

CI C0064966

Tusket Tidal Pool Fish Passage

REDACTED

March 13, 2026





NSEB APPROVAL SHEET

Project Title: Tusket Tidal Pool Fish Passage

CI Number: C0064966

Date: March 13, 2026

Expenditure Profile			Type of Filing	
Year	Budget Amount	Project Estimate	☒	Capital Project Authorization
2024	341,136	341,136	☐	Unforeseen and Unbudgeted (U&U)
2025	597,311	220,149	☐	Planned & Advanced (P&A)
2026	377,048	1,001,669	☒	Subsequent Approval Item
2027		201,017	☐	Authorization to Overspend (ATO)
			☐	Scope Change
			☐	Final Cost (FIN)
Total	\$1,315,495	1,763,971		

COMMENTS

Submitted on behalf of NOVA SCOTIA POWER INCORPORATED

Approved on behalf of NOVA SCOTIA ENERGY BOARD

Authorized Signatory
Dave Pickles
Chief Operating Officer

DATE
March 13, 2026

DATE

CI Number: C0064966

Title: Tusket Tidal Pool Fish Passage

Start Date: 2024/04
In-Service Date: 2026/04
Final Cost Date: 2027/05
Function: Hydro
Forecast Amount: \$1,763,971

DESCRIPTION:

The purpose of this project is to mitigate the risk of fish entrainment at a tidally influenced pool downstream of the Tusket Powerhouse. By raising berms along the pool and altering the northern entrance, NS Power can better manage how water enters and exits the pool. High-tide water levels will recede more slowly to ensure the pool does not drain rapidly and strand fish in the process. Water flow of 6 cubic feet per second (cfs) will also be routed to the pool through a piping system from the headpond. This will ensure there is constant re-oxygenation and sufficient water depth in the pool during annual fish migration season (April to November).

The Tusket Hydro System is located in Yarmouth County, Nova Scotia and consists of one hydroelectric generating station and three generating units (1929) that yield a generating capacity of 2.7 MW. There are four upstream reservoirs that capture the drainage area of 1,462 square kilometers. The Tusket Powerhouse is located near the mouth of the Tusket River and is tidally influenced. Adjacent to the tailrace, there is a tidally influenced pool that experiences inflows and outflows depending on the tide levels. At times, during inflow, fish are able to make their way into the tidally influenced pool where they may become stranded as the tide later ebbs.

Summary of Related CIs +/- 2 years:

Pursuant to Section 11.2 of the CEJC, related CIs for Hydro projects include “Work completed on the same generating unit and dam structures, but not necessarily the same asset.”

- No other projects in 2024, 2025, 2026, 2027 or 2028.

Depreciation Class: Hydraulic Production Plant – Tusket River Hydro System

Estimated Life of the Asset: 25 years

JUSTIFICATION:

Justification Criteria: Environment

Why do this project?

In the spring of 2022, a gaspereau fish mortality event occurred in the Tusket tidally influenced pool. The gaspereau entered the tidally influenced pool during high tide but as the tide lowered, the exit points to the tidally influenced pool were blocked, trapping the fish within the pool. This resulted in a large number of fish within a small amount of water, leading to oxygen depletion and fish mortality. There was a similar fish mortality event in the spring of 2023. At that time, NS Power implemented a temporary mitigation measure, which involved installing a pump operated during the fish migration season to ensure a continuous supply of oxygenated water to the pool and improve pool depth. This measure requires daily inspections to manage pump operations and to monitor the pool for fish.

This project must be completed to provide a permanent solution to mitigate additional fish mortality events during the fish run which begins on April 15 of each year. While the precise combination of tidal and weather conditions varies, the repeated events in 2022 and 2023 demonstrate a repeating mechanism: fish enter the tidally influenced pool at high tide and become trapped as the tide recedes, resulting in rapid dewatering, crowding, and dissolved oxygen depletion. Pumping is only considered a temporary solution to the root cause of the 2022 and 2023 fish mortality events. The investigation and study completed in 2023 and 2024, undertaken as a corrective action following the fish mortality events, confirmed that several assets were constricting the flow in and out of the tidal pool and contributing to mortality risk. These assets include an artificially constructed berm that has eroded in several locations and a deteriorated timber crib outlet structure on NS Power controlled lands that restricts safe fish passage. These assets require remedial works to remove entry points and ensure fish can safely enter and exit through the outlet structure.

