding in general conformity with the *Contract Documents*,
.3 verify quantities of *Work* performed under a *Schedule of Prices* where *Unit Prices* form the basis for payment, and
.4 verify amounts claimed under schedule of values where lump sum stipulated price forms the basis for payment of the *Contract Price*.

2.2.3 If the *Owner* and the *Consultant* agree, the *Consultant* will provide at the *Place of the Work*, one or more project representatives to assist in carrying out the *Consultant*'s responsibilities. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in writing to the *Contractor*.

2.2.4 Based on the *Consultant*'s observations and evaluation of the *Contractor*'s applications for payment, the *Consultant* will determine the amounts owing to the *Contractor* under the *Contract* and will issue certificates for payment as provided in Article A-5 of the Agreement – PAYMENT, GC 5.5 – PAYMENT and GC 5.7 – FINAL PAYMENT.

2.2.5 The *Consultant* will not be responsible for and will not have control, charge or supervision of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs required in connection with the *Work* in accordance with the applicable construction safety legislation, other regulations or general construction practice. The *Consultant* will not be responsible for the *Contractor*'s failure to perform the *Work* in accordance with the *Contract Documents*.

2.2.6 Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER, the *Consultant* will be, in the first instance, the interpreter of the requirements of the *Contract Documents*.

2.2.7 Matters in question relating to the performance of the *Work* or the interpretation of the *Contract Documents* shall be initially referred in writing to the *Consultant* by the party raising the question for interpretations and findings and copied to the other party.

2.2.8 Interpretations and findings of the *Consultant* shall be consistent with the intent of the *Contract Documents*. In making such interpretations and findings the *Consultant* will not show partiality to either the *Owner* or the *Contractor*.

2.2.9 The *Consultant*'s interpretations and findings will be given in writing to the parties within a reasonable time.

2.2.10 With respect to claims for a change in *Contract Price*, the *Consultant* will make findings as set out in GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE.

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2.2.11 The *Consultant* will have authority to reject work which in the *Consultant*'s opinion does not conform to the requirements of the *Contract Documents*. Whenever the *Consultant* considers it necessary or advisable, the *Consultant* will have authority to require inspection or testing of work, whether or not such work is fabricated, installed or completed. However, neither the authority of the *Consultant* to act nor any decision either to exercise or not to exercise such authority shall give rise to any duty or responsibility of the *Consultant* to the *Contractor*, *Subcontractors*, *Suppliers*, or their agents, employees, or other persons performing any of the *Work*.

2.2.12 During the progress of the *Work* the *Consultant* will furnish *Supplemental Instructions* to the *Contractor* with reasonable promptness or in accordance with a schedule for such instructions agreed to by the *Consultant* and the *Contractor*.

2.2.13 The *Consultant* will review and take appropriate action upon *Shop Drawings*, samples and other submittals by the *Contractor*, in accordance with the *Contract Documents*.

2.2.14 The *Consultant* will prepare *Change Orders* and *Change Directives* as provided in GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

2.2.15 The *Consultant* will conduct reviews of the *Work* to determine the date of *Substantial Performance of the Work* and verify that *Ready-for-Takeover* has been attained.

2.2.16 All certificates issued by the *Consultant* will be to the best of the *Consultant*'s knowledge, information and belief. By issuing any certificate, the *Consultant* does not guarantee the *Work* is correct or complete.

2.2.17 The *Consultant* will receive and review written warranties and related documents required by the *Contract* and provided by the *Contractor* and will forward such warranties and documents to the *Owner* for the *Owner*'s acceptance.

2.2.18 If the *Consultant*'s engagement is terminated, the *Owner* shall immediately engage a *Consultant* against whom the *Contractor* makes no reasonable objection and whose duties and responsibilities under the *Contract Documents* will be that of the former *Consultant*.

GC 2.3 REVIEW AND INSPECTION OF THE WORK

2.3.1 The *Owner* and the *Consultant* shall have access to the *Work* at all times. The *Contractor* shall provide sufficient, safe and proper facilities at all times for the review of the *Work* by the *Consultant* and the inspection of the *Work* by authorized agencies. If parts of the *Work* are in preparation at locations other than the *Place of the Work*, the *Owner* and the *Consultant* shall be given access to such work whenever it is in progress.

2.3.2 If work is designated for measurement for payment, tests, inspections or approvals in the *Contract Documents*, by the *Consultant*'s instructions, or by the laws or ordinances of the *Place of the Work*, the *Contractor* shall give the *Consultant* reasonable notification of when the work will be ready for measurements, tests, inspections, and approvals. The *Contractor* shall arrange for and shall give the *Consultant* reasonable notification of the date and time of inspections by other authorities.

2.3.3 The *Contractor* shall furnish promptly to the *Consultant* two copies of certificates and inspection reports relating to the *Work*.

2.3.4 If the *Contractor* covers, or permits to be covered, work that has been designated for measurement for payment, special tests, inspections, or approvals before such measurements, special tests, inspections, or approvals are made, given or completed, the *Contractor* shall, if so directed, uncover such work, have the measurements, special tests, inspections, and approvals satisfactorily completed, and make good covering work at the *Contractor*'s expense.

2.3.5 The *Consultant* may order any portion or portions of the *Work* to be examined to confirm that such work is in accordance with the requirements of the *Contract Documents*. If the work is not in accordance with the requirements of the *Contract Documents*, the *Contractor* shall correct the work and pay the cost of examination and correction. If the work is in accordance with the requirements of the *Contract Documents*, the *Owner* shall pay the cost of examination and restoration.

2.3.6 The *Contractor* shall pay the cost of making any test or inspection, including the cost of samples required for such test or inspection, if such test or inspection is designated in the *Contract Documents* to be performed by the *Contractor* or is required by the laws or ordinances applicable to the *Place of the Work*.

2.3.7 The *Contractor* shall pay the cost of samples required for any test or inspection to be performed by others if such test or inspection is designated in the *Contract Documents*.

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GC 2.4 DEFECTIVE WORK

2.4.1 The *Contractor* shall promptly correct defective work that has been rejected by the *Consultant* as failing to conform to the *Contract Documents* whether or not the defective work was incorporated in the *Work* or the defect is the result of poor workmanship, use of defective products or damage through carelessness or other act or omission of the *Contractor*.

2.4.2 The *Contractor* shall make good promptly *Other Contractors*' work destroyed or damaged by such corrections at the *Contractor*'s expense.

2.4.3 If in the opinion of the *Consultant* it is not expedient to correct defective work or work not performed as provided in the *Contract Documents*, the *Owner* may deduct from the amount otherwise due to the *Contractor* the difference in value between the work as performed and that called for by the *Contract Documents*. If the *Owner* and the *Contractor* do not agree on the difference in value, they shall refer the matter to the *Consultant* for a finding.

PART 3 EXECUTION OF THE WORK

GC 3.1 CONTROL OF THE WORK

3.1.1 The *Contractor* shall have total control of the *Work* and shall effectively direct and supervise the *Work* so as to ensure conformity with the *Contract Documents*.

3.1.2 The *Contractor* shall be solely responsible for construction means, methods, techniques, sequences, and procedures and for co-ordinating the various parts of the *Work* under the *Contract*.

GC 3.2 CONSTRUCTION BY THE OWNER OR OTHER CONTRACTORS

3.2.1 The *Owner* reserves the right to award separate contracts in connection with other parts of the *Project* to *Other Contractors* and to perform work with own forces.

3.2.2 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner*'s own forces, the *Owner* shall:

.1 provide for the co-ordination of the activities and work of *Other Contractors* and the *Owner*'s own forces with the *Work* of the *Contract*;

.2 enter into separate contracts with *Other Contractors* under conditions of contract which are compatible with the conditions of the *Contract*;

.3 ensure that insurance coverage is provided to the same requirements as are called for in GC 11.1 – INSURANCE and co-ordinate such insurance with the insurance coverage of the *Contractor* as it affects the *Work*; and

.4 take all reasonable precautions to avoid labour disputes or other disputes on the *Project* arising from the work of *Other Contractors* or the *Owner*'s own forces.

3.2.3 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner*'s own forces, the *Contractor* shall:

.1 afford the *Owner* and *Other Contractors* reasonable opportunity to store their products and execute their work;

.2 co-ordinate and schedule the *Work* with the work of *Other Contractors* or the *Owner*'s own forces that are identified in the *Contract Documents*;

.3 participate with *Other Contractors* and the *Owner* in reviewing their construction schedules when directed to do so; and

.4 report promptly to the *Consultant* in writing any apparent deficiencies in the work of *Other Contractors* or of the *Owner*'s own forces, where such work affects the proper execution of any portion of the *Work*, prior to proceeding with that portion of the *Work*.

3.2.4 Where a change in the *Work* is required as a result of the co-ordination and integration of the work of *Other Contractors* or *Owner*'s own forces with the *Work*, the changes shall be authorized and valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

3.2.5 Disputes and other matters in question between the *Contractor* and *Other Contractors* shall be dealt with as provided in Part 8 of the General Conditions – DISPUTE RESOLUTION provided the *Other Contractors* have reciprocal obligations. The *Contractor* shall be deemed to have consented to arbitration of any dispute with any *Other Contractor* whose contract with the *Owner* contains a similar agreement to arbitrate. In the absence of *Other Contractors* having reciprocal obligations, disputes and other matters in question initiated by the *Contractor* against *Other Contractors* will be considered disputes and other matters in question between the *Contractor* and the *Owner*.

3.2.6 Should the *Owner*, the *Consultant*, *Other Contractors*, or anyone employed by them directly or indirectly be responsible for ill-timed work necessitating cutting or remedial work to be performed, the cost of such cutting or remedial work shall be valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

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GC 3.3 TEMPORARY WORK

3.3.1 The *Contractor* shall have the sole responsibility for the design, erection, operation, maintenance, and removal of *Temporary Work* unless otherwise specified in the *Contract Documents*.

3.3.2 The *Contractor* shall engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform those functions referred to in paragraph 3.3.1 where required by law or by the *Contract Documents* and in all cases where such *Temporary Work* is of such a nature that professional engineering skill is required to produce safe and satisfactory results.

3.3.3 Notwithstanding the provisions of GC 3.1 – CONTROL OF THE WORK, paragraphs 3.3.1 and 3.3.2 or provisions to the contrary elsewhere in the *Contract Documents* where such *Contract Documents* include designs for *Temporary Work* or specify a method of construction in whole or in part, such designs or methods of construction shall be considered to be part of the design of the *Work* and the *Contractor* shall not be held responsible for that part of the design or the specified method of construction. The *Contractor* shall, however, be responsible for the execution of such design or specified method of construction in the same manner as for the execution of the *Work*.

GC 3.4 CONSTRUCTION SCHEDULE

3.4.1 The *Contractor* shall:

.1 prepare and submit to the *Owner* and the *Consultant* prior to the first application for payment, a construction schedule that indicates the timing of the major activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time*;

.2 monitor the progress of the *Work* relative to the construction schedule and update the schedule on a monthly basis or as stipulated by the *Contract Documents*; and

.3 advise the *Consultant* of any revisions required to the schedule as the result of extensions of the *Contract Time* as provided in Part 6 of the General Conditions – CHANGES IN THE WORK.

GC 3.5 SUPERVISION

3.5.1 The *Contractor* shall provide all necessary supervision and appoint a competent representative who shall be in attendance at the *Place of the Work* while the *Work* is being performed. The appointed representative shall not be changed except for valid reason.

3.5.2 The appointed representative shall represent the *Contractor* at the *Place of the Work*. Information and instructions provided by the *Consultant* to the *Contractor*'s appointed representative shall be deemed to have been received by the *Contractor*, except with respect to Article A-6 of the Agreement – RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING.

GC 3.6 LAYOUT OF THE WORK

3.6.1 The *Owner* shall, in consultation with the *Consultant* and the *Contractor*, establish reference points for construction which are necessary for the *Contractor* to proceed with the *Work*.

3.6.2 The *Contractor* shall be responsible for laying out the *Work*, shall preserve and protect the established reference points, and shall not change or relocate the established reference points without the approval of the *Consultant*.

3.6.3 The *Contractor* shall advise the *Consultant* whenever any established reference point is lost, destroyed, damaged, or requires relocation as a result of the *Contractor*'s operations. The cost to reestablish any reference point that is lost, destroyed, damaged, or requires relocation as a result of the *Contractor*'s operations, shall be at the *Contractor*'s expense.

GC 3.7 SUBCONTRACTORS AND SUPPLIERS

3.7.1 The *Contractor* shall preserve and protect the rights of the parties under the *Contract* with respect to work to be performed under subcontract, and shall:

.1 enter into contracts or written agreements with *Subcontractors* and *Suppliers* to require them to perform their work as provided in the *Contract Documents*;

.2 incorporate the applicable terms and conditions of the *Contract Documents* into all contracts or written agreements with *Subcontractors* and *Suppliers*; and

.3 be as fully responsible to the *Owner* for acts and omissions of *Subcontractors*, *Suppliers* and any persons directly or indirectly employed by them as for acts and omissions of persons directly employed by the *Contractor*.

3.7.2 The *Contractor* shall indicate in writing, if requested by the *Owner*, those *Subcontractors* or *Suppliers* whose bids have been received by the *Contractor* which the *Contractor* would be prepared to accept for the performance of a portion of the *Work*. Should the *Owner* not object before signing the *Contract*, the *Contractor* shall employ those *Subcontractors* or *Suppliers* so identified by the *Contractor* in writing for the performance of that portion of the *Work* to which their bid applies.

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3.7.3 The *Owner* may, for reasonable cause, at any time before the *Owner* has signed the *Contract*, object to the use of a proposed *Subcontractor* or *Supplier* and require the *Contractor* to employ one of the other subcontract bidders.

3.7.4 If the *Owner* requires the *Contractor* to change a proposed *Subcontractor* or *Supplier*, the *Contract Price* and *Contract Time* shall be adjusted by the difference occasioned by such required change.

3.7.5 The *Contractor* shall not be required to employ as a *Subcontractor* or *Supplier*, a person or firm to which the *Contractor* may reasonably object.

3.7.6 The *Owner*, through the *Consultant*, may provide to a *Subcontractor* or *Supplier* information as to the percentage of the *Subcontractor*'s or *Supplier*'s work which has been certified for payment.

GC 3.8 LABOUR AND PRODUCTS

3.8.1 The *Contractor* shall maintain good order and discipline among the *Contractor*'s employees engaged on the *Work* and employ only workers that are skilled in the tasks assigned.

3.8.2 The *Contractor* shall provide and pay for labour, *Products*, tools, *Construction Equipment*, water, heat, light, power, transportation, and other facilities and services necessary for the performance of the *Work* in accordance with the *Contract*.

3.8.3 Unless otherwise specified in the *Contract Documents*, *Products* provided shall be new. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*.

GC 3.9 SHOP DRAWINGS

3.9.1 The *Contractor* shall provide *Shop Drawings* as required in the *Contract Documents*.

3.9.2 The *Contractor* shall provide *Shop Drawings* to the *Consultant* to review in accordance with an agreed schedule, or in the absence of an agreed schedule, in orderly sequence and sufficiently in advance so as to cause no delay in the *Work* or in the work of *Other Contractors* or the *Owner*'s own forces.

3.9.3 The *Contractor* shall review all *Shop Drawings* before providing them to the *Consultant*. The *Contractor* represents by this review that:

.1 the *Contractor* has determined and verified all applicable field measurements, field construction conditions, *Product* requirements, catalogue numbers and similar data, or will do so, and

.2 the *Contractor* has checked and co-ordinated each *Shop Drawing* with the requirements of the *Work* and of the *Contract Documents*.

3.9.4 The *Consultant*'s review is for conformity to the design concept and for general arrangement only.

3.9.5 At the time of providing *Shop Drawings*, the *Contractor* shall expressly advise the *Consultant* in writing of any deviations in a *Shop Drawing* from the requirements of the *Contract Documents*. The *Consultant* shall indicate the acceptance or rejection of such deviation expressly in writing.

3.9.6 The *Consultant*'s review shall not relieve the *Contractor* of responsibility for errors or omissions in the *Shop Drawings* or for meeting all requirements of the *Contract Documents*.

3.9.7 The *Consultant* will review and return *Shop Drawings* in accordance with the schedule agreed upon, or, in the absence of such schedule, with reasonable promptness so as to cause no delay in the performance of the *Work*.

PART 4 ALLOWANCES

GC 4.1 CASH ALLOWANCES

4.1.1 The *Contract Price* includes the cash allowances, if any, stated in the *Contract Documents*. The scope of the *Work* or costs included in such cash allowances shall be as described in the *Contract Documents*.

4.1.2 The *Contract Price*, and not the cash allowances, includes the *Contractor*'s overhead and profit in connection with such cash allowances.

4.1.3 Expenditures under cash allowances shall be authorized by the *Owner* through the *Consultant*.

4.1.4 Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the *Consultant*'s direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the *Contract Price* for overhead and profit. Only where the actual cost of the *Work* under all cash allowances exceeds the total amount of all cash allowances shall the *Contractor* be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the *Contract Documents*.

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4.1.5 The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor*'s overhead and profit on such amount.

4.1.6 The value of the *Work* performed under a cash allowance is eligible to be included in progress payments.

4.1.7 The *Contractor* and the *Consultant* shall jointly prepare a schedule that shows when the items called for under cash allowances must be ordered to avoid delaying the progress of the *Work*.

GC 4.2 CONTINGENCY ALLOWANCE

4.2.1 The *Contract Price* includes the contingency allowance, if any, stated in the *Contract Documents*.

4.2.2 The contingency allowance includes the *Contractor*'s overhead and profit in connection with such contingency allowance.

4.2.3 Expenditures under the contingency allowance shall be authorized and valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

4.2.4 The *Contract Price* shall be adjusted by *Change Order* to provide for any difference between the expenditures authorized under paragraph 4.2.3 and the contingency allowance.

PART 5 PAYMENT

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

5.1.1 The *Owner* shall, at the request of the *Contractor*, before signing the *Contract*, and promptly from time to time thereafter, furnish to the *Contractor* reasonable evidence that financial arrangements have been made to fulfill the *Owner*'s obligations under the *Contract*.

5.1.2 The *Owner* shall give the *Contractor Notice in Writing* of any material change in the *Owner*'s financial arrangements to fulfil the *Owner*'s obligations under the *Contract* during the performance of the *Contract*.

GC 5.2 BASIS OF PAYMENT FOR UNIT PRICE WORK

5.2.1 Payment for *Unit Price Work* shall be based on the *Unit Prices* in the *Contract*.

5.2.2 The *Contractor* shall measure the *Work* and the *Consultant* will verify such measurements to determine payment to the *Contractor* in accordance with the measurement provisions of the *Contract Documents*.

GC 5.3 BASIS OF PAYMENT FOR LUMP SUM WORK

5.3.1 Payment for lump sum *Work* shall be based on the stipulated price(s) in the *Contract*.

GC 5.4 APPLICATIONS FOR PAYMENT

5.4.1 Applications for payment on account as provided in Article A-5 of the Agreement – PAYMENT shall be submitted monthly to the *Owner* and the *Consultant* simultaneously as the *Work* progresses.

5.4.2 Applications for payment shall be dated the last day of each payment period, which is the last day of the month or an alternative day of the month agreed in writing by the parties.

5.4.3 Where the basis of payment of the *Contract Price* is *Unit Prices*, applications for payment shall include quantity measurements and any other data requested by the *Consultant* to assist the *Consultant* in evaluating the application and verifying quantity measurements.

5.4.4 Where the basis of payment of the *Contract Price* is a lump sum stipulated price:

.1 the *Contractor* shall submit to the *Consultant*, at least 15 calendar days before the first application for payment, a schedule of values for the parts of the *Work*, aggregating the total amount of the *Contract Price*, so as to facilitate evaluation of applications for payment;

.2 the schedule of values shall be made out in such form as specified in the *Contract* and supported by such evidence as the *Consultant* may reasonably require;

.3 applications for payment shall be based on the schedule of values accepted by the *Consultant*, and

.4 the amount claimed shall be for the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered to the *Place of the Work* as of the last day of the payment period.

5.4.5 Applications for payment shall comply with the provisions of *Payment Legislation*.

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5.4.6 Each application for payment shall include evidence of compliance with workers' compensation legislation at the *Place of the Work* and after the first payment, a declaration by the *Contractor* as to the distribution made of the amounts previously received using document CCDC 9A 'Statutory Declaration'.

5.4.7 Applications for payment for *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work* shall be supported by such evidence as the *Consultant* may reasonably require to establish the value and delivery of the *Products*.

GC 5.5 PAYMENT

5.5.1 After receipt by the *Consultant* and the *Owner* of an application for payment submitted by the *Contractor* in accordance with GC 5.4 – APPLICATIONS FOR PAYMENT:

.1 The *Consultant* will issue to the *Owner* and copy to the *Contractor*, no later than 10 calendar days after the receipt of the application for payment, a certificate for payment in the amount applied for, or in such other amount as the *Consultant* determines to be properly due. If the *Consultant* certifies a different amount, or rejects the application or part thereof, the *Owner* shall promptly issue a written notice to the *Contractor* giving reasons for the revision or rejection, such written notice to be in compliance with *Payment Legislation*,

.2 The *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT on or before 28 calendar days after the receipt by the *Owner* and the *Consultant* of the application for payment, and in any event, in compliance with *Payment Legislation*.

5.5.2 Where the basis of payment for an item is by *Unit Price*, quantities in progress payments shall be considered estimate until all *Work* required by that *Unit Price* item is complete.

GC 5.6 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

5.6.1 The *Consultant* will review the *Work* to certify or verify the validity of the application for *Substantial Performance of the Work* and will promptly, and in any event, no later than 20 calendar days after receipt of the *Contractor*'s application:

.1 advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or

.2 state the date of *Substantial Performance of the Work* or a designated portion of the *Work* in a certificate and issue a copy of that certificate to each of the *Owner* and the *Contractor*.

5.6.2 Where the holdback amount required by the applicable lien legislation has not been placed in a separate lien holdback account, the *Owner* shall, no later than 10 calendar days prior to the expiry of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*, place the holdback amount in a bank account in the joint names of the *Owner* and the *Contractor*.

5.6.3 Subject to the requirements of any *Payment Legislation*, all holdback amount prescribed by the applicable lien legislation for the *Work* shall become due and payable to the *Contractor* no later than 10 *Working Days* following the expiration of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*.

5.6.4 The *Contractor* shall submit an application for payment of the lien holdback amount in accordance with GC 5.5 –PAYMENT.

5.6.5 Where legislation permits progressive release of the holdback for a portion of the *Work* and the *Consultant* has certified or verified that the part of the *Work* has been performed prior to *Substantial Performance of the Work*, the *Owner* hereby agrees to release, and shall release, such portion to the *Contractor* in accordance with such legislation.

5.6.6 Notwithstanding any progressive release of the holdback, the *Contractor* shall ensure that such parts of the *Work* are protected pending the issuance of a final certificate for payment and be responsible for the correction of defects or work not performed regardless of whether or not such was apparent when the holdback was released.

GC 5.7 FINAL PAYMENT

5.7.1 When the *Contractor* considers that the *Work* is completed, the *Contractor* shall submit an application for final payment.

5.7.2 The *Consultant* will, no later than 10 calendar days after the receipt of an application from the *Contractor* for final payment, review the *Work* to verify the validity of the application and when the *Consultant* finds the *Contractor*'s application for final payment valid, the *Consultant* will promptly issue a final certificate for payment to the *Owner*, with a copy to the *Contractor*.

5.7.3 If the *Consultant* rejects the application or part thereof, the *Owner* will promptly issue a written notice to the *Contractor* giving reasons for the revision or rejection, such written notice to be in compliance with *Payment Legislation*.

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5.7.4 Subject to the provision of paragraph 10.4.1 of GC 10.4 – WORKERS' COMPENSATION, and any legislation applicable to the *Place of the Work*, the *Owner* shall, no later than 5 calendar days after the issuance of a final certificate for payment, pay the *Contractor* as provided in Article A-5 of the Agreement – PAYMENT and in any event, in compliance with *Payment Legislation*.

GC 5.8 DEFERRED WORK

5.8.1 If because of climatic or other conditions reasonably beyond the control of the *Contractor*, or if the *Owner* and the *Contractor* agree that, there are items of work that must be deferred, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such deferred *Work*.

GC 5.9 NON-CONFORMING WORK

5.9.1 No payment by the *Owner* under the *Contract* nor partial or entire use or occupancy of the *Work* by the *Owner* shall constitute an acceptance of any portion of the *Work* or *Products* which are not in accordance with the requirements of the *Contract Documents*.

PART 6 CHANGES IN THE WORK

GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

6.1.1 The *Owner*, through the *Consultant*, without invalidating the *Contract*, may make:

.1 changes in the *Work* consisting of additions, deletions or other revisions to the *Work* by *Change Order* or *Change Directive*, and

.2 changes to the *Contract Time* for the *Work*, or any part thereof, by *Change Order*.

6.1.2 The *Contractor* shall not perform a change in the *Work* without a *Change Order* or a *Change Directive*.

GC 6.2 CHANGE ORDER

6.2.1 When a change in the *Work* is proposed or required, the *Consultant* will provide the *Contractor* with a written description of the proposed change in the *Work*. The *Contractor* shall promptly present to the *Consultant*, in a form that can be reasonably evaluated, a method of adjustment or an amount of adjustment for the *Contract Price*, if any, and the adjustment in the *Contract Time*, if any, for the proposed change in the *Work*.

6.2.2 The method of adjustment of the *Contract Price* presented by the *Contractor* may be:

.1 *Unit Prices* listed in the *Schedule of Prices* that are applicable to the change in the *Work* or, if *Unit Prices* listed in the *Schedule of Prices* are not directly applicable, by unit prices deduced or extrapolated from such *Unit Prices*,

.2 a lump sum or unit price quotation, or

.3 the cost plus method.

6.2.3 When the *Owner* and the *Contractor* agree to the adjustments in the *Contract Price* and *Contract Time* or to the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a *Change Order*. The value of the work performed as the result of a *Change Order* shall be included in the applications for progress payment.

GC 6.3 CHANGE DIRECTIVE

6.3.1 If the *Owner* requires the *Contractor* to proceed with a change in the *Work* prior to the *Owner* and the *Contractor* agreeing upon the corresponding adjustment in *Contract Price* and *Contract Time*, the *Owner*, through the *Consultant*, shall issue a *Change Directive*.

6.3.2 A *Change Directive* shall only be used to direct a change in the *Work* which is within the general scope of the *Contract Documents*.

6.3.3 A *Change Directive* shall not be used to direct a change in the *Contract Time* only.

6.3.4 Upon receipt of a *Change Directive*, the *Contractor* shall proceed promptly with the change in the *Work*.

6.3.5 For the purpose of valuing *Change Directives*, changes in the *Work* that are not substitutions or otherwise related to each other shall not be grouped together in the same *Change Directive*.

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6.3.6 The adjustment in the *Contract Price* for a change carried out by way of a *Change Directive* shall be determined on the basis of the cost of the *Contractor*'s actual expenditures and savings attributable to the *Change Directive*, valued in accordance with paragraph 6.3.7 and as follows:

.1 If the change results in a net increase in the *Contractor*'s cost, the *Contract Price* shall be increased by the amount of the net increase in the *Contractor*'s cost, plus the *Contractor*'s percentage fee on such net increase.

.2 If the change results in a net decrease in the *Contractor*'s cost, the *Contract Price* shall be decreased by the amount of the net decrease in the *Contractor*'s cost, without adjustment for the *Contractor*'s percentage fee.

.3 The *Contractor*'s fee shall be as specified in the *Contract Documents* or as otherwise agreed by the parties.

6.3.7 The cost of performing the work attributable to the *Change Directive* shall be limited to the actual cost of the following in as much as it contributes directly to the implementation of the *Change Directive*:

Labour

.1 rates that are listed in the schedule or as agreed by the *Owner* and the *Contractor* including wages, benefits, compensation, contributions, assessments, or taxes incurred for such items as employment insurance, provincial or territorial health insurance, workers' compensation, and Canada or Quebec Pension Plan for:

(1) trade labour in the direct employ of the *Contractor*;

(2) the *Contractor*'s personnel when stationed at the field office;

(3) the *Contractor*'s personnel engaged at shops or on the road, in expediting the production or transportation of materials or equipment; and

(4) the *Contractor*'s office personnel engaged in a technical capacity, or other personnel identified in Article A-3 of the Agreement – CONTRACT DOCUMENTS for the time spent in the performance of the *Work*.

Products, Construction Equipment and Temporary Work

.2 cost of all *Products* including cost of transportation thereof;

.3 in the absence of agreed rates, cost less salvage value of *Construction Equipment*, *Temporary Work* and tools, exclusive of hand tools under $1,000 owned by the *Contractor*;

.4 rental cost of *Construction Equipment*, *Temporary Work* and tools, exclusive of hand tools under $1,000;

.5 cost of all equipment and services required for the *Contractor*'s field office;

Subcontract

.6 subcontract amounts of *Subcontractor* with pricing mechanism approved by the *Owner*;

Others

.7 travel and subsistence expenses of the *Contractor*'s personnel described in paragraph 6.3.7.1;

.8 deposits lost provided that they are not caused by negligent acts or omissions of the *Contractor*;

.9 cost of quality assurance such as independent inspection and testing services;

.10 charges levied by authorities having jurisdiction at the *Place of the Work*;

.11 royalties, patent license fees, and damages for infringement of patents and cost of defending suits therefor subject always to the *Contractor*'s obligations to indemnify the *Owner* as provided in paragraph 10.3.1 of GC 10.3 – PATENT FEES;

.12 premium for all contract securities and insurance for which the *Contractor* is required, by the *Contract Documents*, to provide, maintain and pay in relation to the performance of the *Work*;

.13 losses and expenses sustained by the *Contractor* for matters which are the subject of insurance under the policies prescribed in GC 11.1 – INSURANCE when such losses and expenses are not recoverable because the amounts are in excess of collectible amounts or within the deductible amounts;

.14 taxes and duties, other than *Value Added Taxes*, income, capital, or property taxes, relating to the *Work* for which the *Contractor* is liable;

.15 charges for voice and data communications, courier services, expressage, transmittal and reproduction of documents, and petty cash items;

.16 cost for removal and disposal of waste products and debris;

.17 legal costs, incurred by the *Contractor*, in relation to the performance of the *Work* provided that they are not:

(1) relating to a dispute between the *Owner* and the *Contractor* unless such costs are part of a settlement or awarded by arbitration or court,

(2) the result of the negligent acts or omissions of the *Contractor*, or

(3) the result of a breach of this *Contract* by the *Contractor*;

.18 cost of auditing when requested by the *Owner*; and

.19 cost of *Project* specific information technology in accordance with the method determined by the parties.

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6.3.8 Notwithstanding any other provisions contained in the General Conditions of the *Contract*, it is the intention of the parties that the cost of any item under any cost element referred to in paragraph 6.3.7 shall cover and include any and all costs or liabilities attributable to the *Change Directive* other than those which are the result of or occasioned by any failure on the part of the *Contractor* to exercise reasonable care and diligence in the *Contractor*'s attention to the *Work*. Any cost due to failure on the part of the *Contractor* to exercise reasonable care and diligence in the *Contractor*'s performance of the *Work* attributable to the *Change Directive* shall be borne by the *Contractor*.

6.3.9 The *Contractor* shall keep full and detailed accounts and records necessary for the documentation of the cost of performing the *Work* attributable to the *Change Directive* and shall provide the *Consultant* with copies thereof.

6.3.10 For the purpose of valuing *Change Directives*, the *Owner* shall be afforded reasonable access to all of the *Contractor*'s pertinent documents related to the cost of performing the *Work* attributable to the *Change Directive*.

6.3.11 Pending determination of the final amount of a *Change Directive*, the undisputed value of the *Work* performed as the result of a *Change Directive* is eligible to be included in progress payments.

6.3.12 If the *Owner* and the *Contractor* do not agree on the proposed adjustment in the *Contract Time* attributable to the change in the *Work*, or the method of determining it, the adjustment shall be referred to the *Consultant* for a finding.

6.3.13 When the *Owner* and the *Contractor* reach agreement on the adjustment to the *Contract Price* and to the *Contract Time*, this agreement shall be recorded in a *Change Order*.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

6.4.1 If the *Owner* or the *Contractor* discover conditions at the *Place of the Work* which are:

.1 subsurface or otherwise concealed physical conditions which existed before the commencement of the *Work* and differ materially from those indicated in the *Contract Documents*; or

.2 physical conditions, other than conditions due to weather, that are of a nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the *Contract Documents*,

then the observing party shall give *Notice in Writing* to the other party of such conditions before they are disturbed and in no event later than 5 *Working Days* after first observance of the conditions.

6.4.2 The *Consultant* will promptly investigate such conditions and make a finding. If the finding is that the conditions differ materially and this would cause an increase or decrease in the *Contractor*'s cost or time to perform the *Work*, the *Owner*, through the *Consultant*, shall issue appropriate instructions for a change in the *Work* as provided in GC 6.2 – CHANGE ORDER or GC 6.3 – CHANGE DIRECTIVE.

6.4.3 If the *Consultant* finds that the conditions at the *Place of the Work* are not materially different or that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* will promptly inform the *Owner* and the *Contractor* in writing.

6.4.4 The *Contractor* shall not be entitled to an adjustment in the *Contract Price* or the *Contract Time* if such conditions were reasonably apparent prior to the time of bid closing.

GC 6.5 DELAYS

6.5.1 If the *Contractor* is delayed in the performance of the *Work* by the *Owner*, the *Consultant*, or anyone employed or engaged by them directly or indirectly, contrary to the provisions of the *Contract Documents*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay.

6.5.2 If the *Contractor* is delayed in the performance of the *Work* by a stop work order issued by a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Contractor* or any person employed or engaged by the *Contractor* directly or indirectly, resulting in the failure of the *Contractor* to attain *Ready-for-Takeover* by the date stipulated in Article A-1 of the Agreement – THE WORK, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay.

6.5.3 If the *Contractor* is delayed in the performance of the *Work* by:

.1 labour disputes, strikes, lock-outs (including lock-outs decreed or recommended for its members by a recognized contractors' association, of which the *Contractor* is a member or to which the *Contractor* is otherwise bound),

.2 fire, unusual delay by common carriers or unavoidable casualties,

.3 abnormally adverse weather conditions, or

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.4 any cause beyond the *Contractor*'s control other than one resulting from a default or breach of *Contract* by the *Contractor*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from actions by the *Owner*, the *Consultant* or anyone employed or engaged by them directly or indirectly.

6.5.4 No extension shall be made for delay unless *Notice in Writing* of the cause of delay is given to the *Consultant* not later than 10 *Working Days* after the commencement of the delay. In the case of a continuing cause of delay only one *Notice in Writing* shall be necessary.

6.5.5 If no schedule is made under paragraph 2.2.12 of GC 2.2 – ROLE OF THE CONSULTANT, then no request for extension shall be made because of failure of the *Consultant* to furnish instructions until 10 *Working Days* after demand for such instructions has been made.

GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

6.6.1 If the *Contractor* intends to make a claim for an increase to the *Contract Price*, or if the *Owner* intends to make a claim against the *Contractor* for a credit to the *Contract Price*, the party that intends to make the claim shall give timely *Notice in Writing* of intent to claim to the other party and to the *Consultant* but no later than 10 *Working Days* after commencement of the event or series of events giving rise to the claim. Failure to provide such *Notice in Writing* shall invalidate the claim.

6.6.2 Upon commencement of the event or series of events giving rise to a claim, the party intending to make the claim shall:

.1 take all reasonable measures to mitigate any loss or expense which may be incurred as a result of such event or series of events, and

.2 keep such records as may be necessary to support the claim.

6.6.3 Within 30 *Working Days* after commencement of the event or series of events giving rise to the claim, or such other reasonable time as may be agreed by the *Consultant*, the party making the claim shall submit to the *Consultant* a detailed account of the amount claimed and the grounds upon which the claim is based and the *Consultant* will make a finding upon such claim.

6.6.4 Where the event or series of events giving rise to the claim has a continuing effect, the detailed account submitted under paragraph 6.6.3 shall be considered to be an interim account and the party making the claim shall, at such intervals as the *Consultant* may reasonably require, submit further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. The party making the claim shall submit a final account after the end of the effects resulting from the event or series of events.

6.6.5 The *Consultant*'s findings, with respect to a claim made by either party, will be given by *Notice in Writing* to both parties within 30 *Working Days* after receipt of the claim by the *Consultant*, or within such other time period as may be agreed by the parties.

6.6.6 If such finding is not acceptable to either party, the claim shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION.

GC 6.7 QUANTITY VARIATIONS

6.7.1 The *Owner* or the *Contractor* may request an adjustment to a *Unit Price* contained in the *Schedule of Prices* provided that the actual quantity of the item in the *Schedule of Prices* exceeds or falls short of the estimated quantity by more than 15%.

6.7.2 Where the actual quantity exceeds the estimated quantity by more than 15%, a *Unit Price* adjusted pursuant to paragraph 6.7.1 shall apply only to the quantity that exceeds 115% of the estimated quantity.

6.7.3 Where the actual quantity falls short of the estimated quantity by more than 15%, a *Unit Price* adjusted pursuant to paragraph 6.7.1 shall not exceed the *Unit Price* that would cause the extended amount to equal the original extended amount derived from the original *Unit Price* and estimated quantity.

6.7.4 If either party requests adjustment of a *Unit Price*, both parties shall make all reasonable efforts to agree on a revised *Unit Price*. The agreed revised *Unit Price* shall be recorded in a *Change Order*.

6.7.5 If agreement on a revised *Unit Price* is not reached, the matter shall be subject to final determination in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION. Pending determination of the revised *Unit Price*, payment for the *Work* performed shall be included in progress payments based on the unrevised *Unit Price*.

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PART 7 DEFAULT NOTICE

GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

7.1.1 If the *Contractor* is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Contractor*'s insolvency, or if a receiver is appointed because of the *Contractor*'s insolvency, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, terminate the *Contractor*'s right to continue with the *Work*, by giving the *Contractor* or receiver or trustee in bankruptcy *Notice in Writing* to that effect.

7.1.2 If the *Contractor* neglects to perform the *Work* properly or otherwise fails to comply with the requirements of the *Contract* to a substantial degree and if the *Consultant* has given a written statement to the *Owner* and *Contractor* which provides the detail of such neglect to perform the *Work* properly or such failure to comply with the requirements of the *Contract* to a substantial degree, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, give the *Contractor Notice in Writing*, containing particulars of the default including references to applicable provisions of the *Contract*, that the *Contractor* is in default of the *Contractor*'s contractual obligations and instruct the *Contractor* to correct the default in the 5 *Working Days* immediately following the receipt of such *Notice in Writing*.

7.1.3 If the default cannot be corrected in the 5 *Working Days* specified or in such other time period as may be subsequently agreed in writing by the parties, the *Contractor* shall be in compliance with the *Owner*'s instructions if the *Contractor*:

.1 commences the correction of the default within the specified time,

.2 provides the *Owner* with an acceptable schedule for such correction, and

.3 corrects the default in accordance with the *Contract* terms and with such schedule.

7.1.4 If the *Contractor* fails to correct the default in the time specified or in such other time period as may be subsequently agreed in writing by the parties, without prejudice to any other right or remedy the *Owner* may have, the *Owner* may by giving *Notice in Writing*:

.1 correct such default and deduct the cost thereof from any payment then or thereafter due the *Contractor* for the *Work* provided the *Consultant* has certified such cost to the *Owner* and the *Contractor*, or

.2 terminate the *Contractor*'s right to continue with the *Work* in whole or in part or terminate the *Contract*.

7.1.5 If the *Owner* terminates the *Contractor*'s right to continue with the *Work* as provided in paragraphs 7.1.1 and 7.1.4, the *Owner* shall be entitled to:

.1 take possession of the *Work* and *Products* at the *Place of the Work*; subject to the rights of third parties, utilize the *Construction Equipment* at the *Place of the Work*; finish the *Work* by whatever method the *Owner* may consider expedient, but without undue delay or expense,

.2 withhold further payment to the *Contractor* until a final certificate for payment is issued,

.3 charge the *Contractor* the amount by which the full cost of finishing the *Work* as certified by the *Consultant*, including compensation to the *Consultant* for the *Consultant*'s additional services and a reasonable allowance as determined by the *Consultant* to cover the cost of corrections to work performed by the *Contractor* that may be required under GC 12.3 – WARRANTY, exceeds the unpaid balance of the *Contract Price*; however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference, and

.4 on expiry of the warranty period, charge the *Contractor* the amount by which the cost of corrections to the *Contractor*'s work under GC 12.3 – WARRANTY exceeds the allowance provided for such corrections, or if the cost of such corrections is less than the allowance, pay the *Contractor* the difference.

7.1.6 The *Contractor*'s obligation under the *Contract* as to quality, correction and warranty of the work performed by the *Contractor* up to the time of termination shall continue in force after such termination of the *Contract*.

GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

7.2.1 If the *Owner* is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Owner*'s insolvency, or if a receiver is appointed because of the *Owner*'s insolvency, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, terminate the *Contract* by giving the *Owner* or receiver or trustee in bankruptcy *Notice in Writing* to that effect.

7.2.2 If the *Work* is suspended or otherwise delayed for a period of 20 *Working Days* or more under an order of a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Contractor* or of anyone directly or indirectly employed or engaged by the *Contractor*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, terminate the *Contract* by giving the *Owner Notice in Writing* to that effect.

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7.2.3 The *Contractor* may give *Notice in Writing* to the *Owner*, with a copy to the *Consultant*, that the *Owner* is in default of the *Owner*'s contractual obligations if:

.1 the *Owner* fails to furnish, when so requested by the *Contractor*, reasonable evidence that financial arrangements have been made to fulfill the *Owner*'s obligations under the *Contract*,

.2 the *Consultant* fails to issue a certificate as provided in Part 5 of the General Conditions – PAYMENT,

.3 the *Owner* fails to pay the *Contractor* when due the amounts certified by the *Consultant* or awarded by adjudication, arbitration or court, or

.4 the *Owner* fails to comply with the requirements of the *Contract* to a substantial degree and the *Consultant*, except for GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER, gives a written statement to the *Owner* and the *Contractor* that provides detail of such failure to comply with the requirements of the *Contract* to a substantial degree.

7.2.4 The *Contractor*'s *Notice in Writing* to the *Owner* provided under paragraph 7.2.3 shall advise that if the default is not corrected within 5 *Working Days* following the receipt of the *Notice in Writing*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, suspend the *Work* or terminate the *Contract*.

7.2.5 If the *Contractor* terminates the *Contract* by giving a *Notice in Writing* to the *Owner* under the conditions set out above, the *Contractor* shall be entitled to be paid for all work performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*.

PART 8 DISPUTE RESOLUTION

GC 8.1 AUTHORITY OF THE CONSULTANT

8.1.1 Differences between the parties to the *Contract* as to the interpretation, application or administration of the *Contract* or any failure to agree where agreement between the parties is called for, herein collectively called disputes, which are not resolved in the first instance by findings of the *Consultant* as provided in GC 2.2 – ROLE OF THE CONSULTANT, shall be settled in accordance with the requirements of Part 8 of the General Conditions – DISPUTE RESOLUTION.

8.1.2 If a dispute arises under the *Contract* in respect of a matter in which the *Consultant* has no authority under the *Contract* to make a finding, the procedures set out in paragraph 8.1.3 and paragraphs 8.3.3 to 8.3.8 of GC 8.3 – NEGOTIATION, MEDIATION AND ARBITRATION, and in GC 8.4 – RETENTION OF RIGHTS apply to that dispute with the necessary changes to detail as may be required.

8.1.3 If a dispute is not resolved promptly, the *Consultant* will give such instructions as in the *Consultant*'s opinion are necessary for the proper performance of the *Work* and to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim the party may have. If it is subsequently determined that such instructions were in error or at variance with the *Contract Documents*, the *Owner* shall pay the *Contractor* costs incurred by the *Contractor* in carrying out such instructions which the *Contractor* was required to do beyond what the *Contract Documents* correctly understood and interpreted would have required, including costs resulting from interruption of the *Work*.

GC 8.2 ADJUDICATION

8.2.1 Nothing in this *Contract* shall be deemed to affect the rights of the parties to resolve any dispute by adjudication as may be prescribed by applicable legislation.

GC 8.3 NEGOTIATION, MEDIATION AND ARBITRATION

8.3.1 In accordance with the rules for mediation as provided in CCDC 40 'Rules for Mediation and Arbitration of Construction Industry Disputes' in effect at the time of bid closing, the parties shall appoint a Project Mediator

.1 within 20 *Working Days* after the *Contract* was awarded, or

.2 if the parties neglected to make an appointment within the 20 *Working Days*, within 10 *Working Days* after either party by *Notice in Writing* requests that the Project Mediator be appointed.

8.3.2 A party shall be conclusively deemed to have accepted a finding of the *Consultant* under GC 2.2 – ROLE OF THE CONSULTANT and to have expressly waived and released the other party from any claims in respect of the particular matter dealt with in that finding unless, within 15 *Working Days* after receipt of that finding, the party sends a *Notice in Writing* of dispute to the other party and to the *Consultant*, which contains the particulars of the matter in dispute and the relevant provisions of the *Contract Documents*. The responding party shall send a *Notice in Writing* of reply to the dispute within 10 *Working Days* after receipt of such *Notice in Writing* setting out particulars of this response and any relevant provisions of the *Contract Documents*.

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8.3.3 The parties shall make all reasonable efforts to resolve their dispute by amicable negotiations and agree to provide, without prejudice, frank, candid and timely disclosure of relevant facts, information and documents to facilitate these negotiations.

8.3.4 After a period of 10 *Working Days* following receipt of a responding party's *Notice in Writing* of reply under paragraph 8.3.2, the parties shall request the Project Mediator to assist the parties to reach agreement on any unresolved dispute. The mediated negotiations shall be conducted in accordance with the rules for mediation as provided in CCDC 40 in effect at the time of bid closing.

8.3.5 If the dispute has not been resolved at the mediation or within such further period as is agreed by the parties, the Project Mediator will terminate the mediated negotiations by giving *Notice in Writing* to the *Owner*, the *Contractor* and the *Consultant*.

8.3.6 By giving a *Notice in Writing* to the other party and the *Consultant*, not later than 10 *Working Days* after the date of termination of the mediated negotiations under paragraph 8.3.5, either party may refer the dispute to be finally resolved by arbitration under the rules of arbitration as provided in CCDC 40 in effect at the time of bid closing. The arbitration shall be conducted in the jurisdiction of the *Place of the Work*.

8.3.7 On expiration of the 10 *Working Days*, the arbitration agreement under paragraph 8.3.6 is not binding on the parties and, if a *Notice in Writing* is not given under paragraph 8.3.6 within the required time, the parties may refer the unresolved dispute to the courts or to any other form of dispute resolution, including arbitration, which they have agreed to use.

8.3.8 If neither party, by *Notice in Writing*, given within 10 *Working Days* of the date of *Notice in Writing* requesting arbitration in paragraph 8.3.6, requires that a dispute be arbitrated immediately, all disputes referred to arbitration as provided in paragraph 8.3.6 shall be:

.1 held in abeyance until:
(1) *Ready-for-Takeover*,
(2) the *Contract* has been terminated, or
(3) the *Contractor* has abandoned the *Work*,
whichever is earlier; and

.2 consolidated into a single arbitration under the rules governing the arbitration under paragraph 8.3.6.

GC 8.4 RETENTION OF RIGHTS

8.4.1 It is agreed that no act by either party shall be construed as a renunciation or waiver of any rights or recourses, provided the party has given the *Notice in Writing* required under Part 8 of the General Conditions – DISPUTE RESOLUTION and has carried out the instructions as provided in paragraph 8.1.3 of GC 8.1 – AUTHORITY OF THE CONSULTANT.

8.4.2 Nothing in Part 8 of the General Conditions – DISPUTE RESOLUTION shall be construed in any way to limit a party from asserting any statutory right to a lien under applicable lien legislation of the jurisdiction of the *Place of the Work* and the assertion of such right by initiating judicial proceedings is not to be construed as a waiver of any right that party may have under paragraph 8.3.6 of GC 8.3 – NEGOTIATION, MEDIATION AND ARBITRATION to proceed by way of arbitration to adjudicate the merits of the claim upon which such a lien is based.

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.1 PROTECTION OF WORK AND PROPERTY

9.1.1 The *Contractor* shall protect the *Work*, the *Owner*'s property and property adjacent to the *Place of the Work* from damage which may arise as the result of the *Contractor*'s operations under the *Contract*, and shall be responsible for such damage, except damage which occurs as the result of:

.1 errors or omissions in the *Contract Documents*; or

.2 acts or omissions by the *Owner*, the *Consultant*, *Other Contractors*, or their agents and employees.

9.1.2 Before commencing any work, the *Contractor* shall determine the location of all underground utilities and structures indicated in the *Contract Documents* or that are reasonably apparent in an inspection of the *Place of the Work*.

9.1.3 Should the *Contractor* in the performance of the *Contract* damage the *Work*, the *Owner*'s property or property adjacent to the *Place of the Work*, the *Contractor* shall be responsible for making good such damage at the *Contractor*'s expense.

9.1.4 Should damage occur to the *Work* or the *Owner*'s property for which the *Contractor* is not responsible, as provided in paragraph 9.1.1, the *Contractor* shall make good such damage to the *Work* and, if the *Owner* so directs, to the *Owner*'s property. The *Contract Price* and *Contract Time* shall be adjusted as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

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GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

9.2.1 For the purposes of applicable legislation related to toxic and hazardous substances, the *Owner* shall be deemed to have control and management of the *Place of the Work* with respect to existing conditions.

9.2.2 Prior to the *Contractor* commencing the *Work*, the *Owner* shall,

.1 take all reasonable steps to determine whether any toxic or hazardous substances are present at the *Place of the Work*, and

.2 provide the *Consultant* and the *Contractor* with a written list of any such substances that are known to exist and their locations.

9.2.3 The *Owner* shall take all reasonable steps to ensure that no person's exposure to any toxic or hazardous substance exceeds the time weighted levels prescribed by applicable legislation at the *Place of the Work* and that no property is damaged or destroyed as a result of exposure to, or the presence of, toxic or hazardous substances which were at the *Place of the Work* prior to the *Contractor* commencing the *Work*.

9.2.4 Unless the *Contract* expressly provides otherwise, the *Owner* shall be responsible for taking all necessary steps, in accordance with applicable legislation in force at the *Place of the Work*, to dispose of, store or otherwise render harmless any toxic or hazardous substance which was present at the *Place of the Work* prior to the *Contractor* commencing the *Work*.

9.2.5 If the *Contractor*

.1 encounters toxic or hazardous substances at the *Place of the Work*, or

.2 has reasonable grounds to believe that toxic or hazardous substances are present at the *Place of the Work*,

which were not brought to the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible and which were not disclosed by the *Owner* or which were disclosed but have not been dealt with as required under paragraph 9.2.4, the *Contractor* shall

.3 take all reasonable steps, including stopping the *Work*, to ensure that no person's exposure to any toxic or hazardous substance exceeds any applicable time weighted levels prescribed by applicable legislation at the *Place of the Work*, and

.4 immediately report the circumstances to the *Consultant* and the *Owner* in writing.

9.2.6 If the *Owner* and the *Contractor* do not agree on the existence, significance of, or whether the toxic or hazardous substances were brought onto the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Owner* shall retain and pay for an independent qualified expert to investigate and determine such matters. The expert's report shall be delivered to the *Owner* and the *Contractor*.

9.2.7 If the *Owner* and the *Contractor* agree or if the expert referred to in paragraph 9.2.6 determines that the toxic or hazardous substances were not brought onto the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Owner* shall promptly at the *Owner*'s own expense:

.1 take all steps as required under paragraph 9.2.4;

.2 reimburse the *Contractor* for the costs of all steps taken pursuant to paragraph 9.2.5;

.3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the expert referred to in paragraph 9.2.6 and reimburse the *Contractor* for reasonable costs incurred as a result of the delay; and

.4 indemnify the *Contractor* as required by GC 13.1 – INDEMNIFICATION.

9.2.8 If the *Owner* and the *Contractor* agree or if the expert referred to in paragraph 9.2.6 determines that the toxic or hazardous substances were brought onto the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Contractor* shall promptly at the *Contractor*'s own expense:

.1 take all necessary steps, in accordance with applicable legislation in force at the *Place of the Work*, to safely remove and dispose the toxic or hazardous substances;

.2 make good any damage to the *Work*, the *Owner*'s property or property adjacent to the *Place of the Work* as provided in paragraph 9.1.3 of GC 9.1 – PROTECTION OF WORK AND PROPERTY;

.3 reimburse the *Owner* for reasonable costs incurred under paragraph 9.2.6; and

.4 indemnify the *Owner* as required by GC 13.1 – INDEMNIFICATION.

9.2.9 If either party does not accept the expert's findings under paragraph 9.2.6, the disagreement shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION. If such disagreement is not resolved promptly, the parties shall act immediately in accordance with the expert's determination and take the steps required by paragraph 9.2.7 or 9.2.8 it being understood that by so doing, neither party will jeopardize any claim that party may have to be reimbursed as provided by GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES.

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GC 9.3 ARTIFACTS AND FOSSILS

9.3.1 Fossils, coins, articles of value or antiquity, structures and other remains or things of scientific or historic interest discovered at the *Place of the Work* shall, as between the *Owner* and the *Contractor*, be deemed to be the absolute property of the *Owner*.

9.3.2 The *Contractor* shall take all reasonable precautions to prevent removal or damage to discoveries as identified in paragraph 9.3.1, and shall advise the *Consultant* upon discovery of such items.

9.3.3 The *Consultant* will investigate the impact on the *Work* of the discoveries identified in paragraph 9.3.1. If conditions are found that would cause an increase or decrease in the *Contractor*'s cost or time to perform the *Work*, the *Owner*, through the *Consultant*, shall issue appropriate instructions for a change in the *Work* as provided in GC 6.2 – CHANGE ORDER or GC 6.3 – CHANGE DIRECTIVE.

GC 9.4 CONSTRUCTION SAFETY

9.4.1 The *Contractor* shall be responsible for establishing, initiating, maintaining, and supervising all health and safety precautions and programs in connection with the performance of the *Work* in accordance with the applicable health and safety legislation.

9.4.2 The *Owner* and the *Contractor* shall comply with all health and safety precautions and programs established at the *Place of the Work*.

9.4.3 The *Owner* and the *Contractor* shall comply with the rules, regulations and practices required by the applicable health and safety legislation.

9.4.4 The *Owner* shall cause the *Consultant*, *Other Contractors* and the *Owner*'s own forces to comply with all health and safety precautions and programs established by the *Contractor* at the *Place of the Work*.

9.4.5 Nothing in this Contract shall affect the determination of liability under the applicable health and safety legislation.

GC 9.5 MOULD

9.5.1 If the *Contractor* or the *Owner* observes or reasonably suspects the presence of mould at the *Place of the Work*, the remediation of which is not expressly part of the *Work*,

.1 the observing party shall promptly report the circumstances to the other party in writing,

.2 the *Contractor* shall promptly take all reasonable steps, including stopping the *Work* if necessary, to ensure that no person suffers injury, sickness or death and that no property is damaged as a result of exposure to or the presence of the mould, and

.3 if the *Owner* and the *Contractor* do not agree on the existence, significance or cause of the mould or as to what steps need be taken to deal with it, the *Owner* shall retain and pay for an independent qualified expert to investigate and determine such matters. The expert's report shall be delivered to the *Owner* and the *Contractor*.

9.5.2 If the *Owner* and the *Contractor* agree, or if the expert referred to in paragraph 9.5.1.3 determines that the presence of mould was caused by the *Contractor*'s operations under the *Contract*, the *Contractor* shall promptly, at the *Contractor*'s own expense:

.1 take all reasonable and necessary steps to safely remediate or dispose of the mould,

.2 make good any damage to the *Work*, the *Owner*'s property or property adjacent to the *Place of the Work* as provided in paragraph 9.1.3 of GC 9.1 – PROTECTION OF WORK AND PROPERTY,

.3 reimburse the *Owner* for reasonable costs incurred under paragraph 9.5.1.3, and

.4 indemnify the *Owner* as required by GC 13.1 – INDEMNIFICATION.

9.5.3 If the *Owner* and the *Contractor* agree, or if the expert referred to in paragraph 9.5.1.3 determines that the presence of mould was not caused by the *Contractor*'s operations under the *Contract*, the *Owner* shall promptly, at the *Owner*'s own expense:

.1 take all reasonable and necessary steps to safely remediate or dispose of the mould,

.2 reimburse the *Contractor* for the cost of taking the steps under paragraph 9.5.1.2 and making good any damage to the *Work* as provided in paragraph 9.1.4 of GC 9.1 – PROTECTION OF WORK AND PROPERTY,

.3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the expert referred to in paragraph 9.5.1.3 and reimburse the *Contractor* for reasonable costs incurred as a result of the delay, and

.4 indemnify the *Contractor* as required by GC 13.1 – INDEMNIFICATION.

9.5.4 If either party does not accept the expert's finding under paragraph 9.5.1.3, the disagreement shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION. If such disagreement is not resolved promptly, the parties shall act immediately in accordance with the expert's determination and take the steps required by paragraphs 9.5.2 or 9.5.3, it being understood that by so doing neither party will jeopardize any claim the party may have to be reimbursed as provided by GC 9.5 – MOULD.

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PART 10 GOVERNING REGULATIONS

GC 10.1 TAXES AND DUTIES

10.1.1 The *Contract Price* shall include all taxes and customs duties in effect at the time of the bid closing except for *Value Added Taxes* payable by the *Owner* to the *Contractor* as stipulated in Article A-4 of the Agreement – CONTRACT PRICE.

10.1.2 Any increase or decrease in costs to the *Contractor* due to changes in taxes and duties after the time of the bid closing shall increase or decrease the *Contract Price* accordingly.

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

10.2.1 The laws of the *Place of the Work* shall govern the *Work*.

10.2.2 The *Owner* shall obtain and pay for development approvals, building permit, permanent easements, rights of servitude, and all other necessary approvals and permits, except for the permits and fees referred to in paragraph 10.2.3 or for which the *Contract Documents* specify as the responsibility of the *Contractor*.

10.2.3 The *Contractor* shall be responsible for the procurement of permits, licences, inspections, and certificates, which are necessary for the performance of the *Work* and customarily obtained by contractors in the jurisdiction of the *Place of the Work* after the issuance of the building permit. The *Contract Price* includes the cost of these permits, licences, inspections, and certificates, and their procurement.

10.2.4 The *Contractor* shall give the required notices and comply with the laws, ordinances, rules, regulations, or codes which are or become in force during the performance of the *Work* and which relate to the *Work*, to the preservation of the public health, and to construction safety.

10.2.5 The *Contractor* shall not be responsible for verifying that the *Contract Documents* are in compliance with the applicable laws, ordinances, rules, regulations, or codes relating to the *Work*. If the *Contract Documents* are at variance therewith, or if, subsequent to the time of bid closing, changes are made to the applicable laws, ordinances, rules, regulations, or codes which require modification to the *Contract Documents*, the *Contractor* shall advise the *Consultant* in writing requesting direction immediately upon such variance or change becoming known. The *Consultant* will issue the changes required to the *Contract Documents* as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

10.2.6 If the *Contractor* fails to advise the *Consultant* in writing; fails to obtain direction as required in paragraph 10.2.5; and performs work knowing it to be contrary to any laws, ordinances, rules, regulations, or codes; the *Contractor* shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations, or codes.

10.2.7 If, subsequent to the time of bid closing, changes are made to applicable laws, ordinances, rules, regulations, or codes of authorities having jurisdiction which affect the cost of the *Work*, either party may submit a claim in accordance with the requirements of GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE.

GC 10.3 PATENT FEES

10.3.1 The *Contractor* shall pay the royalties and patent licence fees required for the performance of the *Contract*. The *Contractor* shall hold the *Owner* harmless from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor*'s performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention by the *Contractor* or anyone for whose acts the *Contractor* may be liable.

10.3.2 The *Owner* shall hold the *Contractor* harmless against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor*'s performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention in executing anything for the purpose of the *Contract*, the physical model, plan or design of which was supplied to the *Contractor* as part of the *Contract*.

GC 10.4 WORKERS' COMPENSATION

10.4.1 Prior to commencing the *Work*, and again with the *Contractor*'s applications for payment, the *Contractor* shall provide evidence of compliance with workers' compensation legislation at the *Place of the Work*.

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PART 11 INSURANCE

GC 11.1 INSURANCE

11.1.1 Without restricting the generality of GC 13.1 – INDEMNIFICATION, the *Contractor* shall provide, maintain and pay for the following insurance coverages, the requirements of which are specified in CCDC 41 'CCDC Insurance Requirements' in effect at the time of bid closing except as hereinafter provided:

.1 General liability insurance in the name of the *Contractor* and include, or in the case of a single, blanket policy, be endorsed to name, the *Owner* and the *Consultant* as insureds but only with respect to liability, other than legal liability arising out of their sole negligence, arising out of the operations of the *Contractor* with regard to the *Work*. General liability insurance shall be maintained from the date of commencement of the *Work* until one year from the date of *Ready-for-Takeover*. Liability coverage shall be provided for completed operations hazards from the date of *Ready-for-Takeover*, as set out in the certificate of *Ready-for-Takeover*, on an ongoing basis for a period of 6 years following *Ready-for-Takeover*.

.2 Automobile Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.

.3 Unmanned aerial vehicle aircraft, manned aircraft or watercraft Liability Insurance when owned or non-owned manned or unmanned aircraft or watercraft are used directly or indirectly in the performance of the *Work*.

.4 "Broad form" property insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. The "Broad form" property insurance shall be provided from the date of commencement of the *Work* until the earliest of:

(1) 10 calendar days after the date of *Ready-for-Takeover*;

(2) on the commencement of use or occupancy of any part or section of the *Work* unless such use or occupancy is for construction purposes, habitational, office, banking, convenience store under 465 square metres in area, or parking purposes, or for the installation, testing and commissioning of equipment forming part of the *Work*; and

(3) when left unattended for more than 30 consecutive calendar days or when construction activity has ceased for more than 30 consecutive calendar days.

.5 Boiler and machinery insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. The coverage shall be maintained continuously from commencement of use or operation of the boiler and machinery objects insured by the policy and until 10 calendar days after the date of *Ready-for-Takeover*.

.6 The "Broad form" property and boiler and machinery policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. In the event of loss or damage:

(1) the *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of *Contract Time* relative to the extent of the loss or damage as the *Consultant* may recommend in consultation with the *Contractor*;

(2) the *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount which the *Owner*'s interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds in accordance with the progress payment provisions. In addition the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor*'s interest in the restoration of the *Work*; and

(3) to the *Work* arising from the work of the *Owner*, the *Owner*'s own forces or *Other Contractors*, the *Owner* shall, in accordance with the *Owner*'s obligations under the provisions relating to construction by the *Owner* or *Other Contractors*, pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as in accordance with the progress payment provisions.

.7 Contractors' Equipment Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.

.8 Contractors' Pollution Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.

11.1.2 Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements applicable to the *Work*.

11.1.3 The parties shall pay their share of the deductible amounts in direct proportion to their responsibility in regards to any loss for which the above policies are required to pay, except where such amounts may be excluded by the terms of the *Contract*.

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11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and give evidence to the *Contractor* and the *Consultant*. The *Contractor* shall pay the cost thereof to the *Owner* on demand or the *Owner* may deduct the cost from the amount which is due or may become due to the *Contractor*.

11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*.

11.1.6 If a revised version of CCDC 41 is published, which specifies reduced insurance requirements, the parties shall address such reduction, prior to the *Contractor*'s insurance policy becoming due for renewal, and record any agreement in a *Change Order*.

11.1.7 If a revised version of CCDC 41 is published, which specifies increased insurance requirements, the *Owner* may request the increased coverage from the Contractor by way of a *Change Order*.

11.1.8 A *Change Directive* shall not be used to direct a change in the insurance requirements in response to the revision of CCDC 41.

PART 12 OWNER TAKEOVER

GC 12.1 READY-FOR-TAKEOVER

12.1.1 The prerequisites to attaining *Ready-for-Takeover* of the *Work* are limited to the following:
- .1 The *Consultant* has certified or verified the *Substantial Performance of the Work*.
- .2 Evidence of compliance with the requirements for occupancy or occupancy permit as prescribed by the authorities having jurisdiction.
- .3 Final cleaning and waste removal at the time of applying for *Ready-for-Takeover*, as required by the *Contract Documents*.
- .4 The delivery to the *Owner* of such operations and maintenance documents reasonably necessary for immediate operation and maintenance, as required by the *Contract Documents*.
- .5 Make available a copy of the as-built drawings completed to date on site.
- .6 Startup, testing required for immediate occupancy, as required by the *Contract Documents*.
- .7 Ability to secure access to the *Work* has been provided to the *Owner*, if required by the *Contract Documents*.
- .8 Demonstration and training, as required by the *Contract Documents*, is scheduled by the *Contractor* acting reasonably.

12.1.2 If any prerequisites set forth in paragraphs 12.1.1.3 to 12.1.1.6 must be deferred because of conditions reasonably beyond the control of the *Contractor*, or by agreement between the *Owner* and the *Contractor* to do so, *Ready-for-Takeover* shall not be delayed.

12.1.3 When the *Contractor* considers that the *Work* is *Ready-for-Takeover*, the *Contractor* shall deliver to the *Consultant* and to the *Owner* a comprehensive list of items to be completed or corrected, together with a written application for *Ready-for-Takeover* for review. Failure to include an item on the list does not alter the responsibility of the *Contractor* to complete the *Contract*.

12.1.4 The *Consultant* will review the *Work* to verify the validity of the application and will promptly, and in any event, no later than 10 calendar days after receipt of the *Contractor*'s list and application:
- .1 advise the *Contractor* in writing that the *Work* is not *Ready-for-Takeover* and give reasons why, or
- .2 confirm the date of *Ready-for-Takeover* in writing to each of the *Owner* and the *Contractor*.

12.1.5 Immediately following the confirmation of the date of *Ready-for-Takeover*, the *Contractor*, in consultation with the *Consultant*, shall establish a reasonable date for finishing the *Work*.

12.1.6 The provision of GC 12.1 – READY-FOR-TAKEOVER shall be subject to GC 12.2 – EARLY OCCUPANCY BY THE OWNER.

GC 12.2 EARLY OCCUPANCY BY THE OWNER

12.2.1 The *Owner* may take occupancy of a part or the entirety of the *Work* before *Ready-for-Takeover* has been attained only as agreed by the *Contractor* which agreement shall not be unreasonably withheld.

12.2.2 The *Owner* shall not occupy a part or the entirety of the *Work* without prior approval by authorities having jurisdiction.

12.2.3 If the *Owner* takes occupancy of a part of the *Work* before *Ready-for-Takeover* has been attained:
- .1 The part of the *Work* which is occupied shall be deemed to have been taken over by the *Owner* as from the date on which it is occupied.
- .2 The *Contractor* shall cease to be liable for the care of such part as from this date, when responsibility shall pass to the *Owner*.
- .3 The warranty period specified in paragraph 12.3.1 of GC 12.3 – WARRANTY for that part of the *Work* shall start from the date on which it is occupied.

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12.2.4 If the *Owner* takes occupancy of the entirety of the *Work* before all the prerequisites are met as described in paragraph 12.1.1 of GC 12.1 – READY-FOR-TAKEOVER, the *Work* shall, subject to the requirements of the applicable lien legislation, be deemed to achieve *Ready-for-Takeover*. This shall not relieve the *Contractor*'s responsibility to complete the *Work* in a timely manner.

GC 12.3 WARRANTY

12.3.1 Except for extended warranties as described in paragraph 12.3.6, the warranty period under the *Contract* is one year from the date when *Ready-for-Takeover* has been attained.

12.3.2 The *Contractor* shall be responsible for the proper performance of the *Work* to the extent that the design and *Contract Documents* permit such performance.

12.3.3 The *Owner*, through the *Consultant*, shall promptly give the *Contractor Notice in Writing* of observed defects and deficiencies which occur during the one year warranty period.

12.3.4 Subject to paragraph 12.3.2, the *Contractor* shall correct promptly, at the *Contractor*'s expense, defects or deficiencies in the *Work* which appear prior to and during the one year warranty period.

12.3.5 The *Contractor* shall correct or pay for damage resulting from corrections made under the requirements of paragraph 12.3.4.

12.3.6 Any extended warranties required beyond the one year warranty period as described in paragraph 12.3.1, shall be as specified in the *Contract Documents*. Extended warranties shall be issued by the warrantor to the benefit of the *Owner*. The *Contractor*'s responsibility with respect to extended warranties shall be limited to obtaining any such extended warranties from the warrantor. The obligations under such extended warranties are solely the responsibilities of the warrantor.

PART 13 INDEMNIFICATION AND WAIVER

GC 13.1 INDEMNIFICATION

13.1.1 Without restricting the parties' obligation to indemnify respecting toxic and hazardous substances, patent fees and defect in title claims all as described in paragraphs 13.1.4 and 13.1.5, the *Owner* and the *Contractor* shall each indemnify and hold harmless the other from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings whether in respect to losses suffered by them or in respect to claims by third parties that arise out of, or are attributable in any respect to their involvement as parties to this *Contract*, provided such claims are:

.1 caused by:

(1) the negligent acts or omissions of the party from whom indemnification is sought or anyone for whose negligent acts or omissions that party is liable, or

(2) a failure of the party to the *Contract* from whom indemnification is sought to fulfill its terms or conditions; and

.2 made by *Notice in Writing* within a period of 6 years from the *Ready-for-Takeover* date or within such shorter period as may be prescribed by any limitation statute of the Province or Territory of the *Place of the Work*.

The parties expressly waive the right to indemnity for claims other than those provided for in this *Contract*.

13.1.2 The obligation of either party to indemnify as set forth in paragraph 13.1.1 shall be limited as follows:

.1 In respect to losses suffered by the *Owner* and the *Contractor* for which insurance is to be provided by either party pursuant to GC 11.1 – INSURANCE, the minimum liability insurance limit for one occurrence, of the applicable insurance policy, as referred to in CCDC 41 in effect at the time of bid closing.

.2 In respect to losses suffered by the *Owner* and the *Contractor* for which insurance is not required to be provided by either party in accordance with GC 11.1 – INSURANCE, the greater of the *Contract Price* as recorded in Article A-4 – CONTRACT PRICE or $2,000,000, but in no event shall the sum be greater than $20,000,000.

.3 In respect to indemnification by a party against the other with respect to losses suffered by them, such obligation shall be restricted to direct loss and damage, and neither party shall have any liability to the other for indirect, consequential, punitive or exemplary damages.

.4 In respect to indemnification respecting claims by third parties, the obligation to indemnify is without limit.

13.1.3 The obligation of either party to indemnify the other as set forth in paragraphs 13.1.1 and 13.1.2 shall be inclusive of interest and all legal costs.

13.1.4 The *Owner* and the *Contractor* shall indemnify and hold harmless the other from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of their obligations described in GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES.

13.1.5 The *Owner* shall indemnify and hold harmless the *Contractor* from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings:

.1 as described in paragraph 10.3.2 of GC 10.3 – PATENT FEES, and

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.2 arising out of the *Contractor*'s performance of the *Contract* which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of the Work*.

13.1.6 In respect to any claim for indemnity or to be held harmless by the *Owner* or the *Contractor*:

.1 *Notice in Writing* of such claim shall be given within a reasonable time after the facts upon which such claim is based become known; and

.2 should any party be required as a result of its obligation to indemnify another to pay or satisfy a final order, judgment or award made against the party entitled by this contract to be indemnified, then the indemnifying party upon assuming all liability for any costs that might result shall have the right to appeal in the name of the party against whom such final order or judgment has been made until such rights of appeal have been exhausted.

GC 13.2 WAIVER OF CLAIMS

13.2.1 Subject to any lien legislation applicable to the *Place of the Work*, the *Contractor* waives and releases the *Owner* from all claims which the *Contractor* has or reasonably ought to have knowledge of that could be advanced by the *Contractor* against the *Owner* under the *Contract*, including, without limitation, those arising from negligence or breach of contract in respect to which the cause of action is based upon acts or omissions which occurred prior to or on the *Ready-for-Takeover* date, except as follows:

.1 claims arising prior to or on the *Ready-for-Takeover* date for which *Notice in Writing* of claim has been received by the *Owner* from the *Contractor* no later than 5 calendar days before the expiry of the lien period provided by the lien legislation applicable at the *Place of the Work* or 20 calendar days following the *Ready-for-Takeover* date, whichever is later;

.2 indemnification for claims advanced against the *Contractor* by third parties for which a right of indemnification may be asserted by the *Contractor* against the *Owner* pursuant to the provisions of this *Contract*;

.3 claims respecting toxic and hazardous substances, patent fees and defect in title matters for which a right of indemnity could be asserted by the *Contractor* pursuant to the provisions of paragraphs 13.1.4 or 13.1.5 of GC 13.1 – INDEMNIFICATION; and

.4 claims resulting from acts or omissions which occur after the *Ready-for-Takeover* date.

13.2.2 The *Contractor* waives and releases the *Owner* from all claims resulting from acts or omissions which occurred after the *Ready-for-Takeover* date except for:

.1 indemnification respecting third party claims, and claims respecting toxic and hazardous substances, patent fees and defect in title matters, all as referred in paragraphs 13.2.1.2 and 13.2.1.3; and

.2 claims for which *Notice in Writing* of claim has been received by the *Owner* from the *Contractor* within 395 calendar days following the *Ready-for-Takeover* date.

13.2.3 Subject to any lien legislation applicable to the *Place of the Work*, the *Owner* waives and releases the *Contractor* from all claims which the *Owner* has or reasonably ought to have knowledge of that could be advanced by the *Owner* against the *Contractor* under the *Contract*, including, without limitation, those arising from negligence or breach of contract in respect to which the cause of action is based upon acts or omissions which occurred prior to or on the *Ready-for-Takeover* date, except as follows:

.1 claims arising prior to or on the *Ready-for-Takeover* date for which *Notice in Writing* of claim has been received by the *Contractor* from the *Owner* no later than 20 calendar days following the *Ready-for-Takeover* date;

.2 indemnification for claims advanced against the *Owner* by third parties for which a right of indemnification may be asserted by the *Owner* against the *Contractor* pursuant to the provisions of this *Contract*;

.3 claims respecting toxic and hazardous substances for which a right of indemnity could be asserted by the *Owner* against the *Contractor* pursuant to the provisions of paragraph 13.1.4 of GC 13.1 – INDEMNIFICATION;

.4 damages arising from the *Contractor*'s actions which result in substantial defects or deficiencies in the *Work*. "Substantial defects or deficiencies" mean those defects or deficiencies in the *Work* which affect the *Work* to such an extent or in such a manner that a significant part or the whole of the *Work* is unfit for the purpose intended by the *Contract Documents*;

.5 claims arising pursuant to GC 12.3 – WARRANTY; and

.6 claims arising from acts or omissions which occur after the *Ready-for-Takeover* date.

13.2.4 Respecting claims arising upon substantial defects and deficiencies in the *Work*, as referenced in paragraph 13.2.3.4, and notwithstanding paragraph 13.2.3.5, the *Owner* waives and releases the *Contractor* from all claims except claims for which *Notice in Writing* of claim has been received by the *Contractor* from the *Owner* within a period of six years from the *Ready-for-Takeover* date, provided that any limitation statute of the Province or Territory of the *Place of the Work* permit such agreement. If the applicable limitation statute does not permit such agreement, the time within which any such claim may be brought shall be such shorter period as may be prescribed by any limitation statute of the Province or Territory of the *Place of the Work*.