As this tidally influenced pool is located on NS Power controlled lands adjacent to the Tusket powerhouse, thereby the Company has the responsibility to mitigate fish mortality, which requires a permanent solution.

Why do this project now?

This project must be completed before the 2026 gaspereau migration season starts and large numbers of fish migrate upstream. Once the fish begin to move upstream, there will be no opportunity to perform work in the tidally influenced pool until the upstream migration is complete. NS Power must complete this work before the 2026 migration to reduce operating costs, reduce resourcing requirements, and mitigate the potential for another fish mortality event.

NS Power has an environmental regulatory obligation to prevent avoidable fish mortality associated with its Hydro operations. DFO has previously issued formal directions on the Tusket system and has communicated expectations that permanent mitigations be implemented prior to the next migratory season. After the event in 2023, DFO issued a directive to NS Power that immediate measures must be taken to prevent further risk of mortality. This order was rescinded once the temporary measure of water pumping was implemented. However, this requirement to prevent further risk of mortality is unchanged and this project implements a permanent solution to resolve this issue.

This project is deemed in-service when the alterations to the tidally influenced pool and the modifications to the fourth bay for fish entrapment mitigation are forecast to be completed (April 2026); therefore, the Final Cost Date (May 2027) is listed as six months after final project activities for site inspections and monitoring are forecast to be completed (November 2026).

Why do this project this way?

NS Power engaged Wood Canada through a competitive procurement process to perform an investigation of the site and provide design alternatives to mitigate the issue. The report completed by Wood Canada in 2023 provided several options to remediate the tidally influenced pool (please refer to Attachment 1). Eight options were divided between alterations that still allowed the fish into the tidally influenced pool and ones that restricted access. The options were assessed based on several criteria including fish access and risk of stranding, constructability, footprint, potential for sediment runoff, project execution schedule, permitting requirements, long term maintenance, and capital cost. Option A-2 was the preferred alternative presented in the report and was recommended by Wood. This option was recommended in the report as it is the least cost option that meets all of the project requirements. The final design option was chosen based on the above and extensive discussions between the project team, environmental services, and the Mi'kmaq of Nova Scotia.

The recommended option raises the berm along one side of the pool to an elevation that will only allow fish to enter the tidally influenced pool from the side during extreme high tides, restricting the regular entrance into the pool to a single location. By restricting the entrance to a single location, water levels within the tidally influenced pool will naturally stay higher for longer, as the pool discharge on the receding tide will also be restricted. The single entrance to the tidally influenced pool will be modified by installing a timber crib structure to ensure that the entrance/exit to the tidally influenced pool remains a consistent size, clear from vegetation growth and sedimentation. To further ensure that any fish trapped within the tidally influenced pool during the low tide can survive until water elevations within the tidally influenced pool rise with the incoming tide 6 cfs of water will be supplied to the tidally influenced pool with the installation of a piping system, where the water will be supplied by water from the fourth bay of the Tusket Powerhouse. The permanent piping system ensures that there is constant flow to the tidally influenced pool with minimal need for operator intervention.

Contingency Statement

Contingency for this project has been determined using a combination of internal subject matter experts' experience with work on the system and within hydro (Professional Engineers) and the non-binding contingency guidelines. Consistent with the maturity matrix, this project is being filed as a Class 3 estimate with contingency value of 15 percent. Risks intended to be covered by the contingency include issues with water management (sealing cofferdams, dealing with tide levels, storm surge, etc.), potential need for additional soils work, possible overtime for extended working days to meet deadlines, unknown conditions within the powerhouse, potential delays receiving all of the required permits to execute the project, potential need to halt construction at the start of the upstream fish migration and resumption after the migration is complete, and potential weather delays.

Reason for Variance

The increase of \$448,476 from the 2026 ACE Plan subsequent submittal estimate of \$1,315,495 is due to changes in the final design compared to the conceptual design. The preliminary design included 6 cfs of water flow routed from the headpond to the tidally influenced pool. This option was determined to be unfeasible due to high potential areas for archaeology. The final design involves routing 6 cfs of water flow from within the powerhouse, which required a condition assessment of the 4th bay and further design efforts to support the change. The work to route the 6 cfs from the powerhouse requires more construction effort due to alterations needed within the powerhouse spare bay. It also requires more materials in comparison to the original concept. Additionally, the actual construction costs from the RFP were higher than what was originally estimated for the work based on Wood's Class 5 estimate.

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.



Instructions: Select option in Column B.
Columns C through G will auto-populate.

Document No: XXX-XX-XXXX-XXXX

Project Cost Estimate Input Checklist and Maturity Matrix						
Hydropower	Required fields:	Estimate Classification				
Project Name: C0064966 Tusket Tidal Pool Fish Passage	Started or Preliminary	Class 5	Class 4	Class 3	Class 2	Class 1
Maturity Level of Project Definition Deliverables	Defined or Complete					
General Project Data						
A. Scope						
Project Scope of Work Description	Defined (D)	P	P	D	D	D
Site Infrastructure (Access, Construction Power, Camp, etc.)	Defined (D)	NR	P	D	D	D
B. Capacity						
Facility Output / Production Profile	Not Applicable (NA)					
Electrical Power Requirements (when not the primary capacity driver)	Not Applicable (NA)	NR				
C. Project Location						
Plant and Associated Facilities	Defined (D)	P	P	D	D	D
D. Requirements						
Codes and/or Standards	Defined (D)	NR	P	D	D	D
Communication Systems	Not Applicable (NA)	NR				
Fire Protection and Life Safety	Not Applicable (NA)	NR				
Environmental Monitoring	Defined (D)	NR	NR	P	P	D
E. Technology Selection						
Not Applicable						
F. Strategy						
Contracting/Sourcing	Defined (D)	NR	P	D	D	D
Escalation	Defined (D)	NR	P	D	D	D
G. Planning						
Regulatory Approval & Permitting	Defined (D)	P	P	D	D	D
Material Utilization (Borrow Sources)	Defined (D)	P	P	P/D	D	D
Logistics Plan	Defined (D)	P	P	P	D	D
Work Breakdown Structure (WBS)	Defined (D)	P	P	P/D	D	D
Decommissioning/Demolition Plan	Defined (D)	NR	P	D	D	D
Integrated Project Plan	Defined (D)	NR	P	D	D	D
Project Code of Accounts	Defined (D)	NR	P	D	D	D
Project Schedule	Defined (D)	NR	P	D	D	D
Risk Register	Preliminary (P)	NR	P			
Stakeholder Consultation/Engagement/Management Plan	Defined (D)	NR	P	D	D	D
Start-up & Commissioning Plan	Preliminary (P)	NR	P	P/D		
H. Studies						
Hydraulics	Defined (D)	P	P	D	D	D
Topography & Bathymetry	Defined (D)	P	P	P/D	D	D
Environmental Impact/Sustainability Assessment	Defined (D)	NR	P	D	D	D
Environment/Existing Conditions	Defined (D)	NR	P	D	D	D
Soils & Hydrology	Not Applicable (NA)	NR				
Geotechnical Investigation	Not Applicable (NA)	NR				
Technical Deliverables (Specifications and/or Drawings)						
Block Flow Diagrams	Not Applicable (NA)					
Hydraulic Design & Probable Maximum Flood (PMF)	Not Applicable (NA)					
Equipment Data Sheets	Not Applicable (NA)	NR/S				
Equipment Lists: Electrical	Not Applicable (NA)	NR/S				
Equipment Lists: Process/Utility/Mechanical	Complete (C)	NR/S	P	C	C	C
Design Specifications	Complete (C)	NR	S/P	C	C	C
Electrical One-Line Drawings	Not Applicable (NA)	NR				
General Equipment Arrangement Drawings	Not Applicable (NA)	NR				
Instrument List	Not Applicable (NA)	NR				
Construction Permits	Not Applicable (NA)	NR				
Civil/Site/Structural/Architectural Discipline Drawings	Complete (C)	NR	S/P	P	C	C
Demolition Plans and Drawings	Complete (C)	NR	S/P	P	C	C
Erosion Control Plan & Drawings	Complete (C)	NR	S/P	P	C	C
Fire Protection & Life Safety Drawings & Details	Not Applicable (NA)	NR				
Mitigation Measures (Aquatic, Terrestrial, Heritage, etc.)	Complete (C)	NR	P	P	C	C
Dam Design & Drawings	Not Applicable (NA)	NR				
De-silting Basins	Not Applicable (NA)	NR				
Gates & Cranes Design & Drawings	Not Applicable (NA)	NR				
Intake Design & Drawings	Not Applicable (NA)	NR				
Penstock Design & Drawings	Not Applicable (NA)	NR				
Powerhouse Design & Drawings	Not Applicable (NA)	NR				
Spillway Design & Drawings	Not Applicable (NA)	NR				
Turbine and Generator Design & Drawings	Not Applicable (NA)	NR				
Electrical Schedules	Not Applicable (NA)	NR	NR/S			
Instrument & Control Schedules	Not Applicable (NA)	NR	NR/S			
Instrument Data Sheets	Not Applicable (NA)	NR	NR/S			
Spare Parts Listings	Not Applicable (NA)	NR	NR			
Electrical Discipline Drawings	Not Applicable (NA)	NR	NR			
Facility Emergency Communication Plan & Drawings	Not Applicable (NA)	NR	NR			
Information Systems/Telecommunication Drawings	Not Applicable (NA)	NR	NR			
Instrumentation/Control System Discipline Drawings	Not Applicable (NA)	NR	NR			
Mechanical Discipline Drawings	Complete (C)	NR	NR	S/P	P/C	C
Auxiliary Electrical Design & Drawings	Not Applicable (NA)	NR	NR			
Auxiliary Mechanical Design & Drawings	Not Applicable (NA)	NR	NR			
Protection & Controls System Design & Drawings	Not Applicable (NA)	NR	NR			
Total # Deliverables for Class Estimate		8	27	28	27	27
% Defined/Complete towards Class Estimate		100%	100%	97%	93%	93%