13.2.5 The *Owner* waives and releases the *Contractor* from all claims arising from acts or omissions which occur after the *Ready-for-Takeover* date, except for:

.1 indemnification for claims advanced against the *Owner* by third parties, as referenced in paragraph 13.2.3.2;

.2 claims respecting toxic and hazardous substances for which a right of indemnity could be asserted by the *Owner* against the *Contractor*, as referenced in paragraph 13.2.3.3;

.3 claims arising under GC 12.3 – WARRANTY; and

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.4 claims for which *Notice is Writing* has been received by the *Contractor* from the *Owner* within 395 calendar days following the *Ready-for-Takeover* date.

13.2.6 "*Notice in Writing* of claim" as provided for in GC 13.2 – WAIVER OF CLAIMS to preserve a claim or right of action which would otherwise, by the provisions of GC 13.2 – WAIVER OF CLAIMS, be deemed to be waived, must include the following:

.1 a clear and unequivocal statement of an intention to claim;

.2 a statement as to the nature of the claim and the grounds upon which the claim is based; and

.3 a statement of the estimated quantum of the claim.

13.2.7 A claim for lien asserted under the lien legislation prevailing at the *Place of the Work* shall qualify as notice of claim for the purposes of this *Contract*.

13.2.8 The party giving the *Notice in Writing* of claim as provided for in GC 13.2 – WAIVER OF CLAIMS shall submit within a reasonable time a detailed account of the amount claimed.

13.2.9 Where the event or series of events giving rise to a claim made under paragraphs 13.2.1 or 13.2.3 has a continuing effect, the detailed account submitted under paragraph 13.2.8 shall be considered to be an interim account and the party making the claim shall submit further interim accounts, at reasonable intervals, giving the accumulated amount of the claim and any further grounds upon which such claim is based. The party making the claim shall submit a final account after the end of the effects resulting from the event or series of events.

13.2.10 Nothing in GC 13.2 – WAIVER OF CLAIMS shall be deemed to affect the rights of the parties under any lien legislation or limitations legislation prevailing at the *Place of the Work*.

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CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE
CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE

CCDC 41
CCDC INSURANCE REQUIREMENTS

PUBLICATION DATE: December 14, 2020

1. General liability insurance shall be with limits of not less than $10,000,000 per occurrence, an aggregate limit of not less than $10,000,000 within any policy year with respect to completed operations, and a deductible not exceeding $10,000. The insurance coverage shall not be less than the insurance provided by IBC Form 2100 (including an extension for a standard provincial and territorial form of non-owned automobile liability policy) and IBC Form 2320. To achieve the desired limit, umbrella or excess liability insurance may be used. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.

2. Automobile liability insurance in respect of vehicles that are required by law to be insured under a contract by a Motor Vehicle Liability Policy, shall have limits of not less than $10,000,000 inclusive per occurrence for bodily injury, death and damage to property, covering all vehicles owned or leased by the *Contractor*. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.

3. Manned Aircraft and watercraft liability insurance with respect to owned or non-owned aircraft and watercraft (if used directly or indirectly in the performance of the *Work*), including use of additional premises, shall have limits of not less than $10,000,000 inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof and limits of not less than $10,000,000 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*.

4. Unmanned aerial vehicle liability insurance with respect to owned or non-owned aircraft (if used directly or indirectly in the performance of the Work), shall have limits of not less than $5,000,000 per occurrence or accident for bodily injury, death and damage to property or such amounts as required by any applicable law or regulation.

5. "Broad form" property insurance shall have limits of not less than the sum of 1.1 times *Contract Price* and the full value, as stated in the *Contract*, of *Products* and design services that are specified to be provided by the *Owner* for incorporation into the *Work*, with a deductible not exceeding $10,000. The insurance coverage shall not be less than the insurance provided by IBC Forms 4042 and 4047 or their equivalent replacement. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.

6. Boiler and machinery insurance shall have limits of not less than the replacement value of the permanent or temporary boilers and pressure vessels, and other insurable objects forming part of the *Work*. The insurance coverage shall not be less than the insurance provided by a comprehensive boiler and machinery policy including hot testing and commissioning.

7. Contractors' equipment insurance coverage written on an “all risks” basis covering *Construction Equipment* used by the *Contractor* for the performance of the *Work*, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance, the *Owner* may agree to waive the equipment insurance requirement.

8. Contractors’ Pollution liability insurance shall have limits of not less than $5,000,000 per occurrence for bodily injury, death and damage to property.

Association of Canadian Engineering Companies

Canadian Construction Association

Construction Specifications Canada

The Royal Architectural Institute of Canada

These Supplementary Conditions amend the Stipulated Price Contract – CCDC 18 – 2023. Where a portion of the Contract is modified or deleted by these Supplementary General Conditions, the unaltered portions of the Contract shall remain in effect.

AGREEMENT BETWEEN *OWNER* AND CONTRACTOR

Page 4, delete the first bullet point within Article 4.1 and replace with the following:

*Unit Prices from the basis for payment of the *Contract Price*. Quantities in the Schedule of Unit Prices within Section 00 41 43 – Tender Form are estimated. The estimated *Contract Price*, which is the total extended amount indicated in the Schedule of Unit Prices within Section 00 41 43 – Tender Form, exclusive of taxes is:

Page 4, after Article A-8 insert the following new Articles A-9 and A-10:

"ARTICLE A-9 SEVERABILITY

9.1 Each and every paragraph, section, clause, sub-clause or other component of the *Contract* is severable one from the other. Should it be found by a court of competent jurisdiction that any one or more paragraphs or parts thereof are null and void, the validity of the remaining paragraphs or parts thereof shall not be affected.

ARTICLE A-10 TIME OF THE ESSENCE

10.1 Time shall be deemed to be of the essence of the *Contract*."

DEFINITIONS

Page 6, Add the following new Definitions:

Approved or Approval

Approved or *Approval* means acceptance by the *Consultant* in accordance with the *Consultant's* responsibilities described in Clause GC 2.2 ROLE OF THE *CONSULTANT*.

Period of Delay

The period of time from *Ready-for-Takeover* date specified in Article A-1, subclause 1.3, and the actual Ready-for-Takeover date; if any.

Site

The *Site* means the geographical location of the *Work* identified in the *Contract Documents*

Total Amount Payable

Total Amount Payable means the sum of the Contract Price as stipulated in Article A-4, subclause 4.3 subject to adjustments made in accordance with the provisions of the Contract Documents plus the amount of *Value Added Taxes*.

GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

PART 2 – ADMINISTRATION OF THE CONTRACT

GC 2.3 REVIEW AND INSPECTION OF THE WORK

Page 10, delete clause 2.3.3 and replace with the following:

2.3.3 The *Contractor* shall furnish promptly to the *Consultant* one (1) electronic file, in pdf file format, of certificates and inspection reports related to the *Work*. The *Contractor* will be required to provide hard copies, in the quantity requested, only upon request of the *Consultant* or *Owner*.

Page 10, within clause 2.3.5, add the following sentence at the end of the clause:

"If the *Consultant's* 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."

PART 3 – EXECUTION OF THE *WORK*

GC 3.4 CONSTRUCTION SCHEDULE

Page 12, in Clause 3.4.1.1, delete "prior to the first application for payment" and replace with "not later than two (2) weeks after receipt of the notice of award".

Page 12, add new clause 3.4.2 as follows:

"3.4.2 If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the Owner or the *Consultant* pursuant to clause 3.4.1.3, the *Contractor* shall take appropriate steps to cause the actual progress of the Work to conform to the schedule or minimize the resulting delay and shall produce and present to the *Owner* and the *Consultant* a recovery plan demonstrating how the *Contractor* will achieve the recovery of the schedule. If the *Contractor* intends to apply for a change in the *Contract Price* in relation to a schedule recovery plan, then the *Contractor* shall proceed in accordance with General Condition 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE."

GC 3.5 SUPERVISION

Page 12, add new clause 3.5.3 as follows:

"3.5.3 The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed representative(s), where the grounds for the request involve conduct which jeopardizes the safety and security of the Site or the *Owner's* operations. Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint a replacement acceptable to the *Owner* and *Consultant*."

GC 3.6 – LAYOUT OF THE WORK

Page 12, delete clause 3.6.1 in its entirety and replace with the following:

"3.6.1 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*."

GC 3.8 LABOUR AND PRODUCTS

Page 13, delete clause 3.8.2 and replace with the following:

"3.8.2 The *Contractor* shall provide and pay for labour, *Products*, tools, *Construction Equipment*, transportation, and other facilities and services necessary for the performance of the *Work* in accordance with the *Contract*. Water, heat, light, and power will be provided by the party identified in Division 01 of these *Specifications*.

GC 3.9 SHOP DRAWINGS

Page 13, delete Clause 3.9.2 and replace with the following:

"3.9.2 Prepare and submit to the *Consultant* for review, a schedule of the dates for provision, review and return of Shop Drawings. Provide this submission a minimum of two (2) working days prior to the project start-up meeting."

PART 4 - ALLOWANCES

GC 4.1 CASH ALLOWANCES

Page 14, delete Clause 4.1.7 and replace with the following:

"4.1.7 The *Contractor* shall prepare a schedule, acceptable to the *Consultant*, that shows when the *Consultant* and *Owner* must authorize ordering of items called for under cash allowances to avoid delaying the progress of the *Work*."

Page 14, add the following new Clause:

"4.1.8 The *Owner* reserves the right to call, or to have the *Contractor* call, for competitive bids for portions of the Work, to be paid for from cash allowances."

PART 5 - PAYMENT

GC 5.5 – PAYMENT

Page 15, delete clause 5.5.1.2 in its entirety and replace with the following:

"5.5.1.2 The *Owner* shall make payment to the Contractor on account as provided in Article A-5 of the Agreement – PAYMENT on or before twenty (20) 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."

Page 15, after clause 5.5.1,2 add the following new clauses:

"5.5.1.3 The Contractor shall agree interim quantities with the *Consultant* for the purposes of progress payment claims, prior to submission of progress payment application.

"5.5.1.4 The *Contractor* shall pay promptly any and all accounts for labour, services and materials used for the purpose of the fulfillment of this Contract as and when such accounts become due and payable and shall furnish the *Consultant* with proof of payment of such accounts in such form and as often as the *Consultant* may request."

GC 5.5 SUBSTANTIAL PERFORMANCE OF THE *WORK* AND PAYMENT OF HOLDBACK

Page 15, after Clause 5.6.1.2, add the following:

"5.6.1.3 Submit a certificate by lien search to the Owner by a solicitor licensed to practice law in the Province of the Place of Work, certifying that no lien associated with the Work exists against the Owner's property or *Work*;

5.6.1.4 Submit a clearance letter from the Workers' Compensation Board or provincially equivalent regulatory body; and

5.6.1.5 All such documents shall be dated not earlier than the expiry of the lien period as stipulated by the lien legislation in the *Place of the Work*."

"5.6.1.6 The *Consultant* will provide an electronic copy of the Certificate of *Substantial Performance* and instruct the *Contractor* to post the certificate at the Site and to website indicated by the lien legislation of the place of *Work*. "

Page 15, delete Clause 5.6.3 and replace with the following:.

5.6.3 Subject to the requirements of the Payment Legislation of the *Place of the Work*, all holdback prescribed by the applicable lien legislation for completed *Work* shall become due and payable to the *Contractor* no later than ten (10) Working Days following the expiration of the sixty (60) holdback period. If, within sixty (60) calendar days after the issue of the certificate of *Substantial Performance of Work*, the *Contractor* has not corrected all the documented deficiencies, the *Owner* shall retain sufficient monies, as determined by the *Consultant*, to cover the cost of completing said deficiencies. These monies shall be held in addition to holdback monies retained in accordance with the provisions of the Contract and subject to the terms of the lien legislation in the *Place of the Work*."

GC 5.7 FINAL PAYMENT

Page 16, Clause 5.7.4, in line 2, change "5 calendar days" to "20 calendar days".

PART 6 – CHANGES IN THE *WORK*

Page 16, add new clause 6.1.1.3 as follows:

6.1.1.3 Changes that do not affect the Contract Price and time by Supplemental Instruction.

Page 16, within clause 6.2.2.1 after "the Work" add "to the limits set forth in GC 6.7 – Quantity Variations".

GC 6.2 CHANGE ORDER

Page 16, after Clause 6.2.3, add the following:

"6.2.4 The mark-up on agreed upon changes are as follows:
.1 *Work* performed by the *Contractor's* own forces will be the cost of the *Work* plus ten (10%) percent overhead and profit.
.2 Work performed by the subcontractor's force will be the cost of *Work* plus 15% overhead and profit. Where the *Work* can be done by the *Contractor's* forces, as solely determined by the *Consultant*, but is done by the Subcontractor's forces, the mark-up for overhead and profit will be limited to ten (10%) percent.

6.2.5 Before the approval of any *Change Order* over $1,000 in value the *Consultant* is entitled to receive, upon request, at a minimum, the following breakdown of cost associated with such *Change Order*:
.1 Labour rates, excluding operators.
.2 Equipment rates including operators.
.3 Supervisory staff rates.
.4 Subcontractor and material or equipment invoices where applicable.
.5 Overhead costs including worker's compensation, *site* trailer cost as applicable, insurance, bonding, small tool expenses, CPP, and EI contributions.

6.2.6 No compensation for extra Work or material shall be allowed unless the Consultant issues a Notice in Writing authorizing such Work or material to be ordered in the form of a *Change Order, Change Directive* or *Supplemental Instruction*.

6.2.7 No compensation will be allowed for the cost of repairs to equipment or in respect of construction equipment of any kind idle on the Site except as directed by the *Consultant* in writing or for damage to anything used in performing any such extra *Work* or making any such alteration.

6.2.8 The price applicable to any Work deleted from the Contract, shall be deducted from the *Contract Price* and shall be mutually agreed upon by the Contractor and the *Consultant*. The price shall be comparable to prices quoted on Work of similar nature.

GC 6.3 – CHANGE DIRECTIVE

Page 18, in clause 6.3.12, add the following sentence at the end of the paragraph:

"If such determination by the *Consultant* is not accepted by either party, then the decision shall be made in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION."

GC 6.4 – CONCEALED OR UNKNOWN CONDITIONS

Page 18, add a new clause 6.4.5 and 6.4.6 as follows:

"6.4.5 If the *Contractor* was given access to the Place of Work and/or professional reports relating thereto (including, without limitation, environmental, geotechnical, and structural reports) prior to the submission of the bid on which the Contract was awarded, then the *Contractor* confirms that they have investigated the *Place of the Work* and, in doing so, applied to that investigation the degree of care and skill required. In those circumstances, notwithstanding the provisions of clause 6.4.1, the *Contractor* is not entitled to an adjustment to the *Contract Price* or to an extension of the Contract Time for conditions which could reasonably have been ascertained by the *Contractor* by such investigation, or which could have been reasonably inferred from the material provided with the Contract Documents. In those circumstances, should a claim arise, the Contractor will have the burden of establishing that it could not have discovered the materially different conditions from an investigation because of restrictions placed on its access or inferred the existence of the conditions from the material provided with the *Contract Documents*.

6.4.6 If such concealed or unknown conditions relate to toxic and hazardous substances and materials, artifacts and fossils, or mould, the parties will be governed by the provisions of GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES, GC 9.3 – ARTIFACTS AND FOSSILS, and GC 9.5 – MOULD."

GC 6.5 DELAYS

Page 18, clause 6.5.2, delete last sentence of paragraph and replace with the following sentence:

"The *Contractor* will not be reimbursed by the Owner for costs incurred by the *Contractor* as a result of such delay."

Page 19, after Clause 6.5.5, add the following new Clauses:

"6.5.6 Should the *Contractor* fail to attain *Ready-for-Takeover* for the *Work* by the date indicated in Article A-1, Clause 1.3 in the AGREEMENT BETWEEN OWNER AND CONTRACTOR, the period of time from this agreed date to the actual date when the *Consultant* confirms the *Work* is *Ready-for-Takeover*, shall be termed the *Period of Delay*.

6.5.7 In the event there is a *Period of Delay*, the *Contractor* shall be liable for and shall pay to the Owner the cost of continuance of supervision during the *Period of Delay*, and all additional fees, disbursements and costs incurred by the *Owner* as a result of the Period of Delay, such charges hereby termed as Delay Charges. The Owner may deduct the amount of such Delay Charges from further progress payments."

GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

Page 18, add the following new Clause as 6.6.6 and renumber the subsequent clause:

"6.6.6 The *Owner* may make claims arising out of the costs incurred for additional services provided by the Consultant resulting from the *Contractor's* failure to reasonably perform the Work in accordance with the terms and conditions of the Contract, including the Contractor's issuance of unnecessary Requests for Information (RFI's). The *Consultant* will notify the *Owner* and *Contractor* where it has been determined that additional services will be required or have been provided in order not to cause a delay. The *Owner* shall make claims based on the *Consultant's* invoices."

GC 6.7 – QUANTITY VARIATIONS

Page 19, delete clause 6.7 in its entirety.

PART 9 - PROTECTION OF PERSONS AND PROPERTY

GC 9.4 – CONSTRUCTION SAFETY

Page 24, after GC 9.4.5, add the following:

"9.4.6 The *Contractor* shall indemnify and save harmless the *Owner*, its agents, officers, directors, employees, *Consultant*, successors, appointees and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* under the

applicable occupational health and safety legislation in the *Place of the Work*, including the payment of legal fees and disbursements on a solicitor and client basis. Such indemnity shall apply to the extent to which the *Owner* is not covered by insurance, provided that the indemnity contained in this clause shall be limited to costs and damages resulting directly from such infractions and shall not extend to any consequential, indirect, or special damages."

PART 10 - GOVERNING REGULATIONS

GC 10.1 TAXES AND DUTIES

Page 25, after Clause 10.1.2, add new Clause 10.1.3 as follows:

"10.1.3 Indicate on each application for payment as a separate amount, the appropriate *Value Added 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*."

GC 10.2 – LAWS, NOTICES, PERMITS AND FEES

Page 25, add the following to clause 10.2.3 after the first sentence:

"Various jurisdictions have requirements for posting non-refundable fees before excavations are carried out within public rights-of-way. The *Contractor* is responsible for the determination of the requirement for each specific project and for any required deposits. The *Contractor* shall obtain all permits, such as those from the Department of Highways; licenses; letters of approval and certificates and pay the fees required for the performance of the *Work* which are in force at the date of tender closing, but this shall not include the obtaining of permanent easements or rights-of-way."

PART 12 – *OWNER* TAKEOVER

Page 25, add new clause 12.1.1.9 and 12.1.1.10 as follows:

.9 Commissioning reports as in Section 01 91 13.

.10 Any other documentation identified as a closeout or Ready-for-Takeover document as specified in Section 01 78 00.

GC 12.3 WARRANTY

Page 26, add new clause 12.3.5 as follows and renumber subsequent clauses:

"12.3.5 All W*ork* of repair or replacement carried out during the Warranty Period shall be maintained for a period of one (1) year from the date of the *Consultant'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*."

PART 13 – INDEMNIFICATION AND WAIVER

GC 13.1 INDEMNIFICATION

Page 26, Clause 13.1.1, in line 2, after "hold harmless the other" replace with "hold harmless the other and the *Consultant*.

PART 14 – CONTRACT SECURITY

GC 14.1 CONTRACT SECURITY

Page 28, add new clause 14.1 as follows:

"14.1 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 or an Irrevocable Letter of Credit in the amount of 20% of the Total Amount Payable. The Irrevocable Letter of Credit shall be issued by a certified financial institution for a period of no less than twelve (12) months after the issue of Substantial Performance Certificate. Include the cost of

providing the Irrevocable Letter of Credit in Contract Price. 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 or Irrevocable Letter of Credit reissued, based on the projected final cost."

14.2 The Contract Security will be retained until the expiration of the Warranty Period."

END OF SECTION

PART 1 - GENERAL

1.1 WORK OF THE PROJECT

.1 The project is located in the Town of Mahone Bay on Edgewater street and surrounding coastlines.

.2 The project generally involves infrastucture improvements and coastline protection. The Work includes but is not necessarily limited to various site removals; supply and installation of sanitary, water, and storm sewer piping; supply and installation of hydrants, water and sanitary services, a pedestrain footbridge, construction of two (2) sanitary pumping stations; road and trail paving complete with signage, lookoff areas, a parking lot, driveways, curbs, sidewalks, retaining walls, handrails, and pedstrain ramps; underground electrical including medium-voltage and secondary services, with associated distribution infrastructure; street lighting and associated cables, supports, fittings, conduits; shoreline protection including three (3) breakwaters and an outlet channel; supply, placement and maintenance of topsoil and sod as well as other plantings; environmental protection; traffic control; and all other work as shown on the Project Drawings and as specified herein.

1.2 DIVISION OF WORK

.1 Division of the Work among Subcontractors and Suppliers is solely Contractor's responsibility. Consultant and Owner assume no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of the Work.

1.3 SPECIFICATIONS LANGUAGE AND STYLE

.1 These specifications are written in the imperative mood and in streamlined form. The imperative language is directed to Contractor, unless stated otherwise.

.2 Fulfill and perform all indicated requirements whether stated imperatively or otherwise.

.3 When used in the context of a Product, read the word “provide” to mean “supply and install to result in a complete installation ready for its intended use”.

1.4 CONTRACT DOCUMENTS FOR CONSTRUCTION PURPOSES

.1 Owner will supply Contractor with a complete set of Contract Documents in electronic form before commencement of the Work. Contractor may print hard copies for construction purposes as required.

1.5 DOCUMENTS AT THE SITE

.1 Keep the following documents at Place of the Work, stored securely and in good order and available to Owner and Consultant:

.1 Current Contract Documents, including Drawings, Specifications and addenda.
.2 Change Orders, Change Directives, and Supplementary Instructions.
.3 Reviewed Shop Drawings, Product data and samples.
.4 Field test reports and records.

.5 Construction progress schedule.
.6 Meeting minutes.
.7 Manufacturer's certifications.
.8 Permits, inspection certificates, and other documents required by authorities having jurisdiction.
.9 Current as-built drawings.
.10 Safety Data Sheets (SDS) for all controlled Products.
.11 Any other documents as stipulated as site documents at the construction start-up meeting.

1.6 CONTRACTOR'S USE OF PREMISES

.1 Other contractors may be on site or on properties adjacent to the Site. Coordinate the use of the Site and surrounding areas with other contractors. Should a conflict in the use of the Site or adjacent areas, promptly report this to the Owner who will provide a resolution.

.2 The Town will be issuing a tender for addition water main work and stormwater separation on Main St in January. The work is expected to take place in the 2025 construction season. Coordinate the Work of this contract with the work on Main Street to the greatest extent possible.

.3 Confine Construction Equipment, Temporary Work, storage of Products, waste products and debris, and all other construction operations to limits required by laws, ordinances, permits, and Contract Documents, whichever is most restrictive. Do not unreasonably encumber Place of the Work.

.4 Note that is community is a tourist destination and Edgewater St is a main entry point into the Town for tour buses. The work area is to keep clean and safe at all times with the ability to allow tour buses and emergency vehicles through

1.7 REFERENCES AND CODES

.1 Perform Work in accordance with the latest edition of the National Building Code (NBC), National Fire Code (NFC), National Plumbing Code (NPC), Canadian Electrical Code, and/or any other code of provincial or local regulations provided that in any case of conflict or discrepancy the more stringent requirement governs.

.2 Reference has been made to certain Domestic, National and International Standards throughout the various sections of the Specification contained herein. These Standards will be considered an integral part thereof and shall be read in conjunction with the Drawings and Specifications as if they were reproduced herein. Be completely familiar with their contents and requirements.

1.8 ASSISTANCE TO THE CONSULTANT AND THE CONSULTANT'S REPRESENTATIVE

.1 During the continuance of the Contract, provide necessary labour and tools to assist the Consultant's authorized representative in measuring, checking, testing and examining the Work and for the setting out and measurement of the Works, the cost of all such being deemed to be covered by and included in the Contract Price.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not Applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Applicable.

END OF SECTION

PART 1 - GENERAL

1.1 RESTRICTIONS ON USE OF PREMISES

.1 This subsection identifies restrictions that may impact the scheduling or execution of the Work. This does not purport to identify all potential disruptions, but rather it is meant to assist the Contractor to understand the project.

.2 Working hours to conform with municipal bylaw restrictions regarding noise.

.3 Make all reasonable efforts to provide access around the Site. Provide temporary gravels, walkways, handrails, markers and other means to maitain safe, clean access to all areas requiring routine access.

1.2 NOISE AND VIBRATION

.1 Operate construction equipment such that there is a minimum amount of noise and vibration. Should excessive noise and vibration be caused, at own expense, rectify the same to the approval of the Consultant.

.2 Operate equipment within the restrictions set forth in the local bylaws.

1.3 WEATHER CONDITIONS

.1 Do not perform work when the weather is unsuitable. Do not place concrete, paving, or paint during freezing weather or upon frozen material unless approved in writing by the Consultant. When work is performed during freezing weather, provide necessary means for heating and all materials required in the work. 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.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1. Unit prices for all items in the Schedule of Quantities and 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 all items as applicable include all of the following as required where individual quantities are not provided in the Tender Form: traffic control, location of inground services by external utilities and coordination of work by external utilities (Water, Electrical, Gas, etc.), environmental protection, protection of existing trees, clearing, grubbing, common excavation, shoring, dewatering, backfilling, bedding, compaction, disposal of surplus materials, fittings, tees, bends, valves, protective coatings, marker tape, anodes reinstatement of all disturbed surfaces with matching materials and thicknesses, testing, pipe cleaning, disinfection, marker stakes, recording as-constructed features, CCTV inspection, and all incidentals.

3. The unit and lump sum prices for all items in the Form of Tender "Schedule of Quantities and Unit Prices" shall include the cost for furnishing all materials, labour, tools, and equipment necessary to complete the work in accordance with the Contract, the Drawings and Specification, and shall cover all costs of surety, insurance mobilization, remobilization permits, coordination with Owner and/or other contractors on-site, assistance to the Consultant, site offices and other general costs. Each item shall include for all necessary supervision, labour, materials, plant and services, security provisions, survey and all operations and allowances customary and necessary to complete each item and the Contract as a whole notwithstanding the fact that not every such necessary operation is mentioned or included specifically for measurement.

4. All measurement shall be along a horizontal plane unless otherwise indicated.

5. The numbers of items described below correspond to the numbers of the items in Section 00 41 43, subsection 4, Schedule of Quantities and Unit Prices.

6. Provisional items shall mean that the unit price as tendered shall be included in the estimated Contract Price and that the Owner reserves the right to delete all or portions of this item from the estimated Contract Price.

7. All volume calculations for trench measurements are based on theoretical trench limits.

PART 2 – ITEMS

1. Mobilization

Unit of Measurement: Lump Sum (LS)

This item includes: all costs associated with mobilizing equipment and personnel to the Site and incidentals. (Post Addendum No.1)

2. Removals

.1 Clearing and Grubbing

Unit of Measurement: Lump Sum (LS)

This item includes: cutting and off Site disposal of all trees, shrubs, plants, and brush from areas included within the limits of the Site. Owner approval required for any clearing or grubbing within existing park areas.

.2 Electrical

.1 Streetlight Service Line

Unit of Measurement: metre (m)

Method of Measurement: along the centreline of service line.

This item includes: removal and off Site disposal of conduit and wiring, including existing power supply, and service connection and mast on service pole.

.2 Light Standards

Unit of Measurement: Each (Ea)

This item includes: removal and off Site disposal of street lights including poles, bases, mast arms, grounding, luminaries, interior wiring, and stub up.

.3 Roadway

.1 Asphalt Milling

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: milling, removal and recycling of asphalt millings at a facility approved by the Consultant. Item applies to asphalt to remain from -0+150 to 0+287 after full asphalt and gravels are removed.

.2 Asphalt incl. gravels to subgrade

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: saw cutting, removal, and recycling of asphalt at an approved facility; removal and off Site disposal of gravels. This item applies to Work completed from - 0+150 to 0+287 from curb to centreline and 0+287 to end of work area for future road width. This item also includes removal of asphalt and gravels at Edgewater St. and Old Edgewater St. intersection improvements.

.3 Curb Islands

Unit of Measurement: Each (Ea)

This item includes: saw cutting, removal, and offsite disposal of curb islands as indicated on the Project Drawings.

.4 Concrete Sidewalks

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: saw cutting, removal, and offsite disposal of concrete sidewalks as indicated on the Project Drawings.

.5 Curb and Gutter

Unit of Measurement: metre (m)

Method of Measurement: along top face of curb.

This item includes: saw cutting, removal, and offsite disposal of curb and gutters as indicated on the Project Drawings.

.6 Timber Curb

Unit of Measurement: metre (m)

Method of Measurement: along top face of curb.

This item includes: removal, and offsite disposal of timber curb and gutters as indicated on the Project Drawings.

.4 Stormwater System

.1 150mm dia. PVC

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through catch basins and manholes.

This item includes: removal and offsite disposal of PVC stormwater piping and asphalt (where not covered under a separate item) as indicated on the Project Drawings.

.2 200mm dia. PVC

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through catch basins and manholes.

This item includes: removal and offsite disposal of PVC stormwater piping and asphalt (where not covered under a separate item) as indicated on the Project Drawings.

.3 250mm dia. PVC

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through catch basins and manholes.

This item includes: removal and offsite disposal of PVC stormwater piping and asphalt (where not covered under a separate item) as indicated on the Project Drawings.

.4 300mm dia. PVC

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through catch basins and manholes.

This item includes: removal and offsite disposal of PVC stormwater piping and asphalt (where not covered under a separate item) as indicated on the Project Drawings.

.5 450mm dia. PVC

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through catch basins and manholes.

This item includes: removal and offsite disposal of PVC stormwater piping as indicated on the Project Drawings.

.6 525mm dia. PVC

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through catch basins and manholes.

This item includes: removal and offsite disposal of PVC stormwater piping and asphalt (where not covered under a separate item) as indicated on the Project Drawings.

.7 Catchbasins and Manholes

Unit of Measurement: Each (Ea)

This item includes: Removal and offsite disposal of precast concrete catchbasins and manholes complete with frames, covers, sections, grates and asphalt (where not covered under a separate item) as indicated on the Project Drawings.

.5 Water Systems

.1 150mm dia. CI

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings, valves and valve chambers.

This item includes: removal and offsite disposal of cast iron water piping and asphalt (where not covered under a separate item) as indicated on the Project Drawings.

.2 Fire Hydrants

Unit of Measurement: Each (Ea)

This item includes: removal and offsite disposal of fire hydrants complete with hydrant valve, lead and asphalt (where not covered under a separate item) as indicated on the Project Drawings.

.6 Guiderail

.1 Wooden

Unit of Measurement: metre (m)

Method of Measurement: along centreline of guiderail.

This item includes: removal and offsite disposal of wooden guiderails complete with posts as indicated on the Project Drawings.

.2 Post and Rope

Unit of Measurement: metre (m)

Method of Measurement: along centreline of guiderail.

This item includes: removal and offsite disposal of post and rope guiderails as indicated on the Project Drawings.

.7 Concrete Park Pad

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: saw cutting and removal of concrete pad used for existing benches, tables, and other park features. Payment for the removal, storage, and protection is covered in items 10.14 through 10.18 herein.

.8 450mm dia. Concrete Sanitary

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings, valves and valve chambers.

This item includes: removal and offsite disposal of concrete sanitary pipe.

3. Abandonments

.1 450mm dia. Concrete Sanitary

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings, valves and valve chambers.

This item includes: filling of concrete sanitary pipe with unshrinkable fill.

.2 150mm dia. CI Water

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings, valves and valve chambers.

This item includes: filling of cast iron water pipe with unshrinkable fill.

4. Trenching for Pipework and Ductbanks (Provisional Items)

.1 Trenching

.1 Trench Rock Excavation (Provisional)

Unit of Measurement: cubic metre (m^3)

Method of Measurement: surface-to-surface volume method between topographical survey taken before and after rock is exposed and removed.

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 trench rock excavation and disposal of surplus material.

.2 Removal of Unsuitable Material and Replacement with Type 2 (Provisional)

Unit of Measurement: cubic metre (m^3)

Method of Measurement: surface-to-surface volume method between topographical survey before and after removal of unsuitable material.

This item includes: excavation of unsuitable material and off Site disposal and replacement with Type 2. Written authorization of the Consultant required. This item also includes unsuitable material identified outside of the trench that requires replacement.

.3 Import Common Fill (Provisional)

Unit of Measurement: cubic metre (m^3)

Method of Measurement: surface-to-surface volume method between topographical survey before and after placement of imported common fill.

This item includes: supply, placement and compaction of common borrow from the Contractor's own sources and matching the description of select backfill as defined in Section 31 20 00.

5. Sanitary Sewers Systems

.1 100mm dia. PVC DR18 Forcemain

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe.

This item includes: supply and installation of pipe complete with all fittings. In areas where asphalt

or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.2 200mm dia. PVC DR18 Sanitary Main

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through catchbasins, manholes and fittings.

This item includes: supply and installation of pipe complete with all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.3 450mm dia. PVC DR18 Sanitary Main

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through catchbasins, manholes and fittings.

This item includes: supply and installation of pipe complete with all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.4 Concrete Manholes

.1 1050mm dia. Precast

Unit of Measurement: Each (Ea)

This item includes: supply and placement of precast concrete manhole complete with all items indicated on the drawings including cover, frame, grout, waterproofing, sealant, benching, gaskets, and grade adjustment as necessary.

.2 1200 Cast-in-Place

Unit of Measurement: Each (Ea)

This item includes: supply and placement of precast concrete manhole complete with all items indicated on the drawings including cover, frame, grout, waterproofing, sealant, benching, gaskets, and grade adjustment as necessary.

.5 Connection to Existing System

.1 At Main Street
Unit of Measurement: Each (Ea)

This item includes: locating existing main and supply and installation of pipe, fittings, and

incidentals. This item also includes coring of new openings as required, making the connections watertight to manhole or piping system as applicable, and bypass pumping as required.

.2 At SMH006B
Unit of Measurement: Each (Ea)

This item includes: locating existing main and supply and installation of pipe, fittings, and incidentals. This item also includes coring of new openings as required, making the connections watertight to manhole or piping system as applicable, and bypass pumping as required.

.6 Sanitary Services

.1 100mm dia. PVC DR35 Sanitary Services

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings from sewer main to property main.

This item includes: supply and installation of pipe complete with all fittings and connection to existing service. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here. Removals and reinstatement of curb, sidewalks, and asphalt paid under the respective pay items. All other removals and reinstatement include in this item.

.2 150mm dia. PVC DR35 Sanitary Services

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings from sewer main to property main.

This item includes: supply and installation of pipe complete with all fittings and connection to existing service. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here. Removals and reinstatement of curb, sidewalks, and asphalt paid under the respective pay items. All other removals and reinstatement include in this item.

.7 100mm Forcemain under 1200mm Culvert Crossing

Unit of Measurement: LS (LS)

This item includes: all materials, excavation, shoring, required to install the 100mm forcemain under the 1200mm culvert

.

.5 Water Systems

.1 150mm dia. PVC DR18 Watermain

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings.

This item includes: supply and installation of pipe complete with all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.2 200mm dia. PVC DR18 Watermain

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings.

This item includes: supply and installation of pipe complete with all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.3 250mm dia. PVC DR18 Watermain

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings.

This item includes: supply and installation of pipe complete with all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.4 Gate Valves

.1 150mm dia.

Unit of Measurement: Each (Ea)

This item includes: supply and installation of gate valves complete with valve box and appurtenances.

.2 200mm dia.

Unit of Measurement: Each (Ea)

This item includes: supply and installation of gate valves complete with valve box and appurtenances.

.3 250mm dia.

Unit of Measurement: Each (Ea)

This item includes: supply and installation of gate valves complete with valve box and appurtenances.

.5 Fire Hydrants

Unit of Measurement: Each (Ea)

This item includes: hydrant complete with lead, gate valve, and valve box. Removals and reinstatement of curb, sidewalks, and asphalt paid under the respective pay items. All other removals and reinstatement include in this item.

.6 Automatic Flushing System

Unit of Measurement: Each (Ea)

This item includes: supply and installation of flushing hydrant complete with shut-off valve. This item also includes connection to the watermain, 50mm water service, freeze protection, discharge line, drain connection to manhole, and all appurtenances as required. Removals and reinstatement of curb, sidewalks, and asphalt paid under the respective pay items. All other removals and reinstatement include in this item.

.7 Connection to Existing System

.1 At Main Street

Unit of Measurement: Each (Ea)

This item includes: locating existing main and supply and installation of pipe, nipples, valves, fittings, and incidentals.

.2 At Parish Street

Unit of Measurement: Each (Ea)

This item includes: locating existing main and supply and installation of pipe, nipples, valves, fittings, and incidentals.

.8 Water Services to Property Line

.1 19mm dia.

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings from watermain to property line.

This item includes: supply and installation of water service complete with corporation stop, pipe, saddle, and reconnection to existing curb stop. In areas where asphalt or gravels are not identified, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here. Removals and reinstatement of curb, sidewalks, and asphalt paid under the respective pay items. All other removals and reinstatement include in this item.

.2 38mm dia.

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings from watermain to property line.

This item includes: supply and installation of water service complete with corporation stop, pipe, saddle, and reconnection to existing curb stop. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here. Removals and reinstatement of curb, sidewalks, and asphalt paid under the respective pay items. All other removals and reinstatement include in this item.

.9 250mm Watermain and Culvert Crossing

Unit of Measurement: Lump Sum (LS)

This item includes: all materials, excavation, shoring, required to install the 250mm watermain under the 1200mm culvert

.

6. Storm Systems

.1 300mm dia. PVC DR35

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through manholes.

This item includes: supply and installation of pipe complete with all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included

here.

.2 375mm dia. PVC DR35

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through manholes.

This item includes: supply and installation of pipe complete with all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.3 450mm dia. Concrete 65D Storm

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through manholes.

This item includes: supply and installation of pipe complete with grouting and all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.4 525mm dia. Concrete 65D Storm

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings.

This item includes: supply and installation of pipe complete with grouting and all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.5 600mm dia. Concrete 65D Storm

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings.

This item includes: supply and installation of pipe complete with grouting and all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.6 750mm dia. Concrete 65D Storm

Unit of Measurement: metre (m)

Method of Measurement: along centreline of pipe through fittings.

This item includes: supply and installation of pipe complete with grouting and all fittings. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.7 Backflow Preventers

.1 300mm dia.

Unit of Measurement: Each (Ea)

This item includes: supply and installing backflow prevention device.

.2 450mm dia.

Unit of Measurement: Each (Ea)

This item includes: supply and installing backflow prevention device.

.3 600mm dia.

Unit of Measurement: Each (Ea)

This item includes: supply and installing backflow prevention device.

.4 750mm dia.

Unit of Measurement: Each (Ea)

This item includes: supply and installing backflow prevention device.

.8 Concrete Catchbasins

.1 1050mm dia. Precast

Unit of Measurement: Each (Ea)

This item includes: supply and installation of precast concrete catch basins complete with

grate, grout, and grade adjustment. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.2 1200mm dia. Precast

Unit of Measurement: Each (Ea)

This item includes: supply and installation of precast concrete catch basins complete with grate, grout, and grade adjustment. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.3 1500mm dia. Precast

Unit of Measurement: Each (Ea)

This item includes: supply and installation of precast concrete catch basins complete with grate, grout, and grade adjustment. In areas where asphalt or gravels are not identified form removal, the removal of these items is to be included here. Where only asphalt milling is identified, reinstatement will have gravel, and asphalt included here.

.9 Concrete Headwalls

Unit of Measurement: Each (Ea)

This item includes: supply and installation of precast concrete headwall.

.10 Concrete Manholes

.1 1050mm dia. Precast

Unit of Measurement: Each (Ea)

This item includes: supply and installation of precast concrete manholes complete with frame, grout, and grade adjustment.

.2 1500mm dia. Precast

Unit of Measurement: Each (Ea)

This item includes: supply and installation of precast concrete manholes complete with frame, grout, and grade adjustment.

.7 Private Property Servicing

.1 Civic 121

.1 Water and Sewer (Provisional)

Unit of Measurement: Lump Sum (LS)

This item includes: Supply and installation of sanitary and water services from the property line to the building. This item also includes all excavation, backfill, pipe, fittings, service drop connections, connection to existing, and all other works required to connect homeowners to newly installed mains. All reinstatement included.

.2 Civic 191

.1 Water and Sewer (Provisional)

Unit of Measurement: Lump Sum (LS)

This item includes: Supply and installation of sanitary and water services from the property line to the building. This item also includes all excavation, backfill, pipe, fittings, service drop connections, connection to existing, and all other works required to connect homeowners to newly installed mains. All reinstatement included.

.2 Electrical

Unit of Measurement: Lump Sum (LS)

This item includes: Supply and installation of underground electrical from property line to buildings including direct buried conduit or concrete encased new bottom-entry meter enclosure, conduit, fittings, for residential services as indicated on the Project drawings. Utility will connect wire to existing meter and remove existing overhead service.

.3 Civic 205

.1 Water and Sewer (Provisional)

Unit of Measurement: Lump Sum (LS)

This item includes: Supply and installation of sanitary and water services from the property line to the building. This item also includes all excavation, backfill, pipe, fittings, service drop connections, connection to existing, and all other works required to connect homeowners to newly installed mains. All reinstatement included.

.2 Electrical

Unit of Measurement: Lump Sum (LS)

This item includes: Supply and installation of underground electrical from property line to

buildings including direct buried conduit or concrete encased new bottom-entry meter enclosure, conduit, fittings, for residential services as indicated on the Project drawings. Utility will connect wire to existing meter and remove existing overhead service

.4 Civic 217

.1 Water and Sewer (Provisional)

Unit of Measurement: Lump Sum (LS)

This item includes: Supply and installation of sanitary and water services from the property line to the building. This item also includes all excavation, backfill, pipe, fittings, service drop connections, connection to existing, and all other works required to connect homeowners to newly installed mains. All reinstatement included.

.2 Electrical

Unit of Measurement: Lump Sum (LS)

This item includes: Supply and installation of underground electrical from property line to buildings including direct buried conduit or concrete encased new bottom-entry meter enclosure, conduit, fittings, for residential services as indicated on the Project drawings. Utility will connect wire to existing meter and remove existing overhead service

8. Pumping Station #4

Unit of Measurement: Lump Sum (LS)

This item includes: supply, installation, and commissioning of pumping station in accordance with Drawing C110 and applicable electrical drawings. Grounding rods are included in this item despite being shown outside of the limits. Include riser pole base and mast per detail 1/E51. Gravity sewer and forcemain to be paid under their respective items herein. Select backfill to be paid under item 10.11 herein and topsoil and sod is to be paid under item 10.23 herein.

9. Pumping Station #5

Unit of Measurement: Lump Sum (LS)

This item includes: supply, installation, and commissioning of pumping station in accordance with Drawing C111 and applicable electrical drawings. Grounding rods are included in this item despite being shown outside of the limits. Gravity sewer and forcemain to be paid under their respective items herein. Select backfill to be paid under item 10.11 herein and topsoil and sod is to be paid under item 10.23 herein.

10. Roadway and Trails

1. 50mm Asphalt Type C-HF

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: supply, placement, and compaction as indicated including tack coat.

2. 100mm Asphalt Type B-HF

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: supply, placement, and compaction as indicated including tack coat.

3. 150mm Type 1 Gravel

Unit of Measurement: square metre (m^2)

Method of Measurement slope measure of indicated area.

This item includes: supply, placement, and compaction.

4. 450mm Type 2 Gravel

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: supply, placement, and compaction.

5. Concrete Curb

.1 Mountable

Unit of Measurement: metre (m)

Method of Measurement: along top face of curb.

This item includes: cast in-place concrete curb complete with reinforcement and formwork. Concrete quality testing will be performed by an independent third party paid for by the Owner.

.2 Curb and Gutter

Unit of Measurement: metre (m)

Method of Measurement: along top face of curb.

This item includes: cast in-place concrete curb complete with reinforcement and formwork. Concrete quality testing will be performed by an independent third party paid for by the Owner.

.3 High back Curb

Unit of Measurement: metre (m)

Method of Measurement: along top face of curb.

This item includes: cast in-place concrete curb complete with reinforcement and formwork. Concrete quality testing will be performed by an independent third party paid for by the Owner.

6. Asphalt Driveways

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area

This item includes: supply, placement, and compaction of asphalt for properties shown on Drawing C102. Reinstatement of all other driveways affected by the Work are to incidental to the applicable pay item.

7. Gravel Driveways

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area

This item includes: supply, placement, and compaction of gravel for PS4 parking area and ramps to existing parking area at Keddy's Landing. Reinstatement of all other driveways affected by the Work are incidental to the applicable pay item.

8. Driveway Ramps

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area

This item includes: cast in-place concrete ramp complete with reinforcement, formwork, and tactile plates. Concrete quality testing will be performed by an independent third party paid for by the Owner.

9. Pedestrian Ramps

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area

This item includes: cast in-place concrete pedestrian ramp complete with reinforcement and formwork. Concrete quality testing will be performed by an independent third party paid for by the Owner.

10. Multi-Use Trail

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area

This item includes: supply, placement, and compaction of asphalt including bedding gravels including lookoff areas.

11. Select Backfill

Unit of Measurement: cubic metre (m^3)

Method of Measurement: surface-to-surface volume method between topographic survey taken before and after placement and compaction of select backfill is placed.

This item includes: supply, placement, and compaction of either reused site common borrow or imported common fill from the Contractor's own sources and matching the description of select backfill as defined in Section 31 20 00.

12. Traffic Signs (Provisional)

.1 Relocate Signs

Unit of Measurement: Each (Ea)

This item includes: removal, storage, protection, and reinstallation of traffic signs where indicated on the Project Drawings.

.2 New Signs

Unit of Measurement: Each (Ea)

This item includes: supply and installation of traffic signs complete with signboard, post and cast in-place concrete base.

13. Relocated Benches

Unit of Measurement: Each (Ea)

This item includes: removal, storage, protection, and reinstallation of benches where indicated on the Project Drawings.

14. Relocate Monuments

Unit of Measurement: Each (Ea)

This item includes: removal, storage, protection, and reinstallation of monuments where indicated on the Project Drawings.

15. Relocate Store Sign Welcome Sign

Unit of Measurement: Each (Ea)

This item includes: removal, storage, protection, and reinstallation of Welcome Sign and store sign where indicated on the Project Drawings.

16. Relocate Tables

Unit of Measurement: Each (Ea)

This item includes: removal, storage, protection, and reinstallation of tables where indicated on the Project Drawings. Supply and installation of concrete pad in new location will be paid for under item 10.19 herein

17. Relocate Garbage Bins

Unit of Measurement: Each (Ea)

This item includes: removal, storage, protection, and reinstallation of garbage bins where indicated on the Project Drawings. Supply and installation of concrete pad in new location will be paid for under item 10.19 herein

18. Concrete Pads for Park Features

Unit of Measurement: Each (Ea)

Method of Measurement: slope measure of indicated area

This item includes: supply and construction of cast-in-place concrete pad complete with reinforcement, formwork and mounting hardware as required. Concrete quality testing will be performed by an independent third party paid for by the Owner.

19. Pedestrian Footbridge (Provisional)

Unit of Measurement: Lump Sum (LS)

This item includes: design, supply, and construction of prefabricated bridge complete with railings, and all items shown on the South bank of the river including but not necessarily limited to retaining wall, imported fill, structural fill, trail, topsoil, sod, concrete sidewalk, lighting, underground electrical, rock protection, and storm pipe. Refer to Drawing S01 for additional details. This item does not includes the design of abutments as the design of these items are complete and shown on the Project Drawings.

20. Guiderails

.1 Black Ornamental

Unit of Measurement: metre (m)

Method of measurement: along the top rail through posts.

This item includes: supply and installation of black ornamental guiderail complete with black powder coating and hardware.

.2 Wooden

Unit of Measurement: metre (m)

Method of measurement: along the top rail through posts.

This item includes: supply and installation of wooden guiderail complete with preservative treatment and hardware.

.3 Post and Rope

Unit of Measurement: metre (m)

Method of measurement: along the top rail through posts.

This item includes: supply and installation of guiderail complete with rope and treated wooden posts.

21. Retaining Walls

.1 Trail Retaining Wall

Unit of Measurement: square metre (m^2)

Method of Measurement: total area of wall face including buried portion.

This item includes: design, supply, and installation of pre-cast retaining walls complete

with foundation preparation, levelling pads, supply and installation of modular wall units, geotextile, guards, drainage, infill gravels, and backfilling up to trail gravels as per Drawing C213. The retaining wall associated with the pedestrian bridge on the south side of the river is not included in this item.

.2 Parking Lot Retaining Wall

Unit of Measurement: square metre (m^2)

Method of Measurement: total area of wall face including buried portion.

This item includes: design, supply, and installation of pre-cast retaining walls complete with foundation preparation, levelling pads, supply and installation of modular wall units, geotextile, guards, drainage, and infill gravels as shown on drawing C213. The retaining wall associated with the pedestrian bridge on the south side of the river is not included in this item

22. Concrete Sidewalk & Ramp

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: cast in-place concrete sidewalk and sidewalk ramps complete with reinforcement, formwork and tactile walking surfaces. Concrete quality testing will be performed by an independent third party paid for by the Owner.

23. Topsoil and Sod

Unit of Measurement: square metre (m^2)

Method of Measurement: slope measure of indicated area at mean depth.

This item includes: supply and placing of topsoil, lime, fertilizer, sod, required accessories, and maintenance.

24. Line Painting

Unit of Measurement: Lump Sum (LS)

This item includes: supply and application of traffic markings including pre-marking as shown on the Project Drawings.

25. Parking Lot A Regrading

Unit of Measurement: Lump Sum (LS)

This item includes: This item includes removal of asphalt and gravels to establish new subgrade elevations and to rebuild to new finished grades.

11. Electrical

1. Decorative Street Lights

Unit of Measurement: Each (Ea)

This item includes: supply and install decorative street lights complete with wiring, grounding, photocell control, luminaries, concrete base, pole and all associated appurtenances as indicated on the Project Drawings.

2. Ductbanks and Conduits

.1 Direct Buried DB7

.1 1x53mm

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of direct buried conduit run.

This item includes: supply, installation of direct buried conduit complete with sand bedding, duct protection, marker tape, and power wiring as applicable and in the arrangement as shown on the Project Drawings.

.2 2x53mm

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of direct buried conduit run.

This item includes: supply, installation of direct buried conduit complete with sand bedding, duct protection, marker tape, and power wiring as applicable and in the arrangement as shown on the Project Drawings.

.3 1x78mm

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of direct buried conduit run.

This item includes: supply, installation of direct buried conduit complete with sand bedding, duct protection, marker tape, and power wiring as applicable and in the arrangement as shown on the Project Drawings.

.4 2x78mm

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of direct buried conduit run.

This item includes: supply, installation of direct buried conduit complete with sand bedding, duct protection, marker tape, and power wiring as applicable and in the arrangement as shown on the Project Drawings.

3. Concrete Encased

.1 DB1 Primary - 2x129mm

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of concrete encased ductbank run.

This item includes: supply, installation of concrete encased ductbanks complete with fibre reinforced cast-in-place concrete, grounding, marker tape, wiring, and cables in the applicable arrangement as shown on the Project Drawings.

.2 DB2 Primary - 4x103mm + Secondary 6x103mm

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of concrete encased ductbank run.

This item includes: supply, installation of concrete encased ductbanks complete with fibre reinforced cast-in-place concrete, grounding, marker tape, wiring, and cables in the applicable arrangement as shown on the Project Drawings.

.3 DB3 Secondary

.1 2x103mm
Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of concrete encased ductbank run.

This item includes: supply, installation of concrete encased ductbanks complete with fibre reinforced cast-in-place concrete, grounding, marker tape, wiring, and cables in the applicable arrangement as shown on the Project Drawings.

.2 4x103mm
Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of concrete encased ductbank run.

This item includes: supply, installation of concrete encased ductbanks complete with fibre reinforced cast-in-place concrete, grounding, marker tape, wiring, and cables in the applicable arrangement as shown on the Project Drawings.

.4 DB4 Primary - 8x103mm

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of concrete encased ductbank run.

This item includes: supply, installation of concrete encased ductbanks complete with fibre reinforced cast-in-place concrete, grounding, marker tape, wiring, and cables in the applicable arrangement as shown on the Project Drawings.

.5 DB5 Primary - 4x103mm

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of concrete encased ductbank run.

This item includes: supply, installation of concrete encased ductbanks complete with fibre reinforced cast-in-place concrete, grounding, marker tape, wiring, and cables in the applicable arrangement as shown on the Project Drawings.

.6 DB8 Primary

Unit of Measurement: Metre (m)

Method of Measurement: along the centreline of concrete encased ductbank run.

This item includes: supply, installation of concrete encased ductbanks complete with fibre reinforced cast-in-place concrete, grounding, marker tape, wiring, and cables in the applicable arrangement as shown on the Project Drawings.

4. Primary Riser Pole Base

Unit of Measurement: Each (Ea)

This item includes: supply and install of primary riser pole base complete with stub up, conduit, cable protection, accessories, terminations, grounding, and interior wiring as indicated on the Project Drawings. This item also includes a cast-in-place concrete base complete with reinforcement and formwork. Concrete quality testing will carried by the Owner third party testing agency.

5. Secondary Riser Pole Base

.1 With Concrete

Unit of Measurement: Each (Ea)

This item includes: supply and install of secondary riser pole base complete with cast-in-place concrete, grounding, conduit, protection, and accessories as indicated on the Project Drawings.

.2 Without Concrete

Unit of Measurement: Each (Ea)

This item includes: supply and install of secondary riser pole base complete with conduit, grounding, protection, and accessories, and as indicated on the Project Drawings.

6. EV Charging Station Pedestal

Unit of Measurement: Each (Ea)

This item includes: supply and installation of EV charging pedestal complete with reinforced cast-in place concrete base, formwork, anchor bolts, conduit within 1m of base, and coordination with the EV charge station provider. Charging units will be provided and installed by Owner. Conduits to the pedestal, paid under corresponding pay item.

7. Pad Mounted Transformers

.1 Single-Phase 75kVA

Unit of Measurement: Each (Ea)

This item includes: supply and install of single or three phase pad mounted transformers as indicated, complete with reinforced cast-in-place or precast concrete pad, arresters, grounding, connectors, and terminations as indicated on the Project Drawings.

.2 Single-Phase 167kVA

Unit of Measurement: Each (Ea)

This item includes: supply and install of single or three phase pad mounted transformers as indicated, complete with reinforced cast-in-place or precast concrete pad, arresters, grounding, connectors, and terminations as indicated on the Project Drawings.

.3 Single-Phase 100kVA

Unit of Measurement: Each (Ea)

This item includes: supply and install of single or three phase pad mounted transformers as indicated, complete with reinforced cast-in-place or precast concrete pad, arresters, grounding, connectors, and terminations as indicated on the Project Drawings.

.4 Three-Phase 45kVA

Unit of Measurement: Each (Ea)

This item includes: supply and install of single or three phase pad mounted transformers as indicated, complete with reinforced cast-in-place or precast concrete pad, arresters, grounding, connectors, and terminations as indicated on the Project Drawings.

8. Pull Pits

Unit of Measurement: Each (Ea)

This item includes: supply and install of traffic rated precast pull pit complete with cover, collar, conduit, grounding, and pulling irons as indicated on the Project Drawings.

9. Sectionalizing Cabinets

Unit of Measurement: Each (Ea)

This item includes: supply and install of three-phase medium-voltage sectionalizing cabinet, complete with grounding, arresters, connectors and terminations, conduit stubs, junctions, and caps as indicated on the Project Drawings.

10. Bollards

Unit of Measurement: Each (Ea)

This item includes: supply and install of bollards complete with safety yellow painting as indicated on the Project Drawings.

11. URD Box

Unit of Measurement: Each (Ea)

This item includes: supply and install of above-grade URD Box, complete with grounding, junctions, connectors and terminations, wiring, and conduit stubs, and secondary terminals as applicable, as indicated on the Project Drawings.

12. Park Area Distribution

Unit of Measurement: Lump Sum (LS)

This item includes: supply and install of all park area distribution infrastructure as indicated on the Project Drawings, including service centre, food truck power pedestal, park power pedestal for other loads, wiring, grounding, as shown on the Project Drawings. This item does not include transformer, URD, EV charger stations, or Street lighting conduit, which will be paid for under other items separately herein.

12. Allowances

.1 Power Utility

Unit of Measurement: Lump Sum (LS)

This item includes: all charges associated with coordinating work with local utility providers including but not limited to Bell, Eastlink, NS Power, and Eastward Energy. Allowances will be paid in accordance with Part 4 of the General Conditions.

.2 Coastal Planting

Unit of Measurement: Lump Sum (LS)

This item includes: Coastal Action Centre will supply, plant, and maintain coastal plants. Allowances will be paid in accordance with Part 4 of the General Conditions. This item will cover all planting starting at top of slope and ending at high watermark. Topsoil and sod at top of bank covered under corresponding pay item.

13. Coastal

1. Tree Planting

.1 Eastern White Pine

Unit of Measurement: Each (Ea)

This item includes: supply, placement, and maintenance of trees complete with planting mixture, lime, fertilizer, tree supports, and all required accessories.

.2 Northern Red Oak

Unit of Measurement: Each (Ea)

This item includes: supply, placement, and maintenance of trees complete with planting mixture, lime, fertilizer, tree supports, and all required accessories.

.3 Paper Birch

Unit of Measurement: Each (Ea)

This item includes: supply, placement, and maintenance of trees complete with planting mixture, lime, fertilizer, tree supports, and all required accessories.

.4 White Ash

Unit of Measurement: Each (Ea)

This item includes: supply, placement, and maintenance of trees complete with planting mixture, lime, fertilizer, tree supports, and all required accessories.

2. Gravels and Stone

.1 Coarse Sand

Unit of Measurement: square metres (m^2)

Method of Measurement: slope measure of indicated area.

This item includes: supply and placement of sand to the lines and elevations indicated.

.2 Surge Rock

Unit of Measurement: tonne (T)

Method of Measurement: weigh scale tickets approved by the Consultant

This item includes: supply, placement, and proof rolling of surge rock to the lines and elevations indicated.

.3 Armour Stone

.1 300-1000kg

Unit of Measurement: tonne (T)

Method of Measurement: weigh scale tickets approved by the Consultant

This item includes: supply and placement of armour stone to the lines and elevations indicated.

.2 500-1500kg

Unit of Measurement: tonne (T)

Method of Measurement: weigh scale tickets approved by the Consultant

This item includes: supply and placement of armour stone to the lines and elevations indicated.

.4 R2 Rip Rap

Unit of Measurement: tonne (T)

Method of Measurement: weigh scale tickets approved by the Consultant

This item includes: supply and placement of rip rap to the lines and elevations indicated.

.5 Filter Stone

Unit of Measurement: tonne (T)

Method of Measurement: weigh scale tickets approved by the Consultant

This item includes: supply and placement of R2 rip rap to the lines and elevations indicated.

.6 Type 2 Gravel

Unit of Measurement: cubic metres (m^3)

Method of Measurement: slope measure of indicated area at mean depth.

This item includes: supply, placement, compaction, and testing of gravel to the thickness indicated on the Project Drawings.

.7 Clearstone

Unit of Measurement: cubic metres (m^3)

Method of Measurement: slope measure of indicated area at mean depth.

This item includes: supply, placement, and proof rolling of clearstone.

3. Nonwoven Geotextiles

Unit of Measurement: Lump Sum (LS)

This item includes: supply and placement of nonwoven geotextile indicated on the Project Drawings.

4. Erosion Blanket

Unit of Measurement: Lump Sum (LS)

This item includes: supply, placement and protection of erosion blanket where indicated on the Project Drawings.

5. Growing Medium

Unit of Measurement: Tonne (T)

This item includes: supply and placement of topsoil, coarse sand and organics for area above +1.0m while high tide is +0.7m and as indicated on the Project Drawings.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITION

.1 In this Section “Substitution” means a Product, a manufacturer, or both, not originally specified in Contract Documents by proprietary name but proposed for use by Contractor in place of a Product, a manufacturer, or both, specified by proprietary name.

1.2 EQUIVALENTS AND ALTERNATES

.1 Where any particular brand of manufactured article is described or specified, it is to be regraded as a standard of acceptance but another brand of equivalent quality and function may be accepted at the discretion of the Consultant.

.2 When the Owner is prepared to permit the use of a non-equivalent brand of manufactured article as an alternative to any specified brand of manufactured article, it may be used at the discretion of the Consultant but only after price adjustments have been negotiated and approved by the Consultant. No extra fees will be charged for approved equivalents.

.3 If the suggested alternative requires modifications, adjustments or additions to the specified Works, submit to the Consultant, drawings and specifications for these modifications, adjustments or additions in the same detail as presented in the Contract. Approval in principle by the Consultant of these modifications, adjustments or additions in no way relieves the Contractor of obligations or liabilities under the Contract to provide for finished piece of Work complete and operational in all essentials.

.4 No change or substitution can be made without the written consent of the Consultant.

.5 The Consultant will record the time required to evaluate equivalents and alternates proposed by the Contractor including making changes to the Contract Documents occasioned thereby. Whether or not the Consultant accepts a proposed substitute, reimburse the Owner for the charges of the Consultant for evaluating any proposed substitute.

1.3 SUSTITUTION PROCEDURES – TENDER PHASE

.1 No request for change will be made during

1.4 SUBSTITUTION PROCEDURES – CONSTRUCTION PHASE

.1 Contractor may propose a Substitution wherever a Product or manufacturer is specified by proprietary name(s), unless there is accompanying language indicating that Substitutions will not be considered.

.2 Contractor may propose a Substitution wherever a Product or manufacturer is specified by proprietary name(s) and accompanied by language such as "or equal", "or approved equal", or other similar words. Do not construe such language as an invitation to unilaterally provide a Substitution without Consultant’s prior acceptance in writing. Do not order or install any Substitution without a Supplemental Instruction, Change Order, or an approved shop drawing that clearly indicates the product shown is a substitution from one that was specified in the Project Documents.

.3 Provided a proposed Substitution submission includes all of the information specified in this Section under Submission Requirements For Proposed Substitutions, Consultant will promptly review and accept or reject the proposed Substitution.

.4 Consultant may accept a Substitution if satisfied that:

.1 the proposed substitute Product is the same type as, is capable of performing the same functions as, interfaces with adjacent Work the same as, and meets or exceeds the standard of quality, performance and, if applicable, appearance and maintenance considerations, of the specified Product, the proposed substitute manufacturer has capabilities comparable to the specified manufacturer, and the Substitution provides a benefit to Owner.

.5 If Contractor fails to order a specified Product or order a Product by a specified manufacturer in adequate time to meet Contractor's construction schedule, Consultant will not consider that a valid reason to accept a Substitution.

.6 If Consultant accepts a Substitution and subject to Owner's agreement, the change in the Work will be documented in the form of either a Supplemental Instruction or Change Order as specified in Section 01 26 00 – Contract Modification Procedures.

.7 If a Substitution is accepted in the form of a Supplemental Instruction or Change Order, Contractor shall not revert to an originally specified Product or manufacturer without Consultant's prior written acceptance.

1.5 SUBMISSION REQUIREMENTS FOR PROPOSED SUBSTITUTIONS

.1 Include with each proposed Substitution the following information:

.1 Identification of the Substitution, including product name and manufacturer's name, address, telephone numbers, and website.
.2 Reason(s) for proposing the Substitution.
.3 A statement verifying that the Substitution will not affect the Contract Price and Contract Time or, if applicable, the amount and extent of a proposed increase or decrease in Contract Price and Contract Time on account of the Substitution.
.4 A statement verifying that the Substitution will not affect the performance [or warranty] of other parts of the Work.
.5 Manufacturer's Product literature for the Substitution, including material descriptions, compliance with applicable codes and reference standards, performance and test data, compatibility with contiguous materials and systems, and environmental considerations. Product samples as applicable.
.6 A summarized comparison of the physical properties and performance characteristics of the specified Product and the Substitution, with any significant variations clearly highlighted.
.7 Availability of maintenance services and sources of replacement materials and parts for the Substitution, as applicable, including associated costs and time frames.
.8 If applicable, estimated life cycle cost savings resulting from the Substitution.
.9 Details of other projects and applications where the Substitution has been used.
.10 Identification of any consequential changes in the Work to accommodate the Substitution and any consequential effects on the performance of the Work as a whole. A later claim for an increase to the Contract Price or Contract Time for other changes in

the Work attributable to the Substitution will not be considered.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 SCHEDULE OF LABOUR RATES

.1 Prior to the first application for payment, submit for the Consultant's review a schedule of labour rates for all trades and classifications of trades, such as journeymen, apprentices, and foremen that will be employed in the Work. Provide a breakdown of payroll burden component of labour rates.

.2 Labour rates shall reflect the salaries, wages, and benefits paid to personnel in the direct employ of the Contractor, Subcontractors, and sub-Subcontractors, stated as hourly rates, that will be used when:

.1 preparing price quotations for Change Orders, and
.2 determining the cost of Work attributable to Change Directives.

.3 Labour rates stated in the schedule of labour rates shall be consistent with rates that will actually be paid, and payroll burden costs that will actually be incurred, in the normal performance of the Work, during regular working hours. Labour rates shall not include any additional overhead and profit component.

.1 Where collective agreements apply, the labour rates shall not exceed those established by collective agreement.
.2 Obtain the Owner's written acceptance of the schedule of labour rates before submitting the first Change Order quotation.
.3 Accepted schedule of labour rates will be used solely for evaluating Change Order quotations and cost of performing Work attributable to Change Directives.

.4 The Contractor may request amendments to the accepted schedule of labour rates if changes in the labour rates that will actually be paid, or payroll burden cost that will actually be incurred, in the normal performance of the Work can be demonstrated. Obtain the Owner's written acceptance of such changes.

1.2 SCHEDULE OF EQUIPMENT RATES

.1 Equipment rates shall reflect the rates that will be used when:

.1 preparing price quotations for Change Orders, and
.2 determining the cost of Work attributable to Change Directives.

.2 Equipment rates stated in the schedule shall be consistent with local equipment rental market rates and shall not include any additional overhead and profit component.

.3 Obtain the Owner's written acceptance of the schedule of equipment rates before submitting the first Change Order quotation.

.4 Accepted schedule of equipment rates will be used solely for evaluating Change Order quotations and cost of performing Work attributable to Change Directives.

.5 The Contractor may request amendments to the accepted schedule of equipment rates if changes in local equipment rental market rates can be demonstrated. Obtain the Owner's written acceptance of such changes.

1.3 VALUATION OF CHANGES BASED ON AGREED UNIT PRICES

.1 The Consultant may, at the outset of the Contract or at any other time, request the Contractor to submit unit prices anticipated to be required in valuing changes in the Work.

.2 The Contractor shall submit such unit prices promptly upon request.

.3 The unit prices shall be valid for a specified duration.

.4 The unit prices shall exclude all fees for overhead and profit and shall be subject to the percentage fees specified in Section 00 73 00 – Supplementary General Conditions.

.5 The Consultant will evaluate the Contractor's quoted unit prices and, if accepted by the Owner in writing, the agreed unit prices shall be used to value subsequent proposed changes in the Work wherever they are applicable.

1.4 METHOD OF CONTRACT PRICE ADJUSTMENT – CHANGE ORDERS

.1 Unless otherwise agreed, the adjustment of the Contract Price on account of a proposed change in the Work shall be based on a quotation for a fixed price increase or decrease to the Contract Price regardless of the Contractor's actual expenditures and savings.

1.5 CHANGE ORDER PROCEDURES

.1 Upon issuance by the Consultant to the Contractor of a proposed change in the Work, and unless otherwise requested in the proposed change or unless otherwise agreed:

- .1 Submit to the Consultant a fixed price quotation for the proposed change in the Work within 5 days after receipt of the proposed change in the Work.
- .2 If requested in the proposed change, provide a detailed breakdown of the price quotation including the following to the extent applicable, with appropriate supporting documentation:
  - .1 Estimated labour costs, including hours and applicable hourly rates based on the accepted schedule of labour rates.
  - .2 Estimated Product costs, including Supplier quotations, estimated quantities and unit prices.
  - .3 Estimated Construction Equipment costs.
  - .4 Enumeration of all other estimated costs included in the price quotation.
  - .5 Estimated credit amounts for labour and Products not required on account of the proposed change.
  - .6 Fees not exceeding the percentages for overhead and profit as specified in Section 00 73 00 - Supplementary General Conditions.
  - .7 Where applicable, Subcontractor quotations, also including a detailed breakdown of all of the above.

.2 Include in the quotation the increase or decrease to the Contract Time, if any, for the proposed change, stated in number of days.

.3 Include in the quotation the number of days for which the quotation is valid.

.4 The quotation will be evaluated by the Consultant and the Owner and, if accepted by the Owner, be documented in the form of a signed Change Order.

1.6 FEES FOR OVERHEAD AND PROFIT – CHANGE ORDERS AND CHANGE DIRECTIVES

.1 Where the Contractor's price quotation for a Change Order results in a net increase to the Contract Price, the Contractor's entitlement to a fee for overhead and profit in the quotation shall be as set forth in Section 00 73 00 – Supplementary General Conditions.

.2 Where a Subcontractor's price quotation for a Change Order results in a net increase to the Subcontractor's contract price, the Subcontractor's entitlement to a fee for overhead and profit in the quotation shall be as set forth in Section 00 73 00 – Supplementary General Conditions.

.3 Where the Contractor's or a Subcontractor's price quotation for a Change Order results in a net decrease in price before adjustment for fees for overhead and profit, such a price quotation shall be for the net decrease without any adjustment for fees for overhead and profit.

.4 Where a Change Directive results in net savings on account of Work not required to be performed and a net decrease in the Contractor's or Subcontractor's cost, the net savings to the Contractor or Subcontractor shall be calculated without any adjustment for fees for overhead and profit.

.5 When a Change Directive is ultimately recorded as a Change Order, there shall be no additional entitlement to fees for overhead and profit beyond those specified in this article.

1.7 CHANGE DIRECTIVE PROCEDURES

.1 If a Change Directive is issued for a change in the Work for which a proposed change was previously issued, but no Change Order has yet been signed, the Change Directive shall cancel the proposed change and any Contractor quotations related to that change in the Work.

.2 When proceeding with a change in the Work under a Change Directive, keep accurate records of daily time sheets for labour and Construction Equipment, and invoices for Product and Construction Equipment costs. Submit such records to the Consultant daily, until the Change Order superseding the Change Directive is issued.

1.8 SUPPLEMENTAL INSTRUCTIONS

.1 The Consultant may issue Supplemental Instructions to provide clarifications to the Contract Documents, provide additional information, or make minor variations in the Work not involving adjustment in the Contract Price or Contract Time.

.2 If the Contractor considers a Supplemental Instruction to require an adjustment in Contract Price or Contract Time, the Contractor shall promptly notify the Consultant and the Owner in writing and shall not proceed with any Work related to the Supplemental Instruction pending receipt of a Change Order, a Change Directive, or, in accordance with the dispute resolution provisions of the General Conditions of Contract, a Notice in Writing of a dispute and instructions to proceed.

PART 2 -PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 SCHEDULE OF VALUES

.1 Prior to the first application for payment, submit for Consultant's review an initial schedule of values. Modify the initial schedule of values if and as requested by the Consultant. Obtain Consultant's written acceptance of the initial schedule of values prior to the first application for payment.

.2 Together with the first and all subsequent applications for payment, submit updated versions of the schedule of values to indicate the values, to the date of application for payment, of Work performed and Products delivered to Place of the Work.

.3 Provide the schedule of values in an electronic spreadsheet format that provides for inclusion of the following information:

.1 Identifying information including title and location of the Work, name of Contractor, number and date of application for payment, and period covered by the application for payment.

.4 A Work breakdown structure that is sufficiently detailed and comprehensive to facilitate Consultant's evaluation of applications for payment at an appropriate level of detail.

.5 Provisions for approved Change Orders and allowances so that the breakdown amounts indicated in the schedule of values aggregate to the current total Contract Price. Also provide for indicating the estimated value of Change Directives within the schedule of values, separately from the current total Contract Price.

.6 For each item in the Work breakdown structure, provide as a minimum the following information, under headings as indicated:

.1 Breakdown Amount: A dollar amount, including an appropriate pro rata portion of Contactor's overhead and profit.
.2 Performed to Date: The value of Work performed and Products delivered to Place of the Work up to the date of the application for payment, stated as a percentage of the Contract Price and in dollars.
.3 Previously Performed: The value of Work performed and Products delivered to the Place of the Work for which payment has been previously certified, stated in dollars.
.4 Current Period: The value of Work performed and Products delivered to Place of the Work for which Contractor is currently applying for payment, stated in dollars.
.5 Balance to Complete: The value of Work not yet performed and Products not yet delivered to Place of the Work, stated in dollars.

1.2 WORKERS' COMPENSATION CLEARANCE

.1 Submit proof of workers' compensation clearance with each application for payment.

1.3 STATUTORY DECLARATIONS

.1 Submit a statutory declaration in the form of CCDC 9A – Statutory Declaration of Progress Payment Distribution by Contractor with each application for payment except the first.

1.4 PAYMENT FOR PRODUCTS STORED OFF SITE

.1 Owner may, due to extraordinary circumstances and at Owner's sole discretion, make payments for Products delivered to and stored at a location other than Place of the Work, subject to:

.1 a request submitted by Contractor in writing, with appropriate justification, and
.2 whatever conditions Owner or Consultant may establish for such payments, as required to protect Owner's interests.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION START-UP MEETING

.1 Within the notice of intent to award the Consultant will establish the time and location of a construction start-up meeting to review and discuss administrative procedures and responsibilities. Where possible, the Consultant will notify Contractor at least five (5) Working Days before the meeting.

.1 Senior representatives of Owner, Consultant, subconsultants, and Contractor, including Contractor's project manager and site superintendent, and major Subcontractors, shall be in attendance.

.2 Confirm attendance of the parties associated with the Contractor's forces listed above. The Consultant will chair the preconstruction meeting. The Contractor will be responsible for all subsequent construction progress meeting as stipulated in subsection 1.2 herein and record and distribute the minutes.

.3 Agenda to include the following as applicable:

.1 Appointment of official representatives of Owner, Contractor, Subcontractors, Consultant, and subconsultants.
.2 Project communications.
.3 Contract Documents for construction purposes.
.4 Documents at the site.
.5 Contractor's use of premises.
.6 Owner-supplied Products.
.7 Work restrictions.
.8 Cash allowances.
.9 Substitution procedures.
.10 Contract modification procedures.
.11 Payment procedures.
.12 Construction progress meetings.
.13 Construction progress schedule, including long lead time items.
.14 Submittals schedule and procedures.
.15 Special procedures.
.16 Quality requirements, including testing and inspection procedures.
.17 Contractor's mobilization.
.18 Temporary utilities.
.19 Existing utility services.
.20 Construction facilities.
.21 Temporary barriers and enclosures.
.22 Temporary controls.
.23 Permitting
.24 Field engineering and layout of Work.
.25 Site safety.
.26 Cleaning and waste management.
.27 Closeout procedures and submittals.
.28 Commissioning.

.29 Other items.

1.2 CONSTRUCTION PROGRESS MEETINGS

.1 Schedule regular weekly construction progress meetings for the duration of the Work. Prepare meeting agendas, chair the meetings, and record and distribute the minutes.

.2 Arrange for and provide physical space for meetings.

.3 Record in the meeting minutes significant decisions and identify action items and action dates by attendees or the parties they represent.

.4 Distribute copies of minutes within two (2) Working Days after each meeting to meeting attendees and any affected parties who may not be in attendance.