Comments:

This project is being filed as a Class 3 estimate. The defined deliverables for this project indicate that 97% of Class 3 deliverables are completed. A contingency value of 10% was selected to account for specific risks include issues with water management, need for additional soils work, possible extended working days to meet permit deadlines, unknown conditions within powerhouse, and potential weather delays.

Legend:

The maturity level is an approximation of the completion status of the deliverable. The completion is indicated by the following descriptors:

General Project Data:

- Not Required (NR): May not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.
- Preliminary (P): Project definition has begun and progressed to at least an intermediate level of completion. Review and approvals for its current status has occurred.
- Defined (D): Project definition is advanced, and reviews have been conducted. Development may be near completion with the exception of final approvals.

Technical Deliverables:

- Not Required (NR): Deliverable may not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.
- Started (S): Work on the deliverable has begun. Development is typically limited to sketches, rough outlines, or similar levels of early completion.
- Preliminary (P): Work on the deliverable is advanced. Interim, cross-functional reviews have usually been conducted. Development may be near completion except for final reviews and approvals.
- Complete (C): The deliverable has been reviewed and approved as appropriate.

Inclusions

For the purposes of this document, the term *hydropower industries* is assumed to include private and public utilities involved with the production of electrical power, exclusive of transmission and distribution, using natural gravitational force of falling or flowing water, excluding tidal forces, to drive a turbine that powers a generator.

The common thread among private and public utilities (for the purpose of estimate classification) is their reliance on user requirements, statement of objectives, design reports (i.e. geotechnical investigations, sourcing borrow materials and hydraulic design/modeling) and/or environmental data collection and studies as primary scope defining documents. These documents are key deliverables in determining the degree of project definition, and thus the extent and maturity of estimate input information.