.5 Arrange for the attendance of Subcontractors as and when appropriate to the progress of the Work.

.6 Agenda for each meeting shall include the following, as a minimum:

.1 Approval of minutes of previous meeting.
.2 Work progress since previous meeting.
.3 Field observations, including any problems, difficulties, or concerns.
.4 Construction progress schedule.
.5 Submittals schedule.
.6 Proposed changes in the Work.
.7 Requests for information.
.8 Site safety issues.
.9 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 This Section specifies Contractor's responsibilities for preparation and submission of schedules and other documentation related to tracking construction progress.

.2 The purpose of submitting progress schedules is to:

.1 Inform Owner and Consultant of actual progress versus planned progress, and
.2 Provide assurance that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

1.2 CONSTRUCTION PROGRESS SCHEDULE

.1 Format and Content:

.1 Provide an updated schedule with each progress claim. Claims will not be certified until an updated progress schedule showing current progress in the form of percent complete is submitted and accepted by the Consultant.
.2 Provide a Work breakdown structure identifying key activities, Work packages, and major milestones, including long delivery Products, inspection and testing activities, and similar items, at a sufficient level of detail to effectively manage construction progress.
.3 Indicate milestone dates for Ready-for-Takeover and Substantial Performance of the Work
.4 Consultant will review format and content of initial schedule and request necessary changes, if any, within five (5) Working Days after receipt.
.5 Provide an updated schedule with each progress claim. Claims will not be certified until an updated progress schedule showing current progress in the form of percent complete is submitted and accepted by the Consultant.

.2 If changes are required, resubmit finalized initial schedule within five (5) Working Days after return of review copy.

.3 Submit updated progress schedule indicating actual and projected start and finish dates with report date line and progress, activity relationships, critical path, float, and baseline comparison to current progress.

1.3 SUBMITTALS SCHEDULE

.1 Format and Content:

.1 Prepare schedule identifying all required Shop Drawing, Product data, and sample submissions, including samples required for testing and including those for pre-purchased or pre-selected Products as applicable.
.2 Prepare schedule in electronic format.
.3 Provide a separate line for each required submittal, organized by Specifications section names and numbers, and further broken down by individual Products and systems as required.
.4 For each required submittal, show planned earliest date for initial submittal as well as the latest date for the return of the submittal without impeding construction progress.

.2 Submission:

.1 Submit initial schedule to Consultant within ten (10) Working Days after Contract award.
.2 Consultant will review format and content of initial schedule and request necessary changes, if any, within five (5) Working Days after receipt.
.3 If changes are required, resubmit finalized schedule within five (5) Working Days after return of review copy. Allow time in schedule for resubmission of submittals, should resubmission be necessary.
.4 Submit updated submittals schedule monthly to Owner and Consultant.

1.4 SCHEDULE MANAGEMENT

.1 A schedule submitted as specified and accepted by Consultant becomes the baseline schedule and will be used as the baseline for updates.

.2 At each regular progress meeting, review and discuss current construction progress and submittals schedules with Consultant and Owner, including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path.

.3 Activities considered behind schedule are those with start or completion dates later than the dates shown on the baseline schedule.

1.5 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

.1 Obtain a hard copy set of construction Drawings for the purpose of creating as-built drawings. Record information and maintain as-built drawings in clean, dry and legible condition.

.2 Obtain from Consultant an electronic copy of the construction Drawings for the purpose of creating as-built drawings. Record information in electronic form, clearly identifying as-built deviations from the originally obtained construction Drawings.

.3 Clearly label each drawing as “AS-BUILT DRAWING”. Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Record actual construction including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.
.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.3 Measured locations of pipes, ducts, conduits, outlets, fixtures, access panels, and appurtenances, referenced to visible and accessible features of construction.
.4 Field changes of dimension and detail.
.5 Changes made by Change Orders and Supplemental Instructions
.6 References to Shop Drawings, where Shop Drawings show more detail.

.5 Do not use as-built drawings for construction purposes.

1.6 PROGRESS PHOTOGRAPHS

.1 Arrange for periodic digital photography to document and provide a photographic record of the progress of the Work.

.2 Provide photographs of any aspect of the Work upon request of the Consultant, made either during the progress of the Work or requested in advance of a part of the Work. Provide as many

photographs as deemed necessary by the Consultant to ascertain the status or condition of the Work.

.3 Identify each photograph by project name and date taken.

.4 Submission: Submit .jpg format files in standard resolution via e-mail at intervals indicated at the start up meeting or as requested by the Consultant.

.5 Do not use progress or any other Project photographs for promotional purposes without Owner's written consent.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Submit specified submittals to Consultant for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time or for Product substitutions or other deviations from the Drawings and Specifications.

.2 Where required by authorities having jurisdiction, provide submittals to such authorities for review and approval.

.3 Do not proceed with Work affected by a submittal until review is complete.

.4 Present Shop Drawings, Product data, and samples in SI metric units. Where items or information is not produced in SI Metric units, converted values are acceptable.

.5 Review submittals, provide verified field measurements where applicable, and affix Contractor's review stamp prior to submission to Consultant. Contractor's review stamp represents that necessary requirements have been determined and verified, and that the submittal has been checked and coordinated with requirements of the Work and Contract Documents.

.6 Verify field measurements and that affected adjacent Work is coordinated.

.7 Submittals not meeting specified requirements will be returned with comments.

.8 Reproduction of construction Drawings to serve as background for Shop Drawings is not permitted.

.9 Do not propose Substitutions or deviations from Contract Documents via Shop Drawing, Product data and sample submittals.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop detail or working drawings and manufacturer's data for all items requiring fabrication, on or off the site, and for all proprietary equipment to the Consultant for review before any such items or equipment are incorporated into the Works. This review of Shop Drawings by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approves the detailed design inherent in the Shop Drawings, the responsibility for which remains with the Contractor submitting them, and such review shall not relieve the Contractor of responsibility for errors or omissions in Shop Drawings or of responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the jobsite, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the Work of all sub-trades.

.2 Indicate Products, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work.

.1 Where Products attach or connect to other Products, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to Drawings, Specifications and other already reviewed Shop Drawings.

.2 Accompany submittals with a transmittal information including:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification of each submittal item and quantity.
- .5 Other pertinent data.

.3 Shop Drawing submittals to include the following as a minimum:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.

.4 Contractor's stamp, date, and signature of Contractor's authorized representative responsible for Shop Drawing review, indicating that each Shop Drawing has been reviewed for compliance with Contract Documents and, where applicable, that field measurements have been verified.

.5 Details of appropriate portions of the Work as applicable:
- .1 Fabrication.
- .2 Layout, showing dimensions, including identified field dimensions, and clearances.
- .3 Setting or erection details.
- .4 Capacities.
- .5 Performance characteristics.
- .6 Standards.
- .7 Operating weight.
- .8 Wiring diagrams.
- .9 Single line and schematic diagrams.
- .10 Relationships to other parts of the Work.

.6 Product data submittals shall include safety data sheets (SDS) for all controlled Products.

.3 Submit one (1) electronic file in pdf file format of all relevant shop drawings to the Consultant. Limit file sizes to 10Mb. Scans must be legible. Illegible pdf files will be returned unreviewed and must be resubmitted so they are legible. For larger projects with multiple shop drawing submissions an FTP site can be set up used upon request to the Consultant for shop drawing submittals if required.

.4 Submit electronic copy of Product data sheets or brochures where specified in the technical Specifications and in accordance with the format restrictions set forth in 1.2.6 above.

.5 Where a submittal includes information not applicable to the Work, clearly identify applicable information and strike out non-applicable information.

.6 The Consultant will not review shop drawings and other material involving a large amount of Work in those instances where it is evident that the Contractor has not used all the information contained in, or where such details are obviously not consistent with the Contract Documents.

.7 Supplement standard information to include details applicable to Project.

.8 Allow five (5) Working Days for Consultant's review of each submittal and incorporate in submittals schedule specified in Section 01 32 00 – Construction Progress Documentation. Allow additional five (5) Working Days where sub-Consultant or commissioning agent review is required.

.9 If upon Consultant’s review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of Work may proceed.

.10 If upon Consultant’s review significant errors or omissions are discovered, a so noted copy will be returned for correction and resubmission. Do not commence fabrication or installation.

.11 Consultant’s notations on submittals are intended to ensure compliance with Contract Documents and are not intended to constitute a change in the Work requiring change to the Contract Price or Contract Time. If Contractor considers any Consultant’s notation to be a change in the Work, promptly notify Consultant in writing before proceeding with the Work.

.12 Resubmit corrected submittals through same procedure indicated above before any fabrication or installation of the Work proceeds. When resubmitting, notify Consultant in writing of any revisions other than those requested by the Consultant.

.13 The Consultant will provide a shop drawing list with ID’s. Shop drawings are to have an ID written on them.

1.3 SAMPLES

.1 Submit samples for Consultant’s review in the number specified in the technical Specifications. Label samples as to origin, Project name, and intended use.

.2 Deliver samples prepaid to Consultant's business address.

.3 Notify Consultant in writing of any deviations in samples from requirements of Contract Documents.

.4 Where a required colour, pattern or texture has not been specified, submit full range of available Products meeting other specified requirements.

.5 Consultant selection from samples is not intended to change the Contract Price or Contract Time. If a selection would affect the Contract Price or Contract Time, notify Consultant in writing prior to proceeding with the Work.

.6 Resubmit samples as required by the Consultant to comply with Contract Documents.

.7 Reviewed and accepted samples will establish the standard against which installed Work will be reviewed.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 -EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures.

1.2 REFERENCE STANDARDS

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

.2 Province of Nova Scotia

.1 Occupational Health and Safety Act, S.N.S. - Updated 2013.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit one (1) copy of Contractor's authorized representative's work site health and safety inspection reports Consultant and/or authority having jurisdiction, weekly.

.3 Submit copies of reports or directions issued by Federal and/or Provincial health and safety inspectors.

.4 Submit copies of incident and accident reports.

.5 Submit WHMIS Safety Data Sheets (SDS) in accordance with Section 01 33 00 – Submittal Procedures.

.6 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to the Consultant.

.7 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

.1 File notice of project with Provincial authorities prior to beginning of work.

.2 Install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.5 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

.1 Schedule and administer health and safety meeting with the Consultant prior to commencement of work.

1.7 REGULATORY REQUIREMENTS

.1 Do work in accordance with Section 01 41 00 - Regulatory Requirements.

1.8 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act, Occupational Safety General Regulations,.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORESEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of work, follow procedures in place for employee's right to refuse work in accordance with acts and regulations of Province having jurisdiction and advise Consultant verbally and in writing.

.2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise the Consultant and the Health and Safety coordinator defined below and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Consultant verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to work, competent and authorized representative as health and safety co-ordinator. Health and safety co-ordinator must:

- .1 Have site-related working experience specific to activities associated with Work similar to the Work being carried out in this project.
- .2 Have working knowledge of occupational safety and health regulations.
- .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
- .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .5 Be on site during execution of Work and report directly to and be under direction of the site supervisor.

1.12 POSTING OF DOCUMENTS

.1 Post applicable items, articles, notices and orders in conspicuous location on site in accordance with acts and regulations of Province having jurisdiction, and in consultation with Consultant.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.

.2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by the Consultant.

.2 Do blasting operations in accordance with Section 31 23 16.26 - Rock Removal.

1.15 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from the Consultant.

1.16 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for work.

1.17 HAZARDOUS MATERIAL

.1 Should material resembling hazardous materials other than those identified within the Contract Documents, including, but not limited to, spray or trowel applied asbestos, be encountered in course of work; stop work immediately. Do not proceed until written instructions have been received from the Consultant.

.2 Where work entails use, storage, or disposal of toxic or hazardous materials, chemicals and or explosives, or otherwise creates a hazard to life, safety, health, or the environment; work shall be in accordance with the Jurisdictional Authority.

1.18 CONFINED SPACES

.1 Carry out Work in confined spaces in compliance with the Provincial occupational Health and Safety Regulations (OH&S), - Occupational Safety General Regulations, Confined Space Entry provisions.

.2 Provide approved air monitoring equipment where workers are working in confined spaces and ensure any test equipment to be used is calibrated, in good working order and used by trained persons.

.3 Develop a confined space entry program specific to the nature of Work performed and in accordance with OH&S Act and Regulations and confirm supervisors and workers are trained in the confined space entry program.

.4 Confirm personal protective equipment and emergency rescue equipment are appropriate to the nature of the work being performed is provided and used.

.5 Provide and maintain training of workers, as required by the Federal and Provincial Legislation.

.6 Provide Consultant with a copy of an “Entry Permit” for each entry into the confined space to ensure compliance with Federal and Provincial Legislation.

1.19 FIRST AID

.1 During the progress of the Works, provide and maintain at all times and in easily accessible positions on the Works adequate first aid kits equal to those required by the Worker’s Compensation Act for the free use as necessary of all persons on the Site.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 -EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 "Reference standards" means consensus standards, trade association standards, guides, and other publications expressly referenced in Contract Documents.

.2 Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing. However, if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version applies.

.3 Reference standards establish minimum requirements. If Contract Documents call for requirements that differ from a referenced standard, the more stringent requirements governs.

.4 If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to the Consultant for clarification.

1.2 TESTING

.1 Owner will appoint and pay for services of testing laboratory including:

.1 Inspection and testing required by laws, ordinances, rules and regulations.
.2 Testing, adjustment and balancing of process, mechanical and electrical equipment systems.
.3 Compaction testing
.4 Concrete quality testing.
.5 Any other test specified as performed by the Owner's third party testing agency in the technical sections herein.

.2 Contractor to arrange and pay for the following tests:

.1 Tests specified to be performed by Contractor.
.2 Inspection and testing performed exclusively for convenience of Contractor.
.3 Testing to ensure a safe Work environment for employees or subcontractors employed by the Contractor.

.3 Provide such assistance, labour and materials as are normally required for examining, measuring and testing the quality, weight or quantity, pay all costs of any material used, and supply samples of materials before incorporation in the Works for testing as may be selected and as specified herein.

.4 Perform or arrange for the performance of all tests on all equipment in complete accordance with the relevant clauses of these Specifications and in the presence of the Consultant.

.5 The cost of providing assistance, samples, etc., for testing and of performing or arranging tests shall be deemed to be covered by and included in the Contract Price unless noted otherwise, elsewhere in these Specifications.

.6 The Contractor shall have no claim against the Owner or the Consultant in respect of any financial loss which may be suffered from the rejection of any materials or equipment due to their failure to meet specified test requirements, and the Contractor shall also bear the cost of

remedying any defects such that the material or equipment will meet the specified tests, or failing this, of removing the material or equipment from the Site. The decision to repair or replace materials and equipment which have failed to meet test requirements will be made by the Consultant.

.7 Employment of inspection and testing agencies by Contractor or Owner does not relieve Contractor from responsibility to perform the Work in accordance with Contract Documents.

.8 Allow and arrange for inspection and testing agencies to have access to the Work, including access to off-site manufacturing and fabrication plants.

.9 For inspection and testing required by Contract Documents or by authorities having jurisdiction, provide Consultant and inspection and testing agencies with timely notification in advance of required inspection and testing.

.10 Submit test samples required for testing in accordance with submittals schedule specified in Section 01 32 00 – Construction Progress Documentation and in accordance with Section 01 33 00 – Submittal Procedures.

.11 Provide labour, Construction Equipment and temporary facilities to obtain and handle test samples on site.

1.3 INSPECTION AND TESTING AGENCY REPORTS

.1 For inspection and testing required by contract documents or by regulatory requirements, and performed by Contractor retained inspection and testing agencies, submit to Consultant and Owner copies of reports. Submit within five (5) days after completion of inspection and testing.

.2 For inspection and testing performed by Owner retained inspection and testing agencies, copies of inspection and testing agency reports will be provided to Contractor.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 TEMPORARY UTILITIES – GENERAL

.1 Provide temporary utilities as specified and as otherwise necessary to perform the Work expeditiously.

.2 Remove temporary utilities after use.

1.2 TEMPORARY WATER SUPPLY

.1 Arrange and pay for a temporary supply of water required during construction.

.2 Arrange and pay for necessary water supply connections and disconnections.

1.3 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating and ventilation required during construction.

.2 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.

.3 Provide temporary heat for the Work as required to:

- .1 Facilitate progress of Work.
- .2 Protect the Work against dampness and cold.
- .3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored Products.
- .4 Maintain specified minimum ambient temperatures and humidity levels for storage, installation and curing of Products.
- .5 After building is enclosed, maintain interior temperature of minimum 10 degrees C.

.4 Provide temporary ventilation for the Work as required to:

- .1 Prevent accumulations of fumes, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe Work environment meeting applicable regulatory requirements.
- .2 Ensure that hazardous, noxious, or volatile substances do not migrate to Owner occupied spaces.
- .3 Ventilate temporary sanitary facilities.

1.4 TEMPORARY ELECTRICAL POWER AND LIGHTING

.1 Arrange and pay for temporary power and lighting required during construction.

.2 Arrange and pay for necessary connections and disconnections of temporary power and lighting in accordance with regulatory requirements.

.3 Protect persons from injury and avoid property damage by providing barricades, construction signs, torches, flashers, and guards as required during the progress of the construction Work. Enclosed material piles, equipment, plant or construction equipment which may serve as obstructions by fences or barricades and protect with proper lights when the visibility is poor.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 CONTRUCTION FACILITIES – GENERAL

.1 Provide temporary construction facilities as necessary for performance of the Work and in compliance with applicable regulatory requirements.

.2 Maintain temporary construction facilities in good condition for the duration of the Work.

.3 Remove temporary construction facilities from Place of the Work when no longer required.

1.2 TRAFFIC CONTROL

.1 Provide traffic control in accordance with Temporary Workplace Traffic Control Manual, latest edition, as issued by the Nova Scotia Department of Public Works (NSPW). Submit a traffic control plan and pedestrian management plans for review by the Owner and the Consultant prior to the commnecement of Work on Site.

.2 A traffic control plan and pedestrian management plan that does not include all of the required elements listed below will be found incomplete, and returned for revision and re-submittal. A full closure of streets will not be permitted unless approved in advance by the Owner.

.3 Traffic control plan to indicate construction methods allowing work within rights-of-way to be completed efficiently and effectively, while maintaining a safe and organized movement of vehicles and pedestrians around and through temporary workplaces and, as well, to protect workers from errant vehicles. Traffic control plans to include details for controlling traffic at any signalized intersections and proposed lengths and estimated duration of each diversion. Traffic control plans to also indicate how vehicular access will be maintained for residents of the affected streets during construction.

.4 Pedestrian management plan to indicate construction methods allowing work within rights-of-way to be completed efficiently and effectively, while maintaining a safe and organized movement of pedestrians around and through temporary workplaces and, as well, to protect and pedestrians from errant vehicles. Where sidewalks require to be closed submit a temporary sidewalk closure plan to the Consultant and Owner for approval.

.5 Prior to construction, survey all pavement markings within the project limits and submit a survey plan of existing markings to the Consultant for review. Reinstate affected pavement markings as per the submitted plan or as per any modifications to the plan required by the Consultant or Owner.

.6 Maintain one lane of traffic at all times on all affected streets.

.7 Maintain access to all adjacent properties.

.8 Local access to properties must be maintained for residents and emergency responders.

1.3 CONSTRUCTION PARKING

.1 Limited parking will be permitted at Place of the Work at locations indicated by the Owner provided it does not disrupt the flow of traffic or Work onsite.

1.4 VEHICULAR ACCESS

.1 Provide and maintain adequate access to Place of the Work.

.2 Build and maintain temporary access roads as required or where indicated on Drawings.

.3 Existing roads at Place of the Work may be used for access to Place of the Work, provided Contractor assumes responsibility for any damage caused by construction traffic, and prevents or promptly cleans up any mud tracking or material spillage.

1.5 SITE OFFICES

.1 If a site office is required, provide at no additional cost.

1.6 SANITARY FACILITIES

.1 Provide sanitary facilities for workers.

.2 Keep sanitary facilities clean and fully stocked with the necessary supplies.

1.7 FIRE PROTECTION

.1 Provide and maintain temporary fire protection systems and equipment during construction.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 BARRIERS AND ENCLOSURES – GENERAL

.1 Provide temporary barriers and enclosures necessary to protect the public and to secure Place of the Work during performance of the Work.

.2 Comply with applicable regulatory requirements.

.3 Maintain temporary barriers and enclosures in good condition for the duration of the Work.

.4 Remove temporary barriers and enclosures from Place of the Work when no longer required.

1.2 FENCING

.1 Erect temporary security and safety site fencing where directed by the Consultant of type and height agreed to by the Consultant and Contractor. Fencing is subject to applicable regulatory requirements. Maintain site fencing in good repair until removed.

.2 Provide lockable access gates as required to facilitate construction access.

1.3 EXTERIOR HOARDING

.1 Erect temporary exterior site hoarding where directed by the Owner that complies with applicable regulatory requirements and as follows:

.1 Use lumber framing and, minimum 13 mm thick exterior grade plywood.
.2 Paint public side of hoarding in colour selected by Consultant with one coat primer and one coat exterior paint. Maintain public side of hoarding clean and in good repair until removed.
.3 Provide lockable access gates for Construction Equipment and lockable pedestrian doors as required to facilitate construction access.
.4 Erect and maintain pedestrian walkways including roof and side covers, complete with pedestrian signage and electrical lighting.

1.4 WEATHER ENCLOSURES

.1 Provide weather tight enclosures to unfinished door and window openings as well as any other openings in floors and roofs.

.1 Provide weather enclosures to protect floor areas where walls are not finished and to enclose Work areas that require temporary heating.
.2 Design weather enclosures to withstand wind pressure and snow loading requirements.

1.5 TEMPORARY ENCLOSURES AND DUST CONTROL

.1 Provide enclosures to localize silica dust generating activities, and for protection of workers, finished areas of Work and public as indicated on the phasing plan drawings.

.1 Erect, maintain, and relocate paritions and screens as required to facilitate construction operations .
.2 Cutting, breaking or pulverizing of concrete products may result in exposure to airborne silica. Appropriate hygiene and personal protection of workers must be developed and

employed as per the applicable Occupational Health and Safety Act with respect to airborne concentrations. Refer to the Ontario Ministry of Labour, Training and Skills Development Health and Safety Guidelines for Silica On Construction Projects for additional procedures.

.3 The size and locations of temporary enclosures shown on the plans are approximate. Adjust size and locations to accommodate repairs but maintain suitable drive aisles during the Work.

.4 Take special care to mitigate dust from migrating to areas outside the enclosed Work areas and the Site. The Consultant reserves the right to stop Work if it is found that areas outside the Site are being subjected to unacceptable dust levels.

.5 Maintain and relocate protection as required until such Work is complete.

.6 At a minimum, provide temporary construction signage indicated on the drawings. Additional signage may be required by the Consultant and/or Owner.

1.6 FIRE ROUTES

.1 Maintain fire access routes, including overhead clearances, for use by emergency response vehicles.

1.7 PROTECTION OF BUILDING FINISHES

.1 Provide necessary temporary barriers and enclosures to protect existing and completed or partially completed finished surfaces from damage during performance of the Work.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 TEMPORARY CONTROLS – GENERAL

.1 Provide temporary controls as necessary for performance of the Work and in compliance with applicable regulatory requirements.

.2 Maintain temporary controls in good condition for the duration of the Work.

.3 Remove temporary controls and Construction Equipment used to provide temporary controls from Place of the Work when no longer required.

1.2 PLANT PROTECTION

.1 Protect trees and other plant material designated to remain on site and on adjacent properties where indicated on Drawings.

.2 Protect trees and shrubs susceptible to damage during construction by encasing with protective wood framework from grade to height of one metre.

.3 For trees designated to remain, protect roots inside dripline from disturbance or damage during excavation and grading. Avoid traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

1.3 DUST AND PARTICULATE CONTROL

.1 Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.

.2 Execute Work by methods that minimize dust from construction operations and spreading of dust on site or to adjacent properties.

.3 Provide temporary enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate Work area.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Use appropriate covers on trucks hauling fine, dusty, or loose materials.

1.4 DEWATERING

.1 Provide temporary drainage and pumping as necessary to dewater excavations, trenches, foundations, and other parts of the Work. Maintain such areas free of water arising from groundwater or surface run-off, as required to keep them stable, dry, and protected from damage due to flooding.

.2 Maintain standby equipment necessary to ensure continuous operation of dewatering system.

.3 Do not pump water containing suspended materials or other harmful substances into waterways, sewers or surface drainage systems. Treat or dispose of such water in accordance with applicable regulatory requirements.

1.5 SITE DRAINAGE

.1 Maintain grades to ensure proper site drainage.

.2 Prevent surface water runoff from leaving the site.

.3 Prevent precipitation from infiltrating or from directly running off stockpiled waste materials. Cover stockpiled waste materials with an impermeable liner during periods of Work stoppage including at end of each Working Day.

.4 Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other Work areas as required to prevent erosion and sedimentation.

.5 Control surface drainage by ensuring that gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure that runoff from unfinished areas is intercepted and diverted to suitable outlets.

1.6 EROSION AND SEDIMENT CONTROL

.1 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and watercourses, and repair damage caused by soil erosion and sedimentation.

.2 Provide and maintain appropriate temporary measures such as silt fences, straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, sedimentation basins, vegetative cover, dikes, and other measures that may be required to prevent erosion and migration of silt, mud, sediment, and other debris.

.3 Do not disturb existing embankments or embankment protection.

.4 Periodically inspect erosion and sediment control measures to detect evidence of erosion and sedimentation. Promptly take corrective measures when necessary.

.5 If soil and debris from site accumulate in ditches or other low areas, remove accumulation and restore area to original condition.

1.7 POLLUTION CONTROL

.1 Take measures to prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.

.2 Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of spills or releases that may occur. Promptly report spills and releases that may occur to:

- .1 authority having jurisdiction,
- .2 person causing or having control of pollution source, if known, and
- .3 Owner and Consultant.
- .4 Contact manufacturer of pollutant, if known and applicable, to obtain safety data sheets (SDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.

.5 Take immediate action to contain and mitigate harmful effects of the spill or release.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Provide Products that are not damaged or defective, and suitable for purpose intended, subject to specified requirements. If requested by Consultant, furnish evidence as to type, source and quality of Products provided.

.2 Unless otherwise specified, maintain uniformity of manufacture for like items throughout.

1.2 MATERIALS AND WORKMANSHIP

.1 All equipment, materials and workmanship shall be the best of the respective kinds described in the Contract and in accordance with the Consultant's instructions and may be subjected to standard tests as the Consultant may direct at the place of manufacture or fabrication or on the Site.

.2 Where the Consultant has requested and before ordering materials for incorporation into the Works inform the Consultant of the source of the materials. No order for such materials will be given except with the authorization of the Consultant. Notwithstanding the fact that such authorization may have been given, the Consultant may forbid the use of any such materials, if upon delivery, they are found to be defective or unsuitable for incorporation in the Works. Keep the Consultant fully advised of the orders and delivery dates of materials.

.3 All material and equipment required to be incorporated into the Work must be new and unused. Any material found during the progress of the Work to have cracks, flaws, or other defects will be rejected by the Consultant.

.4 Replace materials and equipment found defective in manufacturer. This includes the furnishing of all materials and labour required for the replacement of installed material and equipment discovered defective prior to the final acceptance of the Works.

.5 Permanent manufacturer's markings, labels, trademarks, and nameplates on Products are not acceptable in prominent locations, except where required by regulatory requirements or for operating instructions, or when located in mechanical or electrical rooms.

1.3 PRODUCT OPTIONS

.1 Subject to the provisions of Section 01 25 00 –Substitution Procedures:

.1 Wherever a Product or manufacturer is specified by a single proprietary name, provide the named Product only.

.2 Wherever more than one Product or manufacturer is specified by proprietary name for a single application, provide any one of the named Products.

.2 Wherever a Product is specified by reference to a standard only, provide any Product that meets or exceeds the specified standard. If requested by Consultant, submit information verifying that the proposed Product meets or exceeds the specified standard.

.3 Wherever a Product is specified by descriptive or performance requirements only, provide any Product that meets or exceeds the specified requirements. If requested by Consultant, submit information verifying that the proposed Product meets or exceeds the specified requirements.

1.4 PRODUCT AVAILABILITY AND DELIVERY TIMES

.1 Promptly upon Contract award and periodically during construction, review and confirm Product availability and delivery times. Order Products in sufficient time to meet the construction progress schedule and the Contract Time.

.1 If a specified Product is no longer available, promptly notify Consultant. Consultant will take action as required.
.2 If delivery delays are foreseeable, for any reason, promptly notify Consultant.
.3 If a delivery delay is beyond Contractor’s control, Consultant will provide direction.
.4 If a delivery delay is caused by something that was or is within Contractor’s control, Contractor shall propose actions to maintain the construction progress schedule for Consultant’s review and acceptance.

1.5 STORAGE, HANDLING, AND PROTECTION

.1 Store, handle, and protect Products during transportation to Place of the Work and before, during, and after installation in a manner to prevent damage, adulteration, deterioration and soiling.

.1 Comply with manufacturer's instructions for storage, handling and protection.
.2 Store packaged or bundled Products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in Work.
.3 Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labeling and the provision of safety data sheets (SDS).
.4 Store Products subject to damage from weather in weatherproof enclosures.
.5 Store sheet Products on flat, solid, supports and keep clear of ground. Slope to shed moisture.
.6 Remove and replace damaged Products.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 SURVEYOR QUALIFICATIONS

.1 Engage a registered land surveyor, licensed to practice in Place of the Work.

1.2 SUBMITTALS

.1 Submit name and address of registered land surveyor performing survey Work.

.2 Submit to Owner and Consultant the survey of the Work prepared and issued by a registered land surveyor on completion of the building footings and foundations and as required by authorities having jurisdiction and on completion of the Work.

1.3 REFERENCE POINTS

.1 Before the Work of the Contract starts, the Consultant will only once provide the data for sufficient reference points to identify the Site on the ground. Have reference points established on-site by a licensed surveyor at no additional cost to the Contract. Maintain these, and/or re-establish points as required during the Contract period. Preserve and protect permanent reference points on site during construction.

.2 Do not change or relocate reference points without prior written notice to Consultant.

.3 Report to Consultant when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations. Require registered land surveyor to replace reference points in accordance with original survey.

1.4 SURVEY REQUIREMENTS

.1 Establish sufficient permanent benchmarks on site, referenced to established benchmarks by survey control points.

.2 Confirm that existing survey reference points are in accordance with Owner’s survey and property limits.

.3 Establish initial lines and levels for building layout.

.4 Maintain a complete, accurate log of control and survey Work as it progresses. Record locations with horizontal and vertical data in project record documents.

1.5 EXISTING UTILITIES AND STRUCTURES

.1 Before commencing excavation, drilling or other earthwork, establish or confirm location and extent of all existing underground utilities and structures in Work area.

.2 Promptly notify Consultant if underground utilities, structures, or their locations differ from those indicated in Contract Documents or in available project information. Consultant will provide appropriate direction.

.3 Record locations of maintained, re-routed and abandoned utility lines.

1.6 VERIFICATION OF EXISTING CONDITIONS

.1 Where Work specified in any Section is dependent on the Work of another Section or Sections having been properly completed, verify that Work is complete and in a condition suitable to receive the subsequent Work. Commencement of Work of a Section that is dependent on the Work of another Section or Sections having been properly completed, means acceptance of the existing conditions.

.2 Verify ambient conditions are suitable before commencing the Work of any Section and will remain suitable for as long as required for proper setting, curing, or drying of Products used.

.3 Keep substrate surfaces clean, dimensionally stable, cured, and free of contaminants.

.4 Notify Consultant in writing of unacceptable conditions.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Except where otherwise specified in technical Specifications or otherwise indicated on Drawings, comply with requirements of this Section.

1.2 INSTRUCTIONS

.1 Install, erect, or apply Products in strict accordance with manufacturer's instructions.

.2 Notify Consultant, in writing, of conflicts between Contract Documents and manufacturer's instructions where, in Contractor's opinion, conformance with Contract Documents instead of the manufacturer's instructions may be detrimental to the Work or may jeopardize the manufacturer's warranty.

.3 Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.4 Provide manufacturer's representatives with access to the Work at all times. Render assistance and facilities for such access so that manufacturer's representatives may properly perform their responsibilities.

1.3 CONCEALMENT

.1 Conceal pipes, ducts, and wiring in floors, walls and ceilings in finished areas:

.1 after review by Consultant and authority having jurisdiction, and
.2 where locations differ from those shown on Drawings, after recording actual locations on as-built drawings.

.2 Provide incidental furring or other enclosures as required.

.3 Notify Consultant in writing of interferences before installation.

1.4 FASTENINGS – GENERAL

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials.

.2 Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to avoid direct contact.

.3 Use non-corrosive fasteners and anchors for securing exterior Work and in spaces where high humidity levels are anticipated.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.

1.5 FASTENINGS – EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Bolts shall not project more than one diameter beyond nuts.

1.6 FIRE RATED ASSEMBLIES

.1 When penetrating fire rated walls, ceiling, or floor assemblies, completely seal voids with fire-stopping materials, smoke seals, or both, in full thickness of the construction element as required to maintain the integrity of the fire rated assembly.

1.7 LOCATION OF FIXTURES, OUTLETS AND DEVICES

.1 Consider location of fixtures, outlets, and devices indicated on Drawings as approximate.

.2 Locate fixtures, outlets, and devices to provide minimum interference, maximum usable space, and as required to meet safety, access, maintenance, acoustic, and regulatory, including barrier free, requirements.

.3 Promptly notify Consultant in writing of conflicting installation requirements for fixtures, outlets, and devices. If requested, indicate proposed locations and obtain approval for actual locations.

1.8 PROTECTION OF COMPLETED WORK AND WORK IN PROGRESS

.1 Adequately protect parts of the Work completed and in progress from any kind of damage.

.2 Promptly remove, replace, clean, or repair, as directed by Consultant, Work damaged as a result of inadequate protection.

.3 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the safety or integrity of the Work.

1.9 REMEDIAL WORK

.1 Notify Consultant of, and perform remedial Work required to, repair or replace defective or unacceptable Work. Ensure that properly qualified workers perform remedial Work. Coordinate adjacent affected Work as required.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not appliable.

END OF SECTION

PART 1 - GENERAL

1.1 REQUEST FOR CUTTING, PATCHING AND REMEDIAL WORK

.1 Submit written request in advance of cutting, coring, or alteration which affects or is likely to affect:

- .1 Structural integrity of any element of the Work.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or other contractors.
- .6 Warranty of Products affected.

.2 Include in request:

- .1 Identification of Project.
- .2 Location and description of affected Work, including drawings or sketches as required.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and Products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or other contractors.
- .7 Written permission of affected other contractors.
- .8 Date and time Work will be executed.

1.2 PRODUCTS

.1 Unless otherwise specified, when replacing existing or previously installed Products in the course of cutting and patching Work, use replacement Products of the same character and quality as those being replaced.

.2 If an existing or previously installed Product must be replaced with a different Product, submit request for substitution in accordance with Section 01 25 00 - Substitution Procedures.

1.3 PREPARATION

.1 Inspect existing conditions in accordance with Section 01 71 00 - Examination and Preparation.

.2 Provide supports to ensure structural integrity of surroundings; provide devices and methods to protect other portions of the Work from damage.

.3 Provide protection from elements for areas that may be exposed by uncovering Work.

1.4 EXISTING UTILITIES

.1 Known subsurface services and utilities may be indicated on the drawings or otherwise identified. Prior to carrying out any subsurface excavation, contact appliable utilities or Owner’s personnel to precisely locate buried structures or utilities on the ground. All costs to locate and identity such buried services shall be deemed to be included in the Contract Price. Test dig and carefully excavate to locate such services and utilities.

.2 When breaking into or connecting to existing services' utilities, execute the Work at times directed by local governing authorities, with a minimum of disturbance to the Work, pedestrian

and vehicular traffic, and ongoing Owner operations.

.3 Where the Work involves breaking into or connecting to existing services, give Consultant 48 hours notice for necessary interruption of mechanical or electrical services.

.4 Maintain excavations free of water.

.5 Keep duration of interruptions to a minimum.

.6 Carry out interruptions after regular working hours of occupants, preferably on weekends, unless Owner's prior written approval is obtained.

.7 Protect and maintain existing active services. Record location of services, including depth, on as-built drawings.

.8 Construct or erect barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures as required to protect pedestrian and vehicular traffic.

1.5 CUTTING, PATCHING, AND REMEDIAL WORK

.1 Bear costs of repairing damage to the Site, property of others and injuries of persons resulting from the Contractor's operation under the Contract.

.2 Immediately inform the Consultant of damage or injury to persons, property, services or materials.

.3 Coordinate and perform the Work to ensure that cutting and patching Work is kept to a minimum.

.4 Perform cutting, fitting, patching, and remedial Work to make the affected parts of the Work come together properly and complete the Work.

.5 Provide openings in non-structural elements of the Work for penetrations of mechanical and electrical Work.

.6 Perform cutting by methods to avoid damage to other Work.

.7 Provide proper surfaces to receive patching, remedial Work, and finishing.

.8 Perform cutting, patching, and remedial Work using competent and qualified specialists familiar with the Products affected, in a manner that neither damages nor endangers the Work.

.9 Do not use pneumatic or impact tools without Consultant's prior approval.

.10 Do not allow cutting, patching, and remedial Work to jeopardize manufacturers' warranties.

.11 Refinish surfaces to match adjacent finishes. For continuous surfaces refinish to nearest intersection. For an assembly, refinish entire unit.

.12 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces with suitable allowance for deflection, expansion, contraction, acoustic isolation, and firestopping.

.13 Maintain fire ratings of fire rated assemblies where cutting, patching, or remedial Work is performed. Completely seal voids or penetrations of assembly with firestopping material to full depth or with suitably rated devices.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 REGULATORY REQUIREMENTS

.1 Comply with applicable regulatory requirements when disposing of waste materials.

.2 Obtain permits from authorities having jurisdiction and pay disposal fees where required for disposal of waste materials and recyclables.

1.2 GENERAL CLEANING REQUIREMENTS

.1 Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.

.2 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.3 Prevent cross-contamination during the cleaning process.

.4 Notify the Consultant of the need for cleaning caused by Owner or other contractors.

1.3 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL - GENERAL

.1 Keep Work, property, road surfaces, etc. in vicinity of the Works and in areas where Contractor's trucks will travel in a clean and orderly condition, free from excessive dirt, dust, snow, ice, rubbish, etc. at all times during the progress of the Work.

.2 Maintain trucks so that no spillage will occur. Before leaving the Site. Trim loads and free wheels of accumulations of soil.

.3 Keep Site free from accumulations of waste material and rubbish to prevent an unsightly or hazardous condition. On the completion of the Works clear away and remove from the Site all Construction Equipment, surplus materials, rubbish and temporary Works of every kind and leave the whole of the Site and Works in a condition that meets the approval of the Consultant.

.4 Do not dispose of volatile fluid wastes (such as mineral spirits, oil, or paint thinner) in storm or sanitary sewer systems or into streams or waterways.

.5 Dispose of debris and waste materials in accordance with the latest regulations respecting Solid Waste Resource Management issued by Nova Scotia Environment, at no additional cost to the Contract.

.6 Dispose of all construction and demolition waste at an approved C&D waste disposal site.

.7 Where possible, divert construction and demolition waste to the appropriate recycling facilities. Minimize waste generated by the Work.

.8 Do not burn or bury waste materials at Place of the Work.

.9 Cover or wet down dry waste materials to prevent blowing dust and debris.

1.4 PROGRESSIVE CLEANING AND WASTE MANAGEMENT

.1 Maintain the Work in a tidy and safe condition, free from accumulation of waste materials and construction debris.

.2 Provide appropriate, clearly marked, containers for collection of waste materials and recyclables. Locate containers as directed by the Owner and/or Consultant.

.3 Remove waste materials and recyclables from Work areas, separate, and deposit in designated containers at end of each Working Day. Collect packaging materials for recycling or reuse.

.4 Remove waste materials and recyclables from Place of the Work at regular intervals in order to maintain a clean and orderly site.

.5 Clean interior building areas prior to start of finish Work and maintain free of dust and other contaminants during finishing operations.

.6 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly finished surfaces nor contaminate building systems.

.7 Clear snow and ice from public sidewalks as required to comply with applicable municipal regulatory requirements.

1.5 FINAL CLEANING

.1 Before final cleaning, arrange a meeting at Place of the Work to determine the acceptable standard of cleaning.

.2 Remove from Place of the Work surplus Products, waste materials, recyclables, Temporary Work, and Construction Equipment not required to perform any remaining Work.

.3 Lock or otherwise restrict access to each room or area after completing final cleaning in that area.

.4 Re-clean as necessary areas that have been accessed by Contractor’s workers prior to Owner occupancy.

.5 Remove stains, spots, marks, and dirt from finished surfaces, electrical and mechanical fixtures, walls, floors and any other soiled surface.

.6 As applicable, clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and all other finished surfaces, including mechanical and electrical fixtures. Replace broken, scratched or otherwise damaged glass.

.7 Remove dust from lighting reflectors, lenses, lamps, bulbs, and other lighting surfaces.

.8 Vacuum clean and dust exposed wall, floor, and ceiling surfaces, behind grilles, louvres, screens, and any other soiled surface.

.9 Clean mechanical, electrical, and other equipment. Replace filters for mechanical equipment if equipment is used during construction.

.10 Remove waste material and debris from crawlspaces and other accessible concealed spaces.

.11 Remove stains, spots, marks, and dirt from exterior facades.

.12 Clean exterior and interior window glass and frames.

.13 Clean and sweep roofs, clear roof drains, clean gutters and downspouts, sunken wells.

.14 Remove snow and ice from exterior sidewalks, steps, driveways, roads, parking lots, and other paved surfaces.

.15 Use leaf blowers to clean landscaped surfaces.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 SUBSTANTIAL PERFORMANCE OF THE WORK

.1 Complete the prerequisites to, and the procedures for, attaining substantial performance of the Work, or similar such milestone as provided for in the lien legislation applicable to the Place of the Work.

1.2 READY-FOR-TAKEOVER

.1 The prerequisites to attaining Ready-for-Takeover of the Work are described in the General Conditions of the Contract.

1.3 INSPECTION AND REVIEW BEFORE READY-FOR-TAKEOVER

.1 Contractor's Inspection: Before applying for the Consultant’s review to establish Ready-for-Takeover of the Work:

.1 Confirm specified prerequisites to Ready-for-Takeover of the Work are completed.
.2 Conduct an inspection of the Work to identify defective, deficient, or incomplete work.
.3 Prepare a comprehensive and detailed list of items to be completed or corrected.
.4 Provide an anticipated schedule and costs for items to be completed or corrected.

.2 Consultant’s Review: Upon receipt of the Contractor’s application for review, together with the Contractor’s list of items to be completed or corrected, the Consultant and the Contractor will arrange a mutually satisfactory agreed date and time to jointly review the Work. The Consultant will advise the Contractor whether or not the Work is Ready-for- Takeover. Add additional items, if any, to the Contractor’s list of items to be completed or corrected. Provide the Consultant with a copy of the revised list.

.3 Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work. The Contractor’s inspection and Consultant’s review procedures specified above shall be repeated until the Work is Ready-for-Takeover and no items remain on the Contractor’s list of items to be completed or corrected.

.4 When the Consultant determines that the Work is Ready-for-Takeover, the Consultant will notify the Contractor and the Owner in writing to that effect.

1.4 PREREQUISITES TO FINAL PAYMENT

.1 After Ready-for-Takeover of the Work and before submitting an application for final payment in accordance with the General Conditions of Contract:

.1 Correct or complete all remaining defective, deficient, and incomplete work.
.2 Remove from the Place of the Work all remaining surplus Products, Construction Equipment, and Temporary Work.
.3 Perform final cleaning and waste removal necessitated by the Contractor’s work performed after Ready-for-Takeover, as specified in Section 01 74 00 – Cleaning and Waste Management.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 OPERATION AND MAINTENANCE MANUAL

.1 Prepare a comprehensive operation and maintenance manual, in the language of the Contract, using personnel qualified and experienced for this task.

.2 Fifteen working days before the anticipated Ready-for-takeover date submit an initial draft of the operation and maintenance manual for Consultant's review. If required by Consultant's review comments, revise manual contents, and resubmit for Consultant's review. If required, repeat this process until Consultant accepts the draft manual in writing.

.3 Submit final version to Owner in hard copy and electronic format. Provide three (3) hard copies.

1.2 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, three D-rings, loose leaf, 216 x 279 mm, with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with typed or printed title "Operation and Maintenance Manual", name of Project or facility, and subject matter of contents.

.5 Arrange content by systems under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate Product or system, with typed description of Product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 In addition to the hard copy requirements given above, provide an electronic copy of manual in PDF format.

.10 Provide electronic copy of Shop Drawings in manual as 1:1 scaled PDF files in .pdf file format on electronic media acceptable to Owner.

1.3 OPERATION AND MAINTENANCE MANUAL – GENERAL CONTENT

.1 Table of contents for each volume.

.2 Introductory information including:

- .1 Date of manual submission.
- .2 Complete contact information for the Consultant, subconsultants, other consultants, and Contractor, with names of responsible parties.
- .3 Schedule of Products and systems indexed to content of volume.

.3 For each Product or system, include complete contact information for Subcontractors, Suppliers and manufacturers, including local sources for supplies and replacement parts.

.4 Product Data: mark each sheet to clearly identify specific products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.

.5 Reviewed Shop Drawings.

.6 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.

.7 Warranties.

.8 Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.

.9 Training materials as specified in Section 01 79 00 - Demonstration and Training.

1.4 OPERATION AND MAINTENANCE MANUAL – EQUIPMENT AND SYSTEMS CONTENT

.1 Each item of equipment and each system: include description of unit or system and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel Board Circuit Directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include testing and balancing reports.

.15 Include additional content as specified in technical Specifications sections.

1.5 OPERATION AND MAINTENANCE MANUAL – PRODUCTS AND FINISHES CONTENT

.1 Include Product data, with catalogue number, options selected, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured Products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Include an outline of requirements for routine and special inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.

.4 Include additional content as specified in technical Specifications sections.

1.6 OPERATION AND MAINTENANCE MANUAL – WARRANTIES CONTENT

.1 Separate each warranty with index tab sheets keyed to Table of Contents listing.

.2 List each warrantor with complete contact information.

.3 Verify documents are in proper form and contain full information. Confirm warranties are for the correct duration and are in Owner’s name.

1.7 RECORD INFORMATION

.1 Record Drawings:

.1 After award of Contract, Consultant will provide a set of drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Consultant.

.2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Consultant.

.3 On completion of Work and prior to final inspection, submit record documents to Consultant.

.2 Maintain record drawings on site as the work progresses for all aspects of the work.

.3 Owner will mark on "Project Record Copy" modifications made for work under the Owner's Scope of Work.

1.8 PROJECT RECORD DRAWINGS

.1 Transfer all information marked up on the as-built drawings during the progress of the Work to a master set of record drawing files provided by Consultant, in electronic format.

.2 Mark revised drawings as "RECORD DRAWINGS".

.3 Submit completed record drawings in electronic form to Owner and Consultant.

1.9 SPARE PARTS, MAINTENANCE MATERIALS, AND SPECIAL TOOLS

.1 Supply spare parts, maintenance materials, and special tools in quantities specified in technical Specifications sections.

.2 Provide spare parts and maintenance materials that are new, not damaged nor defective, and of same quality, manufacturer, and batch or production run as installed Products.

.3 Provide tags for special tools identifying their function and associated Product.

.4 Deliver to and store items at location directed by Owner at Place of the Work. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.

.5 Catalogue all items and submit to Consultant an inventory listing organized by Specifications section. Include Consultant reviewed inventory listing in operation and maintenance manual.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 – GENERAL

1.1 SUMMARY

.1 When specified in individual Sections, have the manufacturer provide an authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed prior to scheduled date of Ready-for-Takeover of the Work.

.2 Owner will provide list of personnel to receive training and will coordinate their attendance at agreed upon times.

.3 Coordinate and schedule demonstration and training provided by Subcontractors and Suppliers.

1.2 SUBMITTALS

.1 Submit proposed dates, times, durations, and locations for demonstration and training of each item of equipment and each system for which demonstration and training is required. Allow sufficient time for training and demonstration for each item of equipment or system, or time as may be specified in technical Specifications.

.2 Consultant and Owner will review submittal and advise Contractor of any necessary revisions.

.3 Provide a report to the Owner and Consultant within five (5) Working Days after completion of demonstration and training that:

.1 Identifies time and date of each demonstration and training session,
.2 Summarizies the demonstration and training performed, and
.3 Includes a list of attendees.

.4 Provide copies of completed Operation and Maintenance Manuals for use in demonstrations and instructions.

.5 Instruct personnel in all phases of operation and maintenance using Operation and Maintenance Manuals as the basis of instructions.

.6 Review contents of manual in detail to explain all aspects of operation and maintenance. Prepare and insert additional data in Operations and Maintenance Manuals when the need for additional data becomes apparent during instructions.

1.3 PREREQUISITES TO DEMONSTRATION AND TRAINING

.1 Testing, adjusting, and balancing has been performed in accordance with Contract Documents.

.2 Equipment and systems are fully operational.

.3 Copy of completed operation and maintenance manual is available for use in demonstration and training.

.4 Conditions for demonstration and training comply with requirements specified in technical Specifications.

1.4 DEMONSTRATION AND TRAINING

.1 Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment and system.

.2 Review operation and maintenance manual in detail to explain all aspects of operation and maintenance.

.3 Prepare and insert additional information in operation and maintenance manual if required.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 COMMISSIONING

.1 General:

.1 The Commissioning Objectives are:

.1 To bring the mechanical, electrical and other systems and components from a state of "static completion" to a state of "dynamic operation".

.2 To verify conformance to Contract Requirements.

.3 To confirm the equipment meets the design intent of the Specifications and function in accordance with defined operational requirements.

.4 To confirm the completed facility meets user stated requirements.

.2 Commissioning services will be as described herein and as specified in the individual Sections.

.3 Commissioning will need to be completed before Ready-For-Takeover.

1.2 SUBMITTALS

.1 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.

.2 Commissioning services to be as described herein and as specified in the individual specification sections.

1.3 COMMISSIONING PLAN

.1 Commissioning Plan, developed by the Contractor in collaboration with applicable equipment vendors, the Owner and the Consultant, consists of:

.1 Roles and responsibilities of the commissioning team during all phases of commissioning.

.2 Description of systems, intended operation and performance details.

.3 Static testing and verification procedures.

.4 Functional performance testing procedures.

.5 Documentation requirements for test results.

.6 Seasonal or deferred commissioning.

.7 Training plan for operators.

.8 Preparation of the Final Commissioning Reports.

1.4 ROLES AND RESPONSIBILITIES

.1 Contractor's responsibilities:

.1 Prepare Commissioning Plan, with input from equipment vendors, Owner and Consultant.

.1 Manage the commissioning process.

.2 Confirm subcontractors, including equipment suppliers, carry out applicable tests, procedures prior to Consultant's review.

.3 Arrange for walkthrough and commissioning reports, procedures and demonstration, after Work has been reviewed, tested and commissioned.
.4 Arrange and schedule training sessions, including preparation and distribution of materials.
.5 Perform and document all preliminary tests. Assemble manuals of completed test forms and verification forms.
.6 Provide assistance to equipment suppliers during start up to address installation concerns. Provide mechanical and/or electrical trades as required.
.7 Perform system start-up and testing.
.8 Fill out commissioning data sheets and test forms/manual.
.9 Provide training and instruction and prepare Operating and Maintenance Manual for presentation to the operating and maintenance personnel.
.10 Attend operation of system through tests with Consultant and Owner.
.11 Obtain all code-required inspections and certifications and approvals.
.12 Obtain and submit all warranties to Consultant.

.2 Consultant's responsibilities:

.1 Inspect installation.
.2 Certify completion of Contractor's commissioning.
.3 Receive all test reports from the Contractor and verify results.
.4 Participate in the equipment start-up testing conducted by the Contractor and verify results.
.5 Communicate apparent deviations from the specifications.
.6 Participate in the performance testing process.
.7 Review the as-built drawings.
.8 Provide technical assistance on plant operations to assist Contractor planning of Commissioning.
.9 Communicate requirement and coordinate activities relating to system integration work.

.3 Owner's responsibilities:

.1 Making staff available at appointed times for training by manufacturer's representatives and providing labour to conduct work within facilities that is not included in this Contract.
.2 Where applicable, test and commission systems that are Owner-supplied and installed.

1.5 COMMISSIONING MEETINGS

.1 Commissioning meetings: All parties to participate in routine on-site meetings, specific commissioning meetings throughout the period that commissioning is taking place or being planned. Commissioning meetings will be coordinated and chaired by the Contractor. The Contractor will take minutes and distribute minutes within three (3) working days of the subject meeting. Update and circulate the updated commissioning schedule one (1) working day prior to commissioning meetings.

.2 The Contractor, Consultant and Owner will work together in a concerted effort to fully commission all systems in an organized manner and in a manner that will allow all to carry out their own obligations fully.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not applicable.

END OF SECTION

PART 1 -GENERAL

1.1 WORK INCLUDED

.1 This section specifies the requirements for supplying, transporting and installing concrete formwork and falsework.

1.2 RELATED REQUIREMENTS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 30 00 – Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

.1 CSA A23.1:24/A23.2:24, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA O86:24, Engineering Design in Wood.

.3 CSA O121:17(R2022), Douglas Fir Plywood.

.4 CSA O153:19, Poplar Plywood.

.5 CSA S269.1-16(R2021), Falsework and Formwork.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Collect, separate, and recycle all site generated waste materials in accordance with Section 01 74 00 – Cleaning and Waste Management.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Seal and store emptied containers safely for disposal.

.4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings for formwork and falsework as follows:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
.2 Prepare Shop Drawings in accordance with CSA S269.1 for formwork and falsework.
.3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
.4 Indicate sequence of erection and removal of formwork/falsework as directed by Consultant.
.5 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.
.6 Indicate sequence of erection and removal of formwork and falsework.

.7 Include the following information on falsework Shop Drawings:
- .1 Longitudinal, lateral, vertical, dead, live, and impact loads used in design.
- .2 Safe bearing capacity of soil underneath mud sills.
- .3 Maximum column, post and support loads.
- .4 Deflection diagrams for beams with deflection of 10 mm or more.
- .5 Deflection diagrams indicating initial and final elevation of deck surfaces, roofs and soffits.
- .6 Grade of structural steel.
- .7 Indicate steel posts, girders, beams, connections, bracing and welding, providing sufficient detail for safe performance of falsework.
- .8 Fully detailed steel frame shoring.
- .9 Species, grades and sizes of wood.
- .10 Type and weight of equipment (moving or stationary) supported by falsework.
- .11 Sequence, methods and rate of concrete placement.
- .12 Proprietary equipment, adequately identified for checking purposes.
- .13 Full details and locations of splices.

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, CSA O86, and CSA O153.
- .2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.

.2 Form ties:
- .1 Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes minimum 25 mm diameter in concrete surface.
- .2 Concrete designated to be watertight: snap-off metal ties, fixed length with break back points set back minimum 25mm, and to have an integral waterstop at centre of tie. Remove cone and fill void with non-sag concrete repair mortar flush with finished surface.

.3 Non-sag concrete repair mortar:
- .1 Acceptable product: MasterEmaco N425 by BASF Construction Chemicals, or approved equivalent.

.4 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms; having no adverse affect on paint, adhesives, waterproofing, or other treatments which are specified for application to concrete and containing no non-drying ingredients such as mineral oil. Use biodegradable form release agent with low VOC content.

.1 Acceptable products: DuoGuard II by W.R. Meadows, Crete-Lease BIO-TRU-XTRA by Cresset, Enviro-Form by IPA Systems, Bio-Nox by Nox-Crete, or approved equivalent.

.5 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 Consultant's approval for use of earth forms.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Assemble formwork so that concrete is not damaged during its removal.

.5 Fabricate and erect falsework in accordance with CSA S269.1.

.6 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.7 Do not place shores and mud sills on frozen ground.

.8 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.9 Fabricate and erect formwork in accordance with CAN/CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.

.10 Align form joints and make watertight. Keep form joints to minimum.

.11 Use 25 mm chamfer strips on external corners and 25 mm fillets at interior corners, joints, unless specified otherwise.

.12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated. Obtain the Consultant's permission before framing openings not indicated in concrete beams, walls, columns, or slabs.

.13 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.14 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.

.15 Step/lower all foundations as indicated on drawings. Coordinate with plumbing and electrical contractors to step footings down as required to allow all underground plumbing and electrical services to be sleeved through foundation walls or run above footings/zone of influence. Do not locate any services under foundations or their associate zone of influence without written approval from the Consultant.

.16 All stepped footings shown on the drawings are approximate and all required stepped footings may not be shown. Review all foundations and building services and submit to the Consultant the proposed footing locations and elevations to allow all services to be sleeved through the foundation wall and/or provide the required frost cover. Submit the proposed stepped footing

locations and elevations prior to commencing any foundation work.

.17 Construction Joints:

.1 Incorporate either horizontal or vertical construction joints in accordance with CSA A23.1 and to the Consultant's approval. Submit proposed joint locations for review prior to start of formwork erection.

.2 Maximum permitted length between construction joints shall not exceed 18000 mm for liquid-containing structures (tanks).

.3 Provide construction joints in concrete where work is left off at day's end. Immediately before next pour, clean construction joint and brush with grout of neat cement.

.4 Run reinforcement continuously through construction joints and roughen concrete surface to an amplitude of 6 mm, unless indicated otherwise on drawings.

.18 Coat formwork with form release agent before reinforcement, anchors or other accessories are placed, unless soaking with water during hot weather is acceptable. Do not coat plywood forms pre-coated with a chemical release agent.

.19 Do not erect formwork that will prevent or encumber installation or inspection of reinforcing.

.20 Prior to the concrete pour, identify any reinforcing that does not meet cover requirements. Review and correct as necessary formwork tolerances and alignment, particularly where suspended slabs are located.

.21 Provide and maintain during the total duration on site, properly constructed guard rails and toe boards at all slab edges and around all slab openings. Build these in accordance with the Construction Safety Act. When the work of this trade is complete, all guard rails and toe boards are to be left in proper condition and will become Owner’s property. The dismantling of same becomes the responsibility of subsequent subcontractors.

.22 Re-use formwork and falsework subject to requirements of CSA A23.1/A23.2.

3.2 REMOVAL AND RESHORING

.1 Do not remove forms until concrete has cured sufficiently to support its own weight and imposed construction loads. Remove forms in such a manner to ensure the complete safety of the structure and to prevent spalling or chipping of concrete. When removing forms, conform to the following minimum periods of time after placing concrete:

.1 Non-weight supporting forms: remove formwork for columns, walls, footings, slabs on grade, grade beams, and other parts not supporting the weight of concrete as soon as concrete has cured sufficiently to resist damage from removal operations, but in no case sooner than 24 h.

.2 Weight supporting forms: leave formwork for suspended slabs, beams (with clear spans less than 6000 mm), and other parts supporting the weight of concrete in place for a minimum of 7 days or the time needed until the concrete element has achieved 70% of the specified 28-day compressive strength for that element, whichever is greater. Cast additional cylinders for the purpose of early testing to verify 70% of compressive strength has been achieved.

.3 Formwork for beams with clear spans greater than 6000 mm shall be left in place for a minimum of 14 days or the time needed until the concrete element has achieved 70% of the specified 28-day compressive strength for that element, whichever is greater.

.4 Formwork for liquid-containing structures (tanks): In addition to the above, formwork for all concrete elements shall not be removed until the concrete has reached a minimum compressive strength of 25 MPa. Cast additional cylinders for the purpose of early testing to verify compressive strength has been achieved.

.2 After removal of formwork of weight supporting forms, immediately install adequate reshores. Submit proposed stripping and reshoring schedule for review by the Consultant prior to first concrete pour. Keep reshores in place a minimum of 28 days after concrete pour.

.3 Safely maintain structure, both before and after removal of the forms, until concrete has reached its specified 28-day strength.

.4 Provide 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.

.5 Space reshoring in each principal direction at not more than 3000 mm apart.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning and Waste Management. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 00 - Cleaning and Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies the requirements for supplying, fabricating, shipping, and placing the reinforcing as detailed on the drawings and as noted in these specifications.

1.2 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 30 00 – Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

.1 ACI MNL-66(20), ACI Detailing Manual.

.2 ASTM A1064/A1064M-24, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.3 ASTM C1116-15, Standard Specification for Fibre Reinforced Concrete.

.4 CSA A23.1:24/A23.2:24, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.5 CSA A23.3:24, Design of Concrete Structures.

.6 CSA A283:19, Qualification Code for Concrete Testing Laboratories.

.7 CSA A3000:23, Cementitious Materials Compendium.

.8 CSA G30.18:21, Carbon Steel Bars for Concrete Reinforcement.

.9 CSA G40.20-13/G40.21-13 (R2023), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.10 CSA G164-18 (R2023), Hot Dip Galvanizing of Irregularly Shaped Articles.

.11 CSA W186:21, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.12 RSIC-20, Reinforcing Steel Manual of Standard Practice.

.13 ANSI/ACI 315-18, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

- .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .2 Indicate placing of reinforcement and:
  - .1 Bar bending details.
  - .2 Lists.
  - .3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.3 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.

.4 Reinforcement shop drawings must indicate the location of all concrete pour joints. Obtain the Consultant's approval for location of joints prior to cutting and bending of reinforcement.

.5 Detail lap lengths and bar development lengths to CSA A23.3, unless otherwise indicated. Provide Class B tension lap or when bars of different sizes (35M or smaller) are lap spliced in tension, the splice length to be the larger of the development length of the larger bar or the splice length of the smaller bar, as per CSA A23.3.

1.5 SOURCE QUALITY CONTROL

.1 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum four (4) weeks prior to beginning reinforcing work. Mill test reports to include certification that reinforcing steel recycled steel content rating meets or exceeds 90%. Certification to also include a breakdown of the pre-consumer, post-industrial and post-consumer content percentages of recycled content.

.2 Supply test reports at no additional cost to the Contract.

.3 Upon request inform Consultant of proposed source of supplied material.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle reinforcing in accordance with manufacturer's recommendation.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Collect, separate, and recycle all site generated waste materials in accordance with Section 01 74 00 – Cleaning and Waste Management.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Consultant.

.2 Reinforcing steel: billet steel, grade 400W, deformed bars to CSA G30.18, unless indicated otherwise.

.3 Cold-drawn annealed steel wire ties: to ASTM A1064.

.4 Deformed steel wire for concrete reinforcement: to ASTM A1064.

.5 Welded steel wire fabric: Plain in accordance ASTM A1064, fabricated from as drawn steel wire into flat sheets; sizes as indicated on Drawings.

.6 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

.7 Mechanical splices: subject to approval of Consultant.

.8 Plain round bars: to CSA G40.20/G40.21.

.9 Galvanize reinforcing bars to CAN/CSA G164, with minimum zinc coating of 610/m².

.1 All reinforcing bars in cast-in-place concrete shall be hot dip galvanized.
.2 Reinforcing bars in precast, prestressed concrete girders do not require galvanizing, including stirrups and other bars projecting vertically and horizontally from the girders.
.3 Seal galvanized reinforcing steel with chromate treatment.
.4 Carry out chromate treatment immediately after galvanizing by soaking steel in aqueous solution containing minimum 0.2% by weight sodium dichromate. Alternately, quench in a minimum of 0.2% chromatic acid solution. Solution shall be at least 32 degrees Cecius. Immerse each bar for at least 20 seconds. If galvanized steels are at ambient temperature, add sulfuric acid at a concentration of 0.5% to 1.0%.

.10 Electrical power and communications ductbanks to be reinforced using structural synthetic macrofibers.

.1 Provide a minimum of four (4) 15M bars (one in each corner 1200mm at ductbank construction joints. Bars to be embedded 600mm into concrete, the free end to be greased and tapered prior to the subsequent concrete pour.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2, MNL-66 and RSIC. Shop fabricate and bend all reinforcing steel.

.2 Obtain Consultant's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Fabricate to the following tolerances:

.1 Sheared length + 25 mm.
.2 Stirrups, otems and spirals to + 10 mm.
.3 Other bends + 25 mm.

.4 Welding of reinforcing steel must receive prior approval Consultant.

.5 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.

.6 Have welding performed by workers qualified under CSA W47.1.

.7 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide the Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum two (2) weeks prior to beginning reinforcing work. Mill certificates to be in accordance with CAN/CSA G30.18.

.2 Upon request inform the Consultant of proposed source of material to be supplied.

2.4 CLEANING

.1 Clean reinforcing to CSA-A23.1/A23.2. All reinforcing bars are to be free of scale rust and contamination at time of placing in forms.

PART 3 - EXECUTION

3.1 PREPARATION

.1 All steel reinforcing bars to have the necessary net sectional area and will be cut to the exact lengths, bent cold to the exact forms and dimensions, shown on the approved plans, or otherwise required, before being placed in position. Bending must be accurately done, in a bending machine and no welding or heating of any bars will be allowed, except with written approval from the Consultant.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.

.2 When field bending authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Examine formwork to ensure that it has been completed and adequately braced in place before starting reinforcement placing.

.2 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.

.3 Place reinforcing steel as indicated on placing drawings and in accordance with CSA A23.1/A23.2.

- .1 Clean all reinforcing of millscale, oil grease, or other deleterious material before and after erection.
- .2 Secure reinforcing steel rigidly in position with annealed wire or use approved clips at intersections supported on reinforcing chairs.
- .3 Do not allow the position of the bars to alter during concreting and maintain the correct cover at all times.

.4 Prior to placing concrete, obtain the Consultant's approval of reinforcing material and placement. Provide Consultant with a minimum of 48 hours notice when reinforcing material will be installed and ready for inspection.

.5 Maintain cover to reinforcement during concrete pour to the dimensions shown on the drawings.

.6 Place all reinforcing bars and hold rigidly in the exact positions in the forms as shown on the approved plans, or otherwise required, and there must be no displacement of the same by the placing and tamping of the concrete. Adjusting or moving the bars while the concrete is being placed will not be permitted unless specified on the plans. Protect concrete required for

reinforcing steel in accordance with CSA A23.3. Tie all bars properly, brace to prevent displacement. Do not place concrete until the steel reinforcement, after being cleaned and placed in position, has been examined and approved by the Consultant.

.7 Do not cut or trim hooks on hooked bars. If cover with standard hook can not be achieved, rotate/skew hook.

.8 Under no circumstances will concrete trucks or other vehicle traffic be permitted to travel over the reinforcing during concrete placing operations.

.9 After reinforcing is placed and prior to closing of forms. notify the Consultant for inspection of the work.

3.4 STORAGE

.1 Store reinforcing steel to prevent deterioration, contamination, or disfigurement.

.2 Store reinforcing steel off the ground.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies the requirements for providing all labour, tools, materials and equipment to perform all cast-in-place concrete work.

1.2 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 20 00 – Concrete Reinforcing.

1.3 REFERENCE STANDARDS

.1 ASTM C33/C33M-24, Standard Specification for Concrete Aggregates.

.2 ASTM C260/260M-10a(R2016), Standard Specification for Air-Entraining Admixtures for Concrete.

.3 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.4 ASTM C457/C457M-24, Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete

.5 ASTM C494/C494M-24, Standard Specification for Chemical Admixtures for Concrete.

.6 ASTM C827/C827M-23, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

.7 ASTM D1751-23, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)

.8 D1752-18(2023), Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

.9 ASTM C881/C881M-20a, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

.10 ASTM D2240-15(2021), Standard Test Method for Rubber Property - Durometer Hardness.

.11 ASTM D3575-20, Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers.

.12 ASTM E1745-17 (2023), Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

.13 CGSB-51.34-2022, Polyethylene Sheet for Use in Building Construction - Material Specification.

.14 CSA A23.1:24/A23.2:24, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.15 CSA A283:19, Qualification Code for Concrete Testing Laboratories.

.16 CSA A3000:23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.17 ASTM C109/C109M-23, Standard TEst Mwthod for COmpressive Strength of Hydraulic Cement Mortars.

.18 ASTM C939/C939M-22, Standard Test Method for Flow of Grout for Prepaced Aggregate Concrete.

.19 CSA S269.1-16(R2021), Concrete Formwork and Falsework.

.20 ASTM D412-16(2021), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension

.21 ASTM D624-00(2020), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

.22 CSA G30.18:21,Carbon Steel Bars for Concrete Reinforcement

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Minimum of four (4) weeks prior to commencing concrete work, submit shop drawings to Consultant for review containing the following for each concrete mix:

- .1 Cement type.
- .2 Minimum compressive strength at 28 days.
- .3 Class of exposure.
- .4 Nominal size of coarse aggregate.
- .5 Air content%.
- .6 Slump at time and point of discharge.
- .7 Supplementary cementing material type.
- .8 Percentage of supplementary cementing materials by weight of total cementing materias.
- .9 Cement content (kg/m3).
- .10 Proposed admixtures.

.3 Minimum of four (4) weeks prior to commencing slab on grade concrete work, submit shop drawings to Consultant for review containing the following:

- .1 Construction joint placement.
- .2 Isolation joint placement.
- .3 Contraction joint placement.
- .4 Joint filling/sealing details.

.4 Provide two (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.5 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature, and test samples as described herein.

.6 Concrete hauling time: submit for review by the Consultant deviations exceeding maximum allowable time of 120 minutes for concrete delivered to the site of Work and discharged after batching.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with applicable local, provincial and national regulations, and in accordance with Section 01 74 00.

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate a cleaning area for tools to limit water use and runoff.

.4 Carefully coordinate the specified concrete work with weather conditions.

.5 Seal emptied containers and store safely for disposal.

.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, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

.7 Choose least harmful, appropriate cleaning method which will perform adequately.

1.6 QUALITY ASSURANCE

.1 Minimum four (4) weeks prior to starting concrete work submit to the Consultant manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:

- .1 Portland cement.
- .2 Supplementary cementing materials.
- .3 For fly ash, provide details of supplier's quality control program, test data for at least three (3) samples from the previous month's supply and details of proposed quality control tests to be made between shipment to concrete supplier and use in the concrete.
- .4 Grout.
- .5 Admixtures.
- .6 Aggregates.
- .7 Water.
- .8 Waterstops.
- .9 Waterstop joints.
- .10 Joint filler.

.2 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.

.3 Provide certification that plant, equipment and materials to be used in concrete comply with requirements of CSA A23.1. Submit a copy of the plants Atlantic Concrete Association Plant certification.

.4 At least four (4) weeks prior to beginning Work, inform Consultant of source of fly ash. Changing source of fly ash without written approval of Consultant is prohibited. Provide written confirmation from concrete supplier the percent replacement of mass of Portland cement for fly ash/supplementary cementing materials for all concrete mix design.

.5 Minimum four (4) weeks prior to starting concrete work, provide proposed quality control procedures for review by Consultant on following items:

.1 Falsework erection.
.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.
.8 Backfilling.

.6 Quality Control Plan: provide written report to Consultant verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Modifying maximum time limit without receipt of prior written agreement from Consultant and concrete producer as described in CSA A23.1/A23.2 is prohibited.
.2 Submit deviations for review by Consultant.
.3 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.2 Prepare to implement alternative concrete supply and placement contingency plans in the event of concrete material supply issues, batch plant malfunction and/or transport and placement equipment malfunction.

PART 2 - PRODUCTS

2.1 CONCRETE DESIGN CRITERIA

.1 Performance: to CSA A23.1/A23.2, and as described in MIXES of Part 2 PRODUCTS.

.2 Vapour Retarder Membrane: to be a 10 mil (0.25 mm) thick, polyolefin resin sheet in accordance with ASTM E1745 such as Perminator 10mil by W.R. Meadows Inc., or approved equivalent. Seal seams with a 100 mm wide high density polyethylene tape with pressure sensitive adhesive to suit a 150 mm wide sheet overlap in accordance with the manufacturer's written recommendations.

.3 Curing compound: to CSA A231.1/A23.2 and ASTM C309, Type1-D with fugitive dye. Confirm compatibility with finish floor adhesives.

.4 Premoulded concrete expansion joint filler:

.1 Closed-cell, polyethylene joint filler with peel-off tape in accordance with ASTM D3575.
.1 Acceptable products: Foam Tech as manufactured by NMW Inc., Deck-O-Foam as manufactured by W.R. Meadows Inc., or approved equivalent.
.2 For concrete surfaces in contact with hot asphalt, use Foam Tech H as manufactured by NMW Inc. or approved equivalent.

.5 Joint sealer/filler:

.1 A two (2) component, polysulphide sealant, Duoflex SL (self-levelling) for slabs and Duoflex NS (non-sag) for walls, complete with compatible foam back rod and primer.

.2 For slabs subject to vehicle traffic, use either a semirigid epoxy or polyurea filler with a minimum Shore A hardness of 80 in accordance with ASTM D2240.

.1 Acceptable products: Rezi-Weld Flex as manufactured by W.R. Meadows inc., Euco Qwikjoint UVR as manufactured by The Euclid Chemical Company, 3004 PenJoint as manufactured by ASTC Polymers, Loadflex-524 EZ as manufactured by Sika, or approved equivalent.

.6 Weep hole tubes: plastic.

.7 Chemical Adhesive Anchoring System:

.1 Two-component tube inject system. All adhesive anchor and rebar installation, including drilling of holes, preparation, storage, usage, and curbing to be in accordance with the written instructions and training as provided by the manufacturer.

.1 Acceptable products: Hilti HIT-HY 200 V3 or HIT-RE 500 V3 adhesive by Hilti Canada Corp. or approved equivalent.

2.2 CONCRETE PERFORMANCE CRITERIA

.1 Quality Control Plan: Ensure concrete supplier meets performance criteria of concrete as established by Consultant and provide verification of compliance as described in QUALITY ASSURANCE in Part 1 of this section.

.2 Provide concrete as established by the Consultant and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

.1 Cement: to CSA A3001, Type GU to CSA A23.1/A23.2.

.2 Water: to CSA A23.1.

.3 Aggregates: to CSA A23.1/A23.2. Coarse aggregates to be normal density.

.1 Coarse aggregates to be normal density.

.2 Fineness modulus of fine aggregates must not be less than 2.3 and no more than 3.1 as per ASTM C33/C33M.

.4 Supplementary cementing materials: replacement to CAN/CSA A3001. Minimum and maximum content as specified. Acceptable types:

.1 Fly Ash Type "F"

.2 Ground Granulated Blast Furnace Slag Type "S"

.3 Silica Fume Type "SF"

.5 Admixtures:

.1 Air entraining admixture: to ASTM C260, CSA A23.1/A23.2.

.2 Chemical admixture: to CSA A23.1/A23.2. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.

.3 Obtain authorization from the Consultant for use of super plasticizing admixture, water reducer, and/or other admixtures as approved by the Consultant to achieve designed

concrete properties. Pay for all admixtures as required.

.6 Concrete to be normal and have a unit weight of 2350 kg/m^3.

.7 Obtain Consultant approval of accelerating or set retarding admixtures during cold and hot weather placing.

.8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.1 Compressive strength: 50 MPa at 28 days.
.2 Consistency:
.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 s.
.2 Drops in 3 s, (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.
.3 Acceptable products: SikaGrout 212 as manufactured by Sika Canada Inc., Masterflow 928 as manufactured by BASF Corporation, V1 Premium Grout and V3-10K Grout as manufactured by W.R. Meadows, or approved equivalent.

.9 Curing compound: to CSA A231.1/A23.2 and ASTM C309, Type1-D with fugitive dye. Confirm compatibility with finish floor adhesives.

.10 Premoulded concrete expansion joint filler:

.1 Closed-cell, polyethylene joint filler with peel-off tape in accordance with ASTM D3575.
.1 Acceptable products: Foam Tech as manufactured by NMW Inc., Deck-O-Foam as manufactured by W.R. Meadows Inc., or approved equivalent.
.2 For concrete surfaces in contact with hot asphalt, use Foam Tech H as manufactured by NMW Inc. or approved equivalent.

.11 Isolatiom joint fillers:

.1 Bitumous impregnated fiber board: to ASTM D 1751.
.2 Sponge rubber: to ASTM D 1752, Type I, flexible firm grade.
.3 Self-expanding Standard cork: to ASTM D 1752, Type III.

.12 Waterstops:

.1 Ribbed waterstops: 10mm thick by 150mm high, extruded PVC.
.1 Acceptable product: Greenstreak 705 Ribbed Center Bulb by Sika or approved equivalent.
.2 Hydrophilic, non-bentonite modified chloroprene rubber based concrete joint waterstop.
.1 Acceptable product: Hydrotite CJ-0725 by Sika or approved equivalent.
.3 Ribbed waterstop and hydrophilic waterstop must be compatible so they can be lapped where required to create a continuous watertight joint. This joint/lap must be covered under manufacturer’s warranty.

.13 Weep hole tubes: plastic.

.14 Chemical Adhesive Anchoring System:

.1 Two-component tube inject system. All adhesive anchor and rebar installation, including drilling of holes, preparation, storage, usage, and curbing to be in accordance with the written instructions and training as provided by the manufacturer.
  .1 Acceptable products: Hilti HIT-HY 200 V3 or HIT-RE 500 V3 adhesive by Hilti Canada Corp. or approved equivalent.

2.4 CONCRETE MIXES

.1 Proportion normal density concrete in accordance with CSA A23.1/A23.2, alternative 1 - Performance.

.2 Confirm concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.1 Provide concrete mix to meet following plastic state requirements:
  .1 Uniformity: to CSA A23.1
  .2 Workability: free of loss of mortar, segregation.
  .3 Finishability: amount of bleeding.
  .4 Set time: 2 hours maximum.

.2 Mix 1: Mud slabs and lean concrete:
  .1 Compressive strength at 28 days: 10 MPa minimum.
  .2 Exposure classification: N.

.3 Mix 2: Concrete for pedestrian bridge foundations, abutments, bridge deck curbs, sidewalks, retaining walls, and other cast-in-place elements for pedestrian bridge.
  .1 Exposure Classification: C-XL.
  .2 Minimum compressive strength at 28 days: 40 MPa.
  .3 Chemical admixtures: in accordance with ASTM C494; submit to the Consultant for approval.
  .4 Nominal maximum aggregate size: 20mm.
  .5 Air content: 5-8%
  .6 Slump: design for 60mm before addition of superplasticizer/ Tolerances per CAN/CSA A23.1.
  .7 Maximum spacing factor for hardened concrete: 0.2mm to ASTM C457M.
  .8 Maximum chloride ion penetrability: 1000 coulombs within 91 days.

.4 Mix 3: concrete for concrete encased ductbanks:
  .1 Exposure classification: F-1.
  .2 Minimum compressive strength at 28 days: 25MPa.
  .3 Nominal size of coarse aggregate: 20 mm.
  .4 Chemical admixtures: in accordance with ASTM C494; submit to the Consultant for approval.
  .5 Air content: 5 to 8%.

.5 Use super plasticizer in all concrete to achieve workability. Pay for all admixtures as required to achieve specified properties.

.6 Maximum concrete temperature delivered: 25 degrees Celsius, except 18 degrees Celsius where thickness of element exceeds 2 meters.

.7 Maximum concrete temperature in situ: 70 degrees Celsius.

.8 Maximum temperature gradient: 20 degrees Celsius per meter.

.3 Provide quality management plan to ensure verification of concrete quality to specified performance.

.4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

.5 Provide concrete mix designs 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 Consultant.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Confirm founding material on which footings and other concrete work are to be placed are free from water. Place concrete only on frost-free ground. Remove previously frozen bearing surfaces.

.2 Confirm foundations bear on structural fill or undisturbed native material with a minimum factored bearing resistance at ultimate limited states (ULS) of 300kPa and a minimum factored bearing resistance at serviceability limit states (SLS) of 200kPa as per CBCL Geotechnical Report, dated November 4, 2024, and in accordance with Section 31 23 10. Place structural fill as directed by the geotechnical engineer and in the presence of the geotechnical engineer or one of their qualified representatives.

.3 Inspect all foundation surfaces and obtain approval from the Owner's geotechnical engineer prior to placing forms, reinforcing or concrete. If bearing surfaces are deemed unacceptable because conditions do not meet those anticipated during design, make adjustments as directed.

.4 Confirm fill has been placed to meet specified requirements, and that underslab services have been installed, inspected, tested and approved.

.5 Do not place plumbing and electrical conduit under foundations or their associated zone of influence. Coordinate with the mechanical and electrical subcontractors and notify the Consultant of any areas that require step/lowering the foundation so that all services either sleeve through foundation walls or run above footing/zone of influence prior to installing formwork/rebar fabrication. Do not place plumbing or conduit under foundations or their associated zone of influence without written consent from the Consultant.

.6 If necessary, place a mud slab in the bottom of footing excavations to prevent softening of the in-situ foundation soils.

3.2 WORKMANSHIP

.1 Obtain Consultant's approval before placing concrete. Provide 48 hours minimum notice prior to placing of concrete. Do not place concrete until authorized by the Consultant and following satisfactory site review and observations of the geotechnical base preparations, formwork, reinforcing steel, and other associated concrete batching and placing operations.

.2 Pumping of concrete is permitted only after approval of equipment, methods, and mix design.

.3 Secure in position reinforcing steel, embedded parts, anchor bolts and dowels etc. prior to placing concrete and ensure these are not disturbed during concrete placement in accordance with CAN/CSA A23.1/23.2. Place concrete reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing.

.4 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing.

.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air content, temperature and test samples taken.

.6 Do not place load upon new concrete until authorized by Consultant.

.7 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing. Concrete protective cover to reinforcement is as indicated on the drawings.

.8 Support bars on plastic coated steel chairs to maintain exact cover requirements.

.9 For concrete placed against hardened concrete, roughen the existing surface locally with a 6 mm amplitude prior to pouring adjacent concrete.

.10 Placing concrete during rain or weather events that could damage concrete is prohibited.

.11 Prior to placing of concrete obtain the Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.12 In cold weather protect concrete work to CSA A23.1 and the following:

- .1 If there is a probability of the air temperature falling below 5°C within 24 h of placing (as forecast by the nearest official meteorological office), keep all materials and equipment needed for adequate protection and curing on hand and ready for use before concrete placement is started.
- .2 During cold weather provide adequate protection of the concrete that will maintain the concrete temperature at a minimum of 10°C for a minimum of 7 days and for the time necessary to attain 70% of the specified strength.
- .3 Do not place concrete on or against any surface that will lower the temperature of the concrete in place below 10°C.
- .4 Provide protection by means of heated enclosures, coverings, insulation, or a suitable combination of these methods as per CSA A23.1.
- .5 Following the termination of wet curing, surfaces must be dry prior to freezing.
- .6 Do not expose concrete to a sudden temperature change after end of curing period. Do not completely remove protection until the surface of the concrete has cooled to within 10°C of ambient air temperature.
- .7 Cover all heating and heating related costs at no additional cost to the Contract.

.13 In hot weather protect concrete work to CSA A23.1 and following:

- .1 When air temperature is at or above 25°C, do not use curing compounds and keep concrete surface moist continually during protection stage using burlap maintained in a moist condition.
- .2 Regulate generation of heat through hydration to control thermal gradients to prevent thermal cracking.

.14 Monitor concrete temperature and moisture evaporation rates and provide appropriate hot weather protection as defined in clause 7 of CSA A23.1. Maintain records of all measurements during hot weather periods for review by the Consultant.

.15 Protect previous Work from staining.

.16 Clean and remove stains prior to application for concrete finishes.

.17 Keep excavation dry while placing concrete.

.18 Maintain adequate frost protection to all soils under footings and slab on grade for entire duration of work.

3.3 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CSA A23.1.

.2 Concrete to be dense, homogenous and free of cold joints, voids and honeycombing. Concrete to be fully bonded to reinforcing steel, anchors and embedded parts.

.3 Do not permit vertical free fall of concrete mix to exceed 1.5 metres.

.4 For exposed concrete, take special precautions when placing to prevent segregation of concrete, and to avoid cold joints, honeycombing or voids. Do not allow vibrator to touch formwork.

.5 Consolidate concrete using a mechanical form vibrator method complete with mechanical hand held vibrators, if required, and subject to the approval of Consultant.

.6 Use form vibrators only when sections are too narrow for internal type. Employ a sufficient number of vibrators to achieve complete consolidation of concrete throughout entire volume of each layer. Have available at least one (1) extra vibrator on hand for emergency.

.7 Do not use vibrators for the use of moving concrete for concrete slabs.

.8 Use only tools and handling equipment that are clear of rust or other harmful and foreign material to avoid effervescence and staining of slabs or hardened concrete.

.9 Place concrete in consolidated lifts and keep approximately horizontal and evenly distributed throughout the formed assembly. The rate of placement to be such that each successive lift is vibrated into the preceding lift to achieve proper bonding.

.10 Place concrete monolithically without any cold joints. Construction joints to be as indicated on drawing and proposed joint locations as per Section 03 10 00. For liquid-containing structures (tanks), do not place concrete until the previously placed concrete, adjacent to the next pour, has cured for a minimum of 72 hours.

.11 Concrete placement and vibrating activities to be in accordance with the formwork design data, limitations and parameters provided by the Contractor.

.12 Foundations, sleeves, and inserts:

.1 Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by the Consultant.

.2 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Consultant before placing of concrete.
.3 Check locations and sizes of foundations, sleeves and openings shown on drawings. Provide confirmation by qualified surveyor.
.4 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.13 Finishing:

.1 Finish concrete in accordance with CSA A23.1, and Part 3.11 Finishing of this section.
.2 Use procedures acceptable to Consultant or those noted in CSA A23.1 to remove excess bleed water. Confirm surface is not damaged.
.3 Cut back form ties and plug openings in a manner acceptable to Consultant.
.4 Repair holes and surface defects to the satisfaction of Consultant.
.5 Remove honeycombed or otherwise defective concrete and repair in a manner approved and to the satisfaction of Consultant.
.6 Confirm all exposed concrete has neatly formed, 45 degree beveled, 25 mm chamfered edges where designated in accordance with Section 03 10 00 - Concrete Forms and Accessories.
.7 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: brushed on exposed pad footings. Provide written declaration that compounds used are compatible.
.8 Refer to Section 03 10 00 - Concrete Forming and Formwork Accessories for Form Finish Tolerances.
.9 Finish to promote water drainage.
.10 Top surfaces of curbs, barriers, and approach slab: steel trowelled finish to finish classification D per CAN/CSA A23.1.

.14 Anchor bolts:

.1 Place anchor bolts to templates under supervision of trade supplying anchors prior to placing concrete.
.2 Protect anchor bolt holes from water accumulations.

.15 Core-drilling/cutting of holes in any concrete element is not permitted without written consent from the Consultant. All proposed core-drilling/cutting must be submitted to the Consultant for review prior to execution of work. Request for core-drilling/cutting must have 72 hours notice to allow Consultant adequate time to review proposed locations.

.16 Backfilling of non-retaining walls or grade beams may commence once the concrete has cured for the required curing period. Backfill to proceed in approximately equal lifts on both sides of the wall or grade beam.

.17 Backfilling of retaining walls may commence 28 days after placement and the specified 28-day strength of concrete has been achieved.

.18 Deliver and handle concrete with a minimum of rehandling, and without damage to existing structure or work.

3.4 MASS CONCRETE

.1 Concrete placements having a minimum dimension greater or equal to 1000 mm are defined as mass concrete. Do mass concrete in accordance with CSA A23.1.

.2 Design concrete mix and employ construction procedures in accordance with CSA A23.1 such that the maximum temperature in the concrete and the maximum temperature difference from interior of mass to outside face do not exceed those specified in CSA A23.1.

.3 Determine maximum temperature of the concrete at the time of placing by estimating the temperature rise during concrete batching, placing, hydration and curing.

.4 Thermal control plan: in accordance with CSA A23.1.

.1 Submit a thermal control plan for mass concrete placements.
.2 Thermal control plan shall include procedures in place to be implemented if the temperature exceeds specified limits.

.5 Monitor concrete and ambient temperatures during the thermal control period.

3.5 INSERTS

.1 Do not pass sleeves, ducts, pipes or other openings through concrete elements, except where indicated on the structural drawings or approved by the Consultant.

.2 Where approved by Consultant, set sleeves, ties, pipe hangers, miscellaneous metals and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated on the structural drawings must be approved by Consultant.

.3 Maximum diameter of core-drilled holes is 200 mm. Proposed core-drilled penetrations must be approved by the Consultant prior to the placement of concrete. All core-drilled holes to be approved by the Consultant prior to execution of the work.

.4 Do not eliminate or displace reinforcement to accommodate hardware larger than 400 mm. For inserts/ hardware less than 400 mm, displace bars to accommodate. If inserts cannot be located as specified, obtain approval of modifications from Consultant before placing concrete.

.5 Coordinate locations and sizes of sleeves and openings shown on structural, civil, mechanical, electrical and process drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive methos of testing concrete where applicable.

3.6 PLACING GROUT

.1 Grout where indicated using procedures in accordance with manufacturer’s recommendations which result in 100% contact over grouted area.

3.7 WATERSTOPS

.1 Install waterstops to provide continuous water seal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops.

.2 PVC Waterstops:

.1 Tie waterstop rigidly in place with factory applied grommets or pre-punched holes, or field applied hog rings placed at 300 mm centers between the two outermost ribs of the waterstop.

.2 Use only straight heat sealed butt joints in field. Use factory or field welded corners and intersections unless otherwise approved by the Consultant. For field welds, use welding iron as approved by and in accordance with the waterstop manufacturer.

.3 Use only ribbed PVC waterstops for liquid-containing structures (tanks), unless noted otherwise on drawings.

.3 Provide waterstops as required to provide continuous seal and as indicated on the drawings and at all construction joints. Not all waterstops are indicated on the Drawings.

.4 Install waterstops in accordance with manufacturer's written instructions.

.5 Install hydrophilic waterstop with a minimum 50 mm clear cover to edge of concrete.

3.8 SLAB-ON-GRADE JOINTS

.1 Provide construction joint between adjacent concrete pours.

.2 Provide an isolation joint where the slab-on-grade abuts a vertical element.

.3 Provide saw cut contraction joints as indicated on the drawings and in accordance with CSA A23.1 except at those locations where construction joints or isolation joints are provided. Commence sawing as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and before all controlled shrinkage cracking occurs. Locate and complete all saw cuts in accordance with the Project Drawings and terminate all saw cuts at the face of columns, foundation walls and other control joints as shown on the Project Drawings.

.4 Do not provide saw cut contraction joints in slabs with continuous reinforcing unless otherwise indicated or at locations not indicated on the Project Drawings. If the Contractor wishes to revise contraction joint placement, submit deviations to the Consultant for review.

3.9 JOINT FILLERS

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant. 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 contraction joints as indicated. Install joint filler and sealants.

.3 Finish with sealants cold joints around perimeters of equipment pads curbing and other similar locations, before painting work.

.4 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 19mm of finished slab surface unless indicated otherwise. Top joint filler with backer rod and 12 mm sealant.

3.10 FINISHING

.1 Finish concrete in accordance with CSA A23.1, the drawings and process equipment shop drawings (where applicable). Report any discrepancy between the code/drawings/shop drawings to the Consultant in writing.

.2 Use smooth form finish for all concrete surfaces. Use form facing material that will produce a smooth, hard, uniform texture on the concrete. Do not use material with raised grain, torn surfaces, worn edges, patches, dents or other defects that will impair the texture of the concrete surface. Patch the holes and defects. Patch bug holes exceeding 5 mm in any dimension smooth.

.3 Use rubbed finish for all interior concrete exposed to view. Remove fins exceeding 3 mm in height.

.4 Horizontal surfaces:

.1 Exterior slabs on grade, exterior equipment pads, and walkways: After concrete has received float finish, give concrete surface a light broom finish by evenly drawing a concrete broom across surface with even, continuous strokes applied in the transverse or short direction. Do not use power trowel or steel trowel.

.2 Do not apply steel trowel finish to concrete with total air content greater than 2%.

.5 Tolerance:

.1 Finish all slabs and pads in accordance with CSA A23.1. All slabs and pads to have concrete surfaces finished to within 12 mm in 3000 mm as measured with a 3000 mm straight edge paced on surface unless noted otherwise.

.2 Surface tolerances for formed surfaces to be ain accordance with Section 03 10 00 - Concrete Forming and Accessories.

.6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.7 Elevation survey: if requested by Owner, carry out an elevation survey on finished slabs in accordance with the measurement procedures outlined in CSA A23.1 to confirm all concrete slabs meet the specified finishes/tolerances.

3.11 CONCRETE CURING

.1 Protect freshly placed concrete from freezing, dehydration, mechanical shock, and contact with injurious substances.

.2 Do not use curing compounds that would have a detrimental effect on bonding, adhesion, curing, appearance, or similar qualities of materials applied to concrete surfaces. Use only moisture curing.

.3 Protect the concrete from premature drying and extremes of temperature.

.4 Cure, protect, and finish concrete to CAN/CSA A23.1, and CSA S269.1. Curing type in accordance with specified exposure classification unless more stringent requirements are noted otherwise. Special curing and finishing requirements are as follows:

.1 Abutments: Extended wet curing "TYPE 3". A wet curing period of 7 days at greater than 10 degrees Celsius. The curing types allowed are ponding, continuous sprinkling, absorptive mat, or fabric kept continuously wet.

.5 Keep foot traffic off curing concrete for 24 hours after pour.

.6 Keep vehicles off concrete for seven (7) days after pour.

.7 Do not use curing compounds where bond is required for subsequent topping, coating, or applied finishes.

.8 Use approved curing compounds in accordance with the manufacturer's written instructions.

3.12 DEFECTIVE WORK

.1 Repairs and classification of unacceptable concrete to be in accordance with CSA-A23.1/A23.2.

.2 Remove defective concrete and embedded debris and repair as directed by the Consultant.

.3 Concrete with finish tolerances failing to meet those specified, including as per Section 03 10 00 - Concrete forming and Accessories shall be deemed defective. Excessive honeycomb or embedded debris in any concrete shall deem it defective. Remove and replace defective concrete.

.4 Remove to bare concrete curing compounds detrimental to application of specified finishes, including bridge deck waterproofing membrane.

.5 Supply concrete at the minimum strength requirement at 28 days. Tests indicating strengths lower than specified will necessitate further testing as required by the Consultant. Cost for such testing to be at the Contractor's expense. Should further tests confirm low values, the Consultant has the right to require strengthening of the affected area or removal and replacing of the weak concrete all to the Contractor's expense.

.6 Repair all shrinkage cracks in the completed concrete work employing a suitable epoxy injection technique acceptable to Consultant to completely seal all such cracks.

3.13 FIELD QUALITY CONTROL

.1 Testing of concrete and materials will be carried out by an independent testing company appointed by the Owner or Consultant in accordance with CSA A23.1/A23.2. The Owner will pay for the costs associated with these tests.

.1 Testing laboratory to be certified to CSA A283.

.2 Provide access to the Work for the independent testing agency to test concrete in accordance with CSA A23.1/A23.2. They will conduct a complete set of tests consisting of a slump, air test, and compressive strength test (a minimum of six (6) test cylinders are required) for the conditions below. Also note air and concrete temperature as well as weather at time when samples are taken.

.1 Each day's pour.
.2 Each type or grade of concrete.
.3 Each change of concrete supplier.
.4 Each 50 cubic metres or fraction thereof.

.3 Test cylinders at 3, 7, 28, and 56 days and hold two (2) cylinders in reserve. The cylinders held in reserve may be used for additional compressive strength testing should previous test results fail to be conclusive or meet the specified compressive strength.

.4 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.5 Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.2.

.6 Site observations or testing by the Consultant will not augment or replace Contractor quality control nor relieve them or their contractual responsibility.

.7 Distribute test results for discussion at pre-pouring concrete meeting between testing laboratory and Consultant.

3.14 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

.2 Waste Management: separate waste materials in accordance with Section 01 74 00 – Cleaning and Waste Management.

.3 Divert unused concrete materials from landfill to local quarry facility after receipt of written approval from the Consultant.

.4 Provide appropriate area on job site where concrete trucks and be safely washed.

.5 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Consultant.

.6 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.7 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.8 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.

.9 Dispose of waste in accordance with applicable local, Provincial, and National regulations.

END OF SECTION

PART 1- GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for constructing miscellaneous metal items. Work includes supply of materials, fabrication, coatings and installation.

1.2 RELATED SECTIONS

.1 Concrete: Section 03 30 00

.2 Water Main: Section 33 11 00

.3 Sanitary Sewers: Section 33 31 00

.4 Precast Manholes, Catch Basins, and Structures: Section 33 39 00

.5 Storm Sewers and Culverts: Section 33 40 00

1.3 REFERENCE STANDARDS

.1 ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

.2 ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).

.3 ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

.4 ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2022.

.5 ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, Metric Dimensions 830 MPa and 1040 MPA Minimum Tensile Strength; 2022.

.6 ASTM D7803-19, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating.

.7 ASTM A484/A484M-24b, Stainless Steel Bars, Billets and Forgings.

.8 CAN/CGSB-1.40M-97, Primer, Anti-corrosive, Structural Steel, Alkyd.

.9 CAN/CSA S157/S157.1-2017, Strength Design in Aluminum.

.10 CSA G164-18(R2023), Hot Dip Galvanizing of Irregularly Shaped Articles.

.11 CSA S16:24, Design of Steel Structures.

.12 CSA W47.2-11(R2020), Certification of Companies for Fusion Welding of Aluminum

.13 CSA W59M-2018, Welded Steel Construction (Metal-Arc Welding)

.14 CSA W59.2M:24, Welded Aluminum Construction.

.15 ISO 12944-5:2019, Paints and Varnishes – Corrosion Protection of Steel Structures by Protective Paint Systems, Part 5: Protective Paint Systems.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 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, Angles and Plates: to CAN/CSA-G40.21M, grade as indicated.

.2 Steel Pipe: to ASTM A53/A53M, Type S, Grade A, Schedule as indicated.

.3 Stainless Steel Tubing: to ASTM A269/A269M, grade and finish as indicated.

.4 Stainless Steel Plate: to ASTM A480/A480M, grade as indicated.

.5 Stainless Steel Bars: to ASTM A484/A484M, grade as indicated.

.6 Steel Bolts and Anchor Bolts: to ASTM A307.

.7 Bolts, nuts, and washers: to ASTM A307 or ASTM F3125/F3125M as indicated.

.8 Welding Materials:

- .1 Steel: to CSA W59M.
- .2 Aluminum: to CSA W59.2 and CSA W47.2-M.

.9 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 to CSA G164.
- .5 Powder coating: to ASTM D7803.
- .6 Asphaltic paint: to ((ISO 12944-5)).

.10 Aluminum: to CSA S157.

2.2 FABRICATION

.1 Using materials indicated, fabricate items to shapes and dimensions indicated, true and accurate, with joints accurately 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; weld to CSA W59.2.

.5 Apply two (2) 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 g/m2 and in accordance with CSA G164.

2.4 SHOP PAINTING

.1 Prepare surfaces and apply one (1) 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 Leave surfaces unpainted that are 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 means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts, shields and toggles.

.3 Exposed fastening devices to match finish and be compatible with material through which they pass.

.4 Make field connections with bolts to CAN/CSA S16, or weld.

.5 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.6 Prepare surfaces and apply two (2) coats of finish paint to items scheduled for painting in Project Documents.

END OF SECTION

PART 1- GENERAL

1.1 GENERAL

.1 Due to the nature of the work, it is imperative that the work is carried out in a safe manner and that all equipment is locked out and tested for voltage prior to starting this work, where live equipment may be encountered.

1.2 WORK INCLUDED AT LIFTSTATIONS

.1 Provide all labour, tools and equipment necessary to complete the electrical and instrumentation services at the Lift Station site sas indicated on the Drawings and as specified.

.2 Supply and install new underground electrical ductbanks as indicated on the drawings and specified herein.

.3 At lift station #4, arrange and coordinate with the local power authority to provide new utility power to the new lift station. This includes installation of power conductors and conduits, and ductbank from the existing utility pole to the lift station control panel.

.4 At lift station #5, arrange and coordinate with the local power authority to provide new utility power to the new lift station. This includes installation of power conductors, conduits, and duct bank from the new padmount transformer to the lift station control panel.

.5 Arrange for the power utility to supply and install one (1) 600/347V,three phase, four wire underground power service to Pump station 4 and aboveground power service to pump station 5.

.6 At the new lift station #4, supply and install one (1) 600/347V, three phase, four wire secondary service including underground ductbanks and utility metering.

.7 At the new lift station #5, supply and install one (1) 600/347V, three phase, four wire secondary service, including underground ductbanks and utility metering.

.8 Supply and install flow meters where indicated on the drawings.

.9 Provide and install power, control and instrumentation wiring and cables as shown on the drawings.

.10 Provide and install instrumentation and control equipment as indicated on the drawings and specified herein.

.11 Supply and install required junction boxes, pull boxes, cable glands, conduit, conduit fittings and required mounting hardware.

.12 Provide and install all grounding necessary to satisfy the CEC-Part 1 and the local provincial inspection authority.

.13 Document, test and calibrate to the satisfaction of the Engineer and Owner, all electrical, instrumentation and control equipment specified herein to ensure a complete and functioning system.

.14 Safely store electrical, control and instrumentation equipment waiting installation on Site.

.15 During construction protect all installed electrical, control and instrumentation equipment.

.16 Repair/replace equipment damaged during construction, otherwise deemed defective or non-compliant with this specification, at no expense to the Owner or Engineer. These expenses must include all material, labour and other fees.

.17 Coordinate/schedule with other trades to ensure that the construction proceeds in a timely and efficient manner.

.18 Arrange for the power utility to supply and install one (1) 600/347V,three phase, four wire underground power service to Pump station 4 and aboveground power service to pump station 5.

.19 As indicated on the drawings, some areas in and around each pumpstation are Zone 1 and Zone 2 hazardous locations as defined by Section 18 of the Canadian Electrical Code. All electrical installations in these areas must be completed in accordance with the Canadian Electrical Code for the specified classification. These areas may contain hydrogen sulphide (North American Gas Group C, IEC Gas Group IIB) and methane (North American Gas Group D, IEC Gas Group IIA) gases. These areas are also a Category 2location in accordance with Section 22 of the Canadian Electrical Code and the electrical installation must be completed as per the requirements of a Category 2 location. Refer to the electrical design drawings for locations of hazardous locations.

1.3 REFERENCE STANDARDS

.1 NFPA 70-2023, Electrical Code: Most recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendment and Supplements (not applicable to pump stations).

.2 Do complete installation in accordance with CSA C22.1:24, and local regulations, except where specified otherwise.

.3 Do underground systems in accordance with CAN/CSA-C22.3 No.7-2020 except where specified otherwise.

.4 CSA C235:19, Preferred Voltage Levels for AC Systems, 0 to 50 000 V

.5 CSA Z85-83, Abbreviations for scientific and Engineering Terms.

1.4 COORDINATION OF OUTAGES – POWER AND COMMUNICATIONS

.1 Coordinate and meet the requirements of Owner. Confirm availability of power and communications when required.

.2 Coordinate all outages with the Consultant and Utilities well in advance, giving a minimum advance notice of two (2) weeks.

.3 All outages are preferred to occur during weekends or after hours unless specifically instructed otherwise.

.4 Where phasing of work results in requirement for temporary power (overhead or underground), coordinate installations with Owner and Utilities.

1.5 CARE, OPERATION AND START-UP

.1 Instruct Owner and operating personnel in the operation, care and maintenance of equipment.

.2 Arrange and pay for services of manufacturer's factory service engineer if applicable to supervise start-up after installation to check, adjust, balance, and calibrate components.

.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 all aspects of its care and operation.

1.6 VOLTAGE RATINGS

.1 Operating voltages: to CSA-C235.

.2 Control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.7 PERMITS, FEES AND INSPECTION

.1 Submit to the Electrical Inspection Department, Municipal Authority and Supply Authority the necessary drawings and specifications for examination and approval prior to commencement of work. Submit this information within ten (10) working days of the award of Tender and provide the Consultant with written notice at the time this has been submitted.

.2 Provide the Consultant with a copy of the Electrical Inspection Department and Supply Authority Plans Review Report immediately upon receipt. No shop drawings will be reviewed prior to receipt of the Plans Review Report from the Contractor.

.3 Obtain all necessary permits including an Electrical Wiring Permit for electrical work from the authority having jurisdiction prior to commencement of work. Provide a copy of the permit to the Consultant upon receipt. The permits are to be properly displayed on the work site.

.4 Upon specific request, the Consultant will provide to the Contractor up to a maximum of three (3) copies of the drawings and specifications required for submittal to the Electrical Inspection Department and Supply Authority. These drawings and specifications will be provided to the Contractor at no cost, unless specified otherwise.

.5 Arrange for all required inspections to be conducted by the authority having jurisdiction. Provide a copy of all inspection reports to the Consultant immediately upon receipt. Notify the Consultant immediately of changes required by the authority having jurisdiction.

.6 Furnish Certificates of Acceptance from authorities having jurisdiction upon completion of work. Include a copy in the Operation and Maintenance Manual.

.7 Pay all fees associated with installation, permitting and inspections.

1.8 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Sections 01 61 00.

.2 Equipment and material to be CSA certified or certified by an electrical inspection agency approved by the Provincial Electrical Inspection Department.

.3 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval, in writing, from Electrical .

.4 Factory assemble control panels and component assemblies.

1.9 FASTENERS AND EQUIPMENT

.1 Use stainless steel fasteners throughout for all conduits, cables and equipment. Fasteners include nuts, bolts, screws, and washers.

1.10 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS - LIFT STATIONS

.1 Coordinate supplier and installer responsibility for mechanical and process equipment specified in other specification divisions to ensure complete and functioning systems.

.2 Confirm location of mechanical and process equipment specified in other divisions. Device locations may not be necessarily shown on electrical drawings.

1.11 FINISHES

.1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint to the satisfaction of the Consultant. If not acceptable to the Consultant, replace equipment at no additional cost to the Contract.

.3 Clean, prime and paint exposed hangers, racks, fastenings to prevent rusting.

1.12 EQUIPMENT IDENTIFICATION - LIFT STATIONS

.1 Identify electrical equipment with nameplates as specified herein.

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached unless specified otherwise. use steel type "pop-rivets" to fasten nameplates to "metal" surfaces.

NAMEPLATE SIZES				
Size 1	9 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	19 x 90 mm	1 line	9 mm	high letters
Size 5	19 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
Size 8	50 x 100 mm	3 lines	9 mm	high letters
Size 9	60 x 150 mm	3 lines	12 mm	high letters

.3 Have wording on nameplates approved by the Engineer prior to manufacture.

.4 Allow for average of forty (40) letters per nameplate.

.5 Identification to be English.

.6 Nameplates for junction boxes to indicate system and voltage characteristics.

.7 Install lamicoid nameplates on fusible type disconnect switches and also indicate the maximum designated/designed fuse size.

.8 Install lamicoid nameplates on, or adjacent to, all various systems' control panels and/or cabinets. Nameplates are to reflect individual system's assigned name, and where applicable, also indicate designated name of power source and branch circuit breaker number(s), and voltage(s) and phase.

.9 Provide clearly visible marking on electrical equipment to warn persons of potential electrical shock and arc flash hazards as specified in Section 2 of the Canadian Electrical Code.

.10 Provide terminal boxes, panels and miscellaneous equipment fed from two or more sources with a warning nameplate prominently displayed: "CAUTION - MORE THAN ONE SOURCE VOLTAGE".

.11 Provide terminal boxes, panels and miscellaneous wire ways containing intrinsically safe circuits with a warning nameplate prominently displayed: "INTRINSICALLY SAFE CIRCUIT".

1.13 WIRING IDENTIFICATION - LIFT STATIONS

.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.

1.14 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.15 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Consultant.

.2 Porcelain enamel decal signs, minimum size 172mm x 250mm.

.3 Warning signs on, in, and around padmount transformers, sectionalizing cabinets, and switching cubicles as per NSPI requirements.

1.16 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 indicated, verify before proceeding with installation.

.3 Install electrical equipment at the following heights unless indicated otherwise.

.1 Panelboards: as required by the code or as indicated.

1.17 SHOP DRAWINGS, PRODUCTS DATA AND SAMPLES

.1 Submit shop drawings, product data and samples in accordance with Section 01 33 00.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, single line and schematic diagrams.

.4 Include wiring drawings or diagrams showing interconnection with work of other Sections.

1.18 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into operation and maintenance manual in accordance with Section 01 78 00.

.2 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
.3 Wiring and schematic diagrams and performance curves.
.4 Names and addresses of local suppliers for items included in maintenance manuals.
.5 Copy of reviewed shop drawings.

1.19 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

1.20 CONDUIT AND CABLE INSTALLATION - LIFT STATIONS

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50mm.

1.21 TESTS - LIFT STATIONS

.1 Conduct and pay for tests of the following:

.1 Power distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from control panels.
.3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
.4 Pump station control panel.

.2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturers instructions.

.3 Insulation resistance testing

.1 Megger circuits, feeders and equipment up to 350V with 500V instrument.
.2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
.3 Check resistance to ground before energizing.
.4 Provide a type written tabular report indicating test results.

.5 Submit test results for the Consultant's review and approval.

1.22 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Confirm circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings and in accordance with the Canadian Electrical Code and manufacturer's written instructions. Obtain motor data from the Equipment Supplier.

1.23 PROCESS EQUIPMENT PACKAGES - LIFT STATIONS

.1 Connection details and requirements for interwiring between vendor supplied process equipment packages specified under other Divisions and supplied by the Owner are the requirements of the Contractor.

.2 Refer to manufacturer's shop drawings for connection details and recommended installation details.

.3 Provide all cable, conduit, cable channel/trough, supports and miscellaneous hardware as per the requirements of this specification.

1.24 RECORD DRAWINGS

.1 After award of Contract, the Consultant will provide a set of full-sized drawings for the purpose of maintenance record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by the Consultant.

.2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by the Consultant.

.3 On completion of the Work and prior to final inspection, submit record documents to the Consultant.

.4 Refer to Section 01 78 00 for more details.

1.25 CLEANING

.1 Do final cleaning in accordance with Section 01 74 00.

.2 Clean the interior of all cabinets and control equipment.

1.26 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose fo all debris and waste materials at appropriate disposal/recycling facilities.

.2 Separate and recycle waste materials in accordance with applicable Construction?Demolition Waste Management and Disposal.

.3 Refer to Section 01 74 00.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not Applicable

PART 2 – EXECUTION

3.1 NOT USED

.1 Not Applicable

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for power cable 751V and over.

1.2 RELATED REQUIREMENTS

.1 General Commissioning (Cx) Requirements: Section 01 91 13.

.2 Connectors and Terminations: Section 26 05 22

.3 Installation of Cables in Trenches and in Ducts: Section 26 05 44.

1.3 REFERENCE

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C68.3-97 (R2006), Shielded and Concentric Neutral Power Cables Rated 5-46kV.
.2 CAN/CSA C68.5-2023, Shielded and Concentric Neutral Power Cable for Distribution Utilities.
.3 CAN/CSA-C60888-2016 - Zinc-Coated Steel Wires for Stranded Conductors.

.2 Insulated Cable Engineers Association (ICEA)

.1 ICEA S-93-639/NEMA WC74-2017, 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.
.2 ICEA S-94-649-2021, Standard for Concentric Neutral Cables Rated 5 through 46 kV

.3 NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.

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.

.3 Product Data: Provide for cable, terminations, and accessories.

.4 Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 CONCENTRIC NEUTRAL POWER CABLE 5-46 KV

.1 Single concentric stranded aluminum conductor, complete with helically applied copper neutral wires, size as indicated. 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 C68.5.

.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. Neutral size (1/3 or Full) as indicated in drawings.

.5 Separator tape over neutral wires.

.6 Extruded black PVC or LLDPE jacket rated minus 40°C.

.7 Standard of acceptance: General Cable, Southwire, Nexans.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install primary cables in ducts in accordance with Section 26 05 44 - Installation of Cables in Trenches and in Ducts and as indicated by design drawings.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.2, No. 65-18(R2022), Wire Connectors.

.2 CSA C22.2, No. 197-M1983(R2023), PVC Insulating Tape.

PART 2 - PRODUCTS

2.1 WIRE AND BOX CONNECTORS

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Tin-plated copper, colour keyed, crimp type compression connectors, (long barrel, two hole) with a straight, 45° or 90° lug tongue configuration as required.

.1 Acceptable products: Thomas & Betts "Color-keyed" compression connectors or approved eqivalent.

.3 Clamps or connectors for pump cables, liquid tight, flexible conduit, as required.

.4 Wire connectors to be rated for operating voltage indicated.

2.2 ELECTRICAL TAPE

.1 Vinyl Electrical Tape:

.1 Minimum 0.178mm thick, vinyl insulating tape per CSA standard C22.2 No. 197.
.2 Temperature rating up to 105°C continuous.
.3 Tape to be conformable for cold weather application down to -18°C
.4 Pressure sensitive rubber based adhesive.
.5 Suitable for wet and dry locations.
.6 Rated for 600V circuits and below.
.7 Flame retardant and UV resistant.
.8 Colour: Black.
.9 Acceptable Materials: 3M Scotch 33+ or approved equivalent.

.2 Rubber insulating tape:

.1 Highly conformable, ethylene propylene rubber (EPR), high voltage insulating and sealing tape (self bonding).
.2 Temperature rating up to 90 degrees Celsius continuous and 130 degrees Celsius short term overload service.
.3 Suitable for for wet and dry conditions.
.4 Rated for 600V circuits and below.
.5 Flame retardant.
.6 Colour: black.
.7 Acceptable manufacturers: 3M Scotch, or approved equivalent.

PART 3 - EXECUTION

3.1 WIRE AND BOX CONNECTORS INSTALLATION

.1 Make connections and terminations electrically and mechanically secure. Sizes of connectors to be per manufacturer's recommendations for various sizes and combinations of wire sizes.

.2 Make joints in branch wiring utilizing "twist-on" type connectors as manufactured by "Ideal" (colour coded wirenut) or "Marrettes" #31, #33 or #35, or approved equivalents.

.3 Plier tighten "twist-on" type connectors.

.4 For connections to equipment not provided with lugs, install colour keyed, crimp type compression connectors (long barrel, two hole, tin-plated copper, straight lug tongue) complete with manufacturer approved compression tools. Alternate lug tongue configurations (45° and 90°) will be accepted where required by application.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for all wire and cables to be used for operation at 750 V and below, with the following exceptions:

.1 Overhead service-type wire
.2 Network cable
.3 Communications/phone cable
.4 Fibre-optic cable
.5 Bare wire

1.2 RELATED SECTIONS

.1 Refer to drawings for wiring type required under different applications.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.0.3-09(R2019), Test Methods for Electrical Wires and Cables.
.2 CAN/CSA-C22.2 No. 131-17(R2022), Type TECK 90 Cable.
.3 CSA C22.2 No. 65-18(R2022), Wire Connectors.

PART 2 PRODUCTS

2.1 POWER WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper and ACM alloy conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE and RWU90 XLPE as indicated. Provide RWU90 XLPE rated cable for underground wiring. Related to new service entrance feeders and site lighting circuits. RWU90 XLPE 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.

.4 Type ACM conductors permitted for feeders above 60 amps.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.
.2 Circuit conductors: copper and ACM alloy, size as indicated.

.3 Insulation:

.1 Cross-linked polyethylene XLPE, rating - 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum, compliant to applicable Building Code classification for this project.

.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, as indicated.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.

.3 Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250°C.

.4 Overall jacket: PVC applied over the sheath and compliant to applicable Building Code classification for this project for direct buried and wet locations, as indicated.

.5 Two hour fire rating.

.6 Connectors: watertight, field installed, approved for MI cable.

.7 Termination kits: field installed approved for MI cable.

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: standard as required, complete with anti-short rings.

2.5 CONTROL CABLES

.1 Type LVT for low voltage heating and air conditioning controls, thermostats, door bells, annunciator systems, intercom systems, burglar alarm systems, and fire alarm systems: two (2) soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket. Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW-40° C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jacket.

.2 All other control wiring, with the exception of prewired cable assemblies and harnesses, shall consist of 600 volt solid/stranded tinned copper wire, cross-linked polyethylene (XLP) insulation/white jacket, moisture resistant or thermoset, CSA Certified for use in Switchboards, as follows:

.1 #12 AWG for current transformer circuits.
.2 #12 AWG for potential transformer circuits.
.3 #14 AWG for control and signal I/O circuits.

.3 Use 19 or more strand conductors for #14 AWG and larger wire, solid for smaller than #14 AWG wire.

.4 Install wires and run in wiremold raceways as defined herein and secured using PVC tie wrap at no more than 200mm junctures.

.5 Where wire transition from a fixed panel face to a swinging door assembly, install and run using a dynamic cable managing system as defined herein, designed to provide strain relief and protection against the pinch point.

.6 Wires must be continuous between terminals; splices are not permitted.

2.6 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMD90 nylon, size as indicated.

2.7 ACM CONDUCTORS

.1 Annealed, compacted aluminum alloy conductor material (ACM) for circuits 60 amps or more, single or multi-conductor, 600 volt insulation.

.2 Type: AC90, ACWU90 and TECK90.

.3 Armour: interlocked aluminum strip.

.4 Conductivity: 61% IACS to that of copper.

.5 Outer jacket: ACWU90 PVC jacket, FT-4 rated suitable for direct buried and Div. 1 and Div. 2 hazardous locations.

2.8 ACCESSORIES

.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, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

2.9 POWER WIRES - LIFT STATION

.1 Conductors: soft drawn, stranded, copper (of 98% conductivity). Minimum size: 12AWG.

.2 Copper conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated RW90.

.3 Copper conductors: size as indicated, with 1000V insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated RWU90.

.4 Colour code wiring in accordance with Canadian Electrical Code.

2.10 CONTROL WIRES - LIFT STATION

.1 Digital Circuits: stranded copper, minimum size #14 AWG with 600 volt chemically cross-linked thermosetting polyethylene material rated RW90.

.2 Analog Circuits: tinned stranded copper, minimum size #16 AWG with individually twisted shielded pairs and minimum 300 volt chemically cross-linked thermosetting polyethylene material rated RW90.

.3 120VAC control cables:

.1 Conductors: stranded copper, minimum size #14 AWG, with 600V chemically cross-linked thermosetting polyethylene material rated RW90.
.2 Voltage rating: 600V.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Perform tests using method appropriate to site conditions and to approval of the Consultant and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 No splices permitted in panel board feeders in new construction. Splices in re-work or renovation projects only with pre-approval by the Consultant.

3.2 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Section 26 05 43 - Installation of Cables in Trenches and in Ducts.

.2 Terminate cables in accordingly:

.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.

.3 Cable Colour Coding: to Section 26 05 00.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

.9 Support cables independently of supports used for equipment of other trades; do not support from or secure cables to ductwork or piping.

.10 Install cables in a neat, professional manner. Conserve headroom where possible.

.11 Install cables parallel and perpendicular to building lines.

.12 In wet/damp areas and outdoors, cables to enter into the bottom of the equipment.

.13 Twist together stranded conductors at each termination.

.14 Ty-wrap branch circuit phase conductors and neutral (where applicable) at the closest point of entry within all panelboards, pullboxes, and junction boxes.

.15 Conductor length for parallel feeders to be identical.

.16 Terminate conductors/cables.

3.3 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 cable troughs in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.
.3 In underground ducts in accordance with Section 26 05 44- Installation of Cables in Trenches and Ducts.

3.4 INSTALLATION OF TECK CABLE 0-1000V

.1 Install cables.

.2 Group cables wherever possible on channels.

.3 Install cable concealed, securely supported by straps and hangers.

3.5 INSTALLATION OF MINERAL -INSULATED CABLES

.1 Run cable exposed, securely supported by straps.

.2 Support 2 h fire rated cables at 1m intervals.

.3 Make cable terminations by using factory-made kits.

.4 At cable terminations use thermoplastic sleeving over bare conductors.

.5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.

.6 Do not splice cables.

3.6 INSTALLATION OF ARMOURED CABLES (AC-90)

.1 Group cables wherever possible.

.2 Use permitted only for work in movable partitions and vertical power supply drops to lighting fixtures.

.3 Terminate cables make safe prior to ceiling grid being installed. All lighting drops to be terminated safely, with approved connectors, within an approved box, complete with cover.

3.7 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit as indicated.

.2 Ground control cable shield as required.

3.8 INSTALLATION OF NON-METALIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

.3 Use permitted in wood stud construction only.

3.9 INSTALLATION OF ACM CONDUCTORS

.1 Install ACM cables as per the latest edition of the Canadian Electrical Code and manufacturers installation requirements.

.2 Do not terminate ACM conductors with a copper bodied connector.

.3 Apply oxide coating on base cables as per electrical code requirements.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 General Commissioning (Cx) Requirements: Section 01 91 13

.2 Medium Voltage Cable: Section 26 05 13

.3 Grounding - Primary: Section 26 05 27

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.41:22, Grounding and Bonding Equipment.
.2 CSA C22.2 No.65-18(R2022), Wire Connectors.

.2 Institute of Electrical and Electronic Engineers (IEEE):

.1 IEEE 48-2009, IEEE Procedures and Requirements for Alternating Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5kV Through 765kV or Extended Insulation Rated 2.5kV Through 500kV.
.2 IEEE 386-2016, Separable Insulated Connector Systems for Power Distribution Systems.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 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 GENERAL

.1 All inserts, elbows, caps, and junctions to be from the same manufacturer.

.2 Acceptable manufacturers:

.1 Eaton/Cooper
.2 ABB/Elastimold
.3 Hubbell

.3 Nameplate showing information in accordance with CSA C22.1 as applicable.

2.2 ELBOWS

.1 Elbow cable connectors to IEEE 386 and as follows:

.1 15 kV Class, rated for 200A continuous (load break) or 600A continuous (dead break T-body).

.2 Tin-plated copper loadbreak probe.

.3 Copper compression connector with copper barrel for cable connections.

.4 Integral jacket seal to prevent moisture ingress.

.5 Grounding tabs for connection of grounding conductor.

.6 All connectors must be suitable for new and existing bushings. Confirm existing bushing type and size prior to ordering.

.7 Provide elbows with voltage test point with hot stick removable cap.

.8 Suitable for power cable provided in Section 26 05 14.

.9 Identification label stating elbow rating and manufacturer.

2.3 JUNCTIONS

.1 Junctions to IEEE 386 and as follows:

.1 15 kV Class, rated for 600A continuous.
.2 Four (4) terminal bushings, internally bussed together, complete with indicator rings.
.3 Two (2) parking stands to accommodate insulated standoff bushings or portable feed-thrus.
.4 All bus bars and other current-carrying components to be copper. Mounting brackets and hardware to be stainless steel.
.5 Contact assembly identical to bushing insert.
.6 Stainless steel mounting bracket.
.7 Standard interface spacing 100mm (4”).
.8 Grounding lug.

2.4 INSULATED CAPS

.1 Insulated dead-end caps to IEEE 386 and as follows:

.1 15 kV Class, rated for 200A or 600A (compatible with application).
.2 Tin-plated copper probe.
.3 Grounding tabs for connection of grounding conductor.
.4 All caps to be suitable for new and existing bushings.

.2 Install insulated caps on all un-used bushings and bond to ground.

2.5 SURGE ARRESTOR ELBOWS

.1 Surge Arrestor elbow connectors to IEEE 386 and as follows:

.1 MCOV rating suitable for 15 kV Class system as indicated on drawings.
.2 Copper loadbreak probe.

.3 Flexible copper ground lead.
.4 Integral jacket seal to prevent moisture ingress.
.5 All connectors must be suitable for new and existing bushings. Confirm bushing type and size prior to ordering.

2.6 CONNECTORS AND ACCESSORIES

.1 All plugs, inserts, receptacles, amd other medium-voltage separable connectors as indicated on drawings. All must be IEEE 386 compliant and compatible with other components of the system.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install termination kits and connectors in accordance with manufacturer's instructions. Include all accessories or kits required for complete installation.

.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.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE).

.1 ANSI/IEEE 837-2014, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association (CSA)

.1 CSA C22.2 No.0.4-17 (R2022), Bonding and Grounding of Electrical Equipment (Protective Grounding).
.2 CSA C22.2 No.41:22, Grounding and Bonding Equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Conductors: bare, stranded, size as indicated on the Project Drawings, 7 strand copper MHD (medium hard drawn).

.2 Ground Rods: 19mm dia., top 250mm galvanized, lengths as indicated in drawings.

.3 Conductors: PVC insulated coloured green, stranded untinned soft annealed copper wire, size as indicated on the Project Drawings for grounding cable sheaths, raceways, pipe work, screen guards, meter, and relay cases.

.4 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.

.5 Provide grounding electrodes, couplers, and connectors manufactured in accordance with CSA C22.2 No. 41.

.6 Grounding/bonding conductors to be made of copper. Where joints are unavoidable, make such that they do not materially increase the resistance of the grounding conductor, and so they have appropriate mechanical and corrosion-resistant characteristics.

PART 3 - EXECUTION

3.1 GROUNDING INSTALLATION

.1 Install complete, permanent, continuous system including electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of the Consultant 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, structural steel work, using permanent mechanical connectors to ANSI/IEEE 837 and as indicated on drawings.

.5 Use appropriate conductor size for grounding installation associated with each item as indicated on the drawings.

.6 Soldered joints not permitted.

.7 Install grounding connections to distribution equipment ground bars.

.8 Install conductors used to interconnect grounding electrodes or form buried ground grids at a minimum depth of 300mm below grade. Where used, install rod type grounding electrode such that the top ends of the grounding electrodes are a minimum distance of 300mm below final grade level. To optimize grounding effectiveness, the horizontal distance between the grounding electrodes should be greater than or equal to their length and installed as indicated on the drawings.

.9 Install ground tie under ductbank as indicated on the drawings.

.10 Install pull pit internal ground connections and external loop as indicated on the Project Drawings.

3.2 EQUIPMENT GROUNDING

.1 Install grounding wires and loops complete with electrodes/rods and connections as indicated in drawings.

.2 Provide grounding/bonding for underground supply circuits and associated equipment. Ground exposed, normally non-current-carrying metal parts associated with the underground system, including metal poles and the reinforcing steel of other poles.

.3 Leave 3.0m ground tail coiled in cavity beneath padmounted equipment.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

3.3 RISER POLE

.1 Install riser pole ground rods in undisturbed earth approximately 600mm from the base of the pole and buried at least 300mm below grade. Cover the ground wire installed down the pole with non-metallic moulding, from the system neutral to 150mm below grade. Connect metallic cable guards to the ground wire.

3.4 FIELD QULAITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction.

.3 Ground the distribution such that the system neutral-to-earth potential does not exceed 10 volts.

.4 Perform tests before energizing electrical system.

.5 Record all test results and include in the Operation and Maintenance Manual specified in Section 01 78 00.

3.5 MEDIUM VOLTAGE CABLE

.1 Connect concentric neutral primary medium voltage cables to grounding system at terminations and connectors as indicated on the Project Drawings.

.2 Bond all connectors and terminations as indicated on the Project Drawings

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 21 - Wires and Cables (0 - 1000V).

1.2 REFERENCES

.1 IEEE 837-2014, Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA C22.2 No. 41:22, Grounding and Bonding Equipment.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required and suitable for application.

.2 Rod electrodes: copper clad steel 19mm dia. length as indicated on the Project Drawings.

.3 Plate electrodes: be not less than 6.4 mm (1/4 in) in thickness if of iron or steel, or 1.5 mm (0.06 in) if of nonferrous metal, other than aluminum; and have a total surface area of not less than 0.186 m2 (2 ft2).

.4 Direct buried grounding conductors: bare stranded copper of 98% conductivity, soft annealed, size as indicated.

.5 Insulated grounding and bonding conductors: soft drawn stranded copper of 98% conductivity, type RW90 for sizes #10 AWG and #12 AWG (green coloured insulation. Type TW75 green coloured insulation is acceptable for sizes #8 AWG and larger.

.6 Main electrical ground bar: copper, pre-drilled, minimum size 6mm x 100mm x 914mm or as required, complete with cone-shaped insulated supports, fastenings, connectors.

.7 Provide ground connections on the ground bus as follows:

- .1 Copper, one hole, short barrel (single crimp) type lugs are to be used for all wire sizes up to, but not including #6 AWG.
- .2 Copper, two holes, long barrel (dual crimp) type lugs are to be used for all wire sizes #6 AWG and larger.

.8 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.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

.9 Copper compression type, long barrel, two hole type lugs unless specified otherwise.

.10 Copper compression type connectors (cable to cable, cable to ground rod, etc.).

2.2 MANUFACTURERS

.1 Acceptable manufacturers: FCI-Burndy Corporation, Erico Inc., Thomas & Betts, Ilsco.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Conform to the requirements of the Consultant, applicable codes and the local electrical inspection authority having jurisdiction.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding and bonding conductors from mechanical injury.

.4 Make buried connections, and connections to electrodes using copper welding by thermit process or inspectable copper crimp type compression connectors.

.5 Use mechanical connectors for grounding and bonding connections to equipment provided with lugs except grounding terminations in 600V switchboards, 600V CDP panels, 600V MCC's to be copper, compression type, long barrel, two-hole connectors.

.6 Soldered joints not permitted.

.7 Install insulated bonding conductor in all conduits.

.8 Install separate insulated bonding conductor to outdoor lighting standards.

.9 Connect building structural steel to ground as indicated on the drawings.

.10 Bond all copper water pipes at single point as required.

.11 Ground secondary service pedestals.

.12 Make grounding connections in radial configuration only, with connections terminating at single grounding point on street side of water pipe. Avoid loop connections.

.13 Secure the feed bonding conductor, wrapped around unbroken, to the grounding screw of each outlet/device box, before connecting to the other grounding conductors and/or providing a pig-tail lead for device terminations.

.14 Twist ground/bond wires together with a screw-on type wire connector, and then placed in the rear of the outlet box.

.15 Bond EMT stubs and sleeves to ground.

.16 Bonding jumpers are permitted for conduit stubbed into a T-bar ceiling.

.17 Bond EMT wall sleeves to ground on one end of the sleeve using bonding connection of screw-on metal type bushing.

.18 Bond conduits containing insulated grounding/bonding conductor(s) at both ends.

.19 Bend radius of all grounding/bonding conductors to be a minimum of 230mm.

.20 Bond metallic raceways used for telecommunications systems to ground with a minimum of #12 AWG.

.21 Make conductor to conductor connections for grounding/bonding conductors with compression or exothermic welded connection. Mechanical/bolted connections will not be accepted.

3.2 ELECTRODES AND PLATES

.1 Install rod electrodes or grounding plates where indicated on the drawings.and make grounding connections.

.2 Bond separate, multiple electrodes or grounding together.

.3 Use size #4/0 AWG copper conductors for connections to electrodes OR or grounding plates unless otherwise indicated.

.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 systems.

.2 The main incoming ground conductor is to run unbroken to the main electrical service entrance overcurrent device ground bus and then to the wall mounted ground bus.

3.4 EQUIPMENT GROUNDING

.1 Install grounding/bonding 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, distribution panels, outdoor lighting, metallic waste water piping systems, metallic rain water leader systems.

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on each wall of electrical and telecommunications rooms.

.2 Ground items of electrical equipment to ground bus as indicated herein and on the Drawings.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the Consultant and local authority having jurisdiction over installation. Confirm the ground impedance is less than 10 ohms.

.3 Perform tests before energizing electrical system.

.4 Where applicable, disconnect ground fault indicator during tests.

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED

.1 Not applicable.

PART 2 - PRODUCT

2.1 SUPPORT CHANNELS

.1 U shape, size 41 mm x 41 mm, 2.7 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 316 stainless steel.

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 are not acceptable.

.3 The use of cable ties for supporting purposes is not permitted. Cable ties can only be used to hold various system cables in place.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to 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 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 straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole straps for conduits and cables larger than 50 mm.
- .3 Conduit straps to match conduits in material and finish. Cable straps to be stainless steel.
- .4 Use heavy duty pipe clamps (with adjustable saddles) to secure conduits/cables to support channels.

.6 For surface mounting of two (2) or more conduits and cable, use support channels spaced in accordance with the Canadian Electrical Code (maximum 1.5m spacing).

.7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.8 Provide adequate support for conduits and cables dropped vertically to equipment where there is no wall support.

.9 Do not use wire lashing or perforated strap to support or secure conduits or cables.

.10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Consultant.

.11 Provide fastenings and supports as required for each type of equipment, cables and conduits, and in accordance with manufacturer's installation recommendations.

.12 Install isolation pads between dis-similar metals where required.

.13 Coordinate support system locations with other trades before installation.

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 CABINETS, JUNCTION AND PULL BOXES

.1 General: Provide outlet, tap, junction and pull boxes. Provide junction and pull boxes longer than 500mm in any dimension complete with continuously hinged cover.

.2 Tap, junction and pull boxes: Provide boxes constructed of welded and galvanized sheet steel, of sizes required by Canadian Electrical Code. Use 14 USS gauge metal on boxes with no dimension of 600 mm or more, except use 10-gauge boxes with any dimension of 900 mm or more.

.3 Watertight boxes: In damp, wet and outdoor locations, provide NEMA Type 4X water-tight boxes with clamped, threaded or bolted covers. Boxes to be stainless steel (316SS) or copper free cast aluminum boxes.

.4 Hazardous rated boxes:

- .1 Boxes must be suitable for the hazardous classification as noted on the drawings and be corrosion resistant.
- .2 Boxes to be copper free, die cast aluminum boxes with threaded connections for use with threaded aluminum conduit.
- .3 Provide boxes complete with integral terminal blocks where specified. Quantity, size and rating of terminal blocks to match application. Terminal blocks to be DIN-rail mounted.
- .4 Boxes to be weatherproof.

.5 Junction boxes for intrinsically safe circuits

- .1 Boxes to be NEMA 4X (316 stainless steel) or hazardous rated as specified in 2.1.4.
- .2 Pre-configured enclosure with DIN-rail mounted terminal blocks.
- .3 Terminal blocks to be coloured blue.
- .4 Quantity, size and rating of terminal blocks to match application.

.6 Provide outdoor enclosures that house electrical components complete with padlocking attachment.

.7 All hazardous rated, intrinsically safe and NEMA 4X junction and pull boxes shall have corrosion resistant stainless steel external hardware (screws, latches, mounting feet, etc.).

PART 3 - EXECUTION

3.1 JUNCTION AND PULL BOX INSTALLATION

.1 Install junction and pull boxes in inconspicuous but accessible locations.

.2 Mount junction and pull boxes where noted on the Drawings and as described herein.

.3 Provide all required mounting hardware.

.4 Bond all boxes with bonding conductor.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.1:24, Canadian Electrical Code, Part 1 (latest Edition), Safety Standard for Electrical Installations.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 100 mm square or larger outlet boxes as required for special devices.

.3 Blank cover plates for boxes without wiring devices.

.4 Cast FS or FD copper free aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

.5 Boxes to be suitable for installation in the hazardous area classification specified.

2.2 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 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

.5 Watertight bushings and cable connectors for all cable/conduit terminations in NEMA 3R/4/4X and hazardous rated pull/junction boxes, control panels and cabinets.

.6 Sealing rings for conduit connections outdoors and in below grade chambers.

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 Provide correct size of opening in boxes for conduit and cable connections. Reducing washers not allowed.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.2 No. 18.4-15(R2024), Hardware for Support of Conduit, Tubing and Cable.

.2 CSA C22.2 No. 211.2-06(R2021), Rigid PVC Conduit.

.3 CSA C22.2 No. 56-17(R2022), Flexible Metal Conduit and Liquid - Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 45.2-08(R2023), Electrical Rigid Metal Conduit - Aluminum, Red Brass and Stainless Steel.

1.2 LOCATION OF CONDUIT

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Rigid PVC conduit, fittings and connectors to CSA C22.2 No. 211.2 for underground services or as specified on the drawings.

.2 Liquid-tight flexible metal conduit, fittings and connectors to CSA C22.2 No. 56.

.3 Rigid aluminum conduit, fittings and connectors to CSA C22.2 No. 45.2.

.4 Minimum power and control/instrumentation conduit size for all areas: 21mm.

.5 Rigid PVC conduit to be FT4 rated.

2.2 CONDUIT FASTENINGS

.1 One hole cast aluminum straps to secure surface conduits 50 mm and smaller. Two hole cast aluminum straps for conduits larger than 50 mm.

.2 Use stainless steel, heavy duty conduit clamps (with adjustable saddle) to secure conduits to channels.

.3 Refer to specification Section 26 05 29 for surface support systems for conduits.

.4 Isolators between dissimilar metals.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 27mm and larger conduits.

.3 Watertight connectors for liquid tight flexible conduit.

.4 Raintight connectors for connections to outdoor enclosures.

.5 Cast type EYS and EYD type sealing fittings with factory threaded hubs and rated for installation in the hazardous areas as noted on the drawings.

.1 Acceptable Manufacturers: Appleton, Crouse-Hinds or Killark.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion as required.

.2 Watertight expansion fittings with internal bonding jumper suitable for linear expansion and 19mm deflection in all directions.

.3 Provide expansion fittings at exit point (above grade) of all underground services.

2.5 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Use rigid aluminum threaded conduit unless otherwise indicated.

.3 Use rigid PVC conduit underground.

.4 Use liquid tight, flexible metal conduit for final connection to instrumentation and vibrating equipment (motors, valves, etc.) located in non-hazardous areas.

.5 Use flexible couplings (explosion-proof, watertight, Appleton Type EXGJH or EXLK or approved equivalent) for final connection to vibrating equipment (motors, valves, etc.) and instrumentation located in hazardous areas.

.6 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.7 Mechanically bend steel conduit over 21 mm dia.

.8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.9 Install fish cord in empty conduits. Cap and seal at each end.

.10 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.11 Dry conduits out before installing wire.

.12 Provide minimum 300 mm spacing between instrumentation/control conduits and 600V power conduits. Where possible, instrumentation/control conduits to cross at right angles to 600V

power conduits.

.13 Seal conduit sleeves penetrating into the wet well using duxseal at the termination junction box.

.14 Install conduit sealing fittings in hazardous areas in accordance with Canadian Electrical Code requirements. Fill with compound. All conduit leaving a hazardous area shall be sealed using an approved sealing fitting when conduit is continuous.

.15 Drawings do not show all required unions. Install unions to facilitate removal of equipment. Where seals are installed, install unions between the equipment and the seal.

.16 Install conduits to prevent low pockets where moisture can accumulate. Install a combination breather and drain fitting at the lowest point of each above-grade conduit system, which is unbroken by sealing fittings on other obstructions.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to structure lines.

.2 Group conduits wherever possible on surface channels.

.3 Do not pass conduits through structural members except as indicated.

.4 Provide offsets for conduits entering surface mounted enclosures and device boxes and fittings.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 The provisions for pulling cables through new or existing ducts.

1.2 RELATED SECTIONS

.1 General Commissioning (CX) Requirements: Section 01 91 13

.2 Medium Voltage Cable: Section 26 05 13

.3 Wire and Cable (0-1000V): Section 26 05 14

PART 2 PRODUCTS

2.1 CABLES

.1 Refer to Sections 26 05 14 and 27 05 13 for cable specifications.

PART 3 EXECUTION

3.1 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts. 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 Before pulling cable into ducts and until cables are properly terminated, seal ends of non-leaded cables with moisture seal tape.

.5 After installation of cables, seal duct ends with duct sealing compound.

.6 Do not exceed rated pulling tension of cable being installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Sections 01 91 13 - General Commissioning (CX) Requirements.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Provide the Consultant 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.

.4 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 This Section includes materials, installation, and testing for padmounted transformers.

1.2 REFERENCES

.1 Canadian Standards Association (CSA):

- .1 CSA C22.1:24, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.
- .2 CSA C22.1:24, Single-Phase and Three-Phase Liquid-Filled Distribution Transformers
- .3 CAN/CSA C802.1:23, Minimum Efficiency Values for Liquid-Filled Distribution Transformers.
- .4 CAN/CSA C50-14(R2023), Mineral Insulating Oil for Transformers and Switches.
- .5 CSA C227.3-06(R2022), Low-Profile, Single-Phase, Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors.
- .6 CSA C227.4:21 - Three-Phase, Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors
- .7 CSA C227.3:22 - Low-profile, single-phase, pad-mounted distribution transformers with separable insulated high-voltage connectors
- .8 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
- .9 CSA W59:24, Welded Steel Construction (Metal Arc Welding).
- .10 CSA SPE-1000-21, Model Code for the Field Evaluation of Electrical Equipment.

.2 Institute of Electrical and Electronics Engineers (IEEE):

- .1 IEEE 386-2016, Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5kV through 35kV.
- .2 IEEE C57.12.29-2023, Pad-Mounted Equipment-Enclosure Integrity for Coastal Environments.
- .3 IEEE 519-2022, IEEE Standard for Harmonic Control in Electric Power Systems.

.3 American Society of Testing and Materials (ASTM)

- .1 ASTM D3612-02(2017), Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography
- .2 ASTM D1533-20, Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration
- .3 ASTM D971-20, Standard Test Method for Interfacial Tension of Insulating Liquids Against Water by the Ring Method
- .4 ASTM D974-22, Standard Test Method for Acid and Base Number by Color-Indicator Titration
- .5 ASTM D1500-24, Standard Test Method for ASTM Color of Petroleum Products
- .6 ASTM D1524-15(2022), Standard Test Method for Visual Examination of Used Electrical Insulating Liquids in the Field
- .7 ASTM D877/d877m-19E1, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes

.8 ASTM D4059-00(2018), Standard Test Method for Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography
.9 ASTM D924-23, Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids
.10 ASTM D287-22, Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer/Method)

1.3 RELATED SECTIONS

.1 Section 26 05 22: Connectors and Terminations

.2 Section 26 05 27: Grounding - Primary

.3 Section 26 05 28: Grounding - Secondary

1.4 SUBMITTALS

.1 Submittals to be in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings to include, but not be limited to:

.1 The pad-mounted transformer assembly drawings showing assembly, details, and layout including anchor bolts, openings for cables, and all pertinent support structure loading details.
.2 Include on drawings a complete bill of material and show: 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 All terminals, wire and terminal numbering and incorporate equipment schematic details.
.4 Primary fuse time-current characteristics.
.5 Insulating liquid capacity.
.6 Completed factory test report.

.3 Include certificate(s), but not limited to:

.1 CSA certificate.

.4 Include in Operations and Maintenance Manuals, but not limited to:

.1 Furnish manufacturer comprehensive instruction manual covering installation of the pad-mounted transformer assembly and operation of the various components.
.2 Instruction manuals to describe in detail the construction and recommend procedures for assembling, dismantling, maintaining, and operating all equipment and listing all replacement parts. Include copies of all pertinent bulletins and instructions prepared by the manufacturer, of component parts of the equipment, properly catalogued for easy reference.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Unless otherwise noted, give CSA Standards precedence when and where conflicts arise.

.2 Ratings:

.1 Configure all transformers 4160/2400V primary, single or three phase as indicated in drawings, secondary voltage as indicated in drawings, kVA rating as indicated in drawings, HV BIL 90 kV, XV BIL 15 kV, 60Hz.
.2 Transformer impedance shall comply with minimum value as per C227.4/C227.3, and meet minimum efficiency required by C802.1.

.3 General:

.1 Dead-front, integrated, transformer construction.
.2 Three-phase transformers to have three (3) medium-voltage windings, ratings as indicated, complete with two (2) enclosed front-mounted bushing wells HA and HB.
.3 Single-phase transformers to have one medium-voltage winding, ratings as indicated, complete with two (2) enclosed front-mounted bushing wells HA and HB.
.4 The transformer to have low-voltage windings, ratings as indicated, complete with three (3) enclosed front-mounted low-voltage bushings, consisting of spade-type terminals.
.5 All external connections to the transformer are to be via power cables run in underground conduit through bottom entry.
.6 Make medium-voltage terminations via separable insulated connectors inserted into load-break bushing wells.
.7 Low-voltage terminations to be via spade-type terminals.
.8 The medium-voltage winding must 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 25000V. Tap changer to include provision for padlocking and is to be located inside the termination compartment. Operation of the tap changer to be by manual tap switch located inside the transformer termination cabinet.
.9 Transformers to be complete with integral, load-break switch to disconnect the primary winding from the circuit. This load break switch must not interrupt the connection between the HA and HB bushings.

.4 Performance:

.1 Base temperature ratings of the pad-mount transformer 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.
.2 Ancillary equipment such as bushings, winding leads, etc. must not restrict the transformer loading to levels below those permitted by the winding conductor and other metallic part hot spots.
.3 Base the short circuit design of the transformer on a solidly-grounded neutral connection at the low voltage winding and a solidly grounded medium voltage system.
.4 Each transformer must be capable of carrying the maximum total harmonic distortion currents (per IEEE 519) under normal operation without appreciable loss of transformer life expectancy.
.5 Provide transformer efficiencies to meet or exceed CAN/CSA C802.1.

.5 Windings:

.1 Winding material to be copper.

.6 Construction:

.1 Tank to be of welded, brushed 304 stainless steel construction, free from distortion and suitable for permanent installation on flat concrete pad.
.2 All welding to conform to the requirements of CSA W59. Welder qualifications in accordance with CSA W47.1.
.3 Tank cover to be peaked or sloped and the compartment roof coated with anti-condensation material to prevent water accumulation.
.4 Compartment doors: entry to the pad-mounted transformer secured by hex-head bolts and complete with provision for installation of a padlock.
.5 Provide stays to hold compartment doors in 110° open position.
.6 Permanently affix tank lifting provisions consisting of lifting lugs and jacking lugs of sufficient strength and location to provide for lifting the fluid-filled transformer into position on the concrete pad and adjusting its position.
.7 Transformer to have tamper-proof hand holes to permit access to the tank where necessary.

.7 Layout:

.1 Locate terminals on the transformer tank wall.
.2 Arrange the medium-voltage terminals such that, when facing the open termination compartment of the transformer, order the open termination compartment of the transformer, order the terminals HA and HB from left to right to the observer, the terminals HA and HB from left to right to the observer.
.3 Affix one (1) parking stand per medium-voltage terminal, suitable for a medium-voltage, separably-insulated connector (loadbreak/deadbreak elbow) to the transformer tank inside the termination cabinet beside the medium voltage terminals; each parking stand to be constructed from the same material as the tank, welded in place and painted to match the tank.
.4 Arrange low-voltage terminals such that, when facing the open termination compartment of the transformer, the terminals shall be in the order of X0, X1, X2 and X3 from left to right to the observer.
.5 The single-phase transformers shall have a distribution panel board installed inside the cabinet on the low voltage side of the transformer. Configure the panel board per the design drawings, and construct to Section 26 24 17.
.6 Internal panel boards (as required) to be rated NEMA 3S and suitable for installation in marine environments.

.8 Paint finish:

.1 The exterior paint colour to be Equipment Green in accordance with EEMAC Y1-2. Apply paint with appropriate procedure for the equipment material and finish.
.2 Supply primer and finish paint with the equipment for touch up purposes.
.3 Paint finish must be suitable for mounting of the unit outdoors in a coastal environment and capable of resisting the following minimum conditions, in addition to the requirements of C57.12.29:
    .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 Tabor abrasion test resistance to 5000 cycles.

.6 Oil and heat resistant.

.9 Grounding:

.1 Secure a continuous solid copper grounding bus to the exterior transformer tank wall along the inside base of each compartment, complete with all connections and hardware in accordance with CSA C227.4/C227.3.
.2 Grounding connectors to be suitable for up to and including #250 kcmil copper conductor.
.3 Bond all compartment doors, covers, and non-energized extraneous devices to the transformer tank by use of a bonding strap.
.4 Refer to Sections 26 05 27 and 26 05 28.

.10 Acceptable manufacturers:

.1 Eaton
.2 Carte
.3 PTI
.4 Coordinate transformer sizing variances between manufacturers with respect to supporting structures and related details at no additional cost to contract.
.5 ***CES Transformers (Addendum No. 3)***

2.2 ACCESSORIES

.1 Insulating fluid:

.1 The insulating fluid is to be FR3 natural dielectric ester fluid that is free from all materials detrimental to its insulating properties.
.2 The insulating fluid must be certified PCB free.
.3 The insulating fluid is to be suitable for use in power transformers and associated tap changers operating in ambient temperatures below -25°C.

.2 Relays, gauges, indicators, and valves:

.1 Supply transformer with the following accessories with all auxiliary contacts of the devices wired to terminal blocks in the control cabinet:
.1 Pressure Relief Device.
.2 21mm Drain Valve.
.3 21mm Filler Plug.
.4 Tap Switch.
.5 Non-PCB Label.

.3 Terminals and connections:

.1 All terminals must be capable of accepting either Aluminum or Copper conductors with no deleterious electrochemical effects.
.2 Medium-voltage terminals to consist of bushing wells complete with 15kV bushing well inserts for the acceptance of 15kV separable connectors (loadbreak/deadbreak elbows), two (2) per phase (HA and HB).
.3 Provide and ship medium-voltage bushing wells with a protective cap.
.4 Include insulated parking bushings, suitable for the tank-mounted parking stands defined herein, for parking of connectors/elbows for the medium-voltage connections, to IEEE

386.

.5 Four (4)-hole brass, spade-type, low- and neutral-voltage terminals.

.6 Provide each neutral termination complete with one (1) ½ - 13 tapped ground pad with a removable ground strap.

.7 Afford clearance and characteristics for all bushings/wells to CSA C227.4/C227.3 and C22.1 with the following basic impulse levels:

.1 HA and HB (15000 V bushing inserts): 90 kV BIL.

.2 X1, X2 and X3 or 240/120 V bushings: 15 kV BIL.

.3 Fuses: provide transformer with bayonet-type expulsion fuses, sized in accordance with CSA C227.4/C22, in series with current limiting fuses enclosed under insulating fluid in the transformer tank.

2.3 FACTORY TESTS

.1 Carry out all standard tests as defined by CSA C227.4/C227.3 and IEEE C57.12.29 for new pad-mounted transformers.

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Nameplate showing information in accordance with CSA C22.1.

2.5 WARNING SIGNS

.1 Provide warning signs in accordance with Section 26 05 00.

PART 3 - EXECUTION

3.1 FACTORY QUALITY CONTROL

.1 Submit to the Consultant factory test results and certificates of type tests within 48 hours of completion of tests.

3.2 DELIVERY

.1 Ship equipment to the site pre-assembled where possible.

.2 Coordinate delivery and storage with the Consultant.

3.3 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.

3.4 INSTALLATION

.1 Confirm concrete pad is fully cured before transformer is installed.

.2 Set and secure transformer unit in place, rigid, plumb, and square.

.3 Make connections as shown on the drawings.

.4 Connect transformer unit ground bus to system ground and as indicated on the drawings.

.5 Take care to prevent contamination of liquid and components when field filling transformers.

.6 Use only metal hose when field-filling transformer with insulating fluid: never, under any circumstances, use rubber hose.

.7 Set taps to produce rated secondary voltage at no-load.

.8 Install surge arrestor elbows on out-loop of loop-feed transformer(s) when installed in a radial configuration.

.9 Cap spare conduits and seal conduits containing cables.