Cost estimates for hydropower facilities are typically composed of key features such as:

- Reservoir area preparation (e.g., clearing, removal of structures and earthmoving).
- River management (e.g., cofferdams, diversion channels or tunnels, sediment management plans, environmental monitoring programs).
- Principal structures (e.g., dams, dykes, intakes, penstocks, powerhouse(s), low level outlet(s), power tunnel(s), de-silting basin(s), and spillway structure(s)).
- Permanent infrastructure (e.g., access roads, railroads, bridges, offices, warehouse and housing).
- Temporary infrastructure (e.g., construction camp, site access roads, airport, workshops, construction power etc).
- Environmental mitigation features (e.g. fish ladder(s), water bypass and creation of new fish or wildlife habitat).
- Owner's costs (e.g., stakeholder involvement, licensing, studies and investigations, administration and overhead, catering.).

Some, but not all, of these features are unique to the hydropower industries.

Typical hydropower facilities may include: turbines, generators, excitors, governors, transformers, gates for intake, spillway and draft tubes, and supporting electrical, mechanical, telecom, protection, and control systems. The water storage reservoir is typically required to support the operations of the hydropower facility.



Tusket Tidal Pond – Concept Design Report

Project No. 260233

Nova Scotia Power Inc.

1223 Lower Water Street, Halifax NS B3J 3S8



Wood Canada Limited
133 Crosbie Road
P.O. Box 9600
St. John's, NL A1A 3C1
Canada
T: (902) 724-1900
F: 709-739-5458
www.woodplc.com

December 19, 2023

Browren Allard, P.Eng., MBA
Senior Project Manager, Capital Projects
Nova Scotia Power Inc.
1223 Lower Water Street
Halifax, NS B3J 3S8

Via Email: browren.allard@nspower.ca

Dear Ms. Allard,

Re: Tusket Tidal Pond – Concept Design Report

Please find attached one (1) PDF file of the Tusket Tidal Pond – Concept Design Report

Thank you for the opportunity to work with you and your staff on this project. Please contact us if you require any explanation or further discussion.

Sincerely,

A handwritten signature in blue ink, appearing to read "Ellis O'Neil".

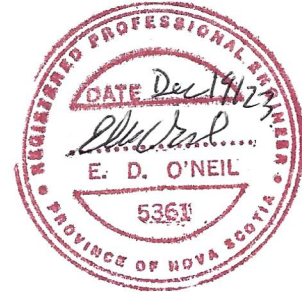
Ellis O'Neil, P.Eng.
Senior Project Manager

EO

Tusket Tidal Pond – Concept Design Report

Prepared for:

Nova Scotia Power Inc.



0	December 19, 2023	Final				
REV.	DATE	REVISION(S)	PREPARED BY	CHECK	APP	CLIENT
TUSKET TIDAL POND – CONCEPT DESIGN REPORT						
			Wood Job No. 260233			
			DOCUMENT NO. 260233-0000-DD10-RPT-0001		REV. 0	
			PAGE 1 OF 1			

IMPORTANT NOTICE

This Document was prepared exclusively for Nova Scotia Power Inc., by Wood Canada Limited, a wholly owned subsidiary of John Wood Group PLC. The quality of information contained herein is consistent with the level of effort agreed in the scope of services and is based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this Document. This Document is intended to be used by Nova Scotia Power Inc. only, subject to the terms and conditions of its contract with Wood Canada Limited. Any other use of, or reliance on, this Document by any third party is at that party's sole risk.

ENF.04 Rev. 2

DISCLAIMER

This report is prepared for Nova Scotia Power Inc. (the “Client”) by Wood Canada Limited (the “CONSULTANT”) and is subject to the following limitations, qualifications, and disclaimers:

1. The report is intended for the exclusive use of the Client, including its affiliates and third-party contractors and consultants engaged by the Client from time to time in relation to the Project, and it may not be used or relied upon in any manner or for any purpose whatsoever by any other party.
2. The report is **Tusket Tidal Pond – Concept Design Report** (the “Project”). Data required to support detailed engineering assessments have not always been available and in such cases engineering judgements have been made which may subsequently turn out to be inaccurate. There are, therefore, risks inherent in the Project which are outlined in the report. The CONSULTANT accepts no liability beyond using reasonable diligence, professional skill and care in preparing the report in accordance with the standard of care, skill, and diligence expected of professional engineering firms performing substantially similar work at the time such work is performed, based on the circumstances the CONSULTANT knew or ought to have known based on the information it had at the date the report was written and after due inquiry based on that information.
3. The CONSULTANT shall not be responsible or liable for any interpretation or recommendation made by others including any determination in respect of any sale by the Client or any purchase by any third party or any valuation in respect of the Project based in whole or in part on the data, interpretations and/or recommendations generated by the CONSULTANT in the report.
4. The work described in the report is based solely upon the site visit carried out on November 9, 2023, by the CONSULTANT, and the information received from the Client.
5. The report speaks only as of its date and to conditions observed at that time, which conditions may change (or may have changed) by virtue of the passage of time or due to direct or indirect human intervention causing any one or more changes in plans or procedures or due to other factors.
6. The report does not extend to any latent defect or other deficiency in the Project which could not have been reasonably discoverable or discovered by such observation, with the exception of any latent defect or other such deficiency of which the CONSULTANT had actual knowledge.
7. The report is to be read in conjunction with all other data and information received and referenced throughout the report, and all correspondence between the Client and the CONSULTANT. Except as stated in the report, the CONSULTANT has not made any independent verification of such data and information and does not have responsibility for the accuracy or completeness thereof.

Table of Contents

1.0	Introduction	6
1.1	Description of the System	6
1.2	Background	6
1.3	Objective	18
1.4	Basis of Design / Design Criteria	18
2.0	Design Approach	20
2.1	General	20
3.0	Concept Design Options	20
3.1	General	20
3.2	Option A-1: Block All Inflow to Tidal Pond to Typical High-Water Level, Except the Channel at Most Downstream End	20
3.2.1	Description.....	20
3.2.2	Capital Cost Estimate and Construction Schedule	21
3.2.3	Drawings.....	21
3.3	Option A-2: Same as Option A-1, but Provide an Additional 6 cfs Inflow.	23
3.3.1	Description.....	23
3.3.2	Capital Cost Estimate and Construction Schedule	23
3.3.3	Drawings.....	23
3.4	Option A-3: Same as Option A-2, Except Block All Inflow to Tidal Pond to Unusual High-Water Levels	25
3.4.1	Description.....	25
3.4.2	Capital Cost Estimate and Construction Schedule	25
3.4.3	Drawings.....	25
3.5	Option A-4: Same as Option A-3, Except Provide Additional Entrance to Existing Fishway to Provide Upstream Passage Out of the Tidal Pond	27
3.5.1	Description.....	27

3.5.2	Capital Cost Estimate and Construction Schedule	27
3.5.3	Drawings.....	27
3.6	Option A-5: Same as Option A-4, Except Block All Inflow to Tidal Pond to Typical High-Water Level.....	29
3.6.1	Description.....	29
3.6.2	Capital Cost Estimate and Construction Schedule	29
3.6.3	Drawings.....	29
3.7	Summary of Options A-1 to A-5	31
3.8	Option P-1: Block All Inflow to Tidal Pond to Unusual High-Water Levels, and Place Hung Culvert with an Aboiteau Gate on Downstream End and Raise the Berm	32
3.8.1	Description.....	32
3.8.2	Capital Cost Estimate and Construction Schedule	32
3.8.3	Drawings.....	32
3.9	Option P-2: Infill the Tidal Pond Area to the Level of the Grasses in the Wetland (No Open Standing Water Visible) and Patch the Berm	34
3.9.1	Description.....	34
3.9.2	Capital Cost Estimate and Construction Schedule	34
3.9.3	Drawings.....	34
3.10	Option P-3: Infill the Tidal Pond Area to the Level of the Tree Line (Top of Existing Berm).....	36
3.10.1	Description.....	36
3.10.2	Capital Cost Estimate and Construction Schedule	36
3.10.3	Drawings.....	36
3.11	Summary of Key Considerations and Functionality of Each Option.....	38
3.12	Other Options Considered.....	38
4.0	Pros and Cons, and Additional Risks	39
5.0	Conclusions and Recommendations.....	61