3.5 TESTING REQUIREMENTS FOR NEW PADMOUNT TRANSFORMERS

.1 Provide service of competent technicians, mechanics or other trained personnel of the supplier or manufacturer to check the complete installation and be present for start-up of the equipment. Submit written report signed by the equipment manufacturer's representative to the Consultant stating that a satisfactory installation of equipment has been performed and outlining any modifications that have been made during the commissioning or testing of the equipment and that the equipment is now ready for permanent operation.

.2 Testing to include, but not be limited to the following:

- .1 Carry out following insulation tests using an instrument 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.
- .2 Measure the impedance of the transformer grounding system using the fall-of-potential method as per IEEE 81. Submit test results to Consultant.
- .3 Inspect primary and secondary connections for tightness and for signs of overheating. Photograph all transformer connections with a thermal-imaging infrared camera and submit photographs in digital format to Consultant in accordance with Section 01 33 00 – Submittal Procedures.
- .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 OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Drawings to include electrical detail of panel, branch breaker type, breaker quantity, ampacity, short circuit rating, bus materials and enclosure dimension.

1.2 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for panelboards for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Include panel schedules.

1.3 REFERENCES

.1 IEEE C62.41.1-02(R2008), Guide on the Surges Environment in Low-Voltage AC Power Circuits.

.2 IEEE C62.45-02(R2008), Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

.3 UL 1449-21, UL Standard for Safety Surge Protection Devices.

.4 UL 1283-17(R2018), UL Standard for Safety Electromagnetic Interference Filters.

PART 2 - PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: use the product of one (1) manufacturer throughout.

.2 250 and 600 V panelboards: bus and breakers rated as indicated.

.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.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two (2) keys for each panelboard and key panelboards alike.

.6 Tin-plated copper bus. Neutral to be 100% rated of mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

.10 Minimum of one (1) terminal screw on factory installed neutral bar for each circuit breaker position.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 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. 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 the Owner.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Electrical General Requirements.

.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 STANDARD OF ACCEPTANCE

.1 Branch panels: Siemens P2.

2.5 ACCEPTABLE MANUFACTURERS

.1 Siemens

.2 Eaton

.3 Schneider

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Section 26 05 00 - Electrical General Requirements or as indicated.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus with respective neutral identified.

.5 Where more than one (1) bonding terminal strip is present in one (1) panel, hardwire both together using same size bonding conductor as the one (1) that accompanies the panel feeder conductors.

END OF SECTION

PART 1 - General

1.1 REFERENCES

.1 CSA C22.2 No. 42-22, General Use Receptacles, Attachment Plugs and Similar Wiring Devices.

.2 CSA C22.2 No. 55:15(R2020), Special Use Switches.

.3 CSA C22.2 No. 111-18(R2023), General Use Snap Switches.

1.2 SHOP DRAWINGS

.1 Submit shop drawings for each device and cover plate type as per Section 01 33 00.

1.3 OPERATIONAL AND MAINTENANCE DATA

.1 Provide operation and maintenance data for wiring devices for incorporation into manual specified in Section 01 78 00

PART 2 - Products

2.1 SWITCHES

.1 Design S1:

.1 20 A, 120 V, specification grade single pole-, two-, three- and four-way switches as indicated or required.

.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 molding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Colour:

.1 White nylon, heavy duty toggle unless otherwise indicated.

.2 Brown nylon, heavy-duty, in-service shops, utility spaces, parts storage.

.6 Integral ground terminal.

.2 Toggle operated fully rated for tungsten filament and fluorescent lamps, LED sources and up to 80% of rated capacity of motor loads.

.3 Use the switches of a single manufacturer throughout the Work.

.4 Standard of Acceptance: Hubbell 1200 Series.

.5 Approved Manufacturers:

.1 Eaton
.2 Hubbell
.3 Legrand
.4 Leviton

2.2 RECEPTACLES

.1 Design R1:

.1 Duplex receptacles, specification grade CSA type 5-20 (T-Slot), 125 V, 15/20A, U ground, with following features:

.1 Colour:

.1 White urea moulded housing unless otherwise indicated.

.2 Brown urea moulded housing in utility spaces.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight (8) back wired entrances, four (4) side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.6 White nylon face.

.7 Standard of Acceptance: Hubbell 5262 Series.

.8 Acceptable Manufacturers:

.1 Eaton

.2 Hubbell

.3 Legrand

.4 Leviton

.2 Design R2:

.1 Duplex receptacles, specification grade CSA type 5-15, 125 V, 15/20A, U ground, with following features:

.1 Colour:

.1 White urea moulded housing unless otherwise indicated.

.2 Brown urea moulded housing in utility spaces.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight (8) back wired entrances, four (4) side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.6 White nylon face.

.7 Standard of Acceptance: Hubbell 5262 Series.

.8 Acceptable Manufacturers:

.1 Eaton

.2 Hubbell

.3 Legrand

.4 Leviton

.3 Design R3:

.1 GFI duplex receptacles. Specification grade, CSA type 5-20R, 125V, 20A T-slot, U-Ground with the following features:

.1 Colour:

.1 White urea moulded housing unless otherwise indicated.

.2 Brown urea moulded housing in, utility spaces, and exterior.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Eight (8) back wired entrances, four (4) side wiring screws.
.4 Triple wipe contacts and riveted grounding contacts.
.5 White nylon face.
.6 CSA Class 'A' 5mA leakage current.
.7 GFI test and reset buttons.
.8 Standard of Acceptance:
.1 Hubbell GF (20)-LA Series.
.9 Approved Manufacturers:
.1 Eaton
.2 Hubbell
.3 Legrand
.4 Leviton

.4 Design R4:

.1 GFI duplex receptacles. Specification grade, CSA type 5-15R, 125V, 15A, U-Ground with the following features:
.1 Colour:
.1 White urea moulded housing unless otherwise indicated.
.2 Brown urea moulded housing in, utility spaces, and exterior.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Eight (8) back wired entrances, four (4) side wiring screws.
.4 Triple wipe contacts and riveted grounding contacts.
.5 White nylon face.
.6 CSA Class 'A' 5mA leakage current.
.7 GFI test and reset buttons.
.8 Standard of Acceptance:
.1 Hubbell GF (15)-LA Series.
.9 Approved Manufacturers:
.1 Eaton
.2 Hubbell
.3 Legrand
.4 Leviton

.5 Other receptacles with ampacity and voltage as indicated.

.6 Use the receptacles of a single manufacturer throughout the Work.

2.3 COVER PLATES

.1 Cover plates for wiring devices.

.1 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
.2 Brushed stainless steel plates for wiring devices mounted in flush-mounted outlet box.

.3 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
.4 Weatherproof recessed box, heavy cast aluminum while-in-use cover plate, duplex receptacles mounted on exterior of building.

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 specified in Section 26 05 00 - Electrical General Requirements or as indicated.

.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 specified in Section 26 05 00 - Electrical General Requirements or as indicated.
.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
.4 Mount receptacles with "U" ground uppermost for vertically mounted and neutral slot at top for horizontally mounted receptacle.
.5 Install pigtail type leads on conductors in all device or outlet boxes where feeding through to other receptacles.
.6 Do not daisy-chain or loop through conductors from one device to another.
.7 Provide separate pigtail conductor leads for final termination to each receptacle for phase, neutral and bond conductors.
.8 Polarity test all receptacles.

.3 Cover plates:

.1 Protect 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 Device leveller and retainer is an approved accessory for securing devices to flush installed device boxes.

.4 Install wiring and make all connections.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.2 No. 248.4-00(R2019), Low-Voltage Fuses - Part 4: Class CC Fuses (Tri-national standard, with UL 248-4, second edition, and the first edition of NMX-J-009/248/4-2000-ANCE)

.2 CSA C22.2 No. 248.10-11(R2020), Low Voltage Fuses – Part 10: Class L fuses.

.3 CSA C22.2 No. 248.8-11(R2020), SET-20, Low Voltage Fuses – Part 8: Class J Fuses.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

1.3 MAINTENANCE MATERIALS

.1 Provide six (6) spare fuses of each type and size.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed.

.3 Store fuses in original containers in moisture free location.

PART 2 - PRODUCTS

2.1 FUSES GENERAL

.1 Fuses: provide the product of a single manufacturer.

.2 Low voltage fuses, types as specified, CSA certified in accordance with the applicable CSA Standard C22.2 No. 248.

2.2 FUSE TYPE

.1 Fuses to be high rupturing capacity (HRC) type, minimum 200kA interrupting rating (momentary RMS symmetrical).

.2 Class J:

.1 Fuses rated 1 to 600 amperes, 600 Vac, to be CSA certified Class J in accordance with Standard C22.2 No. 248.8.

.2 Where a time delay characteristic is required, fuses shall carry 500% of their ampere rating for not less than 10 seconds and shall be clearly labelled "time delay".

.3 Class L:

.1 Fuses rated 601 to 1200 amperes, 600 Vac, to be CSA certified Class L in accordance with Standard C22.2 No. 248.4.

.2 Where a time delay characteristic is required, fuses to carry 500% of their ampere rating for not less than 10 seconds and clearly labelled "time delay".

.4 Class CC:

.1 Fuses rated 1 to 30 amperes, 600 Vac, to be CSA certified Class CC in accordance with Standard C22.2 No. 248.8.

.2 Where a time delay characteristic is required, fuses to carry 200% of their ampere rating for not less than 12 seconds.

.5 Standard of acceptance:

.1 Class J: Mersen type A4J (non-time delay) and AJT (time delay) and HSJ (time delay).

.2 Class L: Mersen type A4BY (non-time delay) and A4BQ (time delay) and A4BT (time delay).

.3 Class CC: Mersen type ATMR (non-time delay) and ATDR (time delay) and ATQR (time delay).

.6 Acceptable manufacturers:

.1 Mersen.

.2 Bussmann.

.3 Littelfuse.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Confirm correct fuses are fitted to physically matched mounting devices.

.3 Confirm correct fuses are fitted to assigned electrical circuit.

.4 Confirm fuse size is correctly identified on equipment.

.5 For feeder circuit fuses, use fast acting Class J and Class L 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 VFD and reduced voltage electronic soft starters, use Class HSJ time delay fuses (15A and above) and fast acting Class J fuses (<15A).

.8 For 600Vac control circuits, use Class CC type fuses. Use time delay Class CC fuses upstream of control transformers and solenoids.

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

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 adjustable trips to range from 5-10 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have interrupting rating (momentary RMS symmetrical) as indicated.

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 so marked.

2.3 OPTIONS

.1 Suitable for service entrance where specified.

.2 Provide enclosures for individual circuit breakers as indicated on the drawings. Include provision for padlocking the breaker in the off position.

.3 Breaker enclosures to be NEMA type 4X unless noted otherwise.

2.4 MANUFACTURERS

.1 Acceptable manufacturers:

.1 Eaton
.2 Siemens
.3 Schneider Electric

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Electrical General Requirements: Section 26 05 00

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Non-hazardous:

- .1 Heavy duty, fusible and non-fusible horsepower rated, disconnect switch in size and voltage as indicated.
- .2 Provision for padlocking in the off switch position by three (3) pad locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size and type as indicated.
- .5 Fuse holders: 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.
- .8 Provide equipment identification in accordance with Section 26 05 00.
- .9 Enclosure:
  - .1 NEMA Type 4X (stainless steel) in corrosive areas and outdoors.
- .10 Provide switches complete with window to view open/close status of disconnect switch blades.
- .11 Include auxiliary contacts (2 N.O.) rated 10A at 120 VAC. Auxiliary contacts must make after and break before the disconnect switch blades.
- .12 Double throw disconnect switches to be suitable for two source one load application.
- .13 Acceptable manufacturers: Schneider Electric, Eaton, Siemens.

PART 3 - EXECUTION

3.1 DISCONNECT SWITCH INSTALLATION

.1 Install disconnect switches complete with fuses, type, rating as indicated on drawings.

.2 Install true, plumb and square to building lines.

.3 Confirm disconnect switch has proper clearance for operation of handle.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 UL 1778-2014, Uninterruptible Power Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for review and approval in accordance with Section 01 33 00.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide maintenance data for UPS for incorporation into manual as specified in Section 01 78 00.

1.4 WARRANTY

.1 Have the manufacturer provide a product warranty for a period of not less than two (2) years from the date of Ready for Takeover. Warranty to include full parts and labour.

1.5 SCOPE OF SUPPLY

.1 One (1) UPS unit for the RTU Control Panel.

1.6 SYSTEM DESCRIPTION

.1 Uninterruptible Power Supply (UPS) System to be a solid state system providing single-phase uninterruptible AC power for sensitive electronic equipment loads. It must comply with the requirements of the Underwriters Laboratories standard 1778, FCC Part 15, Subpart B, Class A (RFI/EMI), IEEE 587 Categories A and B, and shall be listed under the Underwriters Laboratories of Canada.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 UPS to be designed to operate as a true on-line double conversion system in normal, emergency, recharge and bypass modes.

.2 The UPS unit will be comprised of the following components housed in a NEMA type 1 enclosure:

- .1 Input converter.
- .2 Battery charger.
- .3 Inverter.
- .4 Battery (nominal 5 year life, hot swappable, consisting of the appropriate number of sealed battery cells).
- .5 Cooling fan.

.3 UPS system to include a front panel LCD screen or LED type status indicating the following:

.1 UPS on.
.2 Overload.
.3 Load percentage.
.4 Battery charge level.
.5 UPS inverter is operating and supplying power.
.6 UPS is in bypass.
.7 UPS is operating from battery power.
.8 UPS fault condition.

.4 Provide the UPS complete with an On/Off pushbutton and an audible alarm reset pushbutton.

.5 UPS to have built-in protection against under voltage, overcurrent and over voltage conditions, including low-energy lightning surges on primary AC sources.

.6 UPS to have an input power plug (to match UPS rating) and output distribution consisting of minimum three (3) NEMA 5-15R receptacles.

.7 UPS to have automatic transfer bypass protection to transfer output load from the inverter to the bypass source in the event of overload, over temperature, DC bus over voltage and inverter failure conditions.

.8 Design requirements:

.1 Input voltage: 120 Vac nominal, 60 Hz, single phase, 2 wire plus ground.
.2 Output voltage: 120 Vac ± 3%, 60 Hz, single phase, 2 wire plus ground.
.3 Output load capacity:
.1 RTU control panel: minimum 1000VA min at 0.7 lagging power factor.
.4 Battery runtime: minimum ten (10) minute run time at the output load capacity rating.
.5 If required, provide external battery or upsize the UPS VA rating to achieve minimum battery run times.

.9 Performance requirements:

.1 AC input to UPS:
.1 Voltage: 120 Vac nominal, 70-138 V range.
.2 Input frequency: 60 Hz, range 40-70 Hz.
.3 Input power factor: greater than 0.95 lagging at rated load.
.4 Input line transient immunity: conforming to IEEE 587, Category A and B tests.
.2 AC output, UPS inverter:
.1 Voltage: 120 Vac.
.2 Voltage regulation: ±3% steady state.
.3 Frequency: 60 Hz, ±5% synchronized to utility, ±0.1 Hz free running or on battery operation.
.4 Frequency slew rate: 1.0 Hz per second (maximum).
.5 Load power factor range: 0.65 lagging to unity.
.6 Overload capability:
.1 130% rated load for 10 seconds.
.2 150% rated load for 1.5 seconds.
.3 200% sub-cycle.
.7 Voltage transient response:

.1 ±7% for 0-100% loading (normal).
.2 ±9% for 0-100% loading (battery mode).

.8 Transient recovery time: to nominal voltage within 90 milliseconds.

.9 Efficiency: minimum 83%.

.10 UPS to have a relay interface card complete with dry contacts (minimum 24 Vdc) for remote monitoring of the following conditions: input power failure, low battery, and UPS fault.

.11 Acceptable materials:

.1 Leibert GXT4 Series, Eaton 9SX Series, Sola, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Mount one (1) UPS in the RTU control panel.

.2 Assemble and interconnect components to provide complete UPS as specified.

.3 Connect AC mains to UPS.

.4 Connect UPS output to load.

.5 Startup UPS and make preliminary tests to ensure satisfactory performance.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 This section specifies requirements for the supply and installation of Transient Voltage Surge Suppression (SPD) for the protection of the building electrical system.

1.2 REFERENCES

.1 IEEE C62.41.1-02(R2008), IEEE Guide on the Surge Environment in Low-Voltage AC Power Circuits.

.2 ANSI/IEEE 1100-2005, Recommended Practice for Powering and Grounding Electronic Equipment.

.3 OSHA, Occupational Safety and Health Association, Compliance Handbook.

.4 UL 1283-2017, UL Standard for Safety Electromagnetic Interference Filters.

.5 UL 1449-2021, UL Standard for Safety Surge Protective Devices.

1.3 SUBMITTALS

.1 Provide shop drawings with wiring diagrams, installation information, testing and maintenance procedures, and operational information for the transient protection system.

.2 Provide safety data as specified in Section 01 33 00.

.3 Indicate:

- .1 Dimensional Drawing indicating proposed mounting arrangements.
- .2 Written functional description of the transient protection circuit in terms of components, configuration, design approach, and performance capability.
- .3 The means of connection of the SPD to the electrical distribution system.
- .4 Have the manufacturer provide UL-1449, data card showing the Suppressed Voltage Rating (SVR) for the specific catalogue number with data clearly demonstrating the maximum surge current rating has been tested on a complete SPD unit including all necessary fusing/overcurrent protection, thermal disconnects, integral disconnects and monitoring systems.
- .5 Submit data demonstrating the complete SPD unit, including all overcurrent protection, is fully capable of a minimum repetitive surge current rating of 12,000 ANSI/IEEE C62.41.1, Category C3 (10kA) impulses without failure or a change in performance characteristics of more than 10%.

1.4 EXTENDED WARRANTY

.1 Provide an extended product warranty for a period of not less than 10 years from the date of Ready for Takeover. Warranty to cover unlimited replacement of system protection modules during warranty period. The first five (5) years of this warranty must include any field labour required to perform repair or replacement work.

1.5 OPERATION AND MAINTENANCE DATA

.1 Provide maintenance date for SPD for incorporation into manual specified in Section 01 78 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Acceptable manufacturers:

- .1 Liebert.
- .2 Total protection solution.
- .3 Eaton Clipper Supervisor series.
- .4 Schneider Electric.
- .5 CITEL

.2 Inclusion in this list does not exempt the requirements that any proposed manufacturer must be compliant with the specifications.

2.2 ENVIRONMENTAL

.1 General requirements:

- .1 No audible noise must be generated.
- .2 Operating Conditions:
  - .1 0 - 50 Degrees C
- .3 15 - 85 Percent Humidity Non-Condensing

2.3 SURGE PROTECTIVE DEVICE (SPD) - TYPE A

.1 General requirements for service entrance:

- .1 Rated for a 600Y/347 volt, 60 Hertz, 3-phase, 4-wire.
- .2 Provide surge suppressors in accordance with the following requirements:
  - .1 Unit to be parallel in design and connect in parallel into the electrical system. Each surge suppression element (MOV) must be individually fused so that a failure of one element and/or fuse must not affect other surge suppression elements.
  - .2 Unit to be UL 1449, 4th Edition Listed as a type 1 SPD.
  - .3 The maximum continuous operating voltage (MCOV) must be greater than 115% of the nominal system operating voltage.
  - .4 Maximum Voltage Protection Rating (VPR) for 600Y/347 Volt systems as follows:
    - .1 L-L = 3000V
    - .2 L-N = 1800V
    - .3 L-G = 1800V
    - .4 N-G = 1800V

.5 Unit to provide minimum surge current rating of 80,000 amperes per mode (L-N, L-G, N-G) and 160,000 amperes per phase based on ANSI/IEEE C62.41 standard 8 by 20 microsecond current waveform.

.6 Unit to have a short circuit current rating of 200,000A at rated voltage or greater.

.7 EMI/RFI filtering.

.8 Response time no greater than 1 nanosecond for any of the individual protection modes.

.9 Unit to include solid-state, long-life externally mounted LED visual status indicators that indicate the on- line status and operational integrity of each phase of the unit.

.10 Unit to have a Form C summary alarm output contact rated for at least 1 amp at 120VAC for remote annunciation of SPD status.

.11 Include feature that tests the integrity of all modules, MOVs and fuses in the system.

.12 Unit to have an audible alarm with an alarm on/off switch to silence the alarm.

.13 Provide a surge counter to totalize transient voltage surges in both the normal and common mode. Provide the counter with a 10-year battery back-up to maintain counts in the event of power loss.

.14 Enclosure: NEMA 1 unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install surge suppression system where indicated on the drawings and in accordance with the manufacturer's written instructions.

.2 Keep conductors between suppressor and point of attachment to service equipment as short and as straight as practically possible, preferably not exceeding 600 mm.

.3 Grounding: connect suppressor ground to the equipment grounding conductor and service entrance ground.

.4 Arrange and pay for a factory certified representative to set up and commission the SPD's at site for proper operation to the satisfaction of the Consultant. Document all testing and set up and submit to the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 Furnish and install a concrete base, light pole and fixture at each location indicted on the drawings, complete with accessories as indicated herein and as indicated on the drawings.

.2 All materials, accessories, and any other equipment necessary for the complete and proper installation of all light poles and fixtures included in this Contract shall be furnished by the Contractor.

PART 2 - PRODUCTS

2.1 STREET LIGHT FIXTURES AND POLES

.1 Luminaires:

.1 LED post-top round contemporary lanterns.
.2 80 watt LED lamp module.
.3 Optical tempered clear glass globe.
.4 Asymmetrical Distribution type 2.
.5 120 Volt
.6 Color Temperature: 4000K
.7 Color Rendering Index: 80
.8 Color - Textured Black
.9 Photocell to be included with luminaire.
.10 Acceptable Manufacturer: Lumec

.2 Poles:

.1 Round extruded aluminum shaft welded to cast aluminum muffler base, maintenance opening with copper ground lug and ground bar, complete with anchor bolts, nuts, washers and base cover.
.2 Color - Textured Black
.3 Height – 6.7m
.4 Acceptable Manufacturer: Lumec

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Connect fixtures to lighting circuits as indicated.

.2 Install each pole, base, and fixture properly and safely in accordance with manufacturer's written instructions.

.3 Install poles true and plumb, in accordance with manufacturer's instructions.

.4 Ground all poles as indicated on drawings.

.5 Install photo control for each fixture in accordance with manufacturer's written instructions.

3.2 POLE AND FIXTURE CLEANING

.1 Clean all poles and fixtures one (1) week prior to Ready-for-Takeover.

.2 Replace blemished, damaged, or unsatisfactory poles and fixtures as directed.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASME B16.5-2020, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/Inch Standard.

.2 ANSI/NSF-61-2023, Drinking Water System Components - Health Effects.

1.2 WORK INCLUDED

.1 This section describes the requirements for the supply, installation, testing and commissioning of instrumentation and controls.

.2 The Instrumentation and Controls Scope of Work as described in this section and as shown on the drawings consists of, but is not limited to, the following:

.1 Supply, calibrate, store, install, cable, terminate, test and commission instrumentation and controls equipment as identified on the drawings, and as specified herein.
.2 Receive, store, mount, cable, terminate, test and commission instrumentation and controls associated with equipment as supplied under other Divisions including pre-selected equipment.
.3 Supply, install, test and commission PLC control panels and field termination junction boxes as indicated on the drawings and specified herein.
.4 Install and terminate process equipment as indicated on the drawings and specified herein. Refer to Vendor issued shop drawings for installation and termination details.
.5 Assist control system integrator as required to provide complete and operational pump station control systems as indicated.

.3 The drawings supplement this specification section in defining the Instrumentation & Controls scope of work required.

.4 Determine the final instrumentation/ controls cabling requirements after equipment shop drawings have been approved, to meet the control requirements as indicated or implied by the Contract Documents.

.5 Determine the instrumentation and controls equipment/cabling termination details to reflect the equipment and panels actually supplied (after shop drawing approval) and match the intent as indicated or implied in the Contract Documents, to supply a complete and functioning pump station. Document the above instrumentation and controls cabling termination details in the form of "As-built" termination detail drawings/loop drawings.

.6 PLC/RTU and HMI programing will be completed by the Owner’s system integrator.

.7 Assist the control system integrator during testing and commissioning of the pump stations.

.8 Prepare, document and provide a testing and commissioning plan for the pump station. Coordinate this plan with the Owner, the Engineer and the control system integrator.

1.3 SHOP DRAWINGS

.1 Full approved shop drawings of Owner-supplied equipment will be made available after award.

1.4 OPERATION AND MAINTENANCE DATA

.1 Assist the Equipment Supplier in producing complete operation and maintenance data in accordance with Section 01 78 00.

.2 Include in manuals information based on the following requirements:

.1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, calibration, maintenance, and repair of the supplied equipment.
.2 Provide "as-built" wiring and schematic diagrams and general arrangement drawings for control panels including a bill of materials.
.3 Test and calibration sheets for the installed instruments.

1.5 COORDINATION

.1 Coordinate with the Equipment Supplier to confirm the load demands are attained and that the pumping system is fully compatible with the control devices.

1.6 REFERENCES

.1 Carry out the Work of this Section in accordance with all applicable Federal, Provincial, Municipal, and other laws/ordinances, and with the latest edition of the following standards which will be deemed to be included and form part of these specifications:

.1 American Society of Mechanical Engineers
.2 Institute of Electrical and Electronic Engineers.
.3 American Society for Testing and Materials
.4 Manufacturers Standardization Society.
.5 Canadian Standards Association
.6 Instrument Society of America
.7 Canadian Electrical Code

.2 ASME B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 Through 24.

1.7 SUBMITTALS

.1 Submit instrumentation and controls equipment shop drawings in accordance with 01 33 00. Have shop drawings reviewed and approved by the Consultant prior to instrumentation and controls equipment purchase or use.

.2 .2 Instrumentation and controls equipment shop drawings to include, but not be limited to, the following:

.1 .1 Complete model number of each instrument being proposed, with model number breakdown codes.
.2 .2 Identify applicable instrument/equipment tag numbers on every shop drawing.
.3 .3 Equipment operational specifications.
.4 .4 Equipment dimensions, weight, mounting details, and materials of construction.
.5 .5 Equipment power requirements, air supply requirements, process signal type, etc.

.6 .6 Electrical termination information specific to the device being purchased in this contract.
.7 .7 Complete parts list with recommended inventory of spare parts.
.8 .8 Frequency and method of calibration (if applicable).
.9 .9 Manufacturer's installation recommendations/requirements.
.10 .10 Any sizing calculations (if applicable).
.11 .11 For relay control panels and field junction boxes, provide layout and wiring diagram, complete with detailed materials list.

.3 .3 Submit operations and maintenance manuals for all instrumentation and controls equipment in accordance with Section 01 78 00. Include information based on the following requirements:

.1 .1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, calibration, maintenance and repair of the supplied equipment.
.2 .2 Include names and addresses of local suppliers for all items included in maintenance manuals.

.4 .3 Include all instrumentation calibration sheets.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Instrumentation and controls equipment must be of a proven design for each application and designed, manufactured, inspected, and tested in accordance with all applicable regulations, codes, and standards.

.2 Select instrumentation and controls equipment to suit the process and environmental requirements for each application as described or implied in this specification and drawings.

.3 Construct instrumentation and controls equipment to operate safely and reliably under all operating conditions without undue wear, vibration, heat, noise, or other operating problems. Parts subject to wear, corrosion, or other deterioration, or requiring adjustment, inspection or repair must be accessible and capable of convenient field maintenance.

.4 All instrumentation and controls equipment must be certified by an agency (preferably CSA) recognized by the applicable provincial Electrical Inspection Department. Where there is no alternative to supplying equipment that is not appropriately certified, special approval from the applicable provincial Electrical Inspection Department will be required. All costs associated with this will be included in the quote.

.5 All instrumentation and controls equipment must have a minimum enclosure rating of NEMA 4X (IP66).

.6 Equipment requiring intrinsically safe wiring to meet a hazardous area classification shall come complete with all recommended intrinsically safe barriers, etc., as required to meet the applicable hazardous classification.

.7 The minimum instrumentation and controls equipment electrical connection size will be 13 mm NPT.

.8 Instrumentation and controls equipment requiring a power supply will be 120 VAC, 60 Hz.

.9 All wired instrumentation and controls equipment must have provision for externally grounding the instrument housing/enclosure.

.10 Provide instrumentation and controls equipment complete with a securely fastened manufacturer's nameplate indicating instrument model, serial number, calibrated range, etc., as required for ordering a replacement item.

.11 Mount instruments not directly coupled to a process connection on manufactured instrument stands (2 NPS pipe construction with sealed ends, stainless steel) or on a nearby wall. All mounting hardware for mounting instrument stands and instruments must be 316 SS. Mount instruments as per manufacturer's recommendations.

.12 Process impulse line tubing from a process connection to an instrument to be a minimum 13mm x1.2 mm, 316 SS seamless and annealed to ASTM A269.

.13 Use 316 SS twin-ferrule design tube fitting on all instrument impulse and air supply tubing. All threaded fittings to be tapered NPT. Accomplish sealing of threaded connections by using high quality PTFE tape. Acceptable tube fitting manufacturer's: Swagelok, Parker, or approved alternate.

.14 Supply instrument tags for instruments as indicated on the drawings. Affix a stainless-steel tag indicating the instrument tag number to the instrument using stainless steel wire. The tag must be approximately 50 mm x 25 mm and stamped in a legible manner, with a minimum 10 mm character size, and in the same format as shown on the drawings.

2.2 SUBMERSIBLE LEVEL SENSOR

.1 Submersible level transmitter in stainless steel housing, suitable for sanitary sewage, complete with 4-20 mA output. Install as per drawings and manufacturer's recommendations.

.2 Sensors: suitable for a Zone 1 hazardous location. Provide intrinsically safe barrier in the control panel.

.3 Sensor range to be suitable to the wet well depth. Shielded cable to be minimum 15m length and include vent tube and aneroid bellows. Located bellows in junction box.

.4 Provide sensor complete with surge protection.

.5 Acceptable manufacturers: KPSI, Ametek or approved equivalent.

2.3 FLOAT SWITCHES

.1 Level switch design and performance requirements to be as follows:

- .1 Top mounted suspendable float type switch.
- .2 Unit complete with integral cable, length to suit application as determined by the Contractor.
- .3 One (1) SPDT contact, rated for at least 5 amps @ 120VAC (Continuous use).
- .4 Suitable for immersion in liquid type indicated.
- .5 Include intrinsically safe barrier where level switch is installed in a hazardous location.

.6 Acceptable materials: Flygt ENM-10 or approved equivalent

2.4 FLOW INSTRUMENTS

.1 Magnetic flow meters must meet the following design and performance requirements:

.1 Flow tube:

.1 Body/Flange material: ASTM A105 carbon steel; epoxy coated (min. 150 µm).

.2 End connections: flanged, ANSI B16.5 Class 150.

.3 Meter pipe: 304 stainless steel.

.4 Enclosure: fiberglass reinforced polyamide.

.5 Liner: to be compatible with wastewater.

.6 Capable of measuring bidirectional flow and empty pipe detection.

.7 Minimum 316SS, self-cleaning electrodes.

.8 Supply grounding hardware in accordance with the manufacturer's recommendations.

.9 Suitable for installation in a Zone 1 hazardous area, Gas groups IIA & IIB.

.10 Enclosure to be submersible, IP68, NEMA 6P.

.11 Factory calibration certificate, NIST traceability.

.2 Transmitter:

.1 Power: 120Vac, 1-phase, 60Hz.

.2 Display: background illumination with alphanumeric text, 3 x 20 characters to indicate flow rate, totalized values, settings and faults; reverse flow indicated by negative sign.

.3 Online diagnostics of flow sensor and electronics, including process checks, linearity and calibration checks. Operator alarm notification via transmitter display, relay outputs, and output signal (4-20 mA upscale/downscale manipulation.

.4 Accuracy: minimum +/- 0.4%, +/-1 mm/s.

.5 Bi-direction flow: forward and reverse flow indication; net, two (2) eight-digit counters.

.6 4-20 mA (HART) output of flow rate, self powered, isolated. Frequency pulse output for flow totalization (dry contact rated 30 VDC).

.7 Remote transmitter to to have a NEMA 4X enclosure rating.

.8 Transmitter to be remotely installed inside the lift station panel on backplate.

.3 Application specific specifications for pump station flow meter:

.1 Magnetic flow meter diameter as indicated on the drawings.

.2 Calibrated flow range to be verified during construction.

.4 Acceptable manufacturers: Siemens, ABB, Krohne or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Execute work in a professional manner so that it presents a neat appearance when completed.

.2 Install instrumentation and control equipment being supplied by, or issued to, the Contractor where and as indicated on the drawings, and in accordance with the manufacturer's instructions. Manufacturer's installation instructions must be strictly adhered to.

.3 The Drawings indicate the extent and general arrangement of the instrumentation and controls equipment. Exact installation locations, distances and levels will be governed by actual field conditions and is subject to approval by the Consultant. Field verify all dimensions.

.4 If any departures from the original intent of the Drawings and/or the Specifications are deemed necessary by the Contractor, submit details of such departures with Drawings if necessary, together with reasons for the departure to the Consultant as soon as practical for approval. No such departure can be made without prior written consent of the Consultant.

.5 Repair/replace equipment damaged during construction, or otherwise deemed defective or non-compliant with this specification, at no additional expense to the Contract. These expenses include all material, labour and other fees.

.6 Unless otherwise specified, fabricate and erect all support brackets or mounting brackets required. Purchase all supplied instruments with all necessary mounting brackets from the instrument vendor.

.7 Locate instruments to minimize the possibility of damage from high temperature, vibration or humidity, and shall not interfere with, or be damaged by, maintenance of other equipment. Instrument installation must also provide for easy accessibility for operation, inspection, and maintenance purposes.

.8 Store materials in a manner as to ensure the preservation of their quality and fitness for the work, and to facilitate inspection by the Consultant/Owner at any time. Keep instruments and equipment clean and protect against damage, dirt, and moisture.

.9 Protect installed equipment against water, dirt and other debris until it is commissioned. Use clear plastic sheeting of not less than 8-mil thickness for this purpose.

.10 Keep all enclosures, rooms, trenches, etc., free from construction debris, materials, dirt and water at all times during construction.

.11 Coordinate equipment delivery, storage and installation requirements with all of the vendors.

.12 Repair/replace equipment damaged during construction, or otherwise deemed defective or non-compliant with this specification, at no additional expense to the Contract. These expenses include all material, labour and other fees.

3.2 TESTING AND CALIBRATION EQUIPMENT

.1 All test and calibration equipment used must be calibrated to an industry recognized standard and have affixed proof of calibration along with date of next calibration.

3.3 TESTING AND CHECK-OUT

.1 Conduct all tests necessary to confirm material and workmanship are of the required degree of excellence, and that the supplied equipment will perform as specified (verify wiring, wire continuity checks, tubing leak tests, etc.).

.2 Calibrate all instruments before usage. Secure the services of qualified personnel (manufacturer's representative) and equipment to conduct field instrument calibration.

.3 Document the results of all tests/calibrations, make available to the Consultant and include in the project "Operations and Maintenance Manual" submission.

.4 Coordinate with all other Divisions suppliers for their required testing and commissioning procedures.

.5 Document instrument settings and include in the project "Operations and Maintenance Manual Submission".

3.4 IDENTIFICATION

.1 Locate manufacturer's nameplates so that they are easily read. Do not paint over plates.

3.5 COMMISSIONING AND START-UP

.1 Coordinate testing/commissioning at all pump stations and assist the equipment vendors during commissioning. Complete a point-by-point check for all control systems monitored field I/O points. Have the Equipment Supplier perform logic checks, communication checks, complete pump station integration, and equipment start-up tasks.

.2 Provide technical personnel during this phase of the Work for instrument recalibration, re-wiring, reprogramming, etc., as required until the pump station control system is deemed ready for operation.

.3 Perform a series of start/stops of the pumps under normal and emergency power to confirm proper operation of the lift station.

.4 After the instrumentation and controls equipment and vendor packages have been installed, calibrated, checked out and tested by the Contractor, the lift station RTU programming testing/commissioning can begin. Coordinate this work with the Owner's control system integrator. This will involve a point-by-point check for all PLC/RTU system monitored field I/O points, logic checks, communication checks, complete controls integration, and equipment start-ups.

.5 Calibrate, program and verify level sensor and transmitter. Control elevations to be programmed on-site. Refer to drawings for elevations.

.6 Verify and test operation of the float switches for alarming and for emergency operation (i.e.: level sensor failure).

.7 Document the results of the testing, commissioning and start-up.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section and its associated drawings specify the requirements for the design, , fabrication, supply, installation, system integration, testing, and commissioning of the lift station control panel.

.2 The electrical drawings supplement this specification section in defining the scope of Work required.

.3 The following drawings supplement this specification section in defining the control panel and termination junction box scope of work required:

- .1 Control System Block Diagram: identifies the new components of the plant control system architecture,, control system hardware and the control system interconnecting cabling required.
- .2 Instrumentation Cabling Diagrams: shows the number of cables entering each control panel or termination junction box. Confirm each panel/junction box is large enough to accommodate the required number of glanded cables/conduits.
- .3 RTU I/O Lists: lists all of the hardwired I/O required for the RTU control panels.
- .4 Electrical Control Schematic Drawings: use to assist in the design of relay control panels, indicating the number of relays, pushbuttons, switches, field I/O, etc., required for each panel.
- .5 Control Panel and Field Junction Box Layout details: provide basic control panel and field box layouts, required equipment, terminal block arrangements, termination details etc.

1.2 REFERENCES

.1 Carry out the Work under this section in accordance with all applicable Federal, Provincial, Municipal and other laws, ordinances and with the latest edition of the following standards which will be deemed to be and form part of this specification.

- .1 American Society of Mechanical Engineers.
- .2 Institute of Electrical and Electronic Engineers.
- .3 American Society for Testing Materials.
- .4 Manufacturers Standardization Society.
- .5 Canadian Standards Association.
- .6 Instrument Society of America.
- .7 Canadian Electrical Code.

.2 In the event of a conflict between the above mentioned standards, this specification, or the attached drawings, notify the Consultant, who will then advise on which standard is to be followed.

1.3 SUBMITTALS

.1 Supply shop drawings for all control panels and termination junction boxes being supplied. Shop drawings will be reviewed and approved by the Consultant before equipment can be ordered. Submit shop drawings in accordance with 01 33 00.

.2 Control panel and termination junction box shop drawings to include the following information:

.1 Dimensional outlines, sections, and details of all equipment.
.2 Detailed Bill of Materials.
.3 Equipment layout details.
.4 Equipment labeling details.

.3 Terminal block arrangements.

.1 Field cable termination details. Identify field connections of RTU I/O to field terminal blocks.
.2 All equipment specifications and instruction manuals (RTU, I/O cards, relays, etc.). Have the supplier provide a cross reference indicating which specifications refer to which panel.
.3 Instructions for the mounting of the control panels/junction boxes.

.4 For control panels and field termination junction boxes, provide a layout and wiring diagram, complete with a detailed Bill of Materials.

.5 Submit data for operations and maintenance manuals. Include in manuals information based on the following requirements:

.1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification extension and expansion of any portion or feature of the installation.

.6 Provide "Record" wiring and schematic diagrams and general arrangement drawings for control panels and junction boxes including a bill of materials.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Each control panel, remote I/O panel and termination junction box must be supplied, completely tested and ready for terminating field cables. This includes all hardware (terminal blocks, relays, power supplies, pushbuttons, etc.), terminal blocks (for power supplies and field I/O), wire ducts, internal panel wiring etc., as required. Programming by others.

.2 All outdoor control panels and termination junction boxes are to be either wall mounted or mounted on unistrut frames and be NEMA 4X rated and of 316 SS construction. All conduits must be bottom entry.

.3 Inside all panels and junction boxes, label terminal blocks, terminal block strips, and all internal wire conductors in accordance with the panel fabricator standards.

.4 All NEMA 4x panel and junction box hardware (hinges, latches, etc.) must be 316 SS. Provide all panels and junction boxes complete with a back mounting plate.

.5 Provide at least a 32 mm clearance between the terminal blocks and the plastic wiring duct. Wire ducts to be slotted and complete with covers. Wiring ducts to be a minimum size of 25 mm wide x 75 mm high (supplier to determine if a larger size is required).

.6 Generally, terminate field wiring on the right hand side (or bottom side) of terminal strips, and internal panel wiring, or multi-conductor homerun cables (for intermediate junction boxes), shall be terminated on the left hand side (or top side) of terminal strips.

.7 Wire analog and digital signals within the same panel or junction box to separate terminal strips.

.8 Completed relay control panels and junction boxes, hazardous area junction boxes to have CSA approval.

.9 All panels and junction boxes must be adequately sized to accommodate the required hardware, terminal blocks, wire ducts, etc., as well as the number of cables/conduits.

.10 Any required intrinsically safe wiring/equipment must be identified and isolated from non-intrinsically safe wiring/equipment in accordance with the Canadian Electrical Code.

.11 Individually label all panels and junction boxes with a lamicoid tag on the outside of the door and include the cabinet tag number and its associated description. Nameplates to have a white background with black undercut lettering (316 SS screw mounted). Minimum lettering size to be 25 mm.

.12 All pushbutton and switch legend plates to be white (anodized or engraved) on a black background, except emergency stops, which shall have a red background.

.13 All panels and junction boxes to include a drawing pocket to be installed on the inside of the door to hold "As Built" termination drawings.

.14 All panels and junction boxes to have an adequately sized pre-drilled and tapped copper ground bar and to be provided with a grounding lug for a #6 AWG external ground connection. Where applicable, control panels will also have a separate "isolated" copper ground bar for grounding of analog type 4-20 mA control signal cabling.

.15 Terminal blocks to be rated for at least 600V, 35A, minimum 6mm wide, capable of accepting a 10AWG conductor size, DIN rail mounted, complete with white marking tags with black lettering.

.1 Acceptable manufacturers: Weidmuller WDU4, or approved equivalent.

.16 Control wiring circuit breaker type terminal blocks to be rated for 250V, up to 16A, single pole, pushbutton operated, DIN rail mounted, complete with white marking tags with black lettering.

.1 Acceptable manufacturers: Weidmuller 4201 Series, or approved equivalent.

.17 Arrange terminal blocks so that no more than two (2) wires are terminated on any, one (1) terminal block (including field wiring). The use of "wire jumpers" between terminal blocks will not be permitted. Only terminal block vendor approved "cross-connection systems" can be used for cross wiring between panel terminal blocks.

.18 Panel internal wiring to be 16 AWG type TEW as a minimum. All 120 VAC power and control wiring to be black (#14AWG minimum). All 120 VAC neutral wiring to be white (#14AWG minimum). All DC digital signal wiring to be blue (#16AWG minimum). All analog signal wiring to be twisted, pair (Bk/Wh) or triad (Bk/Wh/Rd), shielded (#16AWG minimum). All ground wiring to be green (#14AWG minimum). Provide stranded copper wiring throughout. Segregate AC and DC wiring and install on separate terminal strips.

.19 Panel pushbuttons to be 30.5mm heavy duty, watertight/oiltight, NEMA rating to match enclosure rating, flush, momentary contact (unless indicated otherwise on drawings), complete

with one (1) normally open and one (1) normally closed contact (start, stop, etc.)

.1 Acceptable manufacturers: Allen Bradley 800Series or approved equivalent.

.20 Panel selector switches to be 30.5mm heavy duty, watertightoiltight, NEMA rating to match enclosure rating, front-mounted, two or three position (refer to control schematic drawings), either maintained or spring returned contacts (refer to control schematic drawings), and complete with at least one (1) normally open and one (1) normally closed contact per position, or as required.

.1 Acceptable manufacturers: Allen Bradley 800Series or approved equivalent.

.21 Panel mounted indicating lights to be 30.5mm heavy duty, watertight/oiltight, NEMA rating to match enclosure rating, 120 VAC, LED and coloured as per the drawings.

.1 Acceptable manufacturers: Allen Bradley 800series or approved equivalent.

.22 Control relays to have either 24 VDC or 120 VAC operating coil as required, plug-in socket, minimum 15 amp @ 120 VAC rated contacts (2 form 'C') and LED indicator.

.1 Acceptable materials: Allen Bradley 700-HB Series, or approved equivalent.

.23 Provide a 24 VDC power supply for any 24 VDC I/O, panel equipment requirements and for the transmitters that are loop powered. It must be sized to accommodate at least 150% of its present load requirements (minimum 100 Watt). Fuse the 24 VDC supply to each piece of equipment or protect by a circuit breaker.

.1 Acceptable materials: Omron S8VM series, or approved equivalent.

.24 For breaker circuits, provide 120 VAC, single pole distribution circuit breakers, toggle type, DIN rail mounted, continuous current rating as required, 10 kA interrupting capacity.

.1 Acceptable product: Weidmuller 9926 series or approved equivalent.

.25 For fused circuits, provide Class CC HRC fuses, complete with a 600V, 30A fuse holder, single pole, blown fuse indicator.

.1 Acceptable product: Mersen Cat. No. USCC1I or approved equivalent.

.26 Intrinsically safe relays to be dual channel, 120 Vac input voltage, 1 form 'C' contact per channel (rated 5A @ 120 VAC), Phoenix type P1-EX-ME-2NAM-COC-120VAC or approved equivalent.

2.2 LIFT STATION RTU CONTROL PANEL

.1 Design, supply, and install one (1) new completely assembled control panel for the new lift stations.

.2 Design control panel for two (2) pumps rated 2.2 HP, three phase, 600V, 60 Hz.

.3 Provide generator receptacle 600/347V, 3 pole+ neutral + ground, pin and sleeve type, reversed service, NEMA 4X, polyester material.

.4 Provide the pump station control panel with the following features:

.1 Single insulated enclosure, 316 stainless steel, NEMA 4X, service entrance rated to accommodate the controls, utility metering, main breaker, interlocked normal and emergency breakers and pump starters. Provide a hinged cover for access to the utility meter complete with locking hasp for utility lock. Arrange power components for a dead

front configuration. Include inner swing door (full size) for mounting control components.

.5 Main circuit breaker, three phase, 600 VAC, ampere rating as indicated, service entrance rated. Breaker to be padlockable in the off position. Refer to specification Section 26 28 21. Installation to meet power utility requirements.

.6 Normal power and generator power circuit breakers, mechanically interlocked. Refer to Section 26 28 21 for additional information.

.7 Individually protected motor starters (NEMA design, FVNR, minimum NEMA size 1 with electronic overloads for each pump. Include circuit breaker for each starter in accordance with Section 26 28 21 and complete with padlocking attachment to lock breaker in the off position. Overload relays to include single phase and ground fault protection and RS-485 (Modbus RTU) communicatons to monitor the following data: Phase A, B and C currents, status and reset trip.

.8 Pump motor overload, over temperature and seal failure protection. Coordinate temp/seal relays from pump supplier.

.9 Provide panel mounted HOA selector switches, pilot lights (pump run indication, pump fault indication for each pump and general alarm) and a pump reset button.

.10 Provide control transformer including primary and secondary overcurrent protection for control power. Size for anticipated loads plus 25% additional capacity.

.11 Provide surge protection in accordance with Section 26 43 13.

.12 Provide voltage meter complete with RS-485 (Modbus RTU) communications to monitor Phase A, B and C voltages. Acceptable materials: ELKor WattsOn Mark II energy meter.

.13 Provide enclosure heater with thermostat on individual breaker.

.14 RTU platform: supply and install a microprocessor-based RTU platform. The RTU is to have a minimum of 16 low voltage (24Vdc) digital inputs, 8 digital outputs, 6 analog inputs (4-20mA). The RTU must be capable of Ethernet based 10/100 Modbus TCP/IP communications, and serial communications (Modbus RTU and DF1).

.1 Acceptable products:

.1 Schneider Electric "SCADAPack 334" series Remote Terminal Unit. Include any additional I/O modules and associated hardware required to meet I/O requirements.

.15 Refer to the drawings for required I/O at the pump station.

.16 Cross-wire the RTU I/O to the field I/O terminals within the control panel. All RTU hardware to be installed as per manufacturer's instructions (clearances, grounding, etc.).

.17 Provide the RTU control panel with a UPS to power the control panel components in the event of a disruption in the 24Vdc panel power supply. Sized to suit, minimum 10 minute back-up time, 1000VA min.

.18 Provide a 24Vdc power supply for any 24Vdc I/O, panel equipment requirements and for the transmitters that are loop powered. Size to accommodate at least 150% of its present load requirements (minimum 100Watt). Protect each 24Vdc supply to each piece of equipment by a circuit breaker. Acceptable materials: Weidmuller ProEco series, or approved equivalent.

.19 Pre-wire I/O wiring to field wiring terminal strips. Provide interposing relays complete with dry contacts for each digital output. Protect up to 8 digital outputs by a circuit breaker.

.20 Include space as indicated in the control panel for the radio provided by Others.

.21 Include a minimum spare I/O point for analog and digital inputs/outputs as indicated on the drawings.

.22 Group internal wiring to terminal blocks on a per-card basis.

.23 Protect a maximum of sixteen(16) digital inputs by a circuit breaker.

.24 Individually protect each analog input by fuse.

.25 Include an internal LED light complete with door switch.

.26 Control panel interrupting rating to be minimum 10 kA at 600V, 3-phase.

.27 Include intrinsically safe barriers for float switches and non-hazardous rated instruments.

.28 Install flowmeter transmitter in control panel

2.3 TERMINATION JUNCTION BOXES

.1 Generally, instrumentation and control conduits will run directly from the field device to the associated control panel. Where junction boxes are indicated, or otherwise deemed necessary, provide as follows:

- .1 Provide sufficient terminals to accommodate spare wires plus 20% additional unused terminals.
- .2 Provide junction boxes with hinged covers.
- .3 For junction boxes 200 mm square or less, boxes with screw or hinged covers may be used.
- .4 Minimum NEMA 4X enclosure rating, use PVC enclosure in interior non-hazardous areas. Use 316SS, increased safety assemblies for hazardous areas and in exterior installations.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install control panels, remote I/O panel and field termination junction boxes.

.2 Terminate cables and equipment per the drawings and the manufacturer's instructions and pre-selected equipment shop drawings.

.3 Ground cabling, patch panels, racks and equipment as per manufacturer's instructions (use min. #6).

.4 Terminate each conductor with the appropriate connector and test.

.5 Mount and position equipment, etc., in such a way as to allow for easy access for maintenance purposes.

.6 Store materials in a manner to ensure the preservation of their quality and fitness for the work, and to facilitate inspection by the Consultant at any time. Keep equipment clean and protected against damages, dirt and moisture.

3.2 TESTING

.1 Panel fabricator to test (power-up) all panel components and auxiliary devices to confirm functionality, verify all internal panel wiring, and conduct functionality testing in accordance with the control schematics prior to delivery to site. Provide test reports to the Consultant.

.2 Test communication system cables in accordance with the manufacturer's requirements.

.3 Provide a hard copy of test results.

.4 Refer to Section 26 90 00 for additional testing.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for clearing, grubbing, and disposal.

1.2 RELATED SECTIONS

.1 Erosion and Sediment Control: Section 31 15 53

.2 Earthwork: Section 31 20 00

1.3 DEFINITIONS

.1 Clearing: cutting, 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, root mat, topsoil, and grass surfaces.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not applicable.

PART 3 - EXECUTION

3.1 GENERAL

.1 Obtain permits and/or approvals as required by the authorities having jurisdiction.

.2 Comply with terms and/or conditions of per mits and/or approvals.

.3 Do not remove trees or brush from outside limits indicated except for any tree or branch considered unsafe.

.4 Cut trees and brush close to ground leaving no stump higher than 300 mm.

.5 In absence of directions provided either by a geotechnical report or the Project Drawing, remove grubbings to not less than 200 mm below existing ground surface to a maximum of 300 mm.

.6 Grub out visible rock fragments and boulders, greater than 300 mm in any dimension, but less than 0.25 m3.

3.2 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed material off-site unless permitted otherwise in writing.

.2 If permitted by Owner, bury in designated areas only. Consolidate and cover with soil and finish surface as shown on the Project Drawings.

.3 Do not burn cleared and grubbed material unless permitted by the authorities having jurisdiction.

.4 If permitted, chip or mulch and stockpile or spread vegetation matter on-site as directed. Dispose of surplus chips off-site at an Consultant approved location.

.5 In areas designated as quarantined by the Canadian Food Inspection Agency (CFIA), comply with all CFIA requirements.

3.3 FINISHED SURFACES

.1 Leave ground surface in condition suitable for immediate grading operation.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL

.1 Prior to construction provide erosion prevention and sediment control measures where required by the project Erosion and Sediment Control Plan, or as directed by the Consultant. Co-ordinate locations with the Consultant as required.

.2 Develop a site-specific erosion and sediment control (ESC) plan. Prepare the ESC plan in accordance with the Nova Scotia Department of Environment and Climate Change: Erosion and Sedimentation Control Handbook for Construction Sites, in addition to any specified local requirements.

.3 Maintain erosion prevention and sediment control measures for the duration of the Work. Do not remove any measures until authorized by the Consultant.

.4 All staff and subcontractors to be familiar with the ESC plan, and/or locations and maintenance measures for all ESC measures. Document and keep records of associated ESC maintenance through the duration of the Work, if specified by the project documents.

1.2 REFERENCE STANDARDS

.1 ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use; 2014 (Reapproved 2020).

1.3 REFERENCE DOCUMENTS

.1 Nova Scotia Department of Environment and Climate Change: Erosion and Sedimentation Control Handbook for Construction Sites.

.2 ASTM E449-18, Test Methods for Analysis of Calcium Chloride.

.3 CAN/CGSB 15.1-92, Calcium Chloride.

.4 CSA W208:20, Erosion and Sediment Control Installation and Maintenance

.5 CAN/CSA-W202-18(R2023), Erosion and Sediment Control Inspection and Monitoring

PART 2 – PRODUCTS

2.1 SEDIMENT CONTROL FENCE

.1 Sediment Control fence: preassembled sediment control fence with industrial woven geotextile fabric pre-stapled to wood posts spaced as indicated.

2.2 SEDIMENT CONTROL BERM

.1 Geotextile: non-woven, needle-punched polyester filter fabric.

.2 Construct sediment control berms to the cross sections indicated on the Project Documents.

2.3 SILT CURTAIN

.1 High strength woven geotextile, UV protected, floating boom.

2.4 EROSION CONTROL BLANKET

.1 Biodegradable field construction sediment filtration system manufactured from 70% agricultural straw and 30% coconut fiber stitched with cotton thread between two (2) woven jute nets.

.1 Acceptable product: Bio Fiber Roll by Erosion Control Blanket or approved equivalent.

.2 Growing medium: see Section 32 91 19 - Topsoil and Finish Grading.

2.5 DUST CONTROL AGENT

.1 Materials:

.1 Calcium chloride, Type I, to CAN/CGSB 15.1, flake, 35% aqueous solution.
.2 Magnesium chloride: magnesium liquid meeting the following:

Component	Minimum	Maximum
MgCl2	28	32
Ph	4 to 6	
Specific Gravity	1.29 to 1.3 g/mL	

Solution to contain minimum required percentage by mass concentration of MgCl2 in accordance with ASTM A449.

.3 Water: to Consultant’s approval.

PART 3 – EXECUTION

3.1 TEMPORARY SOIL COVERS

.1 If blown straw or hay is used as temporary soil cover, provide 100% cover to minimize soil erosion.

.2 Where blown straw or hay is used as mulch to protect new seeding, control the thickness of the application to avoid smothering of the seed. If used in lieu of environmental blanket, uniformly apply straw and hay blown onto the seeded areas. Thickness depends on site conditions, seed mix, slope, and soil type.

3.2 SEDIMENT CONTROL FENCE

.1 Excavate 100 mm x 100 mm trench along length of fence. Lay fabric bottom in trench and backfill with selected excavated material.

3.3 MAINTENANCE OF EROSION PREVENTION AND SEDIMENT CONTROL MEASURES

.1 Inspect and monitor erosion and sediment control measures in accordance with CSA W202.

.2 Maintain erosion and sediment control measures in accordance with CSA W208.

.3 Maintain erosion prevention and sediment control measures throughout the construction period. Repair damage to original condition.

.4 Remove accumulated sediment from behind silt fence. Remove flow check berms when and as directed by Consultant.

.5 Maintain vertical alignment of silt fence such that it is always plumb and straight.

3.4 DRAINAGE

.1 Do not pump or drain water containing suspended materials into watercourses, sewer, or drainage systems.

3.5 CATCH BASIN FILTRATION

.1 Install sediment traps on all existing catch basins to prevent sediment from entering stormwater system.

3.6 DUST CONTROL AGENT

.1 Deliver approved dust control agent to site in moisture-proof bags. Indicate name of manufacturer, name of product, net weight or mass and percentage of dust control agent guaranteed by manufacturer.

.2 Store bags of dust control agent in weather-proof enclosures.

.3 Apply dust control agent or water for alleviation and prevention of dust nuisance caused by equipment and traffic movement when directed by Consultant.

.4 Apply dust control agent or water with equipment approved by Consultant, at a rate and in locations approved by Consultant.

.5 Apply water in areas where use of other dust control agent is not permitted. Use distributors equipped with spray system that will promote uniform application and with means of shut-off.

.6 Dust control waste to be appropriately disposed of. Waste from dust control measures is not to enter a watercourse or wetland.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for all earthwork operations. Work includes supply of products, excavating, bedding, backfilling, compacting, shoring, dewatering, and disposal of unsuitable and surplus material.

1.2 REFERENCE STANDARDS

.1 ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

.2 ASTM C127-24, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.

.3 ASTM C131/C131M-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.4 ASTM D4253-16E1, Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

.5 ASTM D4254-16, Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

.6 CAN/CSA A23.1:24/A23.2:24, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard for Concrete.

.7 Nova Scotia Department of Transportation and Public Works - Standard Specification - Highway Construction and Maintenance.

1.3 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.

.1 Volume limits:

.1 Trench excavation: 0.5 m3

.2 Mass excavation: 1.0 m3

.2 Topsoil: soil capable of supporting good vegetative growth and suitable for use in top dressing and landscaping.

.3 Borrow: well-graded material originating from approved off-site sources meeting the specification for Selected Backfill.

.4 Common: in situ excavated soil which is not rock, unsuitable, or topsoil, and meeting the specification for Selected Backfill.

.5 Unsuitable material: all material which is not suitable for use in work and must be disposed of.

.6 Contaminated Material: material with exceedances of Provincial and CCME (Canadian Council of Ministers of the Environment) Soil Quality Guidelines and requiring management as

mandated by this guideline.

.7 Surplus material: excavated material not required for reuse.

.8 Subgrade: the surface of mass excavation and embankment finished to lines and elevations indicated.

1.4 SUBMITTALS

.1 Submit samples, sieve analysis and mix design in accordance with Section 01 33 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 Sand: hard, granular, sharp material; well-graded from coarse to fine; free of impurities, chemicals, or organic matter; and graded as follows:

Sieve Designation	Percent Passing
5 mm	100
0.16 mm	0 - 5

.3 Structural fill: well graded, sound, durable, granular material, free from clay, frozen lumps, organic, or deleterious matter, graded in accordance with Division 3 Section 10 of the NSDPW Standard Specification.

.4 Clear Stone: crushed and screened, hard, durable stone, free from clay and organic matter, and graded as follows:

Sieve Size (µm)	Percent Passing				
	C1	C2	C3 (Surge)	C4	C5
250 000	100				
190 000		100	100		
150 000	20-35	90-100	90-100		
125 000		30-50	40-60		
100 000		0-8	12-30	100	
90 000					
75 000			0-19	85-100	

50 000	0-10				
31 500				10-20	
25 000				0-8	100
19 000			0-10		85-100
9 500					0-40
4 750					0-10

.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:

Sieve Size (µm)	Percent Passing			
	Type 1	Type 1S	Type 2	Type M
75 000			100	
63 000				
50 000			65-98	
37 500				
31 500				
25 000	100	100	48-78	100
19 000	90-100	98-100		85-100
16 000				
12 500	48-82(3)	48-85	33-63	65-90
9 500				
4 750	20-50	30-55	20-50	30-60
2 360				
1 180				15-35
600				
300				
150	5-12	7-20(2)	3-10	5-12
75	3-8(1)	5-12(2)	0-7(1)	3-8

(1). For gravel sources not classified as quarries, the allowable percentage passing the 75 µm sieve shall be 3 to 5%.

(2). Where percentages passing the 4 750 µm sieve are between 30 and 45%, the allowable percentage passing the 75 µm sieve shall be 3 to 12% and the allowable percentage passing the 150 µm sieve shall be 5 to 20%.

(3). For gravel sources classified as quarries, the allowable percentage passing the 12,500 µm sieve shall be 50 to 90%.

.6 Crusher Dust: hard, durable, crushed stone particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials, graded as follows:

Sieve Size (µm)	Percent Passing

9 500	100
4 750	50-100
2 000	30-65
425	10-30
75	5-10

.7 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 1.0 MPa at 28 days.
.2 Portland cement content of 25 kg/m3.
.3 Minimum strength of 0.07 MPa at 24 h.
.4 Concrete aggregates: to CAN/CSA A23.1.
.5 Portland cement: Type GU or GU-L.
.6 Slump: 150 mm minimum.

.8 Armour Stone: as specified in Section 35 31 24.

.9 Riprap: hard, dense (with specific gravity not less than 2.65), non-ore bearing, non-toxic to aquatic life, durable quarry stone, free from seams, cracks, or other structural defects, to meet the following size distribution for use intended:

.1 Class 1: at least 70% of the riprap material shall be between 200 mm and 450 mm.
.2 Class 2: at least 70% of the riprap material shall be between 300 mm and 760 mm.
.3 Class 3: at least 70% of the riprap materials shall be between 500 mm and 1200 mm.

.10 Pipe bedding and backfill: type 1 gravel as specified herein.

.11 Lumber: construction grade stamped by Maritime Lumber Bureau 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 the Consultant if in doubt as to definition of material before material is excavated.

.3 When rock is encountered, notify the Consultant for measurement.

.1 Where unknown rock is encountered, refer to Section 00 72 45 General Condition 6.4.

.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 Prepare trench bottom so pipe can be laid to required line and grade. Remove any boulders or rock within theoretical trench payment area.

.8 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.

.9 Protect granular material from the elements.

.10 Stockpile materials a sufficient distance from excavations in such manner to prevent side failure or bottom uplift.

.11 Replace over excavation of trench bottom with selected site material, granular material, or unshrinkable fill as directed.

.12 Refer to subsection 3.3 herein for excavation of unsuitable and contaminated material.

3.2 TOPSOIL EXCAVATION

.1 Strip topsoil to limits and depth indicated or directed by the Consultant.

.2 Stockpile in designated areas or dispose as directed. Minimize loss and wastage.

3.3 UNSUITABLE OR CONTAMINATED EXCAVATION

.1 Where contaminated material is suspected within the limits of excavation, refer to the Owner and Consultant for testing.

.2 When contaminated material is confirmed by testing notify the Consultant for measurement and assist in investigation to determine depth and type of material. Isolate area to minimize entry of water into excavation.

.3 When unsuitable material is encountered notify the Consultant for measurement and assist in investigation to determine depth and type of material

.4 Excavate unsuitable or contaminated material to extent directed. Handle unsuitable or contaminated material without impacting suitable material on site.

.5 Dispose of contaminated material at a facility as mandated by Provincial and CCME (Canadian Council of Ministers of the Environment) Soil Quality Guidelines and as approved by the Consultant.

.6 Notify the Consultant whenever unsuitable material is encountered, remove to depth and extent directed.

.1 If such Work is due to nature of soil, the Consultant 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.
.3 If such Work is required, refer to Section 00 72 45 General Condition 6.4.

.7 Dispose of unsuitable, contaminated, or surplus materials off site unless otherwise indicated by the Project Documents.

3.4 BLASTING

.1 Obtain appropriate permits before proceeding with blasting.

.2 Conduct blasting operations in accordance with the Nova Scotia Occupational Safety Act and NS Blasting Safety Regulations.

.3 Conduct blasting with all possible care to avoid injury to persons and property.

3.5 SUPPORT OF EXCAVATION

.1 Install and maintain shoring and underpinning as required by the Nova Scotia Occupational Health and Safety General Regulations.

.2 When support of excavation is required, use a shielding and shoring system conforming to the Nova Scotia Occupational Health and Safety General Regulations or engage services of a professional engineer licensed to practice 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 accordance with Section 01 57 00 - Environmental Protection, and 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 Prior to draining water from excavation into sewer, obtain permission from regulatory authorities having jurisdiction.

3.7 BEDDING AND BACKFILLING

.1 Remove all timber, snow, ice, frozen material, and debris from excavation before backfilling. Allow Consultant to inspect excavation prior to backfilling work.

.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 asphalt or concrete 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 D698. Relative Density in accordance with ASTM D4253 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 to consist of Selected Backfill material unless otherwise indicated. Place material to meet following requirements and approval of the Consultant.

.1 Place backfill in horizontal layers not more than 300 mm deep.
.2 Compact each layer using 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 the Consultant lead time required to take measurements. Notify the Consultant 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 the Consultant for measurement.

.5 Break rock to a depth 300 mm below subgrade. Excavate broken rock to subgrade or as indicated by the Project Documents. 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 unless approved by the Consultant.

.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 Top 300 mm of subgrade to be free of boulders or broken rock fragments with dimensions greater than 200 mm.

.11 Shape and compact material to within 40 mm 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 the resulting voids.

3.10 BREAKING ROCK WITHOUT REMOVAL

.1 Break rock without removal to lines and grades indicated.

.2 Break rock below street subgrade 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 exceeding 0.5 cubic metre.

.4 Excavate broken rock to depth indicated at test locations selected by the Consultant 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, compact top 300 mm to 98% Standard Proctor Density and proof-roll in accordance with the Project Documents.

.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.

.3 Before the placement of new material, proof roll the lowest material type by means of a fully loaded tandem dump truck (20 t gross weight). Remove all unsuitable material, as observed by the Consultant, and replace with suitable material.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section specifies the requirements for the supply and installation of geotextile to:

.1 Separate and prevent mixing of granular materials of different grading.
.2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

.2 Only one type of geotextile is required in the Work. This geotextile is to be used under the rock sill and between the back side of the sill and sand fill.

1.2 RELATED SECTIONS

.1 Section 31 23 00 – Earthwork.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D4751-21a, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
.2 ASTM D4355/D4355M-21, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus.
.3 ASTM D4491/D4491M-22, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
.4 ASTM D4533/D4533M-15 (2023), Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
.5 ASTM D4632/D4632M-15a (2023), Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
.6 ASTM D4751-21a, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
.7 ASTM D5261-10(2024), Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
.8 ASTM D6241-22a, Standard Test Method for Measuring Static Puncture Strength of Geotextiles and Geosynthetic-Related Products Using a 50 mm Probe.
.9 ASTM D6432-19, Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation.

1.4 DELIVERY, STORAGE AND HANDLING

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Manage all waste in accordance with Section 01 74 00.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls and made specifically for coastal applications.

.2 Geotextile to have the following minimum physical property and performance ranges:

- .1 Weight: 260-312 g/m2 to ASTM D5261.
- .2 Grab Tensile Strength: 1110-1330N to ASTM D4632.
- .3 Grab Elongation:50-105% to ((ASTM D6432)).
- .4 Tear Resistance: 444-511N to ASTM D4533
- .5 Puncture CBR: 3110-3780N to ((ASTM D6241))
- .6 Permittivity: 1.20-1.00 Sec-1 to ASTM D4491.
- .7 Water Flow: 3055-3251l/min/ m2 to ASTM D4491.
- .8 Apparent Opening Size (A.O.S.): 0.150-0.180mm to ASTM D4751.
- .9 U.V. Resistance: 70%at 500 hrs to ASTM D4355.

.3 Approved geotextile material: TerraFix 600R or Terrafix 800R; or an approved equivalent meeting all specified properties herein.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with security pins.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases. Stop geotextile 100 mm below finished surface.

.3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.4 Overlap each successive strip of geotextile 600 mm over previously laid strip.

.5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.6 After installation, cover with overlying layer within 4 h of placement.

.7 Replace damaged or deteriorated geotextile to approval of the Departmental Representative.

.8 Place and compact material layers in accordance with Section 31 23 00.

3.2 CLEANING

.1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

3.3 PROTECTION

.1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

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 tack coat, hot mix asphalt concrete, and pavement markings.

1.2 RELATED SECTIONS

.1 Earthwork: Section 31 20 00

.2 Pavement Markings: Section 32 17 23

1.3 REFERENCE STANDARDS

.1 Nova Scotia Transportation and Public Works – Standard Specification Highway Construction and Maintenance.

.2 Transportation Association of Canada: Manual of Uniform Traffic Control Devices for Canada.

1.4 PGAB ESCALATION/DE-ESCALATION

.1 If specified in Project Documents, an asphalt index mechanism in accordance with the Nova Scotia Department of Public Works program shall be applicable to the Work. Refer to Section 00 10 00 for additional information.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Asphalt materials: Nova Scotia Department of Public Works - Highway Construction and Maintenance Standard Specification.

.2 Paint for pavement markings: to Section 32 17 23. Pavement Markings.

.3 Recycled engine oil binders (REOB) are not accepted in any PGAB to be used on streets and roads. Provide the Consultant with certification that the PGAB supplied does not contain REOBs.

2.2 ASPHALT CONCRETE

.1 Asphalt concrete mix: to Nova Scotia Department of Public Works – Highway Construction and Maintenance Standard Specification, Division 4, Section 4, and type indicated in the Project Documents.

PART 3 - EXECUTION

3.1 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 Consultant.

3.2 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.

3.3 TACK COAT

.1 Apply tack coat on existing asphalt concrete to Nova Scotia Department of Transportation and Active Transit – Highway Construction and Maintenance Standard Specification, Division 4, Section 1. Apply tack coat to contact surface of curbs, castings and structures.

3.4 PAVING

.1 Transport, place, and compact asphalt concrete mix to Nova Scotia Department of Public Works – Highway Construction and Maintenance Standard Specification. 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.

3.5 PAVEMENT MARKINGS

.1 To Section 32 17 23 – Pavement Markings.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for constructing walks, curbs, and gutters.

.2 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

1.3 REFERENCE STANDARDS

.1 ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

.2 ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

.3 CSA A23.1:24/A23.2:24, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.4 CSA B651:23, Accessible Design for the Built Environment.

.5 Nova Scotia Department of Transportation and Active Transit – Highway Construction and Maintenance Standard Specification.

1.4 PROTECTION

.1 Provide protection, including security 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, type GU or GU-L cement, minimum compressive strength of 32 MPa at 28 days, a maximum water cement ratio of 0.45, C-2 Class of Exposure, 5-8% total air content, slump to suit placement method.

.2 Chemical admixtures: type as approved, and in accordance with ASTM C494

.3 Isolation joint filler: to ASTM D 1751.

.4 Granular base: Type 1 Gravel to Section 31 20 00.

.5 Asphalt materials: to Section 32 12 16.

.6 Curing compound: to CSA A23.1-M, white in colour.

.7 Tactile walking surface indicators:

.1 Cast iron plates in accordance with ASTM A48, minimum class 30B, free from damage or blemishes, sound, free from pouring faults, cracks, blow-holes and other defects.
.2 Attention type (truncated domes): 12 mm top surface diameter, 22 mm base surface diameter, 42-61 mm centre-to-centre between domes to CSA B651.
.3 Slip resistant and colour contrasted with surrounding walking material in accordance with CSA B651.

PART 3 – EXECUTION

3.1 FINE GRADING

.1 Fine grade gravel surface to within 10 mm of elevations and cross sections indicated immediately prior to placement of finishing material. Add or remove gravel as required. Compact to 100% Standard Proctor Density or as directed by the Consultant.

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 a control joint 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 a control joint 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 is permitted 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 an expansion joint every 50m and at every cold joint.
.3 Finishing: Do not apply water to newly placed concrete surfaces.
.1 Broom finish 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 Section 32 12 16.

3.5 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.

3.6 TACTILE WALKING SURFACE INDICATORS

.1 Install tactile walking surface indicators in accordance with the manufacturer's written instructions and to the tolerances specified in the Project Documents.

.2 Install the base surface level with the surrounding surface, or with its edges beveled and not more than 3 mm above the surrounding surface.

.3 Install tactile walking surface for the entire width of curb depression or hazard to a minimum offset width of 600 mm to 650 mm with one side abutting curb depression or hazard and orientation as shown in CSA B651.

.4 Clean plates after installation and inspect for proper height tolerance. Replace any units outside specified tolerances.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies the requirements for the application of pavement markings. The Work consists of the furnishing of all materials, tools, equipment, and labour to lay down pavement markings for the delineation and control of traffic.

1.2 REFERENCE STANDARDS

.1 Manual of Uniform Traffic Control Devices for Canada (MUTCD), (5th Edition), latest revision.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 for items listed in Supplementary Specifications.

1.4 CODES, BYLAWS, ORDINANCES, AND REGULATIONS

.1 All work covered by this section shall be performed according to applicable Municipal Codes, bylaws, ordinances, and regulations.

.2 Nova Scotia Temporary Workplace Traffic Control Manual.

PART 2 - PRODUCTS

2.1 TEMPORARY PAVEMENT MARKINGS

.1 Paint: to CGSB 1-GP-71. Color to conform to Pavement Markings CGSB 1-GP-12C, 505-308 for yellow and 513-301 for white.

.2 Reflectorized self adhesive marking tape.

.3 Milled surfaces to have reflective temporary pavement marking “tabs”.

2.2 PERMANENT PAVEMENT MARKINGS

.1 Yellow paint: to CGSB 1-GP-71. Color to conform to CGSB 1-GP-12C, 505-308. Add 75 g/L titanium dioxide and 100 g/L lead chromate.

.2 White paint: to CGSB 1-GP-71. Color to conform to CGSB 1- GP-12C, 513-301. Add 150 g/L titanium dioxide.

.3 Glass beads: overlay type and to CGSB 1-GP-74M, premix type to CGSB 1-GP-149M.

PART 3 - EXECUTION

3.1 GENERAL

.1 Clean pavement surface of all dirt, dust, oil, surface water and pavement markings that have been previously or poorly applied.

.2 Thoroughly clean distributor tank before refilling with materials of different colour.

.3 Pavement markings which are partially impacted at any intersection shall have the complete marking painted.

.4 Layout pavement markings in accordance with the Nova Scotia Temporary Workplace Traffic Control Manual and the Manual of Uniform Traffic Control Devices for Canada, unless otherwise indicated.

.5 Remove all incorrectly painted pavement markings by grinding, resulting in minimal scarring and removal of at least 95% of existing markings. Remove markings in such a way that the pavement surface is not damaged below a depth of 3 mm. Grooving, rutting or other significant damage is not acceptable. Removal equipment used for pavement making removal must be capable of vacuuming the debris they generate simultaneously with the grinding operation.

3.2 PAVEMENT MARKING DRAWINGS

.1 Where a pavement marking drawing is provided, paint markings as indicated on the drawing. Where a pavement marking drawing is not provided, inventory existing markings. Obtain Owner approval of the inventory drawing prior to the removal of the existing pavement markings.

3.3 PAINT

.1 Apply paint only when air temperature as per the manufacturer’s written instructions.

.2 Apply markings to within a tolerance of 12 mm of the dimensions indicated with a 5 mm maximum deviation in any 3.0 metre of length.

.3 Apply paint under pressure at a rate to achieve a paint thickness of not less than 0.25 mm when sprayed on the surface.

.4 Apply glass beads to all pavement markings. Apply glass beads at a rate of 300 g/m².

.5 Protect newly painted markings from traffic by barricades or cones or other suitable method until paint has dried sufficient so as to not be damaged by traffic.

3.4 MARKING TAPE

.1 Apply marking tape only when the air temperature, pavement temperature, and weather conditions meets or exceeds manufacturer’s recommendations.

.2 Apply markings to within a tolerance of 12 mm of the dimensions indicated with a 5 mm maximum deviation in any 3.0 metre of length.

.3 Apply marking film into the surface of newly laid asphalt and in accordance with manufacturer’s recommendations. Roll marking tape into the asphalt surface using a two-wheel or three-axle

tandem roller.

.4 Protect newly laid markings from traffic by barricades or cones or other suitable method until asphalt has cooled or markings have set sufficiently so as to not be damaged by traffic.

3.5 TEMPORARY PAVEMENT MARKINGS

.1 Apply temporary lane markings (tabs on milled surface, temporary tape on micro and pavement) to arterials immediately after the placement of each lift of asphaltic concrete. Apply permanent markings within 48 hours. For all other streets, apply temporary lane markings to base course of asphalt if the placement of the surface course of asphalt will not be proceeding within one week of the completion of the base course. For all other streets apply permanent markings within one week after the placement of the final lift of asphaltic concrete. Apply pavement markings on speed humps within 48 hours.

3.6 ARROWS, SYMBOLS AND LETTERS

.1 Prepare templates to match patterns supplied by Owner. Obtain approval of all templates prior to use.

.2 Arrows to be sizes as specified in Transportation Association of Canada standards listed in the Uniform Traffic Control Devices for Canada or as specified in the Supplementary Specifications.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies the supply and installation of precast concrete modular block retaining walls.

.2 This section or the Project Drawings does not provide a complete design. It will be emcumbent on the Contractor to have the design completed by the wall manufacturer.

1.2 RELATED WORK

.1 Metal Fabrications: Section 05 50 00

.2 Earthwork: Section 31 20 00

1.3 REFERENCE STANDARDS

.1 ASTM C1372 - Standard Specification for Dry-Cast Segmental Retaining Wall Units; 2017.

.2 ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

.3 ASTM C1776/1776M-17(R2022), Standard Specification for Wet-Cast Precast Modular Retaining Wall Units.

.4 CSA G164-18(R2023), Hot Dip Galvanizing of Irregularly Shaped Articles.

.5 CSA S6:19, Canadian Highway Bridge Design Code.

.6 National Concrete Masonry Association (NCMA) Design Manual for Segmental Retaining Walls, Third Edition.

1.4 SUBMITTALS

.1 Provide shop drawings for the wall design in accordance with Section 01 33 00 for items listed herein and other specification sections.

.2 Submit a completed design complete with calculatiuons and shop drawings that contain sufficient information to supply and construct the wall including but not limited to product type confirming block sizes, colors and textures along with wall plans, elevations, cross sections and any details for gravels, behind wall piping, anchoring, fencing, handrails and guard rails.

.3 The design must be completed by a professional engineer licensed to practice in the Province of Nova Scotia and in accordance with the Supplementary Specifications.

1.5 DESIGN CRITERIA

.1 Design segmental retaining walls in accordance with recommendations of the NCMA Design Manual for Segmental Retaining Walls and the requirements of CSA S6.

1.6 CERTIFICATION

.1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 33 00.

1.7 DELIVERY AND STORAGE

.1 Check materials upon delivery to confirm proper materials have been received and are in good condition.

.2 Check stock numbers on delivered segments to confirm consistent color. If a small amount of one stock number is provided, spread throughout wall face.

.3 Prevent excessive mud, wet cement, and like material from mixing with the materials.

.4 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 and promptly remove damaged units from the site.

1.8 ALLOWABLE TOLERANCES

.1 Finished top of wall surface 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 meter long straightedge.

PART 2 - PRODUCTS

2.1 SEGMENTAL WALL UNITS

.1 Units to conform to ASTM C1776. Cap units and end units to be required at exposed portions of the wall.

.2 Color and texture: as selected by the Consultant from standard product options.

.3 Units to be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or performance of the construction. Any cracks or chips observed during construction shall fall within the guidelines outlined in ASTM C1776 for the product selected.

2.2 LEVELLING PAD

.1 Aggregate wall base as specified in the manufacturer’s shop drawings.

2.3 GEOTEXTILE FILTER

.1 As specified in Section 31 32 21 .

2.4 DRAINAGE STONE

.1 Clearstone as specified in the Section 31 20 00.

2.5 DRAINAGE PIPE

.1 As shown on the Project Drawings and ss specified in Section 33 40 00.

2.6 BACKFILL

.1 In accordance with the wall manufacturer's design.

2.7 UNIT FILL

.1 In accordance with the wall manufacturer's design.

2.8 POSTS AND HANDRAILS

.1 In conformance with Section 05 50 00 – Metal Fabrications and galvanized to CSA G164.

.2 Anchors and fasteners as specified in the design or manufacturer’s specifications.

.3 Include post and hanrail details on the submitted shop drawings.

2.9 ACCEPTABLE MANUFACTURERS

.1 Redi-Rock or approved equivalent.

PART 3 - EXECUTION

3.1 SITE LAYOUT

.1 Before preparation of subgrade layout segmental retaining wall alignment on Site in accordance with the Project Drawings.

3.2 PROTECTION

.1 Protect existing buildings, landscaping, fences, adjacent properties, and all other items designated to remain.

.2 Protect and maintain work including accessories, until Ready-for-Takeover of project Work is achieved.

3.3 SUBGRADE PREPARATION

.1 Complete excavation in accordance with Section 31 20 00 – Earthwork and to the lines and grades shown on the Project Drawings.

.2 Grade and compact subgrade in accordance with the wall manufacturer's design.

.3 Obtain subgrade approval from the Consultant prior to proceeding with the levelling pad to confirm the subgrade meets or exceeds the design bearing capacity.

3.4 LEVELLING PAD

.1 Install aggregate base as specified in the wall manufacturer's design. Top of base must allow bottom wall units to be buried to the required depths according to wall heights and provide secure wall embedment at the elevations indicated in the design.

.2 Grade and compact aggregate base in accordance with wall manufacturer's design.

.3 Levelling pad elevations to be within 25 mm of design grades prior to proceeding with wall block installation.

3.5 UNIT INSTALLATION

.1 Place the first course of wall units on the levelling pad.

.2 Confirm units are in full contact with the levelling pad and check units for level and alignment.

.3 Install drainage pipe, drainage aggregate and geotextile filter as backfilling progresses with each course of wall block.

.4 Fill all voids between and within the blocks with unit fill where applicable.

.5 Place and compact backfill drainage stone behind block units to finished grade, in successive lifts until level with the top of the facing units for each course of wall block in accordance with Section 31 20 00 - Earthwork.

.6 Install successive courses of block units to the design elevations with backfilling and block unit fill installed to the top of each course before placing the next course.

.7 Provide temporary swales or other water control measure to divert runoff away from the wall to prevent soil staining of the wall face, scour of the retaining wall foundation, prevent unsafe working conditions, or erosion of the backfill or unit fill.

.8 The final grade above and below the retaining wall to provide for positive drainage and prevent ponding.

.9 Do not operate large equipment or store materials above the wall that exceeds the design surcharge loads.

3.6 ADJUSTMENT AND CLEANING

.1 Replace units that are or become defective. Immediately remove from site defective and damaged materials. Replace, repair, and re-finish according to the Consultant's approval.

END OF SECTION

PART 1 – GENERAL

1.1 WORK INCLUDED

.1 The Work is comprised of the supply of all labour, construction plant, equipment and materials necessary for the performance of the work required to design, supply, and deliver all components and hardware to construct a painted steel pedestrian bridge complete with a composite steel/concrete deck system.

.2 This sections also includes the surface preparation of the metal surfaces as well as the supply and application of coatings to steel structures. This section is applicable to both coatings applied in the fabrication shop and on-site.

1.2 REFERENCES

.1 CSA S7-23, Pedestrian, cycling, and multiuse bridge design guideline

.2 CSA S6-19, Canadian Highway Bridge Design Code.

.3 CSA W47.1-09(R2014) Certification of Companies for Fusion Welding of Steel.

.4 CSA W59-, Welded Steel Construction (Metal Arc Welding).

.5 CSA G40.20-13/G40.21-13 (R2023), General Requirements for Roller or Welded Structural Quality Steel/Structural Quality Steel.

.6 CSA O141 - Softwood Lumber; 2005 (Reaffirmed 2019).

.7 ASTM A123/A123M-24, Standard Specification for Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.

.8 ASTM D4541-22, Test Method of Pull-Off Strength of Coatings Using Portable Adhesion-Testers.

.9 CGSB 164-FP-IMP, Leachate Extraction Procedure.

.10 SSPC, (Steel Structure Painting Council), Steel Structures Painting Manuals – Volumes 1 and 2, “Good Painting Practice” and “Systems and Specifications”.

.11 SSPC CAN/CSA O141.11, Zinc-Rich Primers.

.12 ASTM A380/A380M-17, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

1.3 QUALIFIED BRIDGE MANUFACTURERS

.1 Bridge Manufacturers must have at least 5 years experience fabricating these types of structures and have an up to date certification by CWB to Division 2 and must be 3rd party certified by CISC. All suppliers must fabricate their product, no brokers are allowed.

.2 The bridge manufacturer will be evaluated by the Consultant for accuracy and ability to provide a bridge(s) in accordance with these specifications.

.3 The Bridge Manufacturer must have as a direct employee, an engineer who is experienced in bridge design to perform all engineering related task and design and employed on a full-time basis. The engineer shall be a currently licensed civil or structural engineer in the Province of

Nova Scotia

1.4 DESIGN

.1 Bridge design to be in general accordance with the CAN/CSA S6 and S16. The superstructure will be a bowstring truss and must be designed to support pedestrian loading as per section 3.8.9 of CSA S6 and the maintenance vehicle load as per section 3.8.11 of CSA S6. Include bridge reaction loads on submitted shop drawings or loading specified in sections 6.5 and 6.7 of CSA S7, respectively, whichever is more stringent. Dead Load reactions mustbe no greater than that presented on the contract drawings unless otherwise approved by the Consultant.

.2 Have the structural design and shop drawings of the bridge and its assembly provided by the manufacturer. Drawings must bear the stamp of a professional engineer registered in the Province of Nova Scotia.

.3 The "step height" between abutment beam seat and top of deck must be no greater than that presented on the drawings without prior approval

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one (1) week prior to beginning work of this Section, with Contractor's Representative and the Consultant to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordinate with other building subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

.2 Prior to start of Work arrange for site visit with the Consultant to examine existing site conditions adjacent to demolition work.

1.6 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Submit the following documents prior to the start of coating operations:

.1 Abrasive to be utilized along with manufacturer’s specifications.

.2 Coating(s) to be utilized along with manufacturer’s specifications.

.3 Submit WHMIS Safety Data Sheet (SDS) in accordance with Section 01 22 00 - Submittal Procedures.

.1 Submit an electronic copy of WHMIS SDS.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Nova Scotia, Canada.

.2 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, threaded fasteners, rivets, and welds. Indicate welds by CSA W59, Welding Symbols.

.3 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.

.4 Submit description of method, temporary bracing and strengthening, sequence of erection and type of equipment proposed for use in erecting structural steel.

.4 Sustainable Design Submittals:

.1 Construction Waste Management

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.5 Design of platform, scaffolds and enclosure stamped by a professional engineer licensed to practice in the province of Nova Scotia.

.6 Structural calculations for the design of the bridge superstructure to be prepared and submitted for review after receipt of the bridge order. Calculations to include complete design, analysis and code checks for the controlling member, connectivity and support conditions, truss stability checks, deck design, deflection checks, bearings and all splices

1.7 DELIVERY

.1 Coordinate delivery of the bridge to Site with the manufacturer.

.2 Package the components in such proportions that are consistent with the manufacturers normal method of packaging. Each container must bear a label on which clearly shows the name of the manufacturer or brand name of coating, the lot number, and date of manufacture. Coat the container if necessary to prevent attach by the coating components.

1.8 QUALITY ASSURANCE

.1 Provide mill certificates upon request as confirmation of the steel quality used for the fabrication of main structural elements. The Owner or Consultant may take random samples from any components supplied and have them independently tested for verification of material specification conformity.

1.9 WARRANTY

.1 Provide a warranty that expressly states the coating system applied under the terms of this contract for new construction will be free of defects in materials and workmanship for a period of 60 months from the date the work is accepted by the Owner and the Consultant.

.2 During the warranty period, the Consultant or an appointed representative will inspect the coating system, and will advise the Contractor and Manufacturer, in writing, of any repairs that are required. Intermediate inspections may be made and warranty repairs claimed and repaired by the Contractor and manufacturer each year of the 36 or 60 month warranty period.

.3 Failure of the protective coating system may include but not be limited to:

.1 Any de-bonding or failure of adhesion of the coating either to the structural steel or other coatings.

.2 The appearance of any rust stains on the coated structure due to loss of coating or leaking from joints between structural members (staining from leaking expansion joints or from structural components not coated under the contract will be exempt from the

provisions of the warranty).
.3 Failure of the coating to resist chipping and abrasion from normal site conditions.
.4 Any loss of normal gloss or rapid colour change.

.4 Warranty repair must be completed within 45 days of notification, or if this would place repair in unsuitable weather conditions, by June 15 of the following year.

.5 Repairs under warranty to include all costs to supply material, labour, and equipment necessary to restore the coating system to acceptable condition.

PART 2 – PRODUCTS

2.1 BRIDGE MATERIALS - GENERAL

.1 All components used in the bridge must be of new manufacture by a fabricator to CSA W47.1 Division 2. Have welding carried out in accordance with CAN/CSA W59 by fabricator certified to CWB Division 2.

.2 Structural steel:

.1 All members of the truss and deck support system must be fabricated from square or rectangular hollow structural shapes (HSS), with the exception that floor beams may be wide flange shapes and stringers may be channels.
.2 Cap all open ends of end posts and floor support beams. Provide drain holes for all sections at the low point of the member that may become filled with water.
.3 Fabricate bridges using A500 Grade C tube, A992 W-Shapes, A36 structural shapes and plates.

.3 Deck material:

.1 Decking to be Corrugated 4 ¼” Structural Bridge Deck, placed transverse across the width of the bridge. The height of the deck to be 108mm from top of the lower trough to top of the profile. Width of the deck to be 325mm with one 20mm overlapping leg. Thickness of the deck shall be 9-gauge or 7-gauge, as determined by the Bridge Manufacturer.
.2 The steel utilized must meet ASTM A653, Grade 50, Class I with a minimum 2 oz galvanized coating.
.3 Decking to be attached per the Bridge Manufacturer’s recommendations. Any damage to the pre-galvanized finish to be wire-brushed cleaned and then treated with an organic zinc-rich coating meeting the material and performance requirements of ASTM A780.
.4 Apply concrete wearing surface to the decking after installation of the bridge.

.4 All structural steel tubing shall be Canadian manufactured hot rolled structural shapesbars, plates CAN/CSA-G40.21-M Grade 300W or 350W or equivalent A500.

.5 Bridge Superstructure to be supplied complete to underside of Baseplates. All Fasteners to be Hot Dip Galvanized to ASTM A123.

.6 Q-Deck to be minimum 22 gauge galvanized shop installed steel. Provide a signed and stamped design of concrete deck and rebar by an engineer licensed to practice in the Province of Nova Scotia. Average slab thickness must not be more than 200mm thick.

.7 Bearings: elastomer bearing pads of neoprene, grade 50 or 60 to CSA S6.

.8 Acceptable product: Algonquin Pedestrian Bridge or approved equivalent.

2.2 COATINGS

.1 Coating Systems:

.1 Coatings applied to structural steel to consist of inorganic zinc primer plus high build modified aluminum epoxy mastic mid-coat plus high build aliphatic polyurethane top coat in a selected colour.

.2 Confirm the latest formulation of the proposed coating products to be utilized in the work satisfy the requirements of this specification. The primer and top coats must be compatible with each other and must be manufactured by the same company. The top coat colour will be selected by the Owner. All coating work and systems for the purpose of this specification will be considered a fully cured system prior to being accepted by the Consultant. No accelerators for the purpose of force curing the coating system will be accepted without prior written approval.

.3 The coating indicated below are approved based on past performance:

.1 Corothane I Galvapac One Pack Zinc Primer by Sherwin Williams, 3.0-4.0 mils DFT, colour gray.
.2 Macropoxy 646 Fast Cure Epoxy by Sherwin Williams, 5.0-10.0 mils DFT, colour Mill White.
.3 Acrolon 218 HS Acrylic Polyurathane by Sherwin Williams.
.4 Coatings other than those listed are to be approved by the Consultant.

.4 Painted structures require special fabrication details to ensure that all exposed surfaces receive the proper surface preparation and correct amount of paint. When overlapping steel surfaces occur, a space of 1.5” or greater must be maintained. If this space cannot be maintained, then insert steel spacers to eliminate the space. Seal weld all overlapping steel surfaces with a space less than 1.5” all around to prevent access by water. Caulking of overlapping surfaces will not be allowed.

.5 Mixed Coating: two components of the system must have a shelf life of 12 months minimum. Pot life for the mixed material to be four hours at 24°C.

.6 Blast cleaning:

.1 Blast clean all surfaces of structural steel in accordance with the Steel Structures Painting Council (SSPC), Surface Preparation Specification No. 6, latest edition, (SSPC-SP6), Commercial Blast
.2 Blast Media:
.1 Abrasive blast media must be clean and sharp silica sand, washed industrial sand, steel grit, or a slag material of suitable size, weight and angular shape to produce the degree of cleaning specified and anchor pattern/profile required. The blast media must contain no more than 1% by weight of water soluble solids. There must be less than 10 ppm oil in the abrasive and no trace of salts or toxic materials. When cleaning by air blasting with sand abrasives, provide adequate separators and traps to remove detrimental amounts of water and oil from the

compressed air before it reaches the nozzle.

.2 Dispose of materials unsuitable for use in the work off-site in an acceptable manner and at the Contractor's expense. With the exception of steel grit, reclaimed abrasive will not be acceptable.

2.3 BRIDGE SYSTEM TYPE

.1 Bowstring Chord Truss: interior verticals of the trusses to be perpendicular to the top face of the bottom chord.

.2 Floor Beam Location: bridge to utilize an H-Section configuration where the ends of the floor beams are welded only to the interior face of the verticals. Have the bridge manufacturer determine the distance from the top of deck to the bottom of the bottom chord by the Bridge Manufacturer during final design.

.3 Diagonal Style: vertical truss to use a single-diagonal, Pratt configuration, where all of the diagonals are in tension. For a truss with odd number of bays, add a second diagonal to the center bay to form an "X"

PART 3 – EXECUTION

3.1 INSTALLATION - PEDESTRAIN BRIDGES

.1 Install pedestrian bridges in accordance with approved shop drawings and in accordance with the manufacturer's written instructions.

.2 If bridge is to be delivered to site in more than one piece. mark pieces in accordance with CSA G40.20/G40.21.

.1 Do not use die stamping.
.2 Place marking at locations hidden when viewed from exterior after erection.

.3 Match marking: shop mark bearing assemblies and splices.

.4 Maintain protection of concrete until after completion of bridge erection.

.1 Remove waterproof covers and drains and holding structures when bridge erection complete.

3.2 COATING APPLICATION - GENERAL

.1 Apply coating system as detailed in these specifications. The manufacturer's data sheets are part of this specification. Should there be any conflict between these two specifications the decision of the Consultant will prevail.

.2 All surfaces to be coated must be free from contamination prior to any application. Do not do coating work when the surface is less than 3°C above the dew point, nor when it is likely that there will be a change in the weather within four (4) hours of application that would be detrimental to the coating system. Uniformly apply coatings without sags, foreign materials, dust, contamination, cracks or other blemishes. Remove defects and repair at the discretion of the Consultant.

.3 Arrange for site visits form the coating manufacturer's technical representative a minimum of one visit per month while the job is in progress. For projects scheduled for completion in less than one (1) month have the manufacturer's representative arrange to visit the site at least once. After each visit, have the manufacturer's representative provide a written report to the Consultant within five (5) working days.

.4 All coating work and systems for the purpose of this specification must be considered a fully cured system prior to being accepted by the Consultant. No accelerators for the purpose of force curing the coating system will be accepted without prior written approval. Do not apply coating when the wind speed exceed 15 km per hour unless the Contractor can demonstrate to the Consultant that adequate precautions have been made available which are acceptable to the Consultant. The decision of the Consultant will be final.

3.3 SURFACE PREPARATION

.1 Abrasive blast cleaning equipment must be of a quality and size sufficient to perform the work within the time available in the contract. Blast equipment must have adequate in line 'driers' to ensure moisture is completely removed during blasting operations. All spray and blasting equipment must be adequately grounded to avoid build-up of static electricity. Remove detrimental amounts of water and oil from any compressed air supply used for blast cleaning by means of appropriate functional traps, separators and heaters before the airstream reaches the nozzles.

.2 Remove deposits of oil or greasy contamination in accordance with SSPC-SP 1, "Solvent Cleaning" before commencing other surface preparation.

.3 Clean field coated surfaces using high pressure fresh water wash to remove all sand, dirt carbonation, salt and other contaminants. Provide an enclosure at this time if necessary to prevent wash material from entering the environment. Filter wash water through an approved filter medium (eg. non-woven geotextile, minimum tensile strength 600 N, permeability 0.22 cm/sec) prior to discharge into the environment. Total maximum chloride contamination on any surface must not exceed 30 ppm as tested using a standard SCAT kit. The high pressure wash will start at the top and proceed down to the bottom of the steel. Special emphasis must be placed on corners and crevices where members are joined together.

.4 Solvent wash solutions shall have prior approval.

.5 Remove weld splatter, slag, rust, burrs, silvers etc. prior to coating in accordance with the requirements of SSPC-SP 2 "Hand Tool Cleaning" and/or SSPC-SP 3 "Power Tool Cleaning". Grind down any sharp edges, not in accordance with Good Painting Practices, to produce a minimum radius of 4mm. Break corners and edges of flanges, stiffeners and bracing on items which are to be coated. Have this work approved by the Consultant or their representative prior to blast cleaning.

.6 All steel surfaces to be coated must be abrasive blast cleaned in accordance with the requirements of SSPC-SP 10, "Near-White Blast Cleaning".

.7 Steel surface profile requirements must be a minimum 20% of the total film thickness specified, or as recommended by the coating manufacturer to achieve good coating adhesion and coverage.

.8 Field disposal of spent abrasive:

.1 The spent abrasive material is to remain dry at all time. Refer to SSPC Guide 7.

.2 Representative samples of the spent blasting medium containing coating chips and dust removed from the bridge will be taken by the Consultant and submitted to a laboratory to be tested according to leachate test procedures in CGSB 164-GP-IMP. The abrasive must be kept in a water tight enclosure until the results of the tests are known in order to ensure that no contaminants are released into the environment.

.3 If the leachate test results indicate the spent blasting medium is classified as a non-hazardous solid waste, transport the medium from the project site to an approved waste disposal site. Pay any required tipping charges at no additional expense to the Contract.

.4 If the leachate test results indicate the spent blasting medium is classified as a hazardous solid waste, transport the medium to a temporary storage location with a fenced storage compound as directed by the Consultant. Pay any required loading and transportation charges at no additional expense to the Contract. Ultimate disposal of the stored material would then become the responsibility of the Owner.

.5 Materials that qualify under the Dangerous Goods and Hazardous Wastes Management Act must be disposed of in a manner acceptable to Nova Scotia Environment and as approved by the Consultant.

.6 Weigh blast abrasive material before delivering to site. Weight the spent abrasive as it is removed from the site. Provide every progress payment application, a weigh slip for all abrasive used in the work.

.7 The Owner will not entertain any claim by the Contractor due to delays in sampling and/or receiving leachate test results for the spent abrasive.

3.4 APPLICATION OF COATING SYSTEMS

.1 Apply inorganic zinc primer to the prepared metal surface by airless spray equipment or as recommended by the manufacturer. Apply inorganic zinc at the shop. Apply intermediate and topcoats in the field after erection. Under exceptional circumstances the Consultant may permit the intermediate coat to be applied at the shop. Written permission from the Consultant must be received prior to the application of the intermediate coat at the shop.

3.5 FILM THICKNESS

.1 Apply coatings as per the specified minimum and maximum film thicknesses. The nominal rate of application for the coatings system will be:

.1 Have a minimum/maximum DFT of 250 – 400 µm. Apply inorganic zinc at 75 ± 25 µm DFT, apply the aluminum epoxy mastic at 150 ± 25 µm DFT and apply the aliphatic polyurethane at 100 ± 25 µm DFT.

.2 All measurements concerning DFT must be measured by calibrating the Dry Film Gauge to read zero at the “top of the blasted profile”. Measuring methods and equipment shall conform to SSPC-PA2.

.3 Strip coat edges, corners, crevices, rivets, bolts, welds, and sharp edges with the aluminum polyamide epoxy mastic prior to the steel receiving the final coat in accordance with the coating manufacturer’s recommendations. Do striping with brushes, daubers, or mitts and extend a minimum of 2.5 cm from the edge being coated. Provide brushes and daubers and use to work coatings into cracks, crevices and locations which cannot be adequately coated by spray application.

3.6 REPAIR OF DEFECTS

.1 Before application of any further coat of material, repair all damage and/or contamination to previous coats to the satisfaction of the Consultant. In the case of repair, the procedures must be in an acceptable manner as authorized by the Consultant. In the case of removal, replace the work by work and materials which conform to the specification. This clause will have full effect regardless of the fact that the defective work may not have been previously identified by the Consultant.

3.7 ENVIRONMENTAL/SAFETY CONTROLS

.1 Confirm during the prosecution of all items of work under the agreement to protect and preserve the environment in conformance with the document “Guidelines for the Application and Removal of Structural Steel Protective Coatings: forming part of this specification.

.2 When washing or removing coating, provide protective enclosures and filters to contain dust or water in an effective manner and to minimize impacts from dust, water and coating particles entering the environment.

.3 Confirm waste materials, i.e. used coatings, solvents and refuse will not be disposed of in the aquatic environment, elsewhere on the highway or adjacent the right-of-way. Dispose of such materials in accordance with applicable legislation.

.4 The methods and materials for constructing the protective enclosure in accordance with regulatory agency requirements will be the responsibility of the Contractor.

.5 Remove materials collected or accumulated within the enclosure and contain so as to prevent their escape. Dispose of the collected materials off-site.

.6 Platforms and enclosures:

- .1 Where environmental protection is required, i.e. to protect the work piece or work place from environment, or the environment from the work being performed. This includes but is not limited to, tents, heating or ventilating, negative air pressure, dust collectors, enclosures etc. Provide these at no additional cost to the Owner. For field operations, install a full (total) enclosure surrounding all washing, coating and surface preparation activities. Refer to SSPC Guide 6.
- .2 Submit the plans and drawings for the enclosure, scaffolds and platforms for review as detailed in Section 3.0. Construction must not begin until all these documents have been reviewed. Drawings are to include but not limited to the following detailed information.
  - .1 Method and schedule of construction.
  - .2 Actual loads to be imposed on the existing structure.
  - .3 Details of proposed attachments to the existing structure.
  - .4 Size and shape of all platform components.
- .3 Scaffold erection and dismantling diagrams.
  - .1 Material specifications and sources.
  - .2 Arrangement of access platforms, ladders and guardrail.
- .4 Access scaffolding and supporting platforms are to be designed in accordance with the provisions of CSA S269.2, the National Building Code of Canada and all relevant codes and standards referenced therein.

.5 At the conclusion of sandblasting and coating operations, dismantle the protective enclosure and remove from the site.

3.8 QUALITY CONTROL/QUALITY ASSURANCE

.1 All material and equipment furnished, and work done, will be subject to inspection by the Consultant. An appointed inspector may be on site during all operations. Such inspection does not relieve the Contractor of the responsibility for furnishing the qualified labour, equipment, staging etc. necessary to meet the requirements of this specification, or the safe accessibility to the work for the purposes of inspection.

.2 Keep accurate records containing details such as weather, temperatures, dew points and times for the various coating applications and make these records available to the Consultant upon request.

.3 All work will be subject to inspection by the Consultant or appointed representative, who will be given at least 48 hours' notice prior to work commencing. Coordinate activities with the inspector to ensure that all aspects of the work are inspected. Repair defective work not conforming to this specification at no additional cost to the Consultant.

.4 Methods of inspection and inspection procedures will be as directed by the Consultant or appointed representative, who will govern both methods and standards. All findings will be recorded and will become part of the Project's Quality Assurance Records.

.5 Perform coating inspection in accordance with the procedures outlined in SSPC Manual, Volume 1, Chapter 6, "Inspection".

.6 Profile measurements will be made on random basis by use of replica tape and spring micrometer or by micrometer depth gauge.

.7 Perform dry film coating thickness readings in accordance with SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Gages".

.8 When necessary, conduct testing of ambient and surface temperature and humidity by thermometer, surface thermometer, and psychrometer with recognized psychometric tables.

.9 Destructive testing may be required where inadequate adhesion of the coating(s) is suspected. Adhesion testing shall be done in accordance with ASTM D4541. The minimum adhesion of the coating under evaluation will be 1.7 MPa (1723.69 kPa). Repair coatings damaged as the result of destructive testing at no additional expense to the Contract if the adhesion does not meet the acceptance criteria. Should the coating meet the adhesion requirements, repairs will be paid for by Halifax Water at a rate agreed to by the Halifax and the Contractor. Have repair procedures and materials approved by the Consultant prior to application.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for planting of trees, shrubs, and groundcover. Work includes supply and installation of planting soil mix or soil amendments, supply and planting of trees, shrubs and groundcover complete with all related components and accessories.

1.2 RELATED SECTIONS

.1 Clearing and Grubbing: Section 31 10 00

.2 Earthwork: Section 31 20 00

.3 Protection of Existing Trees: Section 32 91 10

.4 Topsoiling and Finish Grading: Section 32 91 19

.5 Seeding and Sodding: Section 32 92 00

1.3 REFERENCE STANDARDS

.1 Canadian Nursery Landscape Association (CNLA), Canadian Standards for Nursery Stock – current edition.

.2 Canadian Landscape Standard 2016 (CLS)-Section 9 Plants and Planting and Section 13 Establishment Maintenance – current 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 planting or failure of growth.

1.5 QUALITY ASSURANCE

.1 Landscape planting supervisor to be a Landscape Horticulturist, Journeyperson or Landscape Industry Certified Technician with Softscape Installation designation or equivalent.

.2 Landscape maintenance supervisor to be a Landscape Horticulturist, Journeyperson or Landscape Industry Certified Technician with Turf Maintenance designation or equivalent.

1.6 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 and wire basket root balls, place to protect branches from damage. Maintain adequate moisture level in root zones.
.3 For bare root 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.

1.7 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

1.8 ESTABLISHMENT PERIOD

.1 Establishment Period is the time between when the plant material is installed and the Acceptance Date, as defined herein.

.2 Maintenance, during the Establishment Period, through continual care and accepted horticultural practices, as well as rectifying any defects that become apparent in the Work, under normal use, shall reflect healthy, vigorously growing plant material in those areas indicated in the Contract Documents.

1.9 ACCEPTANCE

.1 Plant material will be accepted after planting operation is completed, provided that:

.1 Plant material has been installed according to industry-accepted standards.
.2 Plant material exhibits healthy, vigorous growth as exhibited in leaf, bud and shoot development, as determined by the Consultant or designated consultant.
.3 Is free from disease, insects, and fungal organisms, as determined by the Consultant or designated consultant.

.2 The Acceptance Date for material installed in the spring will be the end of the growing season.

.3 Plant material installed in fall will be accepted in the following spring, one month after start of growing season, provided acceptance conditions have been met.

.4 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.

.5 Notwithstanding the above subsections, the Owner can provide early acceptance of the plant material at any time of their choosing. Should the Owner elect to accept the plant material early, the warranty period for this plant material will begin from this date of early acceptance.

1.10 WARRANTY

.1 Notwithstanding GC 12.3 - WARRANTY, warrant that plant material provided will be maintained to remain healthy and free of defects for one (1) full year from Acceptance Date.

.2 Extend warranty period an additional one (1) year for plant materials if leaf development and growth is not evident at the end of the original warranty period to ensure future survival as determined by the Consultant.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

.1 Type of root preparation, sizing, grading and quality: comply with Canadian Nursery Landscape Association (CNLA) Standards.

.2 Plant material: free of disease, insects, defects, or injuries and structurally sound with strong fibrous root system, and 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 specified.

.6 Substitution to plant materials: not permitted unless otherwise approved.

.7 Plant materials to be as specified in the Project Documents. Have substitutions regarding size and type approved by the Consultant or designated consultant.

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 Mulch: Aged, shredded, bark and wood from coniferous trees or approved commercial bark nugget. Maximum length of any individual component to be 50 mm and a minimum of 50% of the mulch will pass through a 25 mm screen. Mulch to be free of growth or germination-inhibiting ingredients. Mulch to have characteristics of retaining moisture, forming a mat not susceptible to spreading by wind or rain, and providing a good growth medium for plants. Shredded bark may contain up to 50% shredded wood material. Wood chips are not acceptable. Bark mulch containing shredded wood to be

aged for one (1) year minimum prior to installation.

.2 Inorganic:

.1 Washed River Rock: 25 mm to 76 mm washed river rock, uniform in size. Screen fines from the aggregate within a 6 mm tolerance. Rock mulch to be composed of round stones or pebbles that may be varied in colour. Material to be free of organic and inorganic debris and litter.

2.5 FERTILIZER

.1 Slow-release commercial type, inorganic super phosphate ratio as determined by soil test.

2.6 ANTI-DESICCANT

.1 Wax-like emulsion to reduce transpiration during transplanting.

2.7 FLAGGING TAPE

.1 Fluorescent, colour choice optional.

PART 3 - EXECUTION

3.1 PRE-PLANTING OPERATIONS

.1 Prune and remove damaged roots and branches from plant material using proper pruning cuts.

.2 Apply anti-desiccant to conifers and deciduous trees in accordance with manufacturer's directions. Apply anti-desiccant when material is dug out of recommended season for protection, during extreme temperatures and such other conditions deemed necessary by the Consultant or designated consultant.

3.2 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.

3.3 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 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.

.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 plumb 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. Confirm that the final grade of the soil ball and the tree trunk portion or root collar of the tree is 50 mm higher to allow for settlement. For trees that have been budded or grafted, the visible joint area of the collar is to 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.

3.4 TREE SUPPORTS

.1 Install tree supports unless indicated otherwise.

.2 For deciduous trees 50 mm caliper and greater:

.1 Use double tree support.

.2 Place one (1) stake on the prevailing wind side of tree and second opposite or as directed by Consultant or designated consultant. Place both stakes at 800 mm minimum from trunk on either side of root ball. Where trees are planted next to driveways or walkways, place one (1) stake between tree trunk and driveway or walkway.

.3 Drive stakes a minimum of 300 mm into undisturbed soil beneath root ball. Confirm stakes are secure, vertical, and un-split.

.4 Install two (2) 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. Confirm 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 taller than 1200 mm, use three (3) guy wires:

.1 Install guying collars above branch to prevent slipping at approximately 2/3 height of tree.

.2 Guying collars to be of sufficient length to encircle tree trunk 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 equidistant around the perimeter of the tree.

.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 tightener or turnbuckle such 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.

3.5 MULCHING

.1 Correct soil settlement prior to mulching.

.2 Water plant material thoroughly prior to spreading mulch as indicated.

.3 After installation of tree, shrub and groundcover plantings has been approved by the Consultant, place mulch around plants and spread to a depth of 75 mm for bark mulch and 115 mm for washed river rock mulch. Use weed-free fabrics below mulch only upon approval by Consultant.

3.6 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 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 or Provincial 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 application of pesticides to control insects, fungus and disease shall be deemed to be removed from this Section.

3.7 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 Consultant or designated consultant 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 Consultant or designated consultant.

3.8 CLEAN UP

.1 Remove surplus materials at completion of the Work.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for protecting existing trees during the course of construction. The Work includes protection zone requirements, fence protection, strapping of trunks, protection and pruning of roots, excavation and backfill requirements.

1.2 REFERENCES

.1 ANSI A300-2008, Tree, Shrub and Other Woody Plant Maintenance Tree Care Operations.

.2 Canadian Landscape Standards Section 3, Site Preparation and Protection of Existing Site Elements

1.3 DEFINITIONS

.1 Maximum transplantable size: consider an existing tree to be larger than the maximum transplantable size when its trunk is greater than 100 mm in diameter. This assumes conventional transplanting methods and equipment are being used.

.2 The definition above 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 to consist of wood slat snow fencing fastened securely around the tree trunk and wrapped with yellow or orange warning or marking tape.

.2 Alternately, use wooden planks with a minimum size of 25 x 150 x 2440 mm spaced at 75 to 100 mm around the trunk of the tree and securely fastened.

2.2 FENCING

.1 Fencing: minimum height of 1.5 meter 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.

2.3 MULCH

.1 Use natural bark mulch or wood chips where a protective cover is required over the roots to avoid compaction.

PART 3 - EXECUTION

3.1 IDENTIFICATION AND REMOVAL

.1 Prior to the commencement of the work on site, the Consultant will identify trees that may be impacted by the construction activities.

3.2 CONSTRUCTION METHODS

.1 Undertake protective measures for trees and shrubs, beyond the maximum transplantable size, as indicated on the drawings and as specified herein. Protect trees less than the maximum transplantable size similarly or relocate as required.

.2 Where existing trees have been designated to remain, any excavation within the drip line is to be done by water jet or air excavation. Utilize this procedure where a large group of trees are growing in groves close together. Have exposed roots that need to be pruned inspected by the Consultant prior to any Work commencing. Complete root pruning in accordance with ANSI A300.

3.3 TREE PROTECTION AND PROTECTION ZONE

.1 Critical protection zones

.1 Critical protection zones represent the area surrounding any tree that must be preserved and protected to ensure the safety or survival of the tree. Assess and document these zones prior to commencing work.

.2 Monitor critical protection zones containing horticultural elements and keep sufficiently moist throughout the Work. This may require supplementary irrigation.

.3 Critical protection zones for trees or plants are where the majority of their root mass is located. Under normal conditions, 95% of the root structures for most trees are found in the upper 30 to 45 cm of soil with root development extending beyond the canopy radius

.4 Where possible, establish a protection zone for all trees and shrubs scheduled to be preserved on site.

Table & T-3.1. & Guideline for determining critical protection zones for trees

Trunk & Diameter (DBH*)	Minimum & Protection Radius
20 cm	1.6 meter
25 cm	2.0 meter
30 cm	2.4 meter
35 cm	2.8 meter
40 cm	3.2 meter
45 cm	3.6 meter
50 cm	4.0 meter
55 cm	4.4 meter
60 cm	4.8 meter

75 cm	6.0 meter
90 cm	7.2 meter
100 cm	8.0 meter
120 cm	9.6 meter

*** Diameter at breast height**

.5

.2 Trees within the construction area must have a 2.0 meter radius protection 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 Work.

.3 Provide protective rigid fencing installed around these areas.

.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 Strap existing tree or group of trees where it is not possible to establish a minimum 2.0 meter protection zone.

.2 Install 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.

3.5 EXCAVATION AND BACKFILL AT BASE OF TREES

.1 Minimize stripping of topsoil and vegetation around the base of trees and shrubs being preserved.

.2 Augering under existing trees may be an acceptable method of underground installation. Alternatively, air spade technology may be employed for trenching to minimize root damage

.3 During excavation, protect exposed roots of trees. Where the roots of trees are damaged during excavation, hand prune torn or broken roots to flush cuts.

.4 Excavation within the 2 meter radius protection zone must be approved by the Consultant or Certified Arborist (CA) or Registered Consulting Arborist (RCA) prior to excavation.

.5 Where heavy traffic with construction equipment is anticipated, the Consultant may require a protective layer of mulch 100-150 mm in depth be applied around the bases of the trees to avoid compaction of surface roots.

.6 Keep moist excavated trees, holes, shafts, and trenches associated with construction efforts, and involving exposed roots from adjacent publicly owned trees 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 meter radius protection zone to a depth of 300 mm of the finished grade shall be with a minimum A class soil mix as specified in Section 32 91 19 to allow for proper root regeneration.

3.6 ROOT PRUNING

.1 In the event of major reconstruction efforts, conduct root pruning along the length of the Work in an approved manner, such as with a trencher, chain saw, hand saw, lopping, shears or pruners.

.2 Keep root disturbances to a minimum during excavation.

.3 A clean severance of the root system is required. Do minor root removal, when necessary, according to approved techniques.

.4 Where major roots come into conflict, contact the Consultant prior to any work. Alternate construction methods will be considered where possible to resolve major conflicts.

.5 Do not tear off roots with power equipment.

3.7 LIMB AND BRANCH PROTECTION

.1 Do not damage trees and limbs overhanging the construction area.

.2 If tree canopy height needs to be raised to allow for reasonable construction clearances, perform the Work under the direction of the Consultant using proper arboriculture practices.

.3 Perform all tree pruning Work to the safety standards as prescribed under applicable provincial regulations.

3.8 REMEDIAL REPAIR WORK TO TREES

.1 During the course of construction, immediately notify the Consultant of any significant damage to trees.

3.9 TREES DAMAGED, REMOVED OR LOST DUE TO CONSTRUCTION

.1 Replace trees removed without prior approval from the Consultant.

.2 Replace destroyed trees at the rate of two (2) trees for every tree lost. Replacement trees to have a minimum size of 60 mm calliper measured 15 cm from the base of the tree.

.3 The location and species of replacement trees must be similar to that which was damaged by construction.

.4 In the event that trees larger than the maximum transplantable size are destroyed or damaged, costs to be deducted from monies otherwise due as determined by the Consultant.

3.10 QUALITY CONTROL & FINAL INSPECTION

.1 Final Inspection:

.1 Prior to application for Ready-for-Takeover of the Work where trees have been damaged, the Consultant will arrange for a final inspection of all trees on the project with the Contractor.

END OF SECTION

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, individual planting pits. Work includes supply and placement of materials, complete with all related components and accessories.

1.2 RELATED SECTIONS

.1 Clearing and Grubbing: Section 31 10 00

.2 Earthwork: Section 31 20 00

.3 Planting of Trees, Shrubs and Groundcover: Section 32 90 00

.4 Protection of Existing Trees: Section 32 91 10

.5 Seeding and Sodding: Section 32 92 00

1.3 REFERENCE STANDARDS

.1 Canadian Nursery Landscape Association – Canadian Standards for Nursery Stock – current edition.

.2 Cornell University (CU)-Soil standards or equivalent.

.3 Canadian Council of Ministers of the Environment, 2005; Guidelines for Compost Quality. ISBN 1-896997-60-0; Canadian Council of Ministers of the Environment.

.4 Agriculture and Agri Food Canada; The Canadian System of Soil Classification, current edition.

.5 Canadian Landscape Standard Section 6 Growing Medium – current edition.

1.4 SOURCE QUALITY CONTROL

.1 Inform Consultant of proposed source of topsoil to be supplied. Conduct topsoil sampling according to NS Department of Agriculture standard recommendations.

.2 Arrange to have topsoil tested. Testing to be carried out by Nova Scotia Department of Agriculture laboratory or other approved laboratory.

.3 Test topsoil from source prior to stripping and stockpiling. Test for clay, sand and silt, coarse fragments, particle size, nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg) and organic matter.

.4 Perform pH test to determine acidity or alkalinity and required treatment to bring pH value of soil to values as recommended by the NS Department of Agriculture standard recommendations. Test stockpiled soil after it has been spread in place.

.5 Submit soil analysis to Consultant and provide recommendations for corrections.

.6 Implement approved recommendations as required.

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 01 33 00.

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 mm maximum dimension, sods, debris, or other deleterious materials, as approved by Consultant.

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. Limit the organic matter to a maximum of 20% by volume.

.2 Topsoil to be rated to Canadian System for Soil Classification. Refer to soil rating chart in Clause 2.2.3. B class soil is recommended as a minimum for sodded areas and an A class soil is recommended for seeded areas. Improve manufactured topsoil or topsoil derived from site sources 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 Class	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 2 mm in diameter (% by volume)

2.3 MANURE

.1 Well-rotted, unleached livestock manure, not less than eight (8) months or more than two (2) 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, non-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 mm sieve, 50% passing 0.12 mm sieve.

2.8 PLANTING SOIL MIXTURE

.1 Mechanically mix: nine (9) parts topsoil with one (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% by volume, 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 Composted bio-solids must meet the requirements of the guidelines for Compost Quality, Category (A), produced by the Canadian Council of the Ministers of the Environment (CCME).

2.10 GROWING MEDIUM COMPOSITION

.1 The growing medium shall meet the following parameters:

Topsoil	40 - 45%
Medium to coarse sand (0.25 - 2 mm) plus gravel (2 -5 mm)	40 - 50%
Organic Compounds	12 - 15%
pH	6.0 - 7.5

PART 3 - EXECUTION

3.1 PREPARATION OF EXISTING GRADE FOR SEEDING, SODDING AND PLANTING

.1 Where required, raise subgrade to rough grade levels with landscape fill, deposit in layers not exceeding 200 mm. Compact each layer to minimum 95% Standard Proctor Density.

.2 Verify subgrade elevations are correct.

.3 Grade soil. Eliminate uneven areas and low spots to provide positive drainage.

.4 Cultivate entire area which is to receive topsoil, where practical, to a depth of 100 mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted the soil.

.5 Remove surface debris, roots, vegetation, branches, and stones in excess of 50 mm in diameter.

3.2 GROWING MEDIUM INSTALLATION

.1 Fill the voids in each course of the rock revetment above +1.0m elevation with growing medium before placement of subsequent courses, as per the following sequence:

.1 Place course of C1 clear stone as shown on drawing, then spread 100mm thick maximum layer of growing medium to fill voids within the course of clear stone above +1.0m elevation.

.2 Place first course of armour stone or riprap to a half the thickness indicated on the drawing, then spread 150mm thick maximum layer of growing medium to fill voids within first course of armour stone or riprap above +1.0m elevation.

.3 Place second course of armour stone or riprap to the full total thickness and final grades indicated on the drawing, then spread 150mm thick maximum layer of growing medium to fill voids within second course of armour stone or riprap above +1.0m elevation

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:

.1 150 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 the Consultant.

.2 Spread planting soil mixture with adequate moisture in uniform layers over approved, unfrozen subgrade where planting is indicated.

.3 Place topsoil to the depths indicated in Clause 3.3, and as per Section 32 90 00, Planting of Trees, Shrubs, and Groundcover for individual plant pits.

.4 Lightly compact topsoil. Keep topsoil 25 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 the Consultant.

.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 Consultant will inspect and test topsoil in place and determine acceptance of material, depth, and finish grading.

3.9 CLEAN UP

.1 Remove surplus materials upon completion of the Work.

END OF SECTION

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 Clearing and Grubbing: Section 31 10 00

.2 Earthwork: Section 31 20 00

.3 Planting of Trees, Shrubs and Groundcover: Section 32 90 00

.4 Protection of Existing Trees: Section 32 91 10

.5 Topsoiling and Finish Grading: Section 32 91 19

1.3 REFERENCE STANDARDS

.1 Canadian Nursery Landscape Association –Canadian Standards for Nursery Stock –current edition.

.2 Canadian Landscape Standards Section 7.1 General lawns and Grass - current edition.

1.4 SOURCE 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 33 00 for items listed in Supplementary Specifications.

.2 Provide product data for seed, mulch, tackifier, and fertilizer.

.3 Upon request of the Consultant or designated consultant provide a seed tag for the specified seed mix (for approval before sowing. Seed tag to include the following information:

.1 variety and kind of grass contained in the mix.
.2 percentage by weight of each grass variety and kind.
.3 germination percentage by seed variety.

.4 Submit upon request a 300 mm x 300 mm sample of specified sod to the Consultant or designated consultant for approval prior to harvesting.

1.8 ESTABLISHMENT PERIOD

.1 Establishment Period is that time between seeding, and/or sodding, and Acceptance of the Work.

.2 Maintenance, during the Establishment Period, through continual care and accepted horticultural practices, as well as rectifying any defects that become apparent in the Work, under normal use, shall reflect a healthy and vigorously growing, even and continuous swarth of dense, green, grass vegetation over 100% of the area indicated in the Contract Documents.

1.9 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.
.3 Area meets the following criteria:
  .1 90% weed free at time of acceptance for sodded areas.
  .2 80% weed free at time of acceptance for seeded areas.
.4 Minimal surface soil is visible when grass has been cut to a height of 50 mm.

.2 Areas sodded or seeded in the fall will be accepted the following spring, one (1) month after the start of growing season and the second mowing, provided that acceptance conditions have been met.

.3 Grassed areas will be maintained, including mowing, until Acceptance.

1.10 WARRANTY

.1 Notwithstanding GC 12.3 – WARRANTY, provide warranty that the seeded and sodded areas will be maintained to remain healthy and free of defects or one full year from Acceptance Date, or 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 Drought tolerant seed mixture: 100% Rhizomatous Tall Fescue, 45-50% of the blend cultivars certified to produce average rhizome length of 125 mm or greater and average root depth of 1.4m.

2.2 SOD

.1 Number (#1) Kentucky Bluegrass – nursery 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 RTF (Rhizomatous Tall Fescue) Nursery Sod, grown from a blend of advanced generation turf-type fall fescue with rhizome developing characteristics. Sod to be free from weeds, with no surface soil visible when mowed to its recommended mowing height. Sod to exhibit a dense uniform turf with a strong rooting structure and free from burned or bare spots. Soil portion of the sod to be of uniform thickness, not to exceed 1.9 cm.

.3 Regenerating Perennial Ryegrass (RPR): self-repairing creeping perennial ryegrass that spreads by pseudo-stolons.

.4 Field sod:

.1 Field sod containing a bio-diverse mix of native and naturalized species containing grasses, wildflowers and other herbaceous plants known to thrive in the local area.

.2 Field sod to be free of diseased plants, pest infestations and noxious or invasive species as listed in the Nova Scotia Weed Control Act (e.g., Purple Loosestrife, Japanese Knotweed and Sweet Clover).

.5 Broken, dry, discoloured pieces of sod 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 HYDRAULIC 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 HYDRAULIC 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 the Consultant or designated consultant 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 mechanical 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 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 Consultant.

.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 by approved means.

3.2 PREPARATION OF SURFACES

.1 To Section 32 91 19 – Topsoiling and Finish Grading.

3.3 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 mechanical landscape seeder to place seed at specified depth and rate and roll in single operation.

3.4 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.

3.5 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 meter 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 the Consultant.
.5 Drive pegs to 20 mm above soil surface of sod section.

3.6 HYDRAULIC SEEDING

.1 Seed during local growing season when natural moisture is available, and temperature is suitable to promote germination and growth.

.2 Measure 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 sq m:

.1 Seed - 2.0 kg or as recommended by seed supplier.
.2 Fertilizer – Not less than 1650 g of phosphorus per 100 sq m.
.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 Slurry application RFT and hydraulic seed per 100 sq m.

.1 Hydroseed at 5.3 kg/100 m2.

.7 Apply slurry uniformly, blending into existing grassed areas. Slurry to 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.

.8 Remove slurry from items and areas not designated to be sprayed.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform the following maintenance operations during the Establishment Period (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 grass plants without causing shrinkage or erosion.
.3 Cut and mulch grass to 50 mm, a minimum of twice, when it reaches a height of 70 mm.
.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 (1) month after sodding. Spread evenly at manufacturer’s suggested rate. Postpone fertilizing until next spring if application falls within a four (4)-week period prior to expected end of growth season.
.6 Control weeds utilizing acceptable integrated pest management practices.
.7 Where continued maintenance is required after Acceptance, commence maintenance immediately following installation of work.
.8 Continue it for one year following Acceptance at Project completion.

.9 Notify Consultant upon completion of Maintenance Period to arrange inspection and transfer of maintenance responsibility to Owner.

.10 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 will be deemed to be removed from Maintenance during Establishment Period.

3.8 MAINTENANCE DURING WARRANTY PERIOD

.1 Perform the following maintenance operations from time of Acceptance to end of Warranty Period:

.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 grass plants without causing shrinkage or erosion.

.3 Cut and mulch grass to 50 mm, a minimum of twice, when it reaches a height of 70 mm.

.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 (1) month after sodding. Spread evenly at manufacturer's suggested rate. Postpone fertilizing until next spring if application falls within a four (4)-week period prior to expected end of growth season.

.6 Control weeds utilizing acceptable integrated pest management practices.

.7 Where continued maintenance is required after Acceptance, commence maintenance immediately following installation of work.

.8 Continue it for one year following final acceptance at Project completion.

.9 Notify Consultant upon completion of maintenance period to arrange inspection and transfer of maintenance responsibility to Owner.

.10 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 will be deemed to be removed from Maintenance during Establishment Period.

3.9 CLEAN UP

.1 Remove surplus materials upon completion of the Work.

.2 Placement of Growing Medium:

.1 Fill the voids in each course of the rock revetment above +1.0m elevation with growing medium before placement of subsequent courses, as per the following sequence:

.1 Place course of C1 clear stone as shown on drawing, then spread 100mm thick layer of growing medium over surface and work soil into voids with machinery above +1.0m elevation until rock is exposed and surface is free of growing medium.

.2 Place first course of armour stone or riprap up to half the thickness indicated on the drawing, then spread 150mm thick layer of growing medium over surface and work into store until surface is free of growing medium above +1.0m elevation.

.3 Place second course of armour stone or riprap to the full total thickness and final grades indicated on the drawing, then spread 150mm thick layer of growing medium over surface and work into stone until surface is free of growing medium above +1.0m elevation .

END OF SECTION

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 Main: Section 33 11 00

.10 Sanitary Sewers: Section 33 31 00

.11 Precast Manholes, Catch Basins and Structures: Section 33 39 00

.12 Storm Sewers and Culverts: Section 33 40 00

1.3 REFERENCE STANDARDS

.1 Nova Scotia Department of Public Works – Highway Construction and Maintenance Standard Specification.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Gravels: to Section 31 20 00.

.2 Asphalt Concrete Materials: to Nova Scotia Department of Public Works – Highway Construction and Maintenance Standard 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: to Section 32 12 16

.2 Portland cement concrete: to Section 03 30 00.

.3 Curbs, walks, and gutters: to Section 32 16 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 Repair all damage or disturbances to surfaces, survey markers, properties and structures disturbed during construction.

3.2 GRAVEL SURFACES

.1 Place, spread, and fine grade 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 the following minimum thickness or as indicated in the Project Documents:

.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 Nova Scotia Department of Transportation and Active Transit – Highway Construction and Maintenance Standard Specification. Use curb machine having mould dimensions equal to those of the existing asphalt concrete curb. Hand placing not permitted unless approved by Consultant.

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 material as specified in Section 33 40 00 and as directed by the Consultant to original lines, elevations, and dimensions or those shown on the Project Drawings.

END OF SECTION

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 Earthwork: Section 31 20 00

1.3 REFERENCE STANDARDS

.1 ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.

.2 ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series); 2012, Including July 2013 Errata.

.3 ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts; 2014 (Reapproved 2020).

.4 ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

.5 ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

.6 ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

.7 ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

.8 ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

.9 ASTM B418 - Standard Specification for Cast and Wrought Galvanic Zinc Anodes; 2016a (Reaffirmed 2021).

.10 ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2022, with Editorial Revision.

.11 ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2022.

.12 ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing; 2016a.

.13 ASTM F2023 - Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water; 2021.

.14 ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings; 2020, with Editorial Revision (2022).

.15 AWWA B300 - Hypochlorites; 2010, Addendum 2011.

.16 AWWA B301 - Liquid Chlorine; 2010.

.17 AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; 2016.

.18 AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

.19 AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

.20 AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

.21 AWWA C153/A21.53 - Ductile-Iron Compact Fittings; 2011.

.22 AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe; 2017.

.23 AWWA C502 - Dry-Barrel Fire Hydrants; 2014.

.24 AWWA C504 - Rubber-Seated Butterfly Valves 3 In. (75 mm) Through 72 In. (1,800 mm); 2010.

.25 AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; 2015.

.26 AWWA C606 - Grooved and Shouldered Joints; 2015.

.27 AWWA C651 - Disinfecting Water Mains; 2014.

.28 AWWA C800 - Underground Service Line Valves and Fittings; 2014.

.29 AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2016.

.30 AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; 2017.

.31 AWWA C904 - Cross-Linked Polyethylene (PEX) Pressure Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service; 2016.

.32 AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Waterworks; 2015.

.33 AWWA C909 - Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. Through 24 In. (100 mm Through 600 mm) for Water, Wastewater, and Reclaimed Water Service; 2016.

.34 AWWA C655-18, Field Dechlorination

.35 CSA B137 Series-20, Thermoplastic Pressure Piping Compendium.

.36 CAN/ULC 701.1-17, Standard for Thermal Insulation, Polystyrene Boards.

.37 NSF/ANSI 14-2022, Plastic Piping System Components and Related Materials.

.38 NSF/ANSI/CAN 61-2023, Drinking Water System Components – Health Effects.

.39 NSECC Guidelines for Monitoring Public Drinking Water Supplies.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 for items specified herein.

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 78 00 for items specified herein.

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 the Consultant, water utility, and building occupants a minimum of 24 hours in advance of planned interruptions in service.

.3 Water service interruptions to take place between 10:00 a.m. and 4:00 p.m. local time, unless otherwise authorized by governing utility.

.4 Notify the Fire Authority having jurisdiction of any planned or accidental interruption to water service.

1.8 TEMPORARY WATER PLAN

.1 Submit a temporary water plan for review by the Consultant. Include in the plan as a minimum the following:

.1 Size of temporary water line and pipe material.
.2 Location of backflow preventors.
.3 Location of meters and vaccuum breakers as required.
.4 Plan to inform affected residents and businesses.
.5 Vechile crossing methods.
.6 Insulation and heat tracing methods.
.7 Disinfection plan.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Diameter, material and strength class of pipe and fittings: as indicated.

.2 Any material that comes in contact with drinking water must comply with NSF/ANSI/CAN 61.

2.2 POLYVINYL CHLORIDE PIPE AND PIPE AND FITTINGS

.1 Pipe and Joints: to CSA B137, AWWA C900 or AWWA C909, cast-iron equivalent outside diameter, gasketed bell-end joint.

.2 Fittings:

.1 PVC: to CSA B137.
.2 Ductile iron: to AWWA C110 or C153 cement mortar lined to AWWA C104, minimum pressure rating 1720 kPa for ductile iron.

2.3 TRACER WIRE

.1 RWU90, number 10 gauge (AWG), single stranded, insulated copper wire with 60mil of black cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial

application or approved equivalent.

.2 Make all spliced or repaired wire connections in the tracer wire system waterproof using an approved buried service wire closure.

.3 Test stations and grounding rods as and where indicated on the Project Drawings.

2.4 HYDRANTS

.1 Dry barrel type: to AWWA C502, NSF/ANSI/CAN 61 and as follows:

.1 Depth of bury: as indicated.
.2 Barrel: two-piece with safety breakaway flange and breakaway stem rod coupling.
.3 Main valve: compression type, 134 mm minimum diameter.
.4 Inlet connection: mechanical joint, 150 mm diameter.
.5 Nozzles: two (2) hose and one (1) pumper, with threads to standard of Fire Authority having jurisdiction.
.6 Direction of opening: counter-clockwise.
.7 Operating nut: 32 mm square.
.8 Colour: to standard of the Fire Authority having jurisdiction.

2.5 GATE VALVES

.1 Buried: to AWWA C515 up to 300 mm, minimum working pressure rating 1380 kPa and as follows:

.1 Body: ductile iron to AWWA C515 with mechanical joint ends.
.2 Mechanism (to ((AWWA C515))): 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 Chamber: to AWWA C515 up to 300 mm, minimum working pressure rating 1380 kPa and as follows:

.1 Body: ductile iron to AWWA C515 with Class 125 flanged ends to ASME B16.1.
.2 Mechanism (((AWWA C515))): wedge disc with resilient rubber seat ring and machined seating surface, OS&Y, rising stem and handwheel.
.3 Direction of opening: counter-clockwise.

2.6 BUTTERFLY VALVES

.1 Buried: to AWWA C504, short body, Class 150 B, minimum pressure rating 1035 kPa and as follows:

.1 Body: ductile-iron with mechanical joint or flanged ends.
.2 Mechanism: cast steel, or ductile iron disc, type 304 stainless steel shafts to ASTM A276, 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.
.5 Spacers for HDPE: as required.

.2 Chamber: to AWWA C504, short body, Class 150 B, minimum pressure rating 1035 kPa and as follows:

.1 Body: ductile-iron with flanged ends.
.2 Mechanism: cast steel, or ductile iron disc, type 304 stainless steel shafts to ASTM A276, 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.

2.7 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 "Water".
.3 Lugged to prevent turning and rolling of cover, and cover notched to suit.

2.8 SERVICE PIPE AND FITTINGS

.1 Copper tubing: to ASTM B88, type K annealed, minimum pressure rating 1035 kPa.

.2 Polyethylene pipe: to CSA B137, AWWA C901, NSF/ANSI/CAN 61, type PE, Series 160 or 200.

.3 Cross-linked polyethylene tubing: to CSA B137 and AWWA C904, NSF/ANSI 14, NSF/ANSI/CAN 61, ASTM F2023, ASTM F876 and ASTM F877, type PEX.

.4 Joints: compression type, minimum pressure rating 1035 kPa. For polyethylene pipe, to CSA B137, with stainless steel inserts.

.5 Corporation stop: brass to ASTM B62 and NSF/ANSI/CAN 61-G, compression type, inlet threads to AWWA C800.

.6 Curb stop and drain: brass to ASTM B62 and NSF/ANSI/CAN 61-G, compression type joints and O-ring seal.

.7 Service clamp: bronze body, confined O-ring seal cemented in place and straps suitable for connecting main. Outlet tapped and threaded to AWWA C800.

.8 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.

2.9 GASKETS AND BOLTS FOR FLANGES

.1 Gaskets: unless otherwise specified, supply full face one-piece red virgin rubber gaskets of 3 mm thickness 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 ASME 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 to 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 Consultant.

2.10 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: to AWWA C219, 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.

2.11 THRUST RESTRAINT

.1 Thrust blocks and anchors: 20 MPa concrete and 15M, Grade 400 reinforcing steel as indicated.

.2 Mechanical joint restraint device: (100 mm to 600 mm) ductile iron follower gland to AWWA C153 and AWWA 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.

.3 Mechanical joint restraint devices are generally to be used in combination with thrust blocks. Mechanical joint restraint devices alone are permitted on 11.25o, 22.5o and 45o horizontal bends for sizes up to 300 mm diameter and in accordance with the standard detail.

2.12 DISINFECTANT

.1 Sodium hypochlorite or calcium hypochlorite: to AWWA B300.

.2 Liquid Chlorine: to AWWA B301.

2.13 REDUCING AGENT

.1 Calcium Thiosulfate, to AWWA C655.

2.14 INSULATION

.1 Insulation: to ULC 701.1, Type 4, extruded polystyrene.

2.15 MARKER STAKE

.1 Timber, 40 mm x 90 mm.

2.16 MARKER TAPE

.1 Detectable metallic tape, 50 mm wide, coloured blue, and clearly marked as follows:

.1 "CAUTION - BURIED WATER LINE".

2.17 GEOTEXTILE

.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/m2.

2.18 ANODE PACKS

.1 Zinc anodes, to ASTM B418 as directed, complete with clamps.

2.19 POLYETHYLENE ENCASEMENT

.1 Encasement to be 200-micron clear polyethylene tube sheet to AWWA C105.

2.20 PROTECTIVE COATING

.1 Anti-corrosion petrolatum paste, tape, and mastic.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect products for defects and remove defective products from site.

.2 Confirm pipe, fittings, valves, and hydrants are clean before installation.

3.2 EXCAVATION, BEDDING, AND BACKFILLING

.1 Perform excavation, bedding, and backfilling to Section 31 20 00 - Earthwork.

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:

.1 Horizontal Alignment: 150 mm.
.2 Vertical Alignment: 75 mm.

.3 Face bell ends in direction of laying. On grades of 5% or greater lay pipe up grade. Above 16% grade, install gradient thrust restraint.

.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 Install gaskets in accordance with manufacturer’s published instructions. Use only lubricant supplied by manufacturer. During cold weather, store gaskets in heated area to promote flexibility.

.7 Align pipes before joining.

.8 Support pipes as required to promote concentricity until joint is completed.

.9 Keep pipe joints free from mud, soil, gravel or other foreign materials.

.10 Avoid displacing gasket or contaminating with soil, 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 spigot is fully inserted in bell.

.13 At structures provide flexible joint not more than 1 meter from outside face of structure. Support pipe between structure wall and first joint with 20 MPa concrete.

.14 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 bevelled edge.

.15 Provide concrete thrust blocks to undisturbed ground on all tees, bends, plugs and caps. Construct as indicated and keep joints and cou plings free of concrete.

.16 Install mechanical joint restraint to AWWA C110 and 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.

.17 Place marker tape upon bedding surround of plastic pipe.

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 tunnelling equipment in working pit to approved line and grade of the proposed pipe.

.5 Install casing pipe to proposed line and grade as indicated.

.6 Use mechanical or welded type joints for casing pipe.

.7 After casing pipe has been installed, check line and grade.

.8 Remove any soil that remains in the casing pipe.

.9 Insert carrier pipe into casing pipe, starting from the working pit.

.10 Place carrier pipe one (1) length at a time outside casing pipe. Maneuver pipe into position.

.11 Use approved blocking method to guide carrier pipe to specified alignment.

3.5 TRACER WIRE

.1 Install tracer wire on all non-ductile iron water mains, hydrant laterals, and water services except where such water service pipe is of copper material. Install the wire in such a manner so as to be able to properly trace all water mains, hydrant laterals and water services without loss or deterioration of signal or without the transmittal signal migrating off the tracer wire.

.2 At the point of connection between the cast-iron and ductile iron water mains with any non-iron water mains, connect the tracer wire to the first valve box or as directed by the Consultant.

.3 Lay tracer wire flat and securely affix to each pipe length at three (3) evenly spaced locations. Protect the wire from damage during the excavation of the works. No breaks or cuts in the tracer wire insulation will be permitted. At water service saddles, do not place the tracer wire between the saddle and the water main.

.4 Except for approved splices in connections, tracer wire must be continuous and without splices from valve box to valve box, valve box to fire hydrant or fire hydrant to fire hydrant.

.5 Make all spliced or repaired wire connections in the tracer wire system using an approved wire connector and make waterproof using an approved buried service wire closure.

.6 Install tracer wire test stations at maximum 300 meter intervals or at locations shown on Drawings.

.7 Test the tracer wire system for functionality after it has been confirmed and demonstrated that the entire tracer wire system is installed and is functioning properly.

3.6 HYDRANT INSTALLATION

.1 Install hydrants at locations indicated or where directed.

.2 Install 150 mm gate valve and 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 m3 in volume and backfill with clear stone to a level 150 mm above drain holes from hydrant to main.

.6 Place geotextile over clear stone from hydrant to main.

.7 Notify the Consultant if water table is above drain holes. Plug drain holes and install permanent identification marker on hydrant.

3.7 VALVE CHAMBERS

.1 Construct valve chambers where and as indicated in accordance with applicable Sections. Do not allow valve chambers to rest upon pipe.

3.8 VALVES AND VALVE BOXES

.1 Install valves at locations indicated.

.2 On direct buried valves, install valve boxes centered over operating nut, using centering disc, and true to line and grade.

.3 Use thrust anchors for valves 100 mm or greater on PVC and polyethylene pipe.

3.9 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 connec tion are on hand.

.3 Valves on existing system will be operated only by the water utility.

3.10 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 posi tions 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. Confirm 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 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.

3.11 HYDROSTATIC LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic leakage tests.

.2 Test after services and hydrants are installed.

.3 Backfill to subgrade at a minimum prior to testing operations unless otherwise approved by the Consultant..

.4 Notify the Consultant at least 24 hours in advance of all proposed tests. Perform tests in presence of the Consultant.

.5 Open all valves in test section.

.6 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.

.7 Fill concrete pipe 24 hours before testing to allow for absorption.

.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.

.9 For polyethylene pipe, maintain initial test pressure for four (4) hours. Reduce test pressure by 69 kPa and monitor pressure for one (1) hour. Do not increase pressure or add makeup water. If pressure remains steady within 5% of test pressure, a passing test is achieved. No leakage is permitted. Do not pressurize pipe for more than eight (8) hours. Depressurize pipe and allow a minimum relaxation period of eight (8) hours between tests.

.10 Conduct the test over a full two (2) hour period, maintaining the constant initial test pressure. No leakage is permitted by the test process.

.11 Locate and repair defects if test fails. Retest.

.12 Repair visible leaks regardless of test results.

3.12 FLUSHING, DISINFECTION AND BACTERIOLOGICAL TESTING

.1 Chlorinate water system to AWWA C651 only after system has been successfully pressure tested. Notify Consultant 24 hours in advance of proposed test. Do test in presence of Consultant.

.2 Use the continuous feed method of completely filling the main with potable water, removing air pockets, then flushing the completed main to remove particulates, and refilling the main with potable water that has been chlorinated to 25 mg/L. After a 24-hour holding period in the main, there must be a free chlorine residual of not less than 10 mg/L.

.3 Before the main is chlorinated, fill with potable water to eliminate air pockets and flush to remove particulates. The flushing velocity in the main must not be less than 0.91 meter/s. Flush water mains with potable water through available outlets until particulates have been removed. The size and number of taps should conform to Table 3 of AWWA C651 as provided here.

Pipe Diameter	Flow Required to Produce 0.91 meter/s (approx.) Velocity in Main		Size of Tap			Number 65 mm Hydrant Outlets
			25 mm	38 mm	50 mm	
mm	USgpm	L/s	Number of Taps on Pipe			
100	120	7.4	1	-	-	1
150	260	16.7	-	1	-	1
200	470	29.7	-	2	-	1
250	730	46.3	-	3	2	1
300	1060	66.7	-	-	2	2
400	1880	118.6	-	-	5	2

.4 Slowly open and close valves and hydrants to ensure thorough flushing.

.5 If satisfactory results cannot be achieved by flushing, swab pipe by approved methods and re-flush.

.6 Disinfect water mains upon completion of flushing using chlorine solution distributed throughout entire system.

.7 Inject 1% chlorine solution through a corporation stop 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

100% Chlorine	1.0 kg	100 L
Liquid bleach 5.25% Cl	1.0 L	3.5 L
Liquid bleach 10.5% Cl	1.0 L	8.0 L

.8 Do not use calcium hypochlorite and chlorinated lime when water temperature is less than 5□C.

.9 The following table indicates the quantity of 1% chlorine stock solution required to produce an initial 25 mg/L concentration in 100 meter of pipe by diameter.

Pipe Diameter (mm)	100% Chlorine (grams)	1% Chlorine Stock Solution (L)
100	19.6	2.0
150	44.2	4.4
200	78.5	7.9
250	122.7	12.3
300	176.7	17.7
350	240.5	24.1
400	314.2	31.4
450	397.6	39.8
500	490.9	49.1
600	706.9	70.7
750	1104.5	10.4

.10 Operate valves, hydrants, and appurtenances while the main contains chlorine solution.

.11 Take water samples at all hydrants and termination points, in suitable sequence, to test chlorine residual. When tests indicate minimum chlorine residual of 25 mg/L, leave system charged with

disinfectant solution for 24 hours. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L. If the residual has fallen below 10 mg/L, rechlorinate the system.

.12 Disposing of chlorinated water:

.1 In areas directly connected to a wastewater treatment facility, discharge chlorinated waste into the wastewater treatment facility. Provide prior notice and receive permission from the wastewater treatment facility operator to discharge.

.2 In all other wastewater sewersheds:

.1 Dechlorinate the chlorinated water using calcium thiosulphate (CaS2O3) as outlined in AWWA C655. Once the chlorinated water is neutralized, it can be discharged to a wastewater or stormwater system or the environment.

.2 When disposing to the environment, the disposal of the dechlorinated solution must be at least 100 meter from the nearest watercourse.

.13 Obtain bacteriological samples from a test sampling tap or a water service connection if available. Take samples from every 370 meter of new water main, plus one (1) set from the end of the line and from every branch (see AWWA C651, Section 5.1). If service connections are not available, a hydrant lead may be tapped to provide the required sampling location.

.14 Collect samples in accordance with Appendix A of Nova Scotia Department of Environment and Climate Change’s: "Guidelines for Monitoring Public Drinking Water Supplies". Have analysis done by an independent lab in accordance with these guidelines.

.15 Should any of the test results be positive, repeat disinfection, flushing, sampling and analysis.

.16 After testing and submission of the written results for the passing of the bacteriological tests, remove the corporation stops and install plugs. Check visually for leakage after plugs are installed with water main under normal operating pressure.

END OF SECTION

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

1.3 REFERENCE STANDARDS

.1 CSA B137.3:20, Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications

.2 National Association of Sewer Service Companies (NASSCO) Pipe Condition Assessment Using CCTV Performance Inspection Guideline.

.3 AWWA C909-22, Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. (100 mm) and Larger

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 78 00 for items specified herein.

1.5 HANDLING AND STORAGE

.1 Handle and store pipe and fittings in such manner as to avoid 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 POLYVINYL CHLORIDE PIPE AND FITTINGS

.1 To be used for gravity sewers and forcemains

.2 Pipe: pressure class 235 to CSA B137.3, cast iron equivalent outside diameter, gasketed bell-end joint.

.3 Fittings: to CSA B137

.4 Pipe color to be white, include a print line on the pipe indicating it is sewer and non potable.

.1 Acceptable product; Bionax by IPEX or approved equivalent.

2.3 SERVICE SADDLES

.1 PVC main: PVC strap-on saddle, in-line tee or wye, with gasket, all stainless steel strap and O-ring in branch end.

2.4 MARKER STAKES

.1 Timber, 38 mm x 89 mm, nominal.

2.5 GROUT

.1 Non-shrink: to Section 03 30 00.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect products for defects and remove defective products from site.

.2 Confirm pipe and fittings are clean before installation.

3.2 EXCAVATION, BEDDING, AND BACKFILLING

.1 Perform excavation, bedding, and backfilling in accordance with 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:

.1 Horizontal Alignment: 50 mm.
.2 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 water tight bulkheads when pipe laying is not in progress.

.5 Install gaskets in accordance with the manufacturer’s published instructions. During cold weather, store gaskets in a heated area to promote flexibility.

.6 Install plastic pipe in accordance with CSA B1800.

.7 Align pipe before joining.

.8 Support pipes as required to maintain 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 Where a flexible joint is not integral to the structure, 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 centreline, and as recommended by manufacturer.

.15 Make watertight connections to manholes. Do not use non-shrink grout unless approved by the Consultant.

3.4 UNDERCROSSING

.1 Provide shop drawings showing proposed method of installation for pipe in undercrossing including blocking method to guide pipe.

.2 Excavate working pit according to reviewed shop drawings.

.3 Dewater area of excavation and undercrossing.

.4 Place jacking, boring or tunnelling 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 (1) length at a time outside encasement pipe. Maneuver pipe into position.

.11 Use an Consultant approved, pre-manufactured, non-degradable spacerto guide carrier pipe to specified alignment.

.12 Use pre-manufactured end seal to cap annular space at the end of pipe casing.

3.5 SERVICE CONNECTIONS

.1 Lay and join pipe and fittings to manufacturer’s published instructions.

.2 Maintain minimum 2% grade or as required by authority having jurisdiction.

.3 Maintain a maximum slope of 8% grade. Where greater slopes are required, obtain Consultant’s approval.

.4 Use tee or wye fittings or saddles for connections to sewer. For saddle connections cut hole using appropriate equipment. Obtain Consultant's approval.

.5 Make up required horizontal and vertical bends from standard bends of 45 degrees or less, separated by straight section of pipe, having a minimum length of four (4) pipe diameters. Use long sweep bends where possible.

.6 Plug service laterals with watertight caps or plugs at termination points. Paint stub ends and caps RED.

.7 Place temporary marker stakes at end of each plugged or capped sewer service lateral, extend ing from pipe end at pipe level to 600 mm above grade. Paint exposed portion of stake RED with designation SAN in black.

3.6 LEAK TESTING GRAVITY SEWERS

.1 Backfill to subgrade at a minimum before commencing testing operations unless otherwise approved by the Consultant.

.2 Coordinate testing with the Consultant at a minimum of 48 hours in advance of all proposed tests. Perform tests in presence of Consultant.

.3 Provide labour, equipment and materials required to perform testing.

.4 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.

.5 Locate and repair defects if test fails. Have repair method reviewed by Consultant prior to retesting. Retest.

.6 Repair visible leaks regardless of test results and re test.

.7 Low Pressure Air Testing:

.1 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.

.2 Provide air testing equipment meeting the following requirements:

.1 Air Blower: 14 litres/sec, maximum pressure 70 kPa con tinuous.

.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.

.3 Provide plugs at each end of section, with one plug equipped for air inlet connection.

.4 Fill test section slowly until a constant pressure of 28 kPa is reached. If groundwater is above section being tested, Consultant may recommend increase in air pressure.

.5 Allow minimum 2 minutes for air temperature to stabilize, adding only amount of air required to maintain pressure.

.6 After 2-minute period, shut off air supply.

.7 Decrease pressure to 24 kPa. A pass is when the pressure is maintained at 24 KPa over the time interval in the table below.

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

3.7 DEFLECTION TESTING - GRAVITY SEWERS

.1 Provide deflection gauge to measure a 7 1/2% deflection. Gauges to be a "Go-No-Go" device similar to Standard Detail 33 31 00-02.

.2 Measure deflection of plastic pipe by pulling a deflection gauge through each pipe from manhole to manhole. Notify the Consultant 24 hours prior to deflection testing.

.3 Within thirty days after installation, pull a deflection gauge measuring 7 1/2% deflection through the installed section of pipe. If 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 pipe. If test fails, locate defect and repair. Retest using same methodology.

.5 Record deflection test with Closed Circuit Television (CCTV) inspection specified in subsection 3.8 herein.

3.8 CLOSED CIRCUIT TELEVISION INSPECTION - GRAVITY SEWERS

.1 Flush sewers and related appurtenances to remove foreign materials.

.2 Conduct closed circuit television (CCTV) inspection in accordance with National Association of Sewer Services Companies (NASSCO) Pipe Condition Assessment Using CCTV Performance Specification Guideline.

.3 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 to clearly identify location of camera along the length of the pipe.

.4 Inspection:

.1 Perform inspection of pipe from manhole to manhole by passing CCTV camera through sewer in direction of flow.

.2 Classify results in accordance with (NASSCO) Performance Specification Guideline.

.5 Records:

.1 Maintain inspection record in log form, during CCTV 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 Provide fault image from inspection record. All images to be clear and precise with distinct definition of fault.
.4 Include detailed technical description with images as supporting data for each fault.
.5 Provide minimum of two (2) images for each sewer main section, detailing typical joint, and typical building service lateral.
.6 All images and videos to be in colour.
.7 Identify deflection gauge size in report.

.6 Reports:

.1 Provide a composite report of CCTV inspection in PDF format. Include the following 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 Images of all faults.
.3 Location of all service laterals.
.4 One image each of typical joint and typical service lateral when faults are not found.
.4 Place images on left-hand page and place corresponding description on right-hand page. Number all images in order. Number beside image to correspond with description number.

.7 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 meter of length.

.2 450 mm – 600 mm pipe: ± 150 mm per 100 meter of length.

.3 750 mm – 900 mm pipe: ± 225 mm per 100 meter of length.

.8 Video Record:

.1 Supply a complete record of all inspections in Owner-approved digital format.

.2 Index all files, listing sections of inspections.

.9 Repeat Inspection:

.1 Prior to repairs, have methods reviewed by Consultant. Repair faults detected during CCTV inspection. Repeat CCTV inspection at no additional cost.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for constructing submersible pumping stations. Work generally includes supply and installation of wet well, valve chamber, pumping equipment, pump controller, valves, metal fabrications, related pipe and wet well work, field testing, and commissioning.

1.2 RELATED SECTIONS

.1 Earthwork: Section 31 20 00

1.3 REFERENCE STANDARDS

.1 ASME B16.1–2020, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

.2 ASTM A36/A36M–19, Standard Specification for Carbon Structural Steel.

.3 ASTM A126-04(R2023) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.4 ASTM A181/A181M-23, Standard Specification for Carbon Steel Forgings, for General - Purpose Piping.

.5 AWWA C508-17, Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS.

.6 AWWA C515-20, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.

.7 CSA C22.1-24, Canadian Electrical Code.

.8 CSA C22.2 No. 108-14(r2024), Liquid Pumps.

.9 IEC 60034-22, Rotating Electrical Machines Part 9: Noise Limits

.10 NEMA MG-1-2021, Motors and Generators.

1.4 CSA APPROVAL

.1 All equipment specified herein must be CSA approved for use within the designated environment.

1.5 EQUIPMENT IDENTIFICATION

.1 Fit equipment with the manufacturer’s factory supplied identification nameplates indicating size, equipment model, manufacturer’s name, serial number, voltage, and cycle.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate details of piping, valves, supports, pumps, metal fabrications, access hatches, electrical connections, and appurtenances.

.3 Confirm sufficient equipment cable lengths to reach termination point.

1.7 OPERATING AND MAINTENANCE DATA

.1 Provide operating and maintenance data in accordance with Section 01 78 00 and as follows:

.1 System description.
.2 Design parameters, system hydraulics, design calculations, and system curves.
.3 Performance curves for the pumps, layout, wiring diagrams, control system schematic, and 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.

1.8 FACTORY TESTING

.1 Manufacturer's facility. Perform tests at the specified head and capacity and duplicate actual performance anticipated for the complete station.

1.9 HANDLING AND STORAGE

.1 Handle and store pumps, pipe, valves, and fittings in a dry area and in such a manner as to avoid damage. Do not use chains or cables passed through pipe or equipment. Do not damage coatings or linings.

.2 Rotate pump impeller if pump is stored for two (2) months prior to use to avoid mechanical seal failure.

1.10 MAINTENANCE MATERIAL

.1 Provide manufacturer’s recommended spare parts list.

.2 Parts to be readily accessible during the warranty period for use on site within the shortest period of time possible.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Pump characteristics, flow, total dynamic head (TDH), material selection, pump model, serial number, pump curve number, pump motor horsepower, rated speed, impeller materials, outlet width, and pump manufacturer: as indicated.

.2 Electrical equipment and equipment assemblies comprised of electro-mechanical components to be CSA approved or approved by another electrical certification agency that is acceptable to the electrical inspection authority having jurisdiction.

.3 All products provided for installation must be from a manufacturer's standard product line currently in production. Consideration must given to future availability and is subject to approval of the Consultant.

2.2 PREFABRICATED WET WELL

.1 Equip each station with two (2) submersible, close-coupled wastewater pumps.

.2 The sewage pump station shall be made of Fiberglass reinforced polymer (FRP) equipped with discharge connections, discharge pipes, valves, guide bars and cable holder to assemble 2 submersible wastewater pumps. The material of the complete station must be applicable for wastewater with a PH value from 5.5 to 8.0.

.3 Dimensions including inlet and outlet positions: in accordance with the project drawings.

.4 The station cylinder shall be affixed to the station bottom such that the assembled components are structurally integrated, resulting in a watertight vessel which is capable of withstanding the full hydrostatic head from the exterior of the station while the station is completely empty.

.5 The station must be protected against electrical shock according to the IEC regulation 611 40.

2.3 VALVE VAULT

.1 Each discharge pipe from the sewage wet well to be connected to a check valve and a plug valve in a separate valve vault. Valve vault to be fabricated in FRP and sized as per the drawing set. Equip valve vault with an integral drain and check valve to facilitate drainage from the valve vault back into the wet well.

.2 Valve vault to have a flat base with an anti-flotation exterior flange. Exterior flange to be minimum 75mm wide suitable for position anchoring.

2.4 PUMPS

.1 Submersible, non-clog or grinder wastewater pumps.

.1 Equip each pump with submersible, electric motor and power supply and monitoring cable(s). Pumps to be non-clog submersible suitable for operation in unscreened combined sanitary and storm sewer systems.

.2 Pump unit to be capable of delivering flow and TDH, as indicated per Level A of Hydraulic Institute Standard for Centrifugal Pumps unless impellers are trimmed.

- .1 PS#4:
  - .1 Flow: 6.45 L/sec
  - .2 Total Dynamic Head: 3.60m
- .2 PS#5:
  - .1 Flow: 5.25L/sec
  - .2 Total Dynamic Head: 4.2m

.3 Supply each unit complete with a mating cast iron discharge connection and 316 stainless steel lifting chain, approved for overhead lifting and of adequate strength to permit raising and lowering of the pump. Lifting system must be compatible with existing municipal lifting equipment. Working load of the lifting system to be 50% greater than the pump unit weight.

.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 from above wet well without the need to enter the confined space for inspection and service. It shall be possible to lift and lower the pumps on parallel guides and connect them to wet well mounted discharge connection. There shall be no need for personnel to enter the wet well when removing or reinstalling the pumps.

.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, with a 2-part epoxy or fusion bonded epoxy coating system approved for continuous submergence in sewage-.

.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, single piece, 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 to be wear resistant ductile iron, grey cast iron, Class 30 or better, or high chromium cast iron, dynamically balanced, non-clog or recessed design having a long throughlet without acute turns. Impeller material to be hardened to a minimum hardness of 60 HRC. For applications with expected sand and grit furnished with impeller suitable for high abrasion resistance.

.1 Impeller: capable of handling solids, fibrous material, heavy sludge, and other matter found in sewage applications.
.2 Impeller blades to be self-cleaning upon each rotation and keep the impeller blades clear of debris. The clearance between the insert ring and the impeller leading edges shall be adjustable.
.3 Pump out vanes in the back of impeller shroud to be large enough to sufficiently expel solids away from seal area.

.13 Wear ring or plate system to provide a seal between volute and impeller, consisting of a stationary hard metal wear system, which is fitted to volute inlet. Wear rings to be of softer material than impellers.

.14 Grinder pumps to have hardened stainless shredding ring and grinder to reduce sewage to a small size for discharge through the piping.

.15 Pumps to be rated for operation in Zone 1 or 2 areas as shown on the Project Drawings.

2.5 CABLE AND CABLE ENTRY

.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 continuous and suitable for submerged use and CSA approved. Shielded cable to be used on VFD applications and to be suitable for submersible pump applications. Size the power cable according to CSA C22.1. Outer jacket of the cable to be oil resistant chlorinated polyethylene rubber.

.2 Confirm cable entry design has an impermeable seal.

.3 Combine power, temporary sensing, and moisture sensor conductors into a single cord. Entry into the pump is accomplished in two (2) ways:

.1 On the smaller motors (up to 30 HP), furnish a plug-in power cable to allow easy changes of both voltage and cable length without motor entry.
.2 On the larger motors (30 HP and above) with much larger cable sizes, the cable enters through a double grommet and internal strain relief to a terminal strip for conductor attachment.

.4 Cable and cable entry design must be capable of continuous submergence underwater without loss of watertight integrity to a depth of 20 meter or locate junction boxes above probable flood level.

2.6 GUIDE BARS AND CABLES

.1 Provide corrosion resistant vertical guide bar(s) or cables with each pump to confirm correct alignment of pump with automatic discharge connection.

.2 For each pump, secure guide bar(s) or cables.

.3 Provide bracket with special inserts to position the guide bars rigidly, where applicable.

.4 For rail lengths greater than 3.66m use both upper and intermediate guide bar brackets, or as per the manufacturer’s recommendation.

2.7 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 maintain zero leakage between the pump and its discharge connection.

.5 No part of the pump to bear directly on the floor of the wet well.

.6 Discharge connection bolting material to be 316 stainless steel or galvanized/plated steel.

2.8 PIPING, FITTINGS, AND VALVES

.1 Pipe: all interior station and valve piping to be ANSI 316L SS Schedule 10.

.2 Welded fittings: to ASTM A181.

.3 Flanges to ASME B16.1, Class 125.

.4 Valve coating to be 2-part epoxy or fusion bonded epoxy suitable for environment. Primer coating not accepted.

.1 Check Valves:

.1 Ball check valves: flanged ends, non-clog, unobstructed free flow type.

.1 Acceptable product: Flygt HDL Type 5087 or approved equivalent.

.2 Duckbill check valve: end of pipe check valve to be Tideflex TF1, or approved equivalent.

.2 Plug Valve:

.1 Non-lubricated eccentric plug type, cast iron body to ASTM A126, Class B, with an exterior epoxy finish and BUNA-N interior coating; full round port, wrench operated, with 125lb flanges.

.1 Acceptable products: Keystone, Ballcentric, or approved equivalent.

2.9 ELECTRIC MOTOR

.1 Pump motor: squirrel-cage induction, inverter duty NEMA B & MG1 rated type design, housed in a watertight or dielectric oil-filled chamber of maximum efficiency and durability. Design motor for continuous duty capable of sustaining a minimum of fifteen (15) starts per hour. Motor should be permanently submersible according to standard IEC 60034 and protection class IP68. Motor speed and electrical characteristics as indicated.

.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 be Class F or higher.

.3 Rotor bars and short-circuit rings to be made of aluminium. 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 thermal sensors in conjunction with, and supplemental to, external motor overload protection, and wire them 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 air-filled 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. Equip oil-filled motor housing with thermal switches only.

.6 Integrate moisture sensor detection system consisting of two (2) probes within the oil-filled seal chamber which is isolated from the motor chamber. This sensor will provide early warning of lower seal failure.

.7 Accomplish control of the moisture detector and the winding thermal switches by using a control/indicator relay(s). Install and wire moisture detector and thermal switch for each individual pump inside the control panel to stop each pump unit upon a fault signal.

.8 Motors to be liquid cooled to manufacturer’s standard.

.9 Motor to be able to operate dry without damage while pumping under load.

.10 Motors intended for use with variable frequency drives to be inverter duty rated.

2.10 SHAFT AND SEALS

.1 Pump shaft: AISI 400 series stainless steel. Provide each pump with a tandem mechanical shaft seal system.

.2 Tandem mechanical shaft seal to be of single spring design operating in an intermediate oil-filled seal cavity.

.3 Seal system must not rely upon the pumped media for lubrication. Seal lubricant to be non-hazardous.

.4 The upper of the tandem set of seals operates in cooling medium. This set contains one (1) stationary ring and one positively driven rotating ring.

.5 Seals: tungsten carbide, silicone carbide, or carbon ceramic.

2.11 ACCESS FRAME AND COVER

.1 Fabricate aluminium access frame using an extrusion of 6351 aluminium. Fabricate cover using a plate of 5086 aluminium 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. Cover to rest on a rubber gasket and to be continuously hinged along one side with a heavy-duty aluminium hinge. Confirm loading requirements of pedestrian only or vehicular traffic.

.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 submersible pump which can be installed through its opening.

.5 Frames to be capable of being installed side-by-side by bolting them together using standardized bolting kits.

.6 Provide aluminium 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.

.7 Clearly display a confined space warning label on the underside of the cover.

.8 Provide a safety grate for fall through protection. When installed in pairs, install safety grates so that they open outward unless shown otherwise on the Project Drawings. Safety grate to be capable of supporting the full weight of any submersible pump which can be installed through its opening. Safety grate to be epoxy coated safety orange.

.9 Hatch to be compatible with limit switches to inform intrusion alarm as applicable.

.10 Hatch clear opening size must be sufficient to pass pump and integral appurtenances.

2.12 LEVEL CONTROL REGULATOR

.1 To Section 26 90 00.

2.13 FLOW METER

.1 To Section 26 90 00.

2.14 PUMP CONTROL PANEL

.1 To Section 26 91 00.

2.15 ELECTRICAL WIRING

.1 As specified in Division 26.

2.16 LABELS

.1 Permanently affix suitable nameplates onto the pumps, motors, control enclosure components, and other operating components to indicate the purpose of the component or operating routine and parameters applying to the component. Confirm the lift station pumps and control equipment are CSA approved or approved by another electrical certification agency that is acceptable to the electrical inspection authority having jurisdiction and the certification logo appears on the nameplates of these components.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSPECTION, TESTING AND SHIPMENT

.1 Inspection and Testing:

.1 Test proper pump 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 CSA C22.2. No. 108. Proof of this approval to be submitted by the pump manufacturer together with the approval drawings. An approval of the motor unit only will 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 equipment to the Owner or Consultant 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 Have equipment in the pumping station that may have been provided by another supplier tested by the original supplier.

.5 Provide successful test results prior to shipment.

.2 Shipment: ship equipment assembled to the greatest extent possible to reduce installation and start-up costs.

3.2 INSTALLATION

.1 Verify layouts, dimensions, elevations, and other pertinent data prior to proceeding with the work.

.2 Back-prime metal surfaces being mounted directly against concrete surfaces with bitumastic paint with the exception of surfaces that will be grouted in.

.3 Examine 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 materials and remove dirt and other debris.

.4 Install 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 Complete electrical installations to meet or exceed all applicable codes.

3.3 PIPING

.1 Lubricate pipe and gaskets with lubricant before installing gaskets on pipe and completing joint.

.2 Install piping straight, parallel to walls and in such a manner as to prevent straining during jointing procedures. Install galvanized pipe supports where shown or required.

.3 Prior to assembling flanged joints, thoroughly clean flanges. Use a gasket lubricant to ease gasket installation. Tighten diametrically opposed bolts simultaneously.

.4 Do not correct misalignment using fasteners or other means to pull flanges into alignment. Correct so that no eccentric loads are placed on flanges.

3.4 VALVES

.1 Install valves in the correct orientation with respect to flow direction and in accordance with manufacturer's recommendations. Install isolation valves with the seat side down.

.2 Install valves in a separate waterproof chamber with access for maintenance.

.3 Isolation valves to be plug type on unscreened wastewater service. Valves 200 mm and above to include gear operator unless otherwise specified. Isolation valves located inside wet well require operators to be accessible without entering the station.

.4 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.

.5 Install check valves to be installed on the discharge lines between the isolation valve and the pump. Check valves to be readily accessible for maintenance. Do not locate check valves in the wet well.

3.5 PUMPS AND APPURTENANCES

.1 Locate, align, level, adjust, and install pump discharge base elbows. Locate pumps and discharge base elbows so that the pumps can be easily removed through the openings in the lift station without requiring the removal of any station equipment.

.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 Protect the finish on the pumps, pipe, fittings, valves and appurtenances from scratches and other damage. Repair any damage to the surface finishes.

3.6 ACCESSORIES

.1 Mount level regulator in the position indicated or as directed by the Consultant. The level regulator hanger(s) will otherwise be mounted in a location where it 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. Level regulators to include sway control rings for hanging lengths greater than 3 metres or as shown on the Project Drawings.

.2 Back prime and mount each 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 hooks in accordance with pump and anchor manufacturer's instructions.

.3 Install back-primed galvanized pipe supports complete 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.

3.7 START-UP, TESTING AND COMMISSIONING

.1 Arrange for start-up, testing and commissioning by the equipment manufacturers' representatives in presence of the Consultant and the Owner after the installation has been completed and is ready for start-up and commissioning.

.2 Test interior pipework: gradually increase water pressure inside pipework until it reaches a minimum of 690 kPa and maintain test pressure for one hour. No leakage will be allowed.

.3 Prior to starting the pumps, remove the plug or cap from the pressure sewer in the manhole.

.4 After pumps and piping have been installed, test pumps with wastewater, 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.

.5 Demonstrate 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.

.6 Demonstrate the operation of all valves and make any adjustments necessary to permit the valves to operate smoothly without obstruction.

.7 Demonstrate integrity of pump discharge connection seal to pump by pumping down wet well sufficiently to detect leakage.

.8 Observe wet well and valve chamber piping during pump operation for leaks and/or loose connections. Repair any leaks identified and retest until a successful test is achieved.

.9 Test station piping in accordance with Section 33 34 00, Clause 3.8.

.10 Test pump flow in accordance with specified pump curves stated for pump characteristics. Test pump flow by draw down test, flow meter, or SCADA as directed by the Consultant.

.11 Level instrument set-points must be determined and set to the proper elevations during commissioning. Verify level transducer reading and set to determine height of fluid from the wet well floor. Verify reading against a physical measurement with at least three readings to confirm accuracy.

END OF SECTION

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 and fittings. .

1.2 RELATED SECTIONS

.1 Earthwork: Section 31 20 00

1.3 REFERENCE STANDARDS

.1 AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2016.

.2 AWWA C909 - Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. Through 24 In. (100 mm Through 600 mm) for Water, Wastewater, and Reclaimed Water Service; 2016.

.3 CSA B137.3.1:23, Molecularly Oriented Polyvinyl Chloride (PVCO) Pipe for Pressure Applications.

.4 ULC/CAN S701.1-22, Standard for Thermal Insulation, Polystyrene Boards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 for items specified herein.

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 33 00 for items specified herein.

.2 For fusion jointing of 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, and fittings in accordance with manufacturer’s written instructions and in such a manner as to prevent damage. Do not use chains or cables passed through pipe bore. Do not damage coatings or linings. Inspect the shell of PVC and HDPE pipe lengths for damage prior to installation. Replace all damaged materials.

.2 Store gaskets and other materials in accordance with the manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Diameter, material, and strength/pressure class of pipe and fittings: as indicated in the Project Documents.

2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS

.1 Pipe and Joints: to CSA B137, or AWWA 909; cast-iron outside diameter and gasketed bell-end joint.

.2 Fittings:

.1 PVCO: to CAN/CSA B137, matching or exceeding pipe pressure rating.
.2 Cement mortar lining: to AWWA C104. Provide internal seal coat when required by Project Documents.
.3 Joints to be PVC to AWWA C900 and CSA B137.3 and match pressure rating of pipe. Joints to be fully mechanically restrained and wrapped with a corrosion protect.

2.3 THRUST RESTRAINT

.1 Thrust blocks and anchors: 20MPa Portland cement concrete and 15M Grade 400 reinforcing steel where indicated.

.2 Mechanical joint restraint device: (100 mm to 600 mm) ductile iron follower gland to AWWA C153 and AWWA C111 for mechanical or push-on joints with multiple wedge or gripper ring restraining mechanism, minimum working pressure rating 2410 kPa and minimum safety factor of 2:1. Installation is not to require special tools.

.3 Mechanical joint restraint devices are generally to be used in combination with concrete thrust blocks. Mechanical joint restraint devices alone are permitted on 11.25°, 22.5° and 45° horizontal bends for sizes up to 300 mm diameter. No pipe joints are permitted within the minimum pipe length, refer to Standard Detail 33 11 00-06.

2.4 INSULATION

.1 Insulation: to CAN/ULC S701, Type 4, extruded polystyrene.

2.5 TRACER WIRE

.1 RWU90, number 10-gauge (AWG), single stranded, insulated copper wire with 60mil of black cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial application or approved equivalent.

.2 Waterproof all spliced or repaired wire connections in the tracer wire system using an approved buried service wire closure.

.3 Provide test stations and grounding rods as indicated in Project Documents.

2.6 MARKER TAPE

.1 Detectable metallic tape, 50 mm wide, clearly marked as follows:

.1 "CAUTION - BURIED SEWER LINE", coloured green.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect material for defects and remove defective materials from site.

.2 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, and within following tolerances:

.1 Horizontal Alignment: 150 mm
.2 Vertical Alignment: 75 mm

.3 Face bell ends in direction of laying. On grades of 5% or greater lay pipe up grade. For grades exceeding 16%, install an appropriately designed gradient thrust restraint.

.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 written instructions.

.7 Install gaskets in accordance with manufacturers published instructions. Use only lubricant supplied by manufacturer. During cold weather, store gaskets in heated area to maintain flexibility.

.8 Align pipes before joining.

.9 Where employing butt fusion perform(?)in accordance with ASTM F2620.

.10 Support pipes as required to maintain concentricity until joint is properly completed.

.11 Keep pipe joints free from soil or other foreign materials.

.12 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign materi al. Remove, clean, re-install, and lubricate gaskets so disturbed.

.13 Complete each joint before laying next length of pipe.

.14 Where deflection at joints is permitted, deflect only after joint is completed.

.15 Where entering, exiting, or otherwise passing through a structure, provide flexible joint not more than one (1) metre from outside face of structure(s).

.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, plugs, caps, and bends greater than 45 degrees unless the project documents are more stringent. 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 alternat ing between bolts until lug nuts twist off.

.19 Place marker tape upon bedding surround of pipe.

3.4 UNDERCROSSING AND OVERCROSSING

.1 Provide shop drawings showing proposed method of installation for pipe at undercrossings and overcrossings. Encasing pipe must meet the same pressure requirement of the pipe being encased.

.2 Excavate working pit to dimensions as indicated.

.3 Dewater areas of excavation and crossing.

.4 Where required, place jacking, boring, or tunnelling 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 Encasing pipe not to be in tension.

.7 Use mechanical or welded type joints for encasing pipe.

.8 After encasing pipe has been installed, check line and grade for approval.

.9 Remove any soil that remains in the encasing pipe.

.10 Insert pipe into encasing pipe starting from the working pit.

.11 Place pipe one (1) length at a time outside encasing pipe. Manoeuvre pipe into position.

.12 Use an Consultant approved pre-manufactured, non-degradable spacer as recommended by the pipe manufacturer to guide pipe in true alignment.

.13 Use pre-manufactured end seal to cap annular space at the end of pipe casing.

3.5 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 perpendicular to surface, centered over operating nut, using centering disc, and true to line and grade.

.3 Use thrust anchors for valves greater than 100 mm or greater on PVC and polyethylene pipe.

3.6 TRACER WIRE

.1 Install tracer wire on all non-ductile iron pressure sewers. Install the wire in such a manner as to be able to properly trace all pressure sewers without loss or deterioration of signal or without the transmittal signal migrating off the tracer wire.

.2 At the point of connection between cast and ductile iron pressure sewer piping with any non-iron pressure sewer, connect the tracer wire to the first valve box or as directed by the Consultant.

.3 Lay tracer wire flat and securely affix to each pipe at three (3) evenly spaced locations. Protect the wire from damage during the excavation of the works. No breaks or cuts in the tracer wire insulation will be permitted. At service saddles, do not place the tracer wire between the saddle and the main.

.4 Except for approved splices in connections, tracer wire must be continuous and without splices.

.5 Test the tracer wire system for functionality to confirm the entire tracer wire system is functioning properly.

.6 Install trace wire test stations at 300 metre intervals along pressure sewer or at locations as shown on Drawings.

3.7 MARKER TAPE

.1 Place marker tape in trench upon bedding surround directly above pipe.

3.8 HYDROSTATIC LEAKAGE TESTING

.1 Coordinate testing with the Consultant a minimum of 24 hours in advance of all proposed tests. Perform tests in presence of the Consultant.

.2 If water used for testing is obtained from a potable water supply, continuously separate the supply 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.

.3 Provide labour, equipment, and materials required to perform hydrostatic and leakage tests.

.4 Backfill to subgrade at a minimum prior to testing operations unless otherwise approved by the Consultant.

.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 Apply test pressure of 1035 kPa or pressure equal to 1.5 times working pressure, whichever is greater, as measured at lowest point in test section. Conduct the test over a full two (2) hour period, maintaining a constant test pressure. No leakage is permitted by the test process.

.8 Additionally for polyethylene pipe test in accordance with ASTM F2164.

.9 Locate and repair defects if test fails. Retest as specified herein until a successful test is achieved.

3.9 FLUSHING

.1 Notify the Consultant 24 hours in advance of flushing.

.2 If water used for flushing 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.

.3 Flush mains with water through available outlets with sufficient flow to produce minimum velocity in main of 0.9 meter/s for 10 minutes. Flush until foreign materials have been removed and water is clear.

.4 Slowly open and close valves to confirm thorough flushing.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for constructing precast concrete manholes, catch basins, 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 Submersible Pumping Station: Section 33 32 14

.7 Storm Sewers and Culverts: Section 33 40 00

1.3 REFERENCE STANDARDS

.1 ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

.2 ASTM C478/C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2020.

.3 CAN/CSA A257 Series-24, Standards for Concrete Pipe and Manhole Sections.

.4 CSA A23.4-16(R2021), Precast Concrete – Materials and Construction.

.5 ULC/CAN S701.1-22, Standard for Thermal Insulation, Polystyrene Boards

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 for items specified herein.

1.5 HANDLING AND STORAGE

.1 Prevent damage to materials during storage and handling in accordance with the manufacturer’s written instructions.

.2 Store gaskets in cool location out of direct sunlight, and away from petroleum products.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Diameter or dimensions and type: as indicated.

.2 Precast concrete: to CSA A23.4.

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/A48M, gray cast iron, factory coated.

2.5 WATERPROOFING

.1 Waterproofing membrane: self-adhering, cold-applied, composite sheet membrane minimum thickness 1.016 mm (40 mils). Rubberized asphalt bonded to sheet polyethylene complete with the following accessories:

- .1 Substrate cleaner: non-corrosive type recommended by sealant manufacturer.
- .2 Primer: rubber based, dispersed in solvent, recommended by manufacturer.
- .3 Tape: minimum 0.762 mm thick, self-adhering type, compatible with sheet material.
- .4 Wall flashing membranes: minimum 0.762 mm thick, self-adhering type, compatible with sheet material.
- .5 Mastic: single component rubber based mastic.
- .6 Acceptable material: Blueskin WP200 by Bakor or approved equivalent.

2.6 INSULATION

.1 Rigid Insulation: to ULC/CAN S701.1, Type 4, extruded polystyrene.

2.7 CAST-IN-PLACE CONCRETE

.1 Concrete: to Section 03 30 00, slump 80 mm ±20 mm, minimum compressive strength of 35 MPa at 28 days maximum water cement ratio of 0.45; air entrainment 5 - 8% total air content.

.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.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect products for defects and remove defective products from site.

3.2 EXCAVATION AND BACKFILL

.1 Excavate and backfill 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 in the Project Documents. Top of base to be level.

.4 Place stubs at elevations and in positions indicated. Provide flexible pipe joints within one (1) metre of outside face of cast-in-place and precast structure where there is no in-wall gasket for pipe sizes up to and including 750 mm diameter.

.5 Form benching in manhole bases to provide smooth U-shaped channel(s) with depth equal to inside diameter of pipes or as indicated. Curve channels smoothly and slope uniformly from inlet to outlet. Top of benching to drain towards channel, 4-12% slope.

.6 Install base section of precast shafting on cast-in-place base as indicated and confirm watertightness of 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 seal frame in place with butyl tape or use manufactured type.

.12 Clean debris and foreign material from unit. Remove fins and sharp projections. Prevent debris from entering system.

.13 Where waterproofing is specified, install in accordance with the manufacturer's written instructions.

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, confirm 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 and frames and store for re-use at locations designated by the Consultant.

.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 precast concrete adjustment units with butyl tape placed at each joint.

.3 Monolithic units:

.1 Raise monolithic units by roughening existing top to achieve 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 and frames as directed by the Consultant.

.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 the Consultant.

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 Coordinate testing with the Consultant a minimum of 48 hours in advance of proposed test. Perform test in presence of the Consultant.

.5 Test method: as indicated and in accordance with the authority having jurisdiction.

.6 Perform water 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 Conduct vacuum testing as follows:

.1 Plug all inlet and outlet pipes. Restrain plugs.
.2 Place and seal vacuum tester head to the precast section.
.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 metres, 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 until a successful result is achieved.
.7 Repair leaks regardless of test results.

END OF SECTION

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

1.3 REFERENCE STANDARDS

.1 ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, Culvert Pipe and (Metric); 2020.

.2 ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2022.

.3 ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2020.

.4 CSA G164-18(R2023), Hot Dip Galvanizing of Irregularly Shaped Articles.

.5 CAN/CSA A257 Series-24, Standards for Concrete Pipe and Manhole Sections.

.6 CAN/CSA B1800-24, Thermoplastic Non-Pressure Piping Compendium.

.7 National Association of Sewer Service Companies (NASSCO) Pipe Condition Assessment Using CCTV Performance Specification Guideline.

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 78 00 for items specified herein.

1.5 HANDLING AND STORAGE

.1 Handle and store pipe and fittings in such a manner as to avoid damage. Do not use chains or cables passed through pipe bore.

.2 Store gaskets in accordance with the manufacturer’s written instructions.

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: 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 POLYVINYL CHLORIDE PIPE AND FITTINGS

.1 Type PSM Polyvinyl Chloride: to CAN/CSA B1800.

.2 Profile PVC sewer pipe and fittings: to CAN/CSA B1800, profile as indicated in Project Documents.

.3 Joints: bell and spigot with locked-in rubber gasket.

2.4 MARKER STAKES

.1 Timber, 38 mm x 89 mm, colour: green.

2.5 GROUT

.1 Non-shrink: to Section 03 30 00.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect products for defects and remove defective products from site.

.2 Confirm pipe and fittings are clean before installation.

3.2 EXCAVATING, BEDDING, AND BACKFILLING

.1 Perform excavation, bedding, and backfilling in accordance with 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:

.1 Horizontal Alignment: 50 mm.
.2 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 manufacturers published instructions.

.6 Align pipe before joining.

.7 Support pipes as required to achieve 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 Where a flexible joint is not integral to the structure, provide flexible joint not more than 1 metre from outside face of structure.

.13 Install PVC pipe in accordance with CAN/CSA B1800.

.14 Cut pipe as required for fittings or closure pieces, square to centreline, and as recommended by manufacturer.

.15 Make watertight connections to manholes and catch basins. Do not use non-shrink grout unless approved by Consultant.

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 casing pipe to proposed line and grade as indicated.

.6 Use mechanical or welded type joints for casing pipe.

.7 After casing pipe has been installed, check line and grade for approval.

.8 Remove any soil or debris that remains in the casing pipe.

.9 Insert carrier pipe into casing pipe, starting from the working pit.

.10 Place pipe one (1) length at time outside casing pipe.

.11 Use and Consultant approved, pre-manufactured, non-degradable spacer to guide carrier pipe to specified alignment. Use pre-manufactured end seal to cap annular space at the end of pipe casing.

3.5 INSPECTION

.1 Consultant may require inspection of installed sewers by television camera, photographic camera, or by other visual method.

3.6 DEFLECTION TESTING – PLASTIC PIPE

.1 Provide deflection gauge to measure a 7.5% deflection. Gauges to be a "Go-No-Go" device.

.2 Measure deflection of plastic pipe by pulling a deflection gauge through each pipe from manhole to manhole. Notify the Consultant 24 hours prior to deflection testing.

.3 Within thirty days after installation, pull a deflection gauge measuring 7.5% deflection through the installed section of pipeline. If this test fails locate defect and repair. Retest using same methodology.

.4 Thirty days prior to completion of warranty period, pull a deflection gauge measuring 7.5% deflection through the installed section of pipe. If test fails, locate defect and repair. Retest using same methodology.

.5 Record deflection test with CCTV inspection specified in subsection 3.7 herein.

3.7 CLOSED CIRCUIT TELEVISION INSPECTION

.1 Flush storm sewers and related appurtenances to remove foreign materials.

.2 Conduct closed circuit television inspection procedures to meet National Association of Sewer Service Companies (NASSCO) Pipe Condition Assessment Using CCTV Performance Specification Guideline.

.3 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 to produce continuous 600-line resolution picture, showing entire periphery of pipe.
  - .3 A meter device with readings to clearly identify exact location of camera.

.4 Inspection:

- .1 Perform inspection of pipe from manhole to manhole by passing CCTV camera through sewer in direction of flow.
- .2 Classify results in accordance with NASSCO Performance Specification Guideline.

.5 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 Provide fault image from inspection record. All photographs to be clear and precise with distinct definition of fault.
- .4 Include detailed technical description with images as supporting data for each fault.

.5 Provide minimum of two (2) images for each sewer main section, detailing typical joint, and typical building service lateral.
.6 All images and videos to be in colour.

.6 Reports:

.1 Provide a composite report of CCTV inspection in PDF format. Include following 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 Images of all faults.
.3 Location of all service laterals.
.4 One image each of typical joint and typical service laterals when faults are not found.
.5 Mount images on left-hand page and place corresponding description on right-hand page. Number all images in order. Number beside photograph to correspond with description number.

.7 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 meter of length.
.2 450 mm – 600 mm pipe: ±150 mm per 100 meter of length.
.3 750 mm – 900 mm pipe: ±225 mm per 100 meter of length.

.8 Video Record:

.1 Supply a complete record of all inspections in Owner approved digital format.
.2 Index all files, listing sections of inspections.

.9 Repeat Inspection:

.1 Prior to repairs, have methods reviewed by Consultant. Repair faults detected during CCTV inspection. Repeat television inspection at no additional cost.

END OF SECTION

PART 1- GENERAL

1.1 RELATED WORK

.1 Concrete Reinforcing: Section 03 20 00

.2 Concrete: Section 03 30 00

.3 Earthwork: Section 31 20 00

1.2 REFERENCES

.1 CSA C22.2 No. 211.1:06(R2021), Rigid PVC and EB1 and DB2/ES2 PVC Conduit.

.2 CSA C22.2 No. 211.2:06(R2021), Rigid PVC (Unplasticized) Conduit.

PART 2- PRODUCTS

2.1 GENERAL

.1 Ducts are preferred to be cast-in-place type, with materials and construction as per civil specifications provided.

2.2 PVC DUCTS AND FITTINGS

.1 PVC ducts, type DBII, encased in concrete, with embedded fibre reinforcement where indicated.

.2 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.

.3 Expansion joints where ducts exit the ground.

.4 Rigid PVC 5-degree angle couplings.

.5 Utility long sweep elbows, minimum 36” bend radius, various angles.

2.3 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC conduit joints.

2.4 CABLE PULLING EQUIPMENT

.1 6 mm stranded polypropylene pull rope, tensile strength 5 kN, continuous throughout each conduit run with 3.0 meter spare rope at each end.

2.5 MARKER TAPE

.1 Plastic flagging tape, 50mm wide, clearly marked as follows:

.1 “CAUTION – BURIED ELECTRICAL LINE”, coloured red.

2.6 CONCRETE

.1 Refer to Section 03 30 00 for Cast-in-Place mix design.

2.7 DUCT PROTECTION

.1 38mm thick wood planks. Plank width as indicated on drawings.

2.8 GROUND CONDUCTOR

.1 Electrical power and communications ductbanks to be reinforced using structural synthetic macrofibers. Refer to Section 03 20 00 - Concrete Reinforcing.

.2 Ground conductor per Section 26 05 27 and 26 05 28. Secondary duct runs to have insulated ground conductor within duct with phase conductors.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install concrete encased duct bank as indicated in drawings and in accordance with the authority having jurisdiction, including formwork.

.2 Build duct bank on firm and undisturbed soil or on well compacted granular fill not less than 150mm thick, compacted to 95% of maximum proctor dry density.

.3 Open trench before ducts are laid and confirm no obstructions will necessitate change in grade of ducts.

.4 Install ground conductor in the trench base beneath the ductbank with size and depth as indicated on the drawings. Ensure 1.5 meter slack length of conductor is coiled at the ends of the ductbank runs.

.5 Install ducts at elevations and with slope as indicated and minimum slope of 1:400.

.6 Install base spacers at maximum intervals of 1.5m levelled to grades indicated for bottom layer of ducts.

.7 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 190mm horizontally and vertically (center-to-center). Stagger joints in adjacent layers at least 150mm and make joints watertight. Encase duct bank with minimum 75mm thick concrete cover unless otherwise noted in drawings.

.8 Make transpositions, offsets and slight changes in direction using 5-degree bend sections or couplings. Do not exceed a total of 20 degree with duct offset.

.9 Where ductbank changes direction by more than 20 degrees, make turn using utility long sweep elbows.

.10 Do not field bend ducts. Do not use methods that could deform the duct shape.

.11 Terminate (“stub out”) ductbank at ends by extending conduits and capping as indicated in drawings. Rebar is to be used for future concrete joint lapping. Survey end locations and document on as-built drawings. Install physical marker at end locations, using method approved by Owner.

.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 mandrel not less than 300mm long and of diameter 6mm 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 In each duct, install pull rope continuous throughout each duct run with 3m spare rope coiled neatly and accessible at each end.

3.2 MARKER TAPE

.1 Place marker tape in trench above duct bank as indicated in drawings.

3.3 TEMPORARY INSTALLATION

.1 Work with Utilities, Consultant, and Owner to coordinate temporary power requirements. Such cases may require ductbank configurations not shown in drawings.

3.4 INSPECTION

.1 Arrange for inspection of duct by the Consultant and Inspection Authority as required prior to placing concrete. Place concrete and clean ducts when the Consultant is present.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Earthwork: Section 31 20 00

1.2 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CSA C22.2 No. 211.1-2021, Rigid Types EB1 and DB2/ES2 PVC.
.2 CSA C22.2 No. 211.2-06(R2021), Rigid PVC (Unplasticized) Conduit.

PART 2 - PRODUCTS

2.1 PVC DUCTS AND FITTINGS

.1 Rigid PVC conduit: to CSA C22.2 No. 211.2, with moulded fittings for direct burial.

.2 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, and adaptors of same product material as duct, to make complete installation.

.3 Rigid PVC 90 degree and 45 degree bends.

.4 Rigid PVC 5 degree angle couplings.

.5 Expansion joints where conduits exit ground.

.6 Utility long sweep elbows, minimum 36" bend radius, various angles.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC conduit joints.

2.3 CABLE PULLING EQUIPMENT

.1 6 mm stranded polypropylene pull rope, tensile strength 5 kN, continuous throughout each conduit run with 3 meter spare rope at each end.

2.4 MARKER TAPE

.1 Plastic flagging tape, 50 mm wide, clearly marked as follows:

.1 “CAUTION – BURIED ELECTRICAL LINE”, coloured red.

2.5 DUCT PROTECTION

.1 38 mm wood planks, width as indicated on the Project Drawings, pressure treated with clear coloured, copper naphthenate, or 5% pentachlorophenol solution water repellent preservative.

2.6 GROUND CONDUCTOR

.1 Ground conductor as per Section 26 05 27 and Section 26 05 28. Secondary duct runs to have insulated ground conductor within duct with phase conductors.

PART 3 – EXECUTION

3.1 INSTALLATION

.1 Install direct buried underground cable ducts in accordance with the requirements of the authorities having jurisdiction.

.2 Install duct in accordance with manufacturer's instructions.

.3 Clean inside of ducts before laying.

.4 Open trench before conduits are laid and confirm no obstructions will necessitate change in grade of conduit.

.5 Confirm full and even support every 1.5 meter throughout duct length.

.6 Install conduits at elevations and slope ducts with 0.25% minimum slope.

.7 During construction, cap ends of ducts to prevent entrance of foreign materials.

.8 Pull through each duct 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. Pull stiff bristle brush through each duct immediately before pulling in cables.

.9 In each duct, install pull rope continuous throughout each duct run with 3 meter spare rope at each end.

.10 Make transposition, offsets and slight changes in direction using 5-degree bend sections or couplings. Do not exceed a total of 20 degree with duct offset.

.11 Where conduit changes direction by more than 20 degrees, make turn using utility long sweep elbows.

3.2 MARKERS

.1 Place marker tape in trench upon bedding surround of direct buried cable duct.

3.3 INSPECTION

.1 Arrange for inspection of conduit prior to backfilling by the authority having jurisdiction.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

.1 Pedestal to be tested and certified to be in compliance with ANSI/UL 231.

.2 If a laboratory other than U.L. is used that laboratory must certify, in writing, that the power outlet has been tested and meets all of the requirements of ANSI/UL 231, including 746C polymeric materials, and that the unit will pass the 94V0-5V flame test.

.3 Pedestal to be certified to meet all sections of NFPA 7-551-70 of NEC.

.4 Pedestal to meet 406.8 (B)(2)(a) of the national electric code NFPA 70.

.5 Install receptacle located in a wet location in a weatherproof enclosure, the integrity of which is not affected when the attachment plug cap is inserted.

1.2 REFERENCES

.1 UL 231-2016, Power Outlets.

.2 NFPA 70 – 2023, National Electrical Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - POWER PEDESTAL / DISTRIBUTION EQUIPMENT:

.1 Eaton - Marina Power and Lighting OR Approved equivalent

2.2 POWER PEDESTAL

.1 Main Housing:

.1 Constructed of 3/16" thick injection molded heavy resin material and coated with a two part UV-resistant polyurethane. It shall be UL listed as a type 3R weatherproof enclosure. Suitable for Direct burial type, with provisions for specified amperage.

.2 Lighting Assembly / Housing:

.1 Equip each pedestal with non-metered light. Light to be a LED bulb, that is controlled by an electromechanical photocell and protected by a in-line fuse, or an optional 1P 20A breaker.

.3 Wiring:

.1 Power pedestal to be completely pre-wired at the factory to the load side of the compression lug assembly.
.2 Load copper wiring to be of high stranding and tin plated to resist corrosion.
.3 Maximum size of the line wiring to be 350 MCM direct feed, or loop feed.

.4 Loop Feed Buss Bar System:

.1 Single- and double-barrel mechanical buss bars - rated for copper or aluminum - in sizes ranging from #8 to 350 KCMIL.

.5 Grounding:

.1 All exposed metallic parts must have an integral ground that is a part of the equipment grounding system.

.6 Receptacles:

.1 All receptacles under 60 amps to be of the corrosion resistant type conforming to NEMA TT-30 and/or NEMA 14-50.
.2 20 Amp, 110 Volt, straight blade receptacles to be GFI protected.
.3 30 Amp, 125 Volt, receptacles to be 2 pole, 3 wire (NEMA TT-30).
.4 50 Amp, 125/250 Volt, receptacles to be 3 pole, 4 wire (NEMA 14-50).

.7 Circuit Breakers:

.1 Breakers for receptacles to be of the thermal magnetic type, 10,000 A.I.C. and be UL listed.
.2 Locate circuit breakers under a lockable, weatherproof door.
.3 Circuit breakers for the 20 Amp, 110 Volt, straight blade receptacles to be single pole, 20 Amp rated.
.4 Circuit breakers for the 30 Amp, 125 Volt, straight blade receptacles shall be single pole, 30 Amp rated.
.5 Circuit breakers for the 50 Amp, 125/250 Volt, straight blade receptacles to be 2 pole, 50 Amp rated.
.6 Utility Connection Accessories: Meter sockets (if metered), utility-approved connectors, and junction boxes as required.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

.1 Installation to comply with Manufacturer requirements

.2 All materials, equipment, and methods must align with manufacturer specifications and recommendations.

.3 Obtain necessary permits and perform pre-installation site inspections to identify utility locations and ensure safety compliance.

3.2 SITE PREPARATION

.1 Mark the pedestal's location and confirm it is accessible for users.

.2 Excavate a trench for the pedestal and conduit according to specified burial depths

.3 Maintain clearance from other utility lines, following locate services marking protocols.

3.3 CONDUIT AND WIRING

.1 Install conduit in the trench, ensuring smooth bends with factory elbows.

.2 Pull conductors through the conduit without damaging insulation. Leave extra wire length for terminations at both ends.

3.4 POWER PEDESTAL INSTALLATION

.1 Place the pedestal in the designated location, ensuring it is level and plumb.

.2 Backfill around the pedestal base with compacted soil for stability.

.3 Connect wiring to the pedestal terminals, providing proper torque per manufacturer guidelines.

.4 Install circuit breakers and receptacles as required, ensuring compatibility with RV plugs.

3.5 GROUNDING

.1 Drive a ground rod near the pedestal and connect it to the pedestal's grounding lug using a copper grounding conductor.

3.6 RECEPTACLES

.1 Mount receptacles behind a lockable weatherproof, hinged door that is under tension to ensure proper closing pressure when the receptacle is or is not in use.

.2 .2 Mount receptacles at least 24" above the ground datum.

3.7 FINAL CONNECTIONS

.1 Connect the conduit to the supply panel or transformer and terminate conductors to the appropriate lugs or breakers.

.2 If required, install a utility meter socket and arrange for inspection/utility connection.

3.8 TESTING AND COMMISSIONING

.1 Verify proper voltage and amperage at each receptacle using a multimeter.

.2 Test the operation of circuit breakers and GFCI outlets (if any).

.3 Perform continuity and insulation resistance tests to ensure wiring integrity.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 28 - Grounding - Secondary

.2 Section 26 05 21 – Wires and Cables

.3 Section 26 05 44 – Installation of Cables in Trenches and Ducts

.4 Section 33 65 73 – Concrete Encased Ductbanks

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA A23.1:24/A23.2:24, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.3 DESCRIPTION OF WORK

.1 Underground electrical ductbanks and grounding from utility pole or manhole to pad mounted transformer including duct terminations at each end.

.2 Reinforced concrete transformer pad and grounding to utility requirements.

.3 Underground secondary electrical ductbanks from pad mounted transformer to switchboards.

.4 Secondary conductors from pad mounted transformer to switchboard including terminations. Termination of conductors at transformer by utility: supply conductor lugs for use by utility for termination.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Perform Work to comply with applicable Provincial regulations.

.2 Co-ordinate and meet requirements of power supply authority.

.1 Confirm availability of power when required.

.3 Co-ordinate and meet requirements of communications service provider.

.1 Confirm availability of service when required.

.4 Certificates: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.

.5 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Underground ducts: rigid type DB2, size as indicated.

.2 Conductors: copper, type RWU 90, 600V, size and number of conductors as indicated.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install electrical ducts direct buried in trenches and in concrete encased ductbanks as indicated.

.2 Install ground tie conductor between utility pole and pad mounted transformer as indicated or as required by utility.

.3 Install reinforced concrete pad for utility transformer and grounding as indicated.

.4 Install pull cord in primary electrical and communicating ducts for use by utilities.

.5 Install electrical secondary conductors between pad mounted transformer and service entrance switch as indicated. Allow adequate conductor length for connection to supply by power supply authority and terminations at the switch.

.6 Install meter socket and conduit on switchboard in a weatherproof enclosure with viewing window as indicated.

.7 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.8 Seal ducts at service pole location after installation of cables.

3.3 FIELD QUALITY CONTROL

.1 Arrange for site reviews of installation by utilities as required by respective utility. Do not bury of pour concrete around ducts prior to inspection and acceptance of installation by the utilities.

.2 Site Tests:

.1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.
.2 Perform additional tests if required by authority having jurisdiction.
.3 Submit written test results to the Engineer for review.

3.4 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for supplying and installing guardrail and guide posts.

1.2 RELATED SECTIONS

.1 Earthwork: Section 31 20 00

1.3 REFERENCE STANDARDS

.1 ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

.2 ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

.3 CSA G164-2023, Hot Dip Galvanizing of Irregularly Shaped Articles.

.4 AASHTO M180-2023, Corrugated Sheet Steel Beams for Highway Guard-rails.

.5 AASHTO M270/M270M-2023, Standard Specification for Structural Steel for Bridges.

.6 CAN/CGSB 1.181-99, Ready Mixed Organic Zinc-Rich Coating.

.7 CSA O80 Series-2022, Wood Preservation.

.8 Nova Scotia Department of Transportation and Public Works – Standard Specification Highway Construction and Maintenance.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 10 00 for items specified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Timber posts and guardrail:

- .1 Well seasoned, straight and sound, free from knots or other defects. Acceptable species for posts are Eastern Hemlock, Red Pine or mixed hardwood (birch, maple, oak or ash).
- .2 Treatment (Pressure):
  - .1 Cromated copper arsenate (CCA) or ammonical copper arsenate (ACA) to CAN/CSA O80.
  - .2 Alkaline copper quarternary (ACQ) to CSA O80. Use only double galvanized or stainless steel fasteners when utilizing ACQ in timber.

.2 Rope and timber guardrail:

- .1 Timber as specfied herein.

.2 Rope: as specifed on the Project Drawings. ***Color of rope to be selected by Owner from standard color options during shop drawing review (Addendum No.3)***

PART 3 - EXECUTION

3.1 PREPARATION

.1 Prior to pressure treating, incise posts and blocks on all four sides and dried to their fibre saturation point of 25% to 30% at 25 mm depth.

3.2 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 If soil conditions permit, drive steel guide post to depth specified in the Project Drawings.

.4 Backfill around posts using selected excavated material and place in uniform layers not exceeding 300 mm thickness; compact to 95% Standard Proctor Density.

.5 Cut tops of posts for sloped setting as indicated, with tops parallel to grade of pavement edge. All posts must have a minimum buried depth of 1320 mm.

.6 Erect 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.

3.3 TREATMENT TOUCH UP

.1 Apply treatment on Site to any damaged components or cut end pieces in accordance with the treatment manufacturer's written instructions.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section specifies requirements for construction of rubble mound breakwaters consisting of component layers, including armour and filter stone, to the dimensions indicated.

1.2 REFERENCE STANDARDS

.1 ASTM C127-24, Standard Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.

.2 AASHTO T85-22, Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate.

1.3 SOURCE SAMPLING

.1 Inform the Consultant of proposed source of materials and provide access for sampling at least two (2) weeks prior to commencing work. Forward a prepaid sample rock to be used for testing. This sample will be sent to a third-party testing facility hired by and paid for by the Contractor and approved by the Consultant. Sample to be between 5 and 10 kg and must be representative of the quarry material being used in the Work.

1.4 STONE GRADATION TEST REQUIREMENTS

.1 Armour Stone:

.1 Arrange and pay for two (2) Quality Assurance gradation tests to be conducted by an independent third-party testing provider for the armour stone throughout the scheduled work, unless gradation test results or observations of stone materials indicate additional gradation tests are required.

.2 Arrange and pay for a representative of the third-party testing company to randomly select a representative sample of stone equal to at least 30 times the median stone weight for the stone classification being sampled. The total sample must be accurately weighed to within 1%. Each individual stone in the sample will then be measured along three mutually perpendicular axes (dimensions a, b and c) and the measurements recorded. Individual stone weights will then be initially estimated based on the measured volume (i.e., measured volume = a x b x c) multiplied by the saturated surface dry (SSD) stone density for that stone type. The individual initial estimated weights will then be "adjusted" by an adjustment factor equal to the ratio of the actual total sample weight divided by the sum of the individual initial estimated weights. The resulting "adjusted" stone weights will be used to assemble a gradation curve for the sample. Alternatively, the Contractor may elect to weigh every stone in the sample, in which case the gradation curves will be assembled using the actual measured stone weights.

.2 Filter Stone:

.1 Arrange and pay for one (1) Quality Assurance gradation test to be conducted by a third-party testing provider that is arranged and paid for by the Contractor for the filter stone throughout the scheduled work, unless gradation test results or observations of stone materials indicate additional gradation tests are required.

.2 Undertake Quality Assurance gradation tests for filter stone in accordance with subsection 1.4.1.2 above, with a minimum sample size of 1,000 kg. Alternative methods may be considered, subject to approval by the Consultant.

.3 Provide all equipment required to gather samples. The third-party testing facility will measure/weigh each individual stone. Methods used to weigh each individual stone must be accurate to ±5 kg for stones larger than 50 kg, and to ±0.5 kg for stones smaller than 50 kg.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Rock Material:

.1 Test all rock materials and have approved by the Consultant prior to installation in the work.

.2 All rock materials to be free from cracks, seams and other defects which may impair durability.

.3 Armourstone and Filterstone to meet the following requirements:

.1 Specific Gravity minimum 2.65 and absorption maximum 2.0%.

.2 Slate, sandstone, shale, and stone containing mica not acceptable for filterstone or armourstone.

.4 Actual Specific Gravity and absorption will be determined by testing selected samples of material being incorporated into the works. Materials with a specific gravity less than required minimum specified above or an absorption rate in excess of 2% will be rejected.

.2 Armour Stone:

.1 White granite to match existing armour stone on Site.

.2 Armour stone to be angular in shape, with the ratio of maximum to minimum dimensions (aspect ratio) not exceeding 2.0. Stone to be white granite.

.3 Armour stone class designation ‘500 to 1500 kg’ to conform to 1,000 kg median weight and:

.1 No more than 5% must be less than 300 kg.

.2 No more than 10% must be less than 500 kg.

.3 No less than 70% must be less than 1,500 kg.

.4 No less than 97% must be less than 3,000 kg.

.4 Armour stone class designation ‘300 to 1000 kg’ to conform to 600 kg median weight and:

.1 No more than 5% must be less than 200 kg.

.2 No more than 10% must be less than 300 kg.

.3 No less than 70% must be less than 1,000 kg.

.4 No less than 97% must be less than 1,500 kg.

.5 Armour stones outside of the specified ranges may be acceptable for use at the discretion of the Consultant.

.3 Filter Stone:

.1 Filter stone to be angular in shape, with the ratio of maximum to minimum dimensions (aspect ratio) not exceeding 2.0.

.2 Filter stone to conform to 10 to 100kg Class designation, 50 kg Median weight and:

.1 No more than 5% must be less than 5 kg.

.2 No more than 10% must be less than 10 kg.

.3 No less than 70% must be less than 100 kg.

.4 No less than 97% must be less than 200 kg.

.4 Rip rap: to Section 31 20 00.

.5 Clear stone: to section 31 20 00

.6 Stone from existing embankment: all stone must be accepted before it is used in the work.

.7 Coir logs: as shown on the Project Drawings.

.8 Plantings: as shown on the planting schedule on the Project Drawings.

PART 3 – EXECUTION

3.1 FILTER STONE PLACEMENT

.1 Place filter layer material to lines, grades and dimensions indicated on the plans.

.2 Place filter layer material in two (2) layers as shown on plans.

.3 Place filterstone using mechanical means to the lines, grades and dimensions shown on the plans. Do not dump filter units into place. Commence placement at toe of slope and proceed up the slope towards the crest. Place filterstone so that it is stable, secure on slope and supported by units below. Control placement of filterstone so it produces a uniform and continuous cover over the underlying layer.

.4 Replace filterstone units broken or damaged during placement. Remove damaged units from the work. Provide replacements and removals at no additional cost to the Contract.

.5 Have grades, lines, dimensions, slopes and quantity of filterstone reviewed and approved by the Consultant before proceeding with the overlying armour layer.

3.2 ARMOURSTONE PLACEMENT

.1 Place as shown on the plan to the lines, grades and dimensions shown on the plan.

.2 Place each armourstone individually using mechanical means to the lines, grades and dimensions shown on the plans. Do not dump armour units into place. Place each unit so that it is stable and secure on slope and supported by units below. Control placement of armour units so as to produce a uniform and continuous cover.

.3 Replace armourstone units broken or damaged during placement. Damaged units to be removed from the work and will not be paid for.

3.3 TOLERANCES

.1 Completed component layers to be within following tolerances of line and grades indicated:

.1 Filterstone: +/- 50 mm
.2 Armourstone: +/- 150 mm

.2 Armourcrest: Minimum design elevation not to be uniformly high or low.

3.4 CROSS SECTION

.1 During construction submit cross-section sheets to the Consultant showing the following:

.1 Cross-sections at stations every 10 metres along the breakwaters.
.2 The design cross-section showing proposed, filter and armourstone in solid lines.
.3 Superimposed in dashed lines elevations taken at 2 metre intervals perpendicular to the centreline and at top and toe of slopes showing filter and armourstone as constructed surfaces.
.4 Reference cross-sections to the plan view of the breakwater with stations shown for reference.
.5 Submit cross-sections as work at each station is completed.
.6 After construction is complete and before the Final Certificate of Completion will be paid, submit detailed as-built survey plan to Consultant to show that contract grades and elevations have been achieved. Provide an electronic file and two (2) sets of prints. The following minimum requirements must be met Elevations every 10 meters along the centerline of the breakwaters.

3.5 PROTECTION

.1 Take into account anticipated weather conditions and degree of exposure of site and tidal conditions in setting requirements for protection.

.2 The work site is subject to water level variations due to tidal action.

.3 Replace any stone lost due to storms, tidal erosion or by own activities.

.4 Schedule and carry out construction so that each phase of work is not left exposed longer than necessary.

.5 Record the progress of placement of core and stone daily and provide weekly reports to the Consultant. Replacement of material lost due to storm wave action or tidal erosion damage will be based on daily journal of work progress and is considered incidental to the work.

END OF SECTION

APPENDIX A

Geotechnical Investigation

Edgewater Street Improvements, Mahone Bay, NS



GEOTECHNICAL INVESTIGATION

Edgewater Street Improvements
Mahone Bay, NS

Town of Mahone Bay

Project # 241016.00 • November 4, 2024

CBCL

01	Final	D. McKenney	2024-11-04	N. Basheer
Issue or Revision		**Reviewed By:**	**Date**	**Issued By:**

CBCL

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Project No. 241016.00

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BEST MANAGED COMPANIES
Platinum member

November 4, 2024

Dylan Heide
CAO, Town of Mahone Bay
493 Main Street
PO Box 530
Mahone Bay, NS B0J 2E0

Dear Mr. Heide:

RE: Geotechnical Investigation – Edgewater Street Improvements

Please find attached CBCL Limited's Geotechnical Investigation Report in support of the proposed improvements along Edgewater Street in Mahone Bay, NS.

The main findings/recommendations from our geotechnical investigation are as follows:

- **Pedestrian Bridge**
  - The use of spread footings founded on structural fill could be considered for the abutments; however, the existing soils will have to be removed down to till and reinstated with structural fill.
  - The depth to till was observed to be 3.0 m below existing grade near the southern abutment (BH24-01) and 3.2 m below existing grade near the northern abutment (BH24-02).
  - Water control will be important during excavation. The use of a temporary cofferdam may be required.
- **Shoreline Protection and Rehabilitation**
  - The seabed material adjacent to the toe of the existing shoreline slope generally consists of soft marine sediment. The thickness of this layer varied from 0.1 m to >1.7 m in the area investigated with hand probes.
  - This work along the shoreline was to supplement our previous investigation, "Geotechnical Investigation, Mahone Bay Living Shoreline Extension, Phase II", dated May 3, 2024. Geotechnical recommendations for construction and design can be found within the previous report.
- **Sewer and Water Extension**
  - Inferred bedrock (possible boulder at PH24-04) was encountered between Main Street and 141 Edgewater Street (probes PH24-01 to PH24-04) at depths between 2.4 m and 4.0 m below grade.

- Sulphide sulphur content testing indicated that the bedrock samples would be classified as sulphide bearing according to the Nova Scotia Sulphide Bearing Material Disposal Regulations (N.S. Reg. 57/1995).
- Groundwater was encountered at most borehole and probe locations and ranged in depth from 2.1 m to 4.0 m below existing grade.

Yours very truly,

CBCL Limited



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A Borehole, Auger Probe, and Hand Probe Location Plan – Drawing SK01

B Symbols and Terms Used on Borehole and Test Pit Records

Borehole Records

C Third-Party Laboratory Test Results

D Winter Construction Guidelines

1 Introduction

CBCL Limited (CBCL) was engaged by the Town of Mahone Bay (Town) to provide engineering services associated with the Edgewater Street improvements project which includes:

- A new pedestrian bridge to cross the Harbour (connecting Edgewater and Main Street across Ernst Brook).
- Shoreline protection and rehabilitation.
- Sewer and water pipeline extension from Main Street to near the north end of Edgewater Street.

The purpose of this geotechnical investigation was to:

- Evaluate the subsurface conditions at the location of the proposed pedestrian bridge abutments and provide geotechnical recommendations for design and general site work.
- Estimate the thickness of soft marine sediments along the shoreline for a ~125 m stretch between (approximately) 77 Edgewater Street and 121 Edgewater Street.
- Evaluate the subsurface conditions at the proposed pump stations along the Edgewater Street and provide geotechnical recommendations for design and general site work.
- Investigate the presence of bedrock within the upper 4.5 m along Edgewater Street.

This report presents our findings and geotechnical recommendations for foundation design and general site work.

This report has been prepared for the sole benefit of the Town and was prepared specifically for the subject site. The findings and recommendations contained in this report should not be extrapolated beyond the area investigated.

2 Site Description and Geology

The site includes:

- The stretch of Edgewater Street between Main Street and the Mushamush river, where new sewer and water pipelines are proposed with 2 new pump stations.
- A ~125 m stretch between (approximately) 77 Edgewater Street and 121 Edgewater Street along the shoreline of the harbour, where the shoreline is to be extended.
- Two possible locations for a pedestrian bridge to cross the Harbour, connecting Edgewater and Main Street across Ernst Brook.

Surficial geologic mapping indicates the area generally consists of a stony till plain and drumlins. The stony till plain typically consists of a stony, sandy matrix, and material derived from local bedrock sources and the drumlins typically consist of siltier till, with a higher percentage of distant source material including red clay[1]. Bedrock in the area is mapped as part of the Cunard Formation (Halifax Group) and is described as black to rust-brown slate with thin beds and lenses of minor black metasiltstone; medium bedded, fine grained, crosslaminated metasandstone; sulphide minerals common[2]. This formation is known to be prone to acid rock drainage.

[1] Stea, R.R., Conley, H., Brown, Y. (1992). Surficial Geology of the Province of Nova Scotia – Map 92-3.
[2] O'Brien, B. H. and White, C. E. (2012). Bedrock geology map of the Lunenburg area, NTS sheet 21A/08, Lunenburg County, Nova Scotia; Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2012-085.

3 Fieldwork Procedure

The field program consisted of the following:

- Six (6) boreholes
  - Two (2) conducted along Edgewater Street at the location of proposed pump stations (BH24-03 and BH24-04)
  - Four (4) conducted at the possible locations of the abutments for the pedestrian bridge (BH24-01, BH24-02, BH24-01A, and BH24-02A)
- Seven (7) auger probes (PH24-01 to PH24-07) along Edgewater Street
- Twenty-two (22) hand probes along the shoreline

The fieldwork was completed between September 16th and September 21st, 2024. Boreholes, auger probes, and hand probes were located in the field using handheld surveying equipment. Accuracy with an accuracy of 0.1 m was achieved unless otherwise noted.

The locations of the boreholes, auger probes, and hand probes are shown in Drawing SK01 in Appendix A.

3.1 Boreholes

Borehole drilling was conducted by Logan Drilling using a CME-55 drill rig mounted on a tracked carrier. All boreholes were backfilled with drill cuttings and silica sand and sealed near the surface with a cold asphalt mix (asphalt seal for paved road and parking areas only). During fieldwork, representative samples were collected, and borehole conditions were logged in detail by qualified CBCL geotechnical personnel. Representative samples were taken during the fieldwork, and the soil and rock conditions observed were logged.

Sampling in overburden soils as part of borehole drilling consisted of split-spoon sampling (51-mm outer sampler diameter) with Standard Penetration Testing (SPT) based on the procedures discussed in ASTM D1586. The soil samples were classified by visual examination according to the Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) (ASTM D2488), and limited laboratory testing.

Bedrock was cored in four boreholes (namely BH24-01, BH24-02, BH24-01A, and BH24-02A).

Detailed descriptions of the soil and rock encountered are provided in the attached Borehole Records (Appendix B). The boreholes were advanced to depths ranging from 6.1 m to 8.9 m below the existing ground.

Following completion of the fieldwork, soil samples and rock cores were transported to CBCL's laboratory in Bedford, NS, in general accordance with ASTM Standards to minimize sample disturbance. Additional testing and evaluation were carried out. The samples will be stored in the laboratory for a maximum of three months after this report's date and then discarded.

Table 1: Borehole Locations

Location	Borehole ID	Easting[1] (m)	Northing[1] (m)	Elevation[2] (m)
Bridge Option 1	BH24-01	390189.7	4922686.3	1.2
	BH24-02	390200.6	4922757.2	1.6
Bridge Option 2	BH24-01A	390155.3	4922691.0	1.5
	BH24-02A	390153.4	4922730.5	1.6
Pump Stations	BH24-03	390146.5	4923009.6	2.0
	BH24-04	390215.2	4923369.5	2.6

Notes: [1] UTM Zone 20, NAD 83
[2] Elevation in CGVD2013

3.2 Auger Probes

Seven (7) auger probes were advanced along Edgewater Street (from Main Street to 255 Edgewater Street) by Logan Drilling using 100 mm diameter standard augers. Depths of the probes ranged from 2.4 m to 4.6 m below the existing surface. Probes were carried out to determine whether bedrock was present within a depth of 4.6 m below the surface.

Table 2: Auger Probe Locations

Auger Probe ID	Easting[1] (m)	Northing[1] (m)	Elevation[2] (m)
PH24-01	390095.8	4922718.5	1.8
PH24-02	390206.3	4922842.9	1.7
PH24-03	390174.2	4922906.8	1.8
PH24-04	390129.1	4923111.6	2.5
PH24-05	390104.0	4923214.6	2.8
PH24-06	390141.1	4923307.3	2.6
PH24-07	390319.9	4923399.2	1.9

Notes: [1] UTM Zone 20, NAD 83
[2] Elevation in CGVD2013

3.3 Hand Probes

Twenty-two (22) hand probes were conducted by CBCL personal along the shoreline for a 125 m stretch between (approximately) 77 Edgewater Street and 121 Edgewater Street. Hand probes were conducted using a stiff metal rod. The thickness of soft marine sediments was estimated from the depth at which the hand probes were able to penetrate below seabed.

Table 3: Hand Probe Locations

Hand Probe ID	Easting[1] (m)	Northing[1] (m)	Elevation[2] (m)
HP24-01	390221.7	4922883.0	-1.2
HP24-02	390221.8	4922883.0	-1.2
HP24-03	390221.0	4922882.5	-1.1
HP24-04	390217.9	4922894.7	-1.2
HP24-05	390218.8	4922895.4	-1.3
HP24-06	390216.3	4922893.7	-1.2
HP24-07	390216.6	4922906.3	-1.2
HP24-08	390218.3	4922907.3	-1.3
HP24-09	390213.4	4922904.5	-1.1
HP24-10	390213.8	4922915.0	-1.3
HP24-11	390212.6	4922915.7	-1.2
HP24-12	390204.7	4922944.0	-1.3
HP24-13	390204.7	4922945.4	-1.3
HP24-14	390204.7	4922944.8	-1.1
HP24-15	390194.3	4922955.4	-1.1
HP24-16	390192.9	4922954.7	-1.0
HP24-17	390192.2	4922954.8	-1.0
HP24-18	390188.5	4922964.7	-1.2
HP24-19	390188.8	4922965.4	-1.2
HP24-20	390179.9	4922989.7	-1.2
HP24-21	390164.7[3]	4923011.4[3]	--[3]
HP24-22	390161.4[3]	4923010.8[3]	--[3]

Notes:
[1] UTM Zone 20, NAD 83
[2] Elevation in CGVD2013
[3] GPS accuracy was low.

4 Summarized Subsurface Conditions

The subsurface conditions encountered throughout the site are described in the following sections.

4.1 Boreholes

The subsurface conditions encountered at the boreholes are summarized below and in **Tables 4 and 5** and described in detail in the appended Borehole Records (Appendix B).

The subsurface conditions encountered at the two possible locations of the pedestrian bridge (BH24-01, BH24-02, BH24-01A, and BH24-02A) generally consist of the following profile:

- FILL
- CLAY (only encountered at borehole BH24-02)
- TILL
- BEDROCK

All boreholes near the locations of possible bridge abutments were terminated in bedrock.

The subsurface conditions encountered near the locations of proposed pump stations along Edgewater Street (BH24-03 and BH24-04) generally consists of the following profile

- ASPHALT
- FILL
- TILL

All boreholes along Edgewater Street were terminated in the TILL layer.

The soil classification methodology used on the Borehole Records is based on visual-manual field observations and laboratory testing in general accordance with American Society for Testing and Materials (ASTM) standard test methods D2488 and D2487. These methods provide for a descriptive classification of soils based on engineering properties, which is referenced in many geotechnical engineering design approaches and literature.

Table 4: Subsurface Conditions Summary: Boreholes

Location	Borehole ID	Thickness				Depth (m)		Depth of Groundwater (m)	Depth of Borehole (m)
		Asphalt (mm)	FILL (m)	CLAY (m)	TILL (m)	TILL	BEDROCK		
Bridge Option 1	BH24-01	-	3.6	--	1.8	3.6	5.4	1.0[1]	7.7
	BH24-02	70	2.2	0.9	0.6	3.2	3.8	ND	7.7
Bridge Option 2	BH24-01A	-	3.0	--	3.4	3.0	6.4	1.6[1]	8.9
	BH24-02A	-	2.1		0.6	2.1	2.7	ND	6.1
Pump Stations	BH24-03	150	3.4	--	>2.5	3.6	-	2.4	6.1
	BH24-04	200	1.9	--	>3.6	2.1	-	2.1	5.8

Notes: [1]Possibly influenced by tides.
[2]ND - Not determined.

Two (2) bedrock samples were submitted to the Dalhousie Mineral Resources Center for Acid Producing Potential testing. The results of the testing are provided in Appendix C and are summarized in **Table 5.**

Table 5: Acid Producing Potential Testing Results – BEDROCK

Sample ID	Depth Range of Sample (m)	Wt. (%)			Kg H_2SO_4/t (Acid Prod. Potential)
		Total Sulphur	Sulphate	Sulphide	
BH24-02 SA1	4.8 - 7.7	1.371	0.008	1.362	41.9
BH24-02A SA1	4.1 – 6.1	3.166	0.016	3.150	96.8

As per the Nova Scotia Sulphide Bearing Material Disposal Regulations (N.S. Reg. 57/1995), a sulphide-bearing material is defined as having a sulphide sulphur content equal to or greater than 0.4% (12.51 Kg H2SO4/tonne). Based on the laboratory results, the samples tested are classified as sulphide bearing.

4.2 Auger Probes

Auger probes were conducted to determine whether bedrock was present within the upper 4.5 m along Edgewater Street. Bedrock was not encountered within the upper 4.5 m at the locations of PH24-05 to PH24-07. At the location of PH24-04, auger refusal was encountered on inferred boulders or bedrock. Inferred, highly weathered bedrock was encountered between depths of 2.5 m and 4.0 m in probe holes PH24-01 to PH24-03.

Observations from the auger probes are summarised in the following table.

Table 6: Findings from Auger Probes

Auger Probe ID	Ground Elevation (m)	Depth of Auger Probe (m)	Bottom Elevation (m)	Depth of Inferred Bedrock (m)	Depth of Groundwater (m)
PH24-01	1.8	4.2	-2.4	4.0[1]	4.0
PH24-02	1.7	4.5	-2.8	2.5[1]	2.5
PH24-03	1.8	4.0	-2.1	3.0[1]	2.9
PH24-04	2.5	2.4	0.1	2.4[2]	-
PH24-05	2.8	4.6	-1.7	-	-
PH24-06	2.6	4.6	-1.9	-	3.2
PH24-07	1.9	4.6	-2.7	-	2.8

Notes: [1]Inferred, highly weathered bedrock.
[2]Inferred bedrock or boulder.

4.3 Hand Probes

The seabed material adjacent to the toe of the existing shoreline slope generally consists of soft marine sediment of varying thickness.

Observations from the hand probes are summarised in the following table.

Table 6: Findings from Hand Probes

Hand Probe ID	Seabed Elevation (m)[1]	Thickness of Soft Marine Sediments (m)
HP24-01	-1.2	0.2
HP24-02	-1.2	0.2
HP24-03	-1.1	0.1
HP24-04	-1.2	0.2
HP24-05	-1.3	0.3
HP24-06	-1.2	0.1
HP24-07	-1.2	0.6
HP24-08	-1.3	0.8
HP24-09	-1.1	0.1
HP24-10	-1.3	1.2
HP24-11	-1.2	0.1
HP24-12	-1.3	1.1
HP24-13	-1.3	1.2
HP24-14	-1.1	0.1
HP24-15	-1.1	1.4
HP24-16	-1.0	1.1
HP24-17	-1.0	0.1
HP24-18	-1.2	0.1
HP24-19	-1.2	0.6

Hand Probe ID	Seabed Elevation (m)[1]	Thickness of Soft Marine Sediments (m)
HP24-20	-1.2	0.7
HP24-21	--[2]	>1.7
HP24-22	--[2]	0.2

Notes: [1]Elevation in CGVD2013
[2]GPS accuracy was low.

5 Discussion and Recommendations

It is understood that the proposed improvements along Edgewater Street include (but are not limited to) of the following:

- A new pedestrian bridge to cross the Harbour (connecting Edgewater and Main Street across Ernst Brook).
- Shoreline protection and rehabilitation.
- Sewer and water pipeline extension from Main Street to near north end of Edgewater Street.

The purpose of this geotechnical investigation was to:

- Evaluate the subsurface conditions at the location of the proposed pedestrian bridge abutments and provide geotechnical recommendations for design and general site work.
- Estimate the thickness of soft marine sediments along the shoreline for a ~125 m stretch between (approximately) 77 Edgewater Street and 121 Edgewater Street.
- Evaluate the subsurface conditions at the proposed pump stations along the Edgewater Street and provide geotechnical recommendations for design and general site work.
- Investigate the presence of bedrock within the upper 4.5 m along Edgewater Street.

The subsurface conditions were evaluated for two (2) potential locations for the bridge. Currently, it is understood that the location of the bridge will be located around boreholes BH24-01 and BH24-02; therefore, recommendations provided herein are only in relation to this option.

The main findings/recommendations from our geotechnical investigation are as follows:

- **Pedestrian Bridge**
  - The use of spread footings founded on structural fill could be considered for the abutments; however, the existing soils will have to be removed down to till and reinstated with structural fill.
  - The depth to till was observed to be 3.0 m below existing grade near the southern abutment (BH24-01) and 3.2 m below existing grade near the northern abutment (BH24-02).
  - Water control will be important during excavation. The use of a temporary cofferdam may be required.
- **Shoreline Protection and Rehabilitation**

- The seabed material adjacent to the toe of the existing shoreline slope generally consists of soft marine sediment. The thickness of this layer varied from 0.1 m to >1.7 m in the area investigated with hand probes.
- This work along the shoreline was to supplement our previous investigation, "Geotechnical Investigation, Mahone Bay Living Shoreline Extension, Phase II", dated May 3, 2024. Geotechnical recommendations for construction and design can be found within the previous report.

Sewer and Water Extension

- Inferred bedrock (possible boulder at PH24-04) was encountered between Main Street and 141 Edgewater Street (probes PH24-01 to PH24-04) at depths between 2.4 m and 4.0 m below grade.
- Sulphide sulphur content testing indicated that the bedrock samples would be classified as sulphide bearing according to the Nova Scotia Sulphide Bearing Material Disposal Regulations (N.S. Reg. 57/1995).
- Groundwater was encountered at most borehole and probe locations and ranged in depth from 2.1 m to 4.0 m below existing grade.

The following sections outline our geotechnical recommendations for foundation systems and site preparation.

5.1 Earthworks

5.1.1 Surface Water and Erosion Control

Prior to excavations, surface water drainage controls should be implemented on the up-gradient side of the site to minimize run-off onto exposed soils. Suitable erosion and sedimentation control measures should be employed. These may include silt fences, check dams in ditches and granular working pads.

5.1.2 Excavation

Temporary excavated side slopes should be stable at one horizontal to one vertical (1H:1V) in dry conditions. Saturated slopes will require flatter slopes and should be reviewed by geotechnical personnel. Safe excavated slopes are the responsibility of the earthwork contractor, and as a minimum, must follow provincial guidelines. Control of groundwater will be necessary to improve sloughing and slope instability problems. Excavation slopes should be checked regularly for signs of instability and flattened as required. Temporary slopes should be protected from surface erosion by means such as (but not limited to): swales or ditches around the perimeter of the excavation; and/or by using plastic sheeting placed over the slope.

Stockpiled material, excavated soil, and wheel loads should be kept away from the excavation crest by a distance equal to the depth of the excavation. It is recommended to have a geotechnical engineer review excavations for safety and stability on a regular basis during construction.

If an excavation cannot be properly sloped or benched due to high groundwater, poor soils, or adjacent structures, the contractor should install an engineered shoring system (with appropriate dewatering equipment) to safely support the temporary excavation. The shoring system (or systems) must be designed to resist lateral earth and groundwater pressures. The shoring system must also take into consideration appropriate dewatering.

5.1.2.1 Pedestrian Bridge

Beneath the bridge abutments, it is recommended to remove the existing soils down to undisturbed till and reinstate with structural fill, as required. In the case that the proposed footing base elevation is such that it is bearing within the till, a 300 mm thick layer of structural fill (such as NSDPW Type 1 Gravel) is recommended below the footing.

Excavations should be wide enough such that structural fill can be extended laterally beyond the edges of the footing to include a 300 mm bench and the conventional 1H:1V splay.

The depth to till was observed to be 3.0 m below existing grade near the southern abutment (BH24-01) and 3.2 m below existing grade near the northern abutment (BH24-02).

5.1.2.2 Water and Sewer Extension

At the pump stations (wet well and valve chamber), the existing fill should be removed down to undisturbed till and reinstated with structural fill, as required. In the case that the proposed footing base elevation is such that it is bearing within the till, a 300 mm thick layer of structural fill (such as NSDPW Type 1 Gravel) is recommended below the footing.

Excavations should be wide enough such that structural fill can be extended laterally beyond the edges of the structure to include a 300 mm bench and the conventional 1H:1V splay.

The depth to till was observed to be 3.6 m below existing grade near Pump Station #4 (BH24-03) and 2.1 m below existing grade Pump Station #5 (BH24-05). It should be noted that borehole BH24-03 was conducted along the road, rather than in the ditch where Pump Station #4 is proposed. Borehole BH24-04 was conducted on north side of the road, rather than the proposed location along the southern shoulder (the location had changed after the drilling).

5.1.3 Dewatering of Excavations

At the proposed location of the pedestrian bridge abutments, groundwater was observed at a depth of 1.0 m on the northern side. It was not determined on the southern side due to the influence of drilling water. However, it is expected that the groundwater level is influenced by the tides at these locations.

Along the street, groundwater was observed at depths between 2.1 m and 4.0 m below grade.

Control of groundwater will be critical at the location of the abutments and for deeper excavations along the street. A temporary cofferdam may be required for the excavation of the abutments. The contractor undertaking the earthworks must be prepared to dewater excavations. Excavations should remain free of standing water. Concrete and backfill should not be placed in standing water, slough, or over softened bearing soils.

Discharge from the dewatering activities must be carried out in strict accordance with environmental regulations.

5.1.4 Structural Fill Placement and Compaction

The structural fill required throughout the site should consist of the following:

- Approved, imported, well-graded granular fill (i.e., NSDPW Type 1 or Type 2 Gravel).
- Approved sand and gravel pit run.

To prevent adfreeze, backfill placed directly against foundations/pump stations should consist of a well-graded granular material, ideally containing less than 5% fines (silt/clay). The backfill material for the foundation walls (interior/exterior) should have a maximum particle size of 80 mm.

Reuse of the on-site soils within the street may be permissible; however, the condition of the soils along the pipe alignments was not reviewed during this investigation. These materials could be reviewed during construction.

Structural fill should be placed within 2% of optimum moisture content (ASTM D698). Moisture conditioning may be needed to achieve the optimum moisture content. Structural fill materials should be compacted to the following percentage of maximum Standard Proctor dry density:

Structural fill below foundations, wet well and valve chamber	100%
Structural fill within 300 mm of paved area subgrade	98%
Structural fill below 300 mm of paved area subgrade	95%
Foundation, wet well, and valve chamber backfill	95%

The lift thickness used during the placement of structural fill must be compatible with the compaction equipment and the material type to ensure the specified density throughout. For preliminary consideration, the lift thickness should not exceed approximately 300 mm for mass filling and 200 mm for backfilling foundations and services. The maximum particle size should be no larger than ⅔ of the lift thickness.

Lightweight compaction equipment should be used within 1.0 m of the wet wells, valve chambers, and abutments.

Where structural fill is needed below the wet wells, valve chambers, or abutments, the fill must extend laterally beyond the edges of the structure to include a 300 mm bench and the conventional 1H:1V splay.

5.1.5 Infilling and Slopes Adjacent the Bridge

Permanent slopes around the bridge abutments should be stable at 1.5H:1V, or lower, provided that a minimum of 3 m of structural fill (approved rockfill) is placed along the outside of the slope. In the case that this amount of buttress material is undesirable, a 2H:1V slope could be considered if at least 0.6 m of structural fill (approved rockfill) is placed along the outside of the slope.

Any soft marine sediment present within the brook must be removed within the limits of the slope. Supplemental hand probes are recommended within this area.

We should be consulted as the design for the bridge progresses. Currently the full extents of the fill placement and proposed grades are unknown. Once final grades are known, a review of the potential settlement induced from infilling should be conducted.

5.1.6 Street Subgrade

The contractor must take precautions to avoid disturbance of the site soils or reinstate the material to the required condition. The condition of the subgrade should be reviewed prior to placement of base gravels.

5.1.7 Observation and Testing

It is recommended that all bearing surfaces be observed by an experienced geotechnical engineer prior to the placement of concrete. Observation and testing are also recommended during site grading and backfilling operations.

5.2 Foundations

5.2.1 Pedestrian Bridge Foundations

A conventional spread footing may be considered for the bridge abutment foundation system. For a footing founded on structural fill over undisturbed till the following geotechnical bearing resistances are recommended for preliminary design:

- Factored Geotechnical Bearing Resistance (ULS): 300 kPa
- Service Geotechnical Bearing Resistance (SLS): 200 kPa

The above noted resistances are based on the following assumptions:

- Footings are under level ground and are loaded concentrically.
- Footings are far enough away from the edge of the slope that there is no reduction.
- Footings are founded a minimum of 1.5 m below grade.
- Footing width between 1.0 m and 3.0 m.

Under service loading, total and differential settlement will be less than 25 mm and 20 mm, respectively, for the service bearing pressure (SLS) mentioned above.

Geotechnical bearing resistances for other footing sizes or conditions can be provided upon request. We should be contacted as the design progresses to ensure that the surrounding slopes do not reduce the bearing resistances provided above.

Footings should be founded a minimum of 1.5 m below grade for frost protection or equivalent insulation provided. Along a slope, footings may have to be founded deeper to ensure that a minimum cover of 1.5 m is achieved from the face of the slope.

It is recommended that the abutments be designed based on backfill consisting of a granular wedge within a zone bounded by the wall and a line drawn upwards and outwards at 45 degrees from the base of the wall. Drainage from the backfill zone with a positive outlet is recommended.

For design, the following parameters can be used:

- Total unit weight of soil, γT = 22 kN/m^3 (structural fill)
- Ultimate friction factor for sliding, μ = 0.4 (cast-in-place concrete to structural fill)
- At-rest earth pressure coefficient, Ko = 0.40 (if laterally restrained)
- Active earth pressure coefficient, Ka = 0.24
- Passive earth pressure coefficient, Kp = 4.2
- Angle of internal friction, Φ = 38 degrees (structural fill)

The design should include the influence of sloping backfill, surcharge loads behind the abutment, and the effects of compaction equipment.

5.2.2 Wet Well and Valve Chamber

As mentioned in Section 5.1, we recommend a 300 mm thick layer of imported granular material, such as NSDPW Type 1 Gravel, below the structures.

It is anticipated that the net bearing pressure of the wet well and valve chamber will be less than the existing in-situ vertical effective stress; therefore, adequate bearing resistance should be available.

Settlement will be proportional to the total applied weight of the structure and surrounding fill (if required). We can review once a design weight and final grades are available; however, post construction settlement will likely be less than 25 mm based on the subsurface conditions encountered.

A minimum soil cover of 1.5 m is required for frost protection. Based on the conceptual depths of the structures, this should be achieved.

The structures should be designed to resist buoyant forces.

5.3 Seismic Classification

The site classifications for seismic site response were based on our geotechnical investigation.

With the site prepared as discussed in Section 5.1, the recommended site classification for seismic site response, as per Table 4.1.8.4.A of NBCC 2015, is Site Class C at the bridge location and Site Class D at the pump stations.

5.4 Winter Construction

Additional effort will be required to conduct earthwork during winter conditions. Winter construction guidelines are attached in Appendix D.

Undertaking earthworks in the winter is not ideal and despite best efforts and good intentions, the quality of earthworks often is compromised.

5.5 Additional Geotechnical Services

It is recommended that observations of the footing bearing surfaces be conducted by CBCL Limited prior to the placement of concrete. Observation and testing services are also recommended during site grading and backfilling operations.

Additional geotechnical input is recommended as the design progresses to ensure that the project fully considers all of the information from the geotechnical investigation.

6 Closure

This report has been prepared for the sole benefit of the Client. All information, documentation or other material contained in, attached to, or forming part of this report reflects CBCL's opinion and best judgment based on the information available to us at the time of preparation. Any use or reliance on this report by the Client in circumstances where there has been a change in site conditions or for any purpose not expressly intended by or delineated in this report shall be the sole responsibility of the Client and CBCL accepts no liability for such use or reliance. Any use or reliance on this report by any third party, without CBCL's prior express written consent, shall be the sole responsibility of that third party. CBCL accepts no liability whatsoever for such use or reliance.

The information and conclusions contained in this report are generally consistent with professional standards for engineering and scientific professionals providing similar services at the same time, in similar locations and under similar circumstances.

A geotechnical field investigation is a limited sampling of a site. Some variation between sampling locations should be expected. The conclusions presented in this report represent the technical judgment of CBCL, based on the data obtained from the work and on CBCL's understanding of the project. The data obtained by CBCL is specific to the time the work was performed at the specific testing and/or sampling locations and can only be extrapolated to an undefined limited area surrounding these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the site reflecting natural, construction and other activities. Due to the nature of the investigation and the limited data available, CBCL cannot and does not warrant that undiscovered environmental liabilities and/or undetected subsurface conditions may not arise.

We trust this is the information you require at this time. We are available to discuss the contents of this report at your convenience. This report was prepared by Nivya Basheer, P.Eng., and reviewed by, Devan McKenney, P.Eng.

Respectfully submitted,

CBCL Limited

APPENDIX A

Borehole, Auger Probe, and Hand Probe Location Plan – Drawing SK01

CLEARLAND ROAD

EDGEWATER STREET

MAHONE BAY

PARRISH STREET

EDGEWATER STREET

ERNST BROOK

MAIN STREET

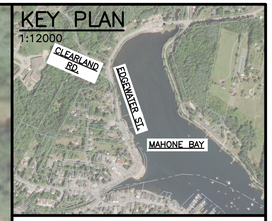
PH01
PH02
PH03
PH04
PH05
PH06
PH07
BH01
BH01A
BH02
BH02A
BH03
BH04
HP24–01
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HP24–03
HP24–04
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HP24–06
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HP24–08
HP24–09
HP24–10
HP24–11
HP24–12
HP24–13
HP24–14
HP24–15
HP24–16
HP24–17
HP24–18
HP24–19
HP24–20
HP24–21
HP24–22

NORTH

PLAN
1:1000

0 20 40 60 80 100m
1:1000

KEY PLAN
1:12000



No.	Description	Date	By

Revision or Issue

NOT FOR CONSTRUCTION

TOWN OF MAHONE BAY

EDGEWATER STREET IMPROVEMENTS

BOREHOLE LOCATION PLAN

CBCL

CBCL No 241016.00	Contract No
Date MAY 2024	Scale AS NOTED
Designed -	Drawn DS
Checked -	Approved -
Sheet No 1 of 1	
Drawing No SK01	

DRAWING NAME: Y:\HALIFAX\DATA\PROJECTS\2024\241016.00 MAHONE BAY EDGEWATER STREET REDEVELOPMENT\44 CAD\01 CIVIL\03 DRAWING SHEETS\241016.00 - SITE PLAN.DWG LAYOUT NAME: BOREHOLE PLAN PLOT DATE: Monday, November 4, 2024 1:21:41 PM CAD OPERATOR: DSWINAMER

CBCL-610x914 TITLE SHEET (ARCH D)

APPENDIX B

Symbols and Terms Used on Borehole and Test Pit Records

Borehole Records

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil	variable mixture of mineral particles and organic matter
Peat	decomposing vegetative matter having fibrous and/or amorphous structure
Till	unstratified glacial deposit which may range from clay to boulders
Fill	any materials below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of regular alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	>75 mm
Seam	2 mm to 75 mm
Parting	< 2 mm
Well Graded	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded	predominantly of one grain size

Terminology describing soils on the basis of grain size and plasticity is based on the ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The classification excludes particles larger than 76 mm (3 inches). This system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	Greater than 20%

The standard terminology to describe cohesionless soils includes the compactness as determined by laboratory test or by the Standard Penetration Test 'N' – value.

Relative Density	'N' Value	Compactness %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by in-situ vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength (Su)		'N' Value
	Kips/sq.ft.	KPa	
Very Soft	< 0.25	< 12.5	< 2
Soft	0.25 – 0.5	12.5 – 25	2 – 4
Firm	0.5 – 1.0	25 – 50	4 – 8
Stiff	1.0 – 2.0	50 – 100	8 – 15
Very Stiff	2.0 – 4.0	100 – 200	15 – 30
Hard	> 4.0	> 200	> 30

ROCK DESCRIPTION

Rock Quality Designation (RQD)

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on N-size (45 mm) core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from in situ fractures.

RQD	ROCK QUALITY
90 – 100	Excellent, intact, very sound
75 – 90	Good, massive, moderately jointed or sound
50 – 75	Fair, blocky and seamy, fractured
25 – 50	Poor, shattered and very seamy or blocky, severely fractured
0 – 25	Very poor, crushed, very severely fractured

Terminology describing rock mass:

Spacing (mm)	Bedding, Laminations, Bands	Discontinuities
2000 – 6000	*Very Thick*	*Very Wide*
600 – 2000	*Thick*	*Wide*
200 – 600	*Medium*	*Moderate*
60 – 200	*Thin*	*Close*
20 – 60	*Very Thin*	*Very Close*
< 20	*Laminated*	*Extremely Close*
< 6	*Thinly Laminated*	

Strength Classification	Uniaxial Compressive Strength (MPa)
Very Weak	1 – 5
Weak	5 – 25
Medium Strong	25 – 50
Strong	50 – 100
Very Strong	100 – 250
Extremely Strong	> 250

Terminology describing weathering:

Slight - Weathering limited to the surface of major discontinuities. Typically iron stained.
Moderate - Weathering extends throughout rock mass. Rock is not friable.
High - Weathering extends throughout rock mass. Rock is friable.

CBCL

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Metamorphic Bedrock | Sedimentary

WATER LEVEL MEASUREMENT



Borehole or Standpipe

Piezometer

SAMPLE TYPE AND/OR FIELD TESTS

SS	Split Spoon Sample (obtained by performing the Standard Penetration Test)	AS	Auger Sample
		BS	Bulk Sample
		WS	Wash Sample
ST	Shelby Tube or Thin Wall Tube	HQ, NQ, BQ, etc. Rock Core Samples (obtained with the use of standard size diamond drilling bits)	
PS	Piston sample		
DC	Dynamic Cone Penetration		
FSV	Field Shear Vane		

N- VALUE

Numbers in this column are the results of the SPT (Standard Penetration Test): the number of blows of a 140 pound (64kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and 'N' values cannot be presented, the abbreviation SSR (Split Spoon Refusal) will appear in place of a numerical value.

OTHER TESTS

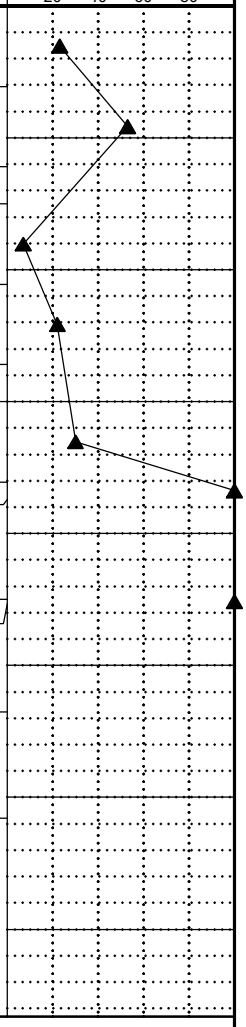
Symbols in this column indicate that the following laboratory tests have been carried out and the results are presented separately.

S	Sieve analysis	H	Hydrometer analysis
G_s	Specific gravity of soil particles	γ	Unit weight
k	Permeability	C	Consolidation
	Single packer permeability test; test interval from depth shown to bottom of borehole	CD	Consolidated drained triaxial
		CU	Consolidated undrained triaxial with pore pressure measurements
	Double packer permeability test; Test interval as indicated	UU	Unconsolidated undrained triaxial
		DS	Direct shear
	Falling head permeability test using casing	Q_u	Unconfined compression
		I_p	Point Load Index (I_p on Borehole Records equals I_p (50); the index corrected to a reference diameter of 50 mm)
	Falling head permeability test using well point or piezometer	MSV	Laboratory Miniature Shear Vane

BOREHOLE RECORD: BH24-01

CLIENT Town of Mahone Bay
PROJECT NAME Edgewater Street Improvements
PROJECT NUMBER 241016.00
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 2024-09-21
GROUND ELEVATION 1.2 m
GWT DATE 2024-09-21
BORING END DATE 2024-09-21
DATUM CGVD2013
BORING CONTRACTOR Logan Drilling
COORDINATES 4922686 m N; 390190 m E
BORING METHOD Solid Stem Auger and Rotary Diamond Drilling
LOGGED BY NB
CHECKED BY DM

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))
			1.2	Moist to wet, grey, silty sand with gravel to silty gravel with sand: FILL - frequent to some organics	SS	1	450	23
1	▽				SS	2	150	53
2					SS	3	150	7
					SS	4	100	22
3					SS	5	220	30
			-2.4	Very dense, moist to wet, brown to grey, silty GRAVEL with sand (GM): TILL - frequent to some cobbles and/or boulder	SS	6	130	SSR
4								
					SS	7	0	SSR
5			-4.2	Very severely fractured to fractured, grey, SLATE: BEDROCK	HQ	1	68	12
6								
7					HQ	2	81	60
			-6.5	End of borehole at 7.7 m				

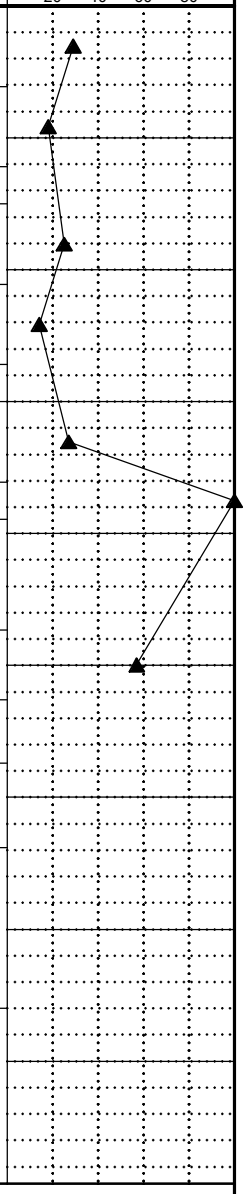


BOREHOLE RECORD: BH24-01A

CLIENT Town of Mahone Bay
PROJECT NAME Edgewater Street Improvements
PROJECT NUMBER 241016.00
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 2024-09-20
GROUND ELEVATION 1.5 m
GWT DATE 2024-09-20
BORING END DATE 2024-09-20
DATUM CGVD2013
BORING CONTRACTOR Logan Drilling
COORDINATES 4922691 m N; 390155 m E
BORING METHOD Solid Stem Auger and Rotary Diamond Drilling
LOGGED BY NB
CHECKED BY DM

DEPTH SCALE (m)	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))
	1.5					
	1.3	Dry, brown, ROOTMAT with silty sand, some gravel				
		Dry to moist, grey, silty sand to silty gravel with sand: FILL	SS	1	250	29
	0.9					
1		Moist to wet, grey, sandy clay with gravel: FILL - some organics	SS	2	190	18
	0.0					
		Wet, brown, silty sand with gravel: FILL	SS	3	150	25
2			SS	4	0	14
	-1.5					
3		Compact to very dense, wet, brown to grey, silty SAND with gravel (SM) to silty GRAVEL with sand (GM): TILL - some clay - some to frequent cobbles and/or boulders	SS	5	320	27
			SS	6	170	SSR
4						
5			SS	7	120	57
6			HQ	1	59	-
	-4.9					
		Very severely to severely fractured, grey, SLATE: BEDROCK	HQ	2	74	8
7						
8			HQ	3	79	45
	-7.4					

End of borehole at 8.9 m

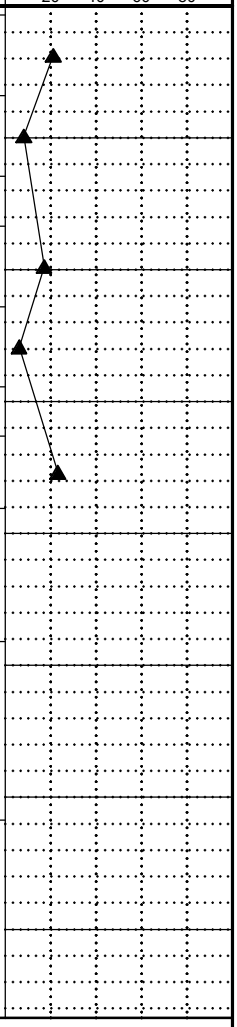


BOREHOLE RECORD: BH24-02

CLIENT Town of Mahone Bay
PROJECT NAME Edgewater Street Improvements
PROJECT NUMBER 241016.00
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 2024-09-19
GROUND ELEVATION 1.6 m **GWT DATE** -
BORING END DATE 2024-09-19
DATUM CGVD2013
BORING CONTRACTOR Logan Drilling
COORDINATES 4922757 m N; 390201 m E
BORING METHOD Solid Stem Auger and Rotary Diamond Drilling
LOGGED BY NB **CHECKED BY** DM

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))
			1.6					
			1.6	70 mm thick ASPHALT				
1				Wet, grey to brown, silty gravel and sand to silty, clayey gravel with sand: FILL - some cobbles (shale rock fragments)	SS	1	250	21
					SS	2	100	8
2					SS	3	50	17
			-0.7	Firm, moist to wet, grey, sandy CLAY with gravel:	SS	4	100	6
3			-1.6					
			-2.2	Compact, wet, grey, silty, clayey GRAVEL with sand (GC-GM): TILL	SS	5	220	23
4				Very severely fractured, grey, SLATE: BEDROCK	HQ	1	59	10
5					HQ	2	70	7
6								
7					HQ	3	73	17
			-6.1					

End of borehole at 7.7 m

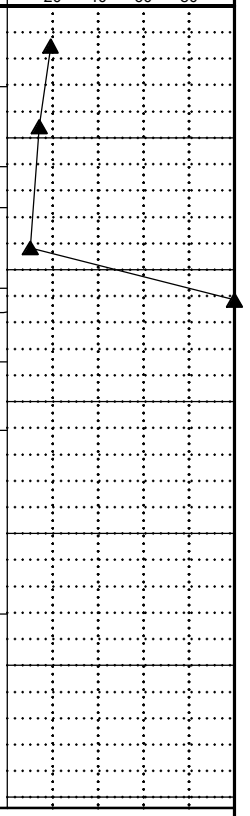


BOREHOLE RECORD: BH24-02A

CLIENT Town of Mahone Bay
PROJECT NAME Edgewater Street Improvements
PROJECT NUMBER 241016.00
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 2024-09-19
GROUND ELEVATION 1.6 m **GWT DATE** -
BORING END DATE 2024-09-19
DATUM CGVD2013
BORING CONTRACTOR Logan Drilling
COORDINATES 4922731 m N; 390153 m E
BORING METHOD Solid Stem Auger and Rotary Diamond Drilling
LOGGED BY NB **CHECKED BY** DM

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))
			1.6	Moist to wet, brown to grey, silty gravel with sand: FILL - trace rootlets - some clay	SS	1	240	19
1					SS	2	220	14
2					SS	3	100	10
			-0.5	Very dense, moist, grey, clayey GRAVEL with sand (GC): TILL	SS	4	180	SSR
			-1.1	Very severely to severely fractured, grey, SLATE: BEDROCK				
3					HQ	1	58	0
4					HQ	2	45	0
5					HQ	3	95	27
6			-4.5					

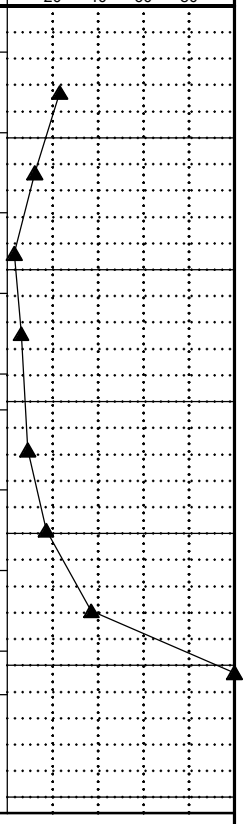
End of borehole at 6.1 m



BOREHOLE RECORD: BH24-03

CLIENT Town of Mahone Bay
PROJECT NAME Edgewater Street Improvements
PROJECT NUMBER 241016.00
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 2024-09-18
GROUND ELEVATION 2.0 m
GWT DATE 2024-09-18
BORING END DATE 2024-09-18
DATUM CGVD2013
BORING CONTRACTOR Logan Drilling
COORDINATES 4923010 m N; 390147 m E
BORING METHOD Split Spoon Sampling and/or Solid Stem Auger
LOGGED BY NB
CHECKED BY DM

DEPTH SCALE (m)	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))
	2.0					
	1.9	150 mm thick ASPHALT				
1		Moist to wet, brown to grey, silty sand to silty sand with gravel: FILL - some clay - from 3.5 to 3.7 m, moist, dark grey, sandy silt with organics	SS	1	300	23
			SS	2	200	12
2			SS	3	50	3
			SS	4	360	6
3						
	-1.6		SS	5	230	9
4		Compact to very dense, moist to wet, brown, silty sand (SM) to silty, clayey sand with gravel (SC-SM): TILL - organics present from 3.7 m to 4.3 m	SS	6	400	17
			SS	7	200	37
5			SS	8	350	SSR
6	-4.1					
		End of borehole at 6.1 m				

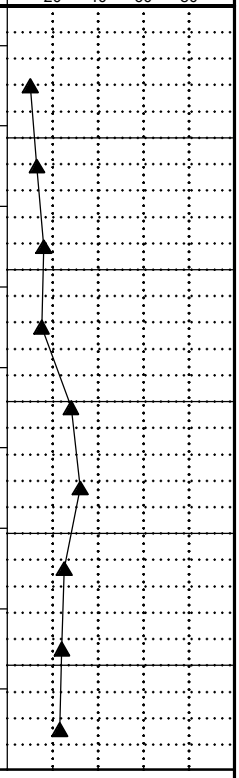


BOREHOLE RECORD: BH24-04

CLIENT Town of Mahone Bay
PROJECT NAME Edgewater Street Improvements
PROJECT NUMBER 241016.00
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 2024-09-17
GROUND ELEVATION 2.6 m
GWT DATE 2024-09-17
BORING END DATE 2024-09-17
DATUM CGVD2013
BORING CONTRACTOR Logan Drilling
COORDINATES 4923369 m N; 390215 m E
BORING METHOD Split Spoon Sampling and/or Solid Stem Auger
LOGGED BY NB
CHECKED BY DM

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))
			2.6					
			2.4	200 mm thick ASPHALT				
			1.8	Moist, grey to brown, silty clay with sand: FILL - trace roots	SS	1	330	10
1				Moist to wet, brown, silty sand: FILL - some clay - trace gravel	SS	2	100	13
2	▽		0.4		SS	3	200	16
				Very stiff to hard, moist to wet, brown, sandy silty CLAY (CL-ML) to compact to dense, miost to wet, silty, clayey SAND (SC-SM): TILL - trace to some gravel	SS	4	250	15
3					SS	5	180	28
					SS	6	0	32
4					SS	7	130	25
5					SS	8	0	24
			-3.2		SS	9	150	23

End of borehole at 5.8 m



APPENDIX C

Third-Party Laboratory Test Results

DALHOUSIE UNIVERSITY
Inspiring Minds

Minerals Engineering Laboratory

Dalhousie University
1360 Barrington Street
5273 DaCosta Row
Chemical Engineering Bldg. Rm. 3305
PO Box 15000, Halifax, NS
B3H 4R2

minerals.engineering.dal.ca
Tel: 902.497.3958
Email: mec@dal.ca

24-Oct-24

CBCL
348 Bluewater Road
Bedford, NS
B4B 1J6
Attention: Nivya Basheer

Re: Results of analysis on submitted samples.
Acid producing potential based on total sulphur, or sulphide sulphur content if available.

Project # 241016.00

	Wt. %			kg H2SO4/t
Sample	S(Total)	Sulphate	Sulphide	Acid Prod. Potential
BH24-02 SA1	1.371	0.008	1.362	41.7
BH24-02A SA1	3.166	0.016	3.150	96.3

	Wt. %
Certified Ref. Sa.	S(Total)
KZK-1 (0.80% S)	0.797

Digitally signed by Daniel Chevalier, MASc
Date: 2024.10.25 09:52:15 -03'00'

Daniel Chevalier, MASc
Manager, Minerals Engineering Laboratory

APPENDIX D

Winter Construction Guidelines

GEOTECHNICAL RECOMMENDATIONS
WINTER CONSTRUCTION

The following are general geotechnical recommendations for earthworks for building areas in winter conditions.

General

- Earthworks conducted during freezing conditions are suspect. Special procedures and precautions must be exercised to minimize the risk of future problems.

- A site meeting should be held at project start-up to discuss the schedules of the various contractors in relation to the following geotechnical recommendations.

Excavation

- The rootmat/topsoil layer and any overlying snow will reduce the frost penetration. Conducting only the excavation work required for each day of work is recommended to minimize freezing of the soil in the foundation areas.

- Excavated material to be used as structural fill should not be stockpiled but should be placed and compacted immediately after excavation.

Fill Placement

Based on our experience, it is generally impractical to place well-graded gravel, sand, or fine-grained soils in temperatures lower than about -5 degrees Celsius. On very cold days, loose material starts to freeze within about 15 minutes. At temperatures below -5 degrees Celsius, clear gravel or clear rockfill is recommended but subject to design considerations governing the work.

The following provides recommendations for all structural fill types.

- Structural fill placement should be conducted in small areas. Depending on the temperature, this may allow for continuous placement of fill lifts during the workday without the requirement for excavation of frozen material prior to placement of the next lift.

- Material containing snow or ice should not be incorporated in the work. During snow events, fill placement should be stopped. When the earthwork restart, all snow and ice should be removed from the fill surface prior to subsequent fill placement. In order to remove all snow and/or ice after a snow event, some of the underlying fill may have to be removed and wasted.

- For intermediate fill lifts, frost protection (e.g., straw, insulated tarp, etc) should be provided

at the end of the workday, or alternatively, fill that freezes overnight should be removed in the morning. Also, any snow or ice should also be removed. Fill surfaces should be sloped to prevent ponding of water during milder weather.

- The final fill surface, the base of footing excavations and slab subgrade should be protected from freezing. If the final fill surface is exposed to freezing temperatures, heat will be required to thaw the soil. Test pits and temperature readings could be completed to determine if the soil is above freezing. Consideration should also be given to the installation of thermocouples in the fill during placement, as a means of reading temperatures at depth. The areas that were frozen should be proof rolled.

- The moisture content of fill materials should be approximately 2% below optimum. Fill materials with moisture contents above the optimum should not be used.

- Loose edges of the structural fill lifts should be avoided to reduce frost penetration. Edges of fill lifts should be tapered and compacted.

- Regular checks of the temperature of the fill should be made. The soil temperature should be greater than +2°C to allow for compaction to the specified degree.

Slab Construction

- Cast-in-place concrete should be protected during colder weather conditions as per CSA A23.1- 2014.

Geotechnical Inspection and Testing

The information herein should be reviewed by geotechnical personnel and customized to the specific geotechnical aspects and design considerations of a site. Full-time inspection and testing by experienced geotechnical personnel is particularly important during earthworks in winter conditions and is strongly recommended.



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Photo by Coastal Action

GEOTECHNICAL INVESTIGATION

Mahone Bay Living Shoreline Expansion

Phase II

Mahone Bay, NS

Coastal Action

2024-05-03

CBCL

01	Final	CC	2024-05-14	MA
Issue or Revision		**Reviewed By:**	**Date**	**Issued By:**

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Project No. 231170.01

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902-421-7241 | CBCL.ca | info@CBCL.ca

BEST MANAGED COMPANIES
Platinum member

May 3, 2024

Jordan Veinot (she/her)
Climate Change Team Lead
Office: 587-990-4934
Mobile: 902-403-0332
coastalaction.org

Dear Ms. Veinot:

RE: Mahone Bay Living Shoreline Phase II

Please find attached CBCL Limited's Geotechnical Investigation Report for engineering services related to the expansion of the Living Shoreline Protection of the iconic Mahone Bay waterfront.

Yours very truly,

CBCL Limited

Prepared by:
Mohammad Ashari, P.Eng.
Geotechnical Engineer
Direct: 902-233-1665
E-Mail: mashari@cbcl.ca

Reviewed by:
Chris Carr, P.Eng.
Director, Geotechnical Engineering

CC: Vincent Leys

Project No: 231170.01

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6 Closure 12

Appendices

A Borehole Location Plan
B Borehole Records
C Grain Size Analysis

1 Introduction

The summer of 2022 saw the successful completion of an innovative natural infrastructure pilot project in Mahone Bay, NS, led by Coastal Action, with the support of the Town of Mahone Bay. CBCL was pleased to provide engineering services on that landmark project, which shows how the living shoreline protects existing infrastructure and restores the existing shoreline into a saltwater marsh. The implementation of the pilot project (the 60 m pilot section was part of an overall coastal protection design for the entire 700 m) was critical in demonstrating how soft infrastructure (living shorelines) combined with strategically placed rock structures can be used instead of hard seawalls which have traditionally been used.

Phase 2 of the living shoreline expansion will consist of project extension to the north, extending the shoreline generally 20 m to 30 m beyond its current edge. The newly created shoreline will include beaches/vegetated areas as well as rock sills (~2 m to 2.5 m high) along its outer perimeter.

As part of the design services, CBCL has conducted a geotechnical investigation to assess the subsurface conditions throughout the proposed development length (640 m extension). Prior to this investigation, Conquest Engineering (acquired by CBCL Limited in 2018) conducted two investigations related to the same project. The first one was reported in 2016, "Geotechnical Investigation – Mahone Harbour Flood Prevention and Shoreline Enhancement" and consisted of fourteen (14) hand probes using a hand auger and a dynamic cone penetrometer along the shoreline (700 m length of the project). The second one was reported in 2021, "Geotechnical Investigation, Edgewater Street Living Shoreline Pilot" and consisted of 5 boreholes drilled on water and focused only on the 60 m pilot section of the project.

This report presents our findings and geotechnical recommendations for the shoreline design and construction.

This report has been prepared for the sole benefit of Coastal Action and was prepared specifically for the subject site. The findings and recommendations contained in this report should not be extrapolated beyond the area investigated.

2 Site Description and Geology

The proposed improvement site starts near the intersection with Edwater Street and Parish Street and continues northward in line with Edgewater Street, ending close to the mouth of the Mushamush River in Mahone Bay, NS, as shown in Figure 1, Appendix A.

Surficial geologic mapping indicates the area generally consists of Stony Till Plain, which consists of stony, sandy matrix, and material derived from local bedrock sources[1]. Bedrock in the area is mapped as part of the Halifax Formation and is described as slate, siltstone, minor sandstone, and Fe-Mn nodules (in places metamorphosed to schist)[2].

[1] Stea, R.R., Conley, H., Brown, Y. (1992). Surficial Geology of the Province of Nova Scotia – Map 92-3.
[2] Keppie, J.D. (2000). Geological Map of the Province of Nova Scotia – Map ME 2000-1.

3 Fieldwork Procedure

The field program consisted of twelve (12) boreholes (BH24-01 to BH24-12) completed between January 9th and January 15th, 2024, as summarized in **Table 1**. Also, the coordinates of the hand probes completed in 2016 are summarized in **Table 2**. The approximate borehole locations are shown in Appendix A. The location of the 2021 boreholes and 2016 hand probes are also shown in Appendix A.

Table 1 Borehole Summary

Borehole ID	Easting[1] (m)	Northing[1] (m)	Elevation[2] (m)	Borehole Depth (m)
BH-01-2024	390278.3	4922814.3	-2.1	1.7
BH-02-2024	390257.7	4922855.7	-1.5	2.7
BH-03-2024	390233.9	4922926.1	-1.6	5.3
BH-04-2024	390195.0	4922996.6	-1.5	5.5
BH-05-2024	390172.8	4923083.1	-1.4	6.8
BH-06-2024	390168.1	4923159.1	-1.2	9.6
BH-07-2024	390169.9	4923236.6	-1.2	2.7
BH-08-2024	390172.7	4923286.6	-0.9	2.5
BH-09-2024	390206.6	4923327.6	-0.9	2.1
BH-10-2024	390247.9	4923338.6	-1.0	2.4
BH-11-2024	390210.9	4922970.0	-1.7	3.3
BH-12-2024	390242.1	4922897.4	-1.7	3.6

Notes: [1] UTM Zone 20, NAD 83
[2] Harbour Bottom Elevation in CGVD2013

Table 2 2016 Hand Probe Summary

Borehole ID	Easting[1] (m)	Northing[1] (m)	Elevation[2] (m)	Hand Probe Depth (m)
HP1	390245.9	4923365.5	0.7	1.5
HP2	390172.5	4923323.6	0.5	1.4
HP3	390124.1	4923233.5	0.2	0.9
HP4	390132.8	4923150.2	0.1	1.5
HP5	390153.3	4923054.3	0	1.5
HP6	390195.4	4922947.1	-0.1	1.8
HP7	390233.7	4923353.5	-0.2	1.1
HP8	390177.6	4923317.3	-0.3	1.7
HP9	390129.2	4923233.1	-0.5	0.5
HP10	390136.8	4923151	-0.4	1.5

HP11	390231.5	4922864.1	-0.2	0.5
HP12	390247.2	4922809.8	-0.1	0.5
HP13	390220.9	4922759.5	0.1	0.8
HP14	390175.2	4923315.9	-0.3	1.4

Notes: [1] UTM Zone 20, NAD 83
[2] Elevation in CGVD28

All boreholes were advanced using a CME-55 drill mounted on a sectional barge supplied and operated by Nova Drilling Inc. from Mount Uniacke, NS. Representative samples were taken during the fieldwork, and the soil and rock conditions observed were logged. The boreholes were advanced to depths ranging from 1.7 m to 9.6 m below the existing harbour bottom.

Sampling in overburden soils consisted of split-spoon sampling (51-mm outer sampler diameter) with Standard Penetration Testing (SPT) based on the procedures discussed in ASTM D1586, as well as Shelby tube sampling (75 mm diameter thin-walled tube) based on the procedures discussed in ASTM D1587. The soil samples were classified by visual examination according to the Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) (ASTM D2488) and limited laboratory testing.

Following completion of the fieldwork, soil samples were transported to CBCL's laboratory in Bedford, NS, in general accordance with ASTM Standards to minimize sample disturbance. Additional testing and evaluation were carried out. The samples will be stored in the laboratory for a maximum of three months after this report's date and then discarded.

Boreholes were located in the field using surveying equipment with an accuracy of 0.1 m.

4 Summarized Subsurface Conditions (2024)

The subsurface conditions encountered in the boreholes (2024) are summarized in **Table 3**, described in the following section, and described in detail in the appended Borehole Records (Appendix B).

The soil classification methodology used on the Borehole Records is based on visual-manual field observations and laboratory testing in general accordance with American Society for Testing and Materials (ASTM) standard test methods D2488 and D2487. These methods provide for a descriptive classification of soils based on engineering properties, which is referenced in many geotechnical engineering design approaches and literature.

The subsurface soil conditions encountered in the boreholes mainly consist of the following profile:

- Organic SILT
- SAND/GRAVEL
- BEDROCK

Table 3 Subsurface Conditions Summary

Borehole ID	Organic SILT Thickness (m)	SAND/GRAVEL Thickness (m)	Depth to BEDROCK (m)	Depth of Borehole (m)
BH-01-2024	-	0.7	0.7	1.7
BH-02-2024	-	1.6	1.6	2.7
BH-03-2024	3.0	1.6	4.6	5.3
BH-04-2024	2.1	2.7	4.8	5.5
BH-05-2024	2.4	>4.5[1]	-	6.8
BH-06-2024	2.9	5.0	7.9	9.6
BH-07-2024	1.5	>1.2[1]	-	2.7
BH-08-2024	1.5	>1.0[1]	-	2.5
BH-09-2024	1.5	>0.6[1]	-	2.1
BH-10-2024	0.7	>1.7[1]	-	2.4
BH-11-2024	2.5	>0.8[1]	-	3.3
BH-12-2024	3.4	-	3.4[2]	3.6

Notes: [1]A thicknesses shown with a greater than sign (>) means the borehole was terminated within this strata
[2] Inferred Weathered Bedrock
-not encountered

4.1 Organic SILT

A layer of very soft organic SILT was encountered at the seafloor in all boreholes except for BH-01-2024 and BH-02-2024. The thickness of this layer varied from 0.7 m to 3.4 m.

Moisture content tests were conducted on fifteen (15) samples in this layer. The average moisture content from the laboratory results for this layer is 202.6%, with a minimum of 58.7% and a maximum of 337.1%. The moisture content results are shown on the appended Borehole Records.

Organic content tests were conducted on eight (8) samples in this layer. The average organic content from the laboratory results for this layer is 19.8%, with a minimum of 4.8% and a maximum of 29.2%. The organic content results are shown on the appended Borehole Records.

Ten (10) Shelby tube samples were collected in this layer. The saturated unit weight of the Shelby tube samples was calculated based on the volume of the samples in the tube. The average calculated saturated unit weight for this layer is 11.5 kN/m^3 with a minimum of 10.1 kN/m^3 and a maximum of 13.9 kN/m^3.

Laboratory vane test was conducted on four (4) samples in this layer. The fibrous material was observed in two of the four samples. The undrained shear strength of the samples with fibrous material was between 10.0 and 10.5 kPa, with a remoulded shear strength of 4.0 kPa. The undrained shear strength of the two samples without any visible fibrous material was 4.5 kPa, and the remoulded shear strength was between 1.5 and 2.0 kPa. Boylan and Long (2013) reported that field vane undrained shear strength compared to simple shear test could overpredict the undrained shear strength of highly organic soil by a factor of up to 5.7. This overprediction is due to the presence of fibrous material in the soil and negative pore pressure caused by the vacuum behind the vane blades.

4.2 SAND/GRAVEL (Granular Stratum)

A granular layer that consisted of varying amounts of SAND and GRAVEL was encountered below the organic silt in all boreholes except for BH-01-2024 and BH-02-2024, where this layer was observed at the harbour bottom. Boreholes BH-05-2024 and BH-07-2024 to BH-12-2024 were terminated in this layer. This layer generally consisted of compact to very dense, moist to wet, grey to dark blue/brown-black, silty SAND, trace gravel to well-graded GRAVEL with silt and sand.

Moisture content tests were conducted on eleven (11) samples of this layer. The average moisture content from the laboratory results is 12.6%, with a minimum of 8.9% and a

maximum of 16.6%. Five (5) sieve analysis tests were also conducted on samples of this layer, with results showing 32% to 47% gravel, 43% to 58% sand and 9% to 15% fines content.

The test results are shown on the appended borehole records. Grain size analysis tests are also presented in Appendix C.

4.3 BEDROCK

Bedrock was encountered in five boreholes, namely BH-01-2024, BH-02-2024, BH-03-2024, BH-04-2024 and BH-06-2024, which were all terminated in this layer. The elevation of the bedrock varied from -3.2 m to -9.0 m from the south end of the proposed structure (at the location of BH-01-2024 close to the pilot stretch) towards the north end of the structure (at the location BH-06-2024). The bedrock was described as weathered, dark blue, SHALE/SLATE.

5 Discussion and Recommendations

It is understood that approximately 700 m of shoreline improvements are proposed along Edgewater Street in Mahone Bay, NS, in order to restore the existing shoreline to a saltwater marsh. The improvements include extending the shoreline seaward by approximately 20 m to 30 m beyond its current crest to include beaches, vegetated areas, and rock sills along the harbour. The proposed improvement work generally includes the construction of outer Rock Sills that run lengthwise and parallel to the existing shoreline. A Rock Sill is analogous to a breakwater but is discontinuous such that narrow openings provide seawater ingress and tidal inundation of an inner beach area. Between the Rock Sills and the shoreline, the beach area is to be infilled with a gravel base layer and a coarse sand topping layer.

A 60 m long pilot section of the project has been successfully constructed (cover photo). The pilot section lies south of and adjoining the proposed new shoreline improvement work. The subsea soil conditions encountered throughout the pilot section generally consisted of compact to very dense silty SAND with gravel overlying bedrock. Similar soil conditions were observed in boreholes BH-01-2024 and BH-02-2024 immediately to the north of the pilot section.

Heading north for ~100 m along the existing shoreline, starting from the end of the pilot project, the subsea soil conditions over this length appeared to be similar to the conditions that prevailed for the pilot section. Beyond this ~100 m proposed section, starting approximately at BH-12-2024, a layer of very soft organic SILT was observed above the granular soils and BEDROCK. This organic SILT layer is not a suitable bearing stratum for the proposed fill placement. The placement of fill on top of the organic SILT layer will result in various types of deformation and/or failure, such as but not limited to:

- penetration of rock particles into the SILT, causing displacement, bulging and/or distortion of the proposed infill;
- Excessive settlement due to consolidation of the organic SILT layer in both the short and long term; and,
- Development of a failure plane in the organic SILT layer resulting in ultimate bearing failure of the berm/embankment construction.

The main findings and recommendations from our investigation are as follows:

- The subsurface conditions encountered at the locations of BH-01-2024 and BH-02-2024 generally consist of very loose to compact silty SAND with gravel over bedrock. As with the pilot project, significant settlement of the proposed earthwork is not expected at these locations.
- The subsurface condition encountered in the rest of the borehole locations (BH-03-2024 to BH-12-2024) consists of a layer of organic SILT (several meters thick) over competent granular soil and BEDROCK.
- Fill placement over organic SILT is not recommended due to risks of failure, excessive distortion, and settlement.
- Geotechnical engineers should continue to be engaged as the design progresses to allow for review and revision of recommendations.

5.1 Earthworks for Shoreline Improvement

5.1.1 Pilot Project + 100m

The following discussion and recommendations are limited to the shoreline improvements for ~100 m from the pilot project.

The existing armour stone along the current shoreline is to be replaced with well-graded fill. The coastal design calls for well-graded surge rock (150 mm minus) to build out the shoreline with a berm having a crest width of 3600 mm and a 2H:1V slope. This built-out berm can be founded on the native granular soil. The existing armour stone may be salvaged and used in the construction of the new Rock Sill.

Armour stones with a median mass of 1000 kg are proposed for the Rock Sills and can also be placed over the native granular soils. Placing armour stone on the very soft organic SILT layer is not recommended. Organic SILT that exists within the footprint of the shoreline work should be dredged. If this is cost-prohibitive or otherwise deemed impractical by the owner, significant deformation must be expected for any work constructed over the organic SILT. Placing the armour stones on the organic SILT will cause displacement of the organic material and bulging of the soil as stones penetrate into the soft bottom.

Between the outer Rock Sills and the newly proposed surge berm, the coastal design calls for a base layer, ~750 mm to ~1500 mm thick, of NS Type 2 Gravel. The design also calls for this layer to be covered with 500 mm of coarse Sand. These fill layers should be placed over the native granular seafloor soils, avoiding filling over any organic SILT. Significant settlement, deformation and/or or shear failure must be expected if the earthworks are constructed over organic SILT.

Where it is practical, compact all fill using compaction equipment that is commensurate with the layer thickness and prevailing field conditions. Some end dumping of fill below the sea level will be necessary, and compaction of that material will not be feasible. Above the sea level, fill should be kept in thin lifts on the order of 300 mm.

As the design progresses, it is recommended that the designer continue to engage geotechnical personnel to review the specifics of the design and allow optimization of the geotechnical matters.

5.1.2 Beyond 100 m From Pilot Project

Beyond 100 m from the pilot project, the thickness of the very soft organic SILT becomes more significant. It presents an extremely difficult condition that does not lend to a simple engineered solution other than dredging the organic SILT layer.

The very soft organic SILT layer should not be considered a competent stratum that can support the proposed rock sills and inner beach layers. The placement of fill on top of the organic SILT layer will result in various types of deformation and/or failure, such as but not limited to:

- Penetration of rock particles into the organic SILT causing displacement, bulging and/or distortion of the proposed infill;
- Excessive settlement due to consolidation of the organic SILT layer in both the short and long term; and,
- Development of a failure plane in the organic SILT layer resulting in ultimate bearing failure of the berm/embankment construction.

Nonetheless, if Coastal Action and the Town of Mahone Bay decide to go ahead with widening the embankment, the following discussion is a guide to mitigate (not eliminate) the risks associated with building on the very soft organic SILT layer.

Even just widening the existing Edgewater Roadway embankment to accommodate a walking trail is likely to result in major deformation of the widened section. Based on normal design standards, it is not recommended that Coastal Action and the Town of Mahone Bay proceed with building over the soft organic SILT. Notwithstanding this, Coastal Action and the Town of Mahone Bay may consider the following.

5.1.2.1 Measures to Mitigate the Risk of Construction on Organic SILT

The investigations completed for the project did not fully delineate the extent of the organic SILT layer. However, the data shows that this layer discontinues before reaching the Edgewater Street roadway embankment. As such, widening the embankment by a nominal width to allow for an adjacent walkway may be a consideration. However, it is likely that some very soft organic SILT would exist under the footprint of a widened embankment section and would be displaced during construction, resulting in the slumping of newly placed soils and bulging (mud-wave) of underlying organic SILT. With careful construction and accepting that large displacements will result, building the widened section may be manageable. Before taking this approach, additional geotechnical investigation within the footprint of the proposed widened embankment is recommended, along with the development of a

mitigation strategy. Further, it needs to be recognized that any significant bulging and deformation will disturb the site environment. The purpose of this report is not to address Environmental impacts.

6 Closure

This report has been prepared for the sole benefit of the Client. All information, documentation or other material contained in, attached to, or forming part of this report reflects CBCL's opinion and best judgment based on the information available to us at the time of preparation. Any use or reliance on this report by the Client in circumstances where there has been a change in site conditions or for any purpose not expressly intended by or delineated in this report shall be the sole responsibility of the Client and CBCL accepts no liability for such use or reliance. Any use or reliance on this report by any third party, without CBCL's prior express written consent, shall be the sole responsibility of that third party. CBCL accepts no liability whatsoever for such use or reliance.

The information and conclusions contained in this report are generally consistent with professional standards for engineering and scientific professionals providing similar services at the same time, in similar locations and under similar circumstances.

A geotechnical field investigation is a limited sampling of a site. Some variation between sampling locations should be expected. The conclusions presented in this report represent the technical judgment of CBCL, based on the data obtained from the work and on CBCL's understanding of the project. The data obtained by CBCL is specific to the time the work was performed at the specific testing and/or sampling locations and can only be extrapolated to an undefined limited area surrounding these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the site reflecting natural, construction and other activities. Due to the nature of the investigation and the limited data available, CBCL cannot and does not warrant that undiscovered environmental liabilities and/or undetected subsurface conditions may not arise.

We trust this is the information you require at this time. We are available to discuss the contents of this report at your convenience. This report was prepared by Mohammad Ashari, P.Eng., and reviewed Chris Carr, P.Eng.

Respectfully submitted,

CBCL Limited

APPENDIX A

Borehole Location Plan



APPROXIMATE BOREHOLE LOCATIONS (JANUARY 2024)

APPROXIMATE BOREHOLE LOCATIONS (SEPTEMBER 2021)

HAND PROBES 2016

CBCL

PROJECT

BOREHOLE LOCATION PLAN

MAHONE BAY LIVING SHORELINE PHASE 2

JOB #:	231170.01
DATE:	03-MAR-2024
DRAWN BY:	NB
CHECKED BY:	MA

DOCUMENTS PREPARED BY CBCL ARE TO BE USED ONLY FOR THE SPECIFIC PROJECT AND SPECIFIC USE FOR WHICH THEY WERE PREPARED. ANY EXTENSION OF USE TO OTHER PROJECTS, BY OWNER, OR ANY OTHER PARTY, WITHOUT THE EXPRESSED, WRITTEN AUTHORIZATION OF CBCL IS DONE AT THE USERS OWN RISK. IF USED IN A WAY OTHER THAN WHAT WAS SPECIFICALLY INTENDED, THE OWNER WILL HOLD CBCL HARMLESS FROM ALL CLAIMS AND LOSSES.

DRAWING: 1

REV: 0

APPENDIX B

Borehole Records

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil	variable mixture of mineral particles and organic matter
Peat	decomposing vegetative matter having fibrous and/or amorphous structure
Till	unstratified glacial deposit which may range from clay to boulders
Fill	any materials below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of regular alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	>75 mm
Seam	2 mm to 75 mm
Parting	< 2 mm
Well Graded	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded	predominantly of one grain size

Terminology describing soils on the basis of grain size and plasticity is based on the ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The classification excludes particles larger than 76 mm (3 inches). This system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	Greater than 20%

The standard terminology to describe cohesionless soils includes the compactness as determined by laboratory test or by the Standard Penetration Test 'N' – value.

Relative Density	'N' Value	Compactness %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by in-situ vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength (Su)		'N' Value
	Kips/sq.ft.	KPa	
Very Soft	< 0.25	< 12.5	< 2
Soft	0.25 – 0.5	12.5 – 25	2 – 4
Firm	0.5 – 1.0	25 – 50	4 – 8
Stiff	1.0 – 2.0	50 – 100	8 – 15
Very Stiff	2.0 – 4.0	100 – 200	15 – 30
Hard	> 4.0	> 200	> 30

ROCK DESCRIPTION

Rock Quality Designation (RQD)

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on N-size (45 mm) core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from in situ fractures.

RQD	ROCK QUALITY
90 – 100	Excellent, intact, very sound
75 – 90	Good, massive, moderately jointed or sound
50 – 75	Fair, blocky and seamy, fractured
25 – 50	Poor, shattered and very seamy or blocky, severely fractured
0 – 25	Very poor, crushed, very severely fractured

Terminology describing rock mass:

Spacing (mm)	Bedding, Laminations, Bands	Discontinuities
2000 – 6000	*Very Thick*	*Very Wide*
600 – 2000	*Thick*	*Wide*
200 – 600	*Medium*	*Moderate*
60 – 200	*Thin*	*Close*
20 – 60	*Very Thin*	*Very Close*
< 20	*Laminated*	*Extremely Close*
< 6	*Thinly Laminated*	

Strength Classification	Uniaxial Compressive Strength (MPa)
Very Weak	1 – 5
Weak	5 – 25
Medium Strong	25 – 50
Strong	50 – 100
Very Strong	100 – 250
Extremely Strong	> 250

Terminology describing weathering:

Slight - Weathering limited to the surface of major discontinuities. Typically iron stained.
Moderate - Weathering extends throughout rock mass. Rock is not friable.
High - Weathering extends throughout rock mass. Rock is friable.

CBCL

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Metamorphic Bedrock | Sedimentary

WATER LEVEL MEASUREMENT



Borehole or Standpipe

Piezometer

SAMPLE TYPE AND/OR FIELD TESTS

SS	Split Spoon Sample (obtained by performing the Standard Penetration Test)	AS	Auger Sample
		BS	Bulk Sample
		WS	Wash Sample
ST	Shelby Tube or Thin Wall Tube	HQ, NQ, BQ, etc. Rock Core Samples (obtained with the use of standard size diamond drilling bits)	
PS	Piston sample		
DC	Dynamic Cone Penetration		
FSV	Field Shear Vane		

N- VALUE

Numbers in this column are the results of the SPT (Standard Penetration Test): the number of blows of a 140 pound (64kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and 'N' values cannot be presented, the abbreviation SSR (Split Spoon Refusal) will appear in place of a numerical value.

OTHER TESTS

Symbols in this column indicate that the following laboratory tests have been carried out and the results are presented separately.

S	Sieve analysis	H	Hydrometer analysis
G_s	Specific gravity of soil particles	γ	Unit weight
k	Permeability	C	Consolidation
	Single packer permeability test; test interval from depth shown to bottom of borehole	CD	Consolidated drained triaxial
		CU	Consolidated undrained triaxial with pore pressure measurements
	Double packer permeability test; Test interval as indicated	UU	Unconsolidated undrained triaxial
		DS	Direct shear
	Falling head permeability test using casing	Q_u	Unconfined compression
		I_p	Point Load Index (I_p on Borehole Records equals I_p (50); the index corrected to a reference diameter of 50 mm)
	Falling head permeability test using well point or piezometer	MSV	Laboratory Miniature Shear Vane

BOREHOLE RECORD: BH-01-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/9/2024
SEA FLOOR ELEVATION -2.1 m **GWT DATE** -
BORING END DATE 1/9/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4922814.3 m N; 390278.3 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY AS **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	▲ SPT N VALUE ▲ 20 40 60 80 PL MC LL 20 40 60 80 ☐ FINES CONTENT (%) ☐ 20 40 60 80	OTHER TESTS
			-2.1										
				Very loose, moist to wet, grey to dark blue, silty SAND with gravel	SS	1	180	3					
			-2.8										
1				Weathered, greyish blue, SHALE/SLATE BEDROCK	SS	2	350	SSR					
					HQ	3	102	-					
			-3.8										

End of borehole at 1.7 m

BOREHOLE RECORD: BH-02-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/9/2024
SEA FLOOR ELEVATION -1.5 m **GWT DATE** -
BORING END DATE 1/9/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4922855.7 m N; 390257.7 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY AS **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80	OTHER TESTS
			-1.5	Very loose to compact, dark brown-black, silty SAND, trace gravel to silty SAND with gravel/ silty GRAVEL with sand - organic ordour - trace rootlets	SS	1	170	0					
1													
					SS	2	300	26	43	44	13		
			-3.1	Weathered, greyish blue, SHALE/SLATE BEDROCK	SS	3	80	SSR					
2					HQ	4	160	-					
					HQ	5	-	-					
			-4.3	End of borehole at 2.7 m									

BOREHOLE RECORD: BH-03-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/11/2024
SEA FLOOR ELEVATION -1.6 m **GWT DATE** -
BORING END DATE 1/11/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4922926.1 m N; 390233.9 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY AS **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	▲ SPT N VALUE ▲ 20 40 60 80 PL MC LL 20 40 60 80 ☐ FINES CONTENT (%) ☐ 20 40 60 80	OTHER TESTS
			-1.6	Very soft, organic SILT	SS	1	350	0					
1					SS	2	250	0				276	
2					SS	3	360	0					
3			-4.6		SS	4	260	0					
				Very dense, wet, dark brown/ black, silty SAND, trace gravel to silty SAND with gravel - greyish blue rock fragments present	SS	5	300	57					
4													
			-6.2		SS	6	300	68	42	43	15		
5				Weathered, greyish blue, SHALE/SLATE BEDROCK	HQ	7	101	-					
			-6.9										

End of borehole at 5.3 m

BOREHOLE RECORD: BH-04-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/11/2024
SEA FLOOR ELEVATION -1.5 m **GWT DATE** -
BORING END DATE 1/11/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4922996.6 m N; 390195.0 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY AS **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	SPT N VALUE / PL MC LL / FINES CONTENT (%)	OTHER TESTS
			-1.5	Very soft, organic SILT	SS	1	0	0					
1					SS	2	80	0				337	OC = 25.7 %
					SS	3	80	0				278	
2			-3.7										
				Compact to dense, brown/ grey, silty SAND, trace gravel to silty SAND with gravel	SS	4	-	28					
				- cobbles and boulders present	SS	5	0	SSR					
3				- blue rock fragments present below 4.3 m	HQ	6	54	-					
				- cored through inferred cobbles and boulders	SS	7	160	43					
4					SS	8	610	47	38	49	13		
			-6.4		HQ	9	-	-					
5				Weathered, blue, SHALE/SLATE BEDROCK	SS	10	80	SSR					
			-7.0		HQ	11	100	-					

End of borehole at 5.5 m

Note(s)
OC: Organic content

BOREHOLE RECORD: BH-05-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/11/2024
SEA FLOOR ELEVATION -1.4 m **GWT DATE** -
BORING END DATE 1/11/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4923083.1 m N; 390172.8 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY AS **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80	OTHER TESTS
			-1.4	Very soft, organic SILT	SS	1	220	0				273	OC = 26.6 %
1					SS	2	0	0					
2					SS	3	80	0					
			-3.7	Compact to dense, dark brown/ grey, silty SAND, trace gravel to well graded GRAVEL with silt and sand - blue rock fragments present from 4.3 to 5.1 m - inferred cobbles and/or boulders below 3.8 m	SS	4	150	14					
3					SS	5	380	32	47	44	9		
4					SS	6	250	28					
5													
6					HQ	7	-	-					
			-8.2	End of borehole at 6.8 m									

Note(s)
OC: Organic content

BOREHOLE RECORD: BH-06-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/12/2024
SEA FLOOR ELEVATION -1.2 m **GWT DATE** -
BORING END DATE 1/12/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4923159.1 m N; 390168.1 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY AS **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	SPT N VALUE / PL MC LL / FINES CONTENT (%)	OTHER TESTS
			-1.2	Very soft, organic SILT	SS	1	50	0					
1					SS	2	150	0				236	OC = 21.9 %
					SS	3	50	0					
2					SS	4	200	0					
			-4.0										
3				Compact to very dense, dark brown/ grey, silty SAND, trace gravel to well graded SAND with silt and gravel - blue rock fragments were observed from 2.8 to 3.5 m - coarse grained sand from 3.8 m to 5.1 m - inferred cobbles and/or boulders below 5.9 m	SS	5	270	65					
4					SS	6	180	23					
					SS	7	380	74	32	58	10		
5													
6					SS	8	0	SSR					
7													
			-9.0		SS	9	150	SSR					
8				Weathered, blue, SHALE/SLATE BEDROCK	HQ	10	69	-					
9					HQ	11	100	-					
			-10.8										

End of borehole at 9.6 m

Note(s)
OC: Organic content

BOREHOLE RECORD: BH-07-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/14/2024
SEA FLOOR ELEVATION -1.2 m **GWT DATE** -
BORING END DATE 1/14/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4923236.6 m N; 390169.9 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY MA **CHECKED BY** CC

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL / ☐ FINES CONTENT (%) ☐	OTHER TESTS
			-1.2	Very soft, organic SILT	ST	1	360	-					γ_{sat} = 10.1 kN/m^3
1					SS	2	50	0				168	OC = 10.9 %
			-2.7										
2				Very loose to very dense, dark grey to brown, GRAVEL with sand - rock fragments present	ST	3	280	-					γ_{sat} = 16.2 kN/m^3
			-3.9		SS	4	420	57					

End of borehole at 2.7 m

Note(s)
OC: Organic content
γ_{sat}: Saturated unit weight

BOREHOLE RECORD: BH-08-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/14/2024
SEA FLOOR ELEVATION -0.9 m **GWT DATE** -
BORING END DATE 1/14/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4923286.6 m N; 390172.7 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY MA **CHECKED BY** CC

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80	OTHER TESTS
			-0.9	Very soft, organic SILT	ST	1	340	-					OC = 12.2 % γ_{sat} = 11.1 kN/m^3 s_u = 10.5 kPa
1					SS	2	50	0				189	
			-2.4										
2				Dense, moist, dark grey, GRAVEL with sand - rock fragments present	SS	3	150	40					
			-3.4										

End of borehole at 2.5 m

Note(s)
OC: Organic content
γ_{sat}: Saturated unit weight
s_u: Undrained shear strength (from laboratory shear vane)

BOREHOLE RECORD: BH-09-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/15/2024
SEA FLOOR ELEVATION -0.9 m **GWT DATE** -
BORING END DATE 1/15/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4923327.6 m N; 390206.6 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY MA **CHECKED BY** CC

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80	OTHER TESTS
			-0.9	Very soft, organic SILT	ST	1	340	-					γ_{sat} = 12.5 kN/m^3
1			-2.4		SS	2	20	0					OC = 4.8 %
2			-3.0	Compact, moist/wet, dark grey, GRAVEL with sand - rock fragments present	SS	3	150	19					

End of borehole at 2.1 m

Note(s)
OC: Organic content
γ_{sat}: Saturated unit weight

BOREHOLE RECORD: BH-10-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/15/2024
SEA FLOOR ELEVATION -1.0 m **GWT DATE** -
BORING END DATE 1/15/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4923338.6 m N; 390247.9 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY MA **CHECKED BY** CC

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80	OTHER TESTS
			-1.0										
			-1.7	Very soft, organic SILT	ST	1	380	-					γ_{sat} = 12.0 kN/m^3
1				Compact, moist, grey/brown, GRAVEL and SAND - inferred cobbles and/or boulders present from 1.3 to 1.8 m	SS	2	200	16					
2			-3.4		SS	3	-	34					

End of borehole at 2.4 m

Note(s)
γ_{sat} : Saturated unit weight

BOREHOLE RECORD: BH-11-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/15/2024
SEA FLOOR ELEVATION -1.7 m **GWT DATE** -
BORING END DATE 1/15/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4922970.0 m N; 390210.9 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY MA **CHECKED BY** CC

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	SPT N VALUE / PL MC LL / FINES CONTENT (%)	OTHER TESTS
			-1.7	Very soft, organic SILT	ST	1	100	-				294	OC = 29.2 % γ_{sat} = 10.3 kN/m^3 s_u = 10.0 kPa s_r = 4.0 kPa
1					SS	2	30	0				231	
2					ST	3	400	-					γ_{sat} = 13.9 kN/m^3
			-4.2		SS	4	310	6					
3				Loose, moist, grey/brown, GRAVEL and SAND - inferred cobbles and/or boulders present									
			-5.0										

End of borehole at 3.3 m

Note(s)
OC: Organic content
γ_{sat}: Saturated unit weight
s_u: Undrained shear strength (from laboratory shear vane)
s_r: Remoulded shear strength (from laboratory shear vane)

BOREHOLE RECORD: BH-12-2024

CLIENT Coastal Action
PROJECT NAME Mahone Bay Living Shoreline Ph2 Geotech
PROJECT NUMBER 231170.01
PROJECT LOCATION Mahone Bay, NS
BORING START DATE 1/15/2024
SEA FLOOR ELEVATION -1.7 m **GWT DATE** -
BORING END DATE 1/15/2024
DATUM CGVD2013
BORING CONTRACTOR Nova Drilling Inc.
COORDINATES 4922897.4 m N; 390242.1 m E
BORING METHOD Rotary Diamond Drilling
LOGGED BY MA **CHECKED BY** CC

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION Gravel (%)	Sand (%)	Fines (%)	SPT N VALUE / PL MC LL / FINES CONTENT (%)	OTHER TESTS
			-1.7	Very soft, organic SILT	ST	1	280	-					γ_{sat} = 11.9 kN/m^3
1					ST	2	300	-				241	OC = 22.8 % γ_{sat} = 10.8 kN/m^3 s_u = 4.5 kPa s_r = 1.5 kPa
					ST	3	470	-				212	OC = 23.9 % γ_{sat} = 10.9 kN/m^3 s_u = 4.5 kPa s_r = 2.0 kPa
2													
3					ST	4	480	-					γ_{sat} = 11.8 kN/m^3
			-5.1										
			-5.3	Inferred weathered BEDROCK	SS	5	-	SSR					
				End of borehole at 3.6 m									

Note(s)
OC: Organic content
γ_{sat}: Saturated unit weight
s_u: Undrained shear strength (from laboratory shear vane)
s_r: Remoulded shear strength (from laboratory shear vane)

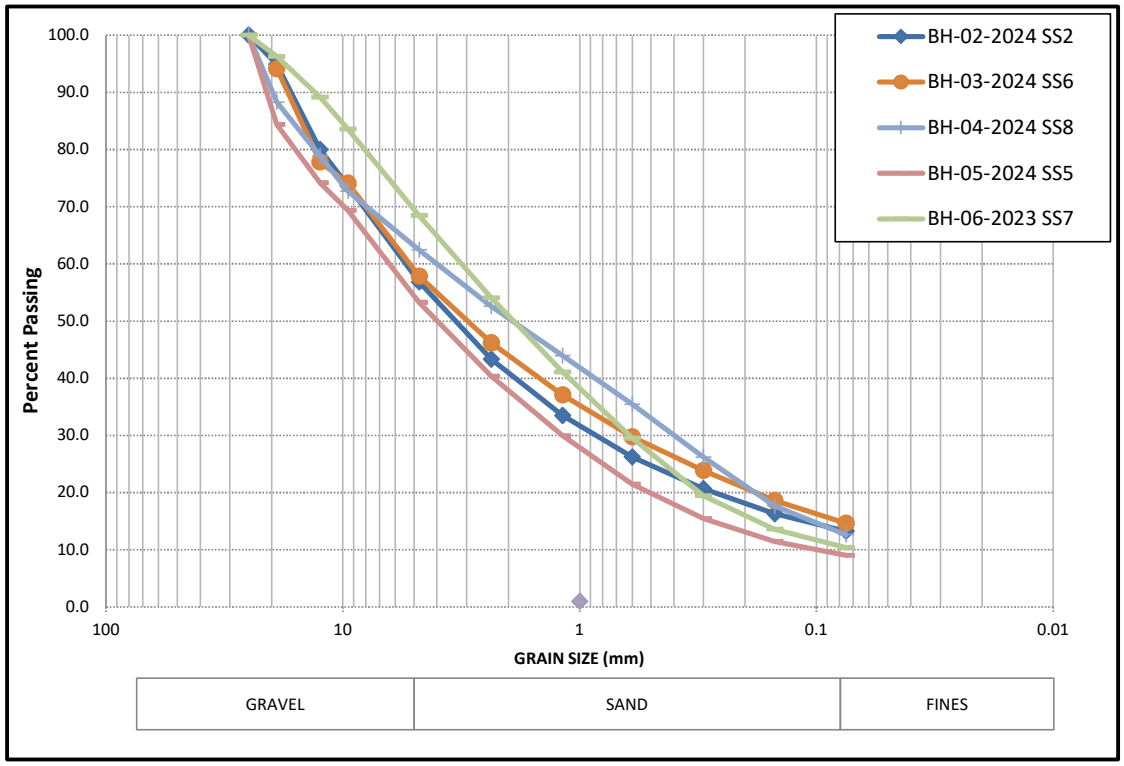
APPENDIX C

Grain Size Analysis

GRAIN SIZE REPORT

Project: Mahone Bay Living Shoreline Expansion Phase II
Client: Coastal Action
Project No: 231170.01

GRAIN SIZE DISTRIBUTION PLOT



SOIL CLASSIFICATION

Sample No	Depth(m)	Classification	Moisture Content (%)	Gravel (%)	Sand (%)	Silt and Clay (%)
BH-02-2024 SS2	1.2	Silty SAND with gravel (SM)	14.1%	43	44	13
BH-03-2024 SS6	4.3	Silty SAND with gravel (SM)	8.9%	42	43	15
BH-04-2024 SS8	4.3	Silty SAND with gravel (SM)	10.7%	38	49	13
BH-05-2024 SS5	3.3	Well graded GRAVEL with silt and sand (GW-GM)	12.4%	47	44	9
BH-06-2023 SS7	4.8	Well graded SAND with silt and gravel (SW-SM)	12.3%	32	58	10

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Comments: _____

Figure 1



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