5.1	Conclusions.....	61
5.2	Recommendations.....	62

1.0 Introduction

1.1 Description of the System

The Tusket Hydro System is located in Yarmouth County, Nova Scotia and is owned and operated by NSPI. This hydro system has been in continuous operation since 1929 and consists of one (1) hydroelectric generating station containing three (3) generating units with a combined generating capacity of 2.7 MW and a combined rated discharge of 2,012 cfs. It also includes four storage reservoirs at Lake Vaughan, Raynards/Carleton Lake, Mink Lake and Great Barren Lake.

The main tributary of the Tusket watershed, the Tusket River, drains into the Atlantic Ocean. The headwaters of the watershed begin at Long Tusket Lake in the north and Oakland Lake to the northeast. The Tusket powerhouse is located near the mouth of the Tusket River.

The Tusket hydro system has a drainage area of 1462 km², with the runoff captured in the storage reservoirs and diverted through a power canal from Lake Vaughan (impounded by Tusket Main Dam) to the Tusket powerhouse. The location of the Tusket hydro system is shown in Figure 1-1. A site plan showing the location of the Tusket powerhouse in relation to the Tusket Main Dam is presented in Figure 1-2.

1.2 Background

In the spring of 2022 and 2023, NSPI experienced fish mortality events involving gaspereau downstream of the Tusket powerhouse and powerhouse fish ladder (see Figure 1-3) during the upstream gaspereau spawning migration to the freshwater reservoirs, lakes, and ponds of the watershed above the powerhouse. The water levels in the vicinity of the tailrace of the Tusket powerhouse are tidally influenced, and the fish have the potential to enter the tidal pond on the rising tide through the various channels shown in Figures 1-4 and 1-5. (Photos of these areas taken on November 9, 2023, are shown in Table 1-1 at the end of this Section). The fish can become trapped in the tidal wetland pools when water levels drop as the tide recedes and outlets become too shallow for downstream passage back to the river (see Figures 1-6 and 1-7 for deep areas within the tidal pond). When the numbers of fish in the remaining tidal pond are high, they deplete the oxygen levels in the remaining water pools and the trapped fish perish.

Modifications to the powerhouse fish ladder were made in Summer/Fall 2022 to try to improve fish passage around the powerhouse. While this improved passage, it did not prevent the fish mortality in the tidal pond in 2023. This is partially due to the fish being attracted into the tidal pond area by riding in on the rising tide through multiple entrances to the pond downstream of the fishway, and actively swimming into the pond attracted by the flow as the water level begins to fall. The flow in and out of the tidal pond area during every tidal cycle attracts fish before they reach the powerhouse fishway. Once in the tidal pond, they have no access to the fishway.

The environmental conditions that resulted in the fish kill are not clear. The movement of gaspereau in and out of the pond occurs each day during the migration run, but there was only one large, recorded kill in each of 2022 and 2023 and other smaller kills through the season. The tide levels and range on May 2, 2023, the day of the fish kill, were not unusually high. The run had just become strong, with gaspereau seen finning in the tailrace and the tidal pond in the late morning that day. By mid-afternoon, the tailrace level had dropped with the falling tide and the outlet channel by the fishway was almost dry. As observed on later site visits, the low water level at this channel near the fishway means all the other channels to the river

were either dry or too low for the fish to escape. The following days had similar observation in the tailrace of finning fish, the same powerhouse flow and spill at the main dam, with higher tidal ranges, but no additional noticeable fish kills those days. The environmental conditions that resulted in the fish being trapped perhaps need further study but it is clear that the outlets were too shallow for the fish to escape back down to the river, and the high number of fish in the ponds would deplete the oxygen levels. The resulting kills can be large as on May 2nd, 2023, or smaller kills on other dates but this does not happen on every tide. Therefore, it is now necessary to design and implement additional remediation measures to prevent further fish mortalities at the Tusket Powerhouse before the Spring 2024 upstream gaspereau migration.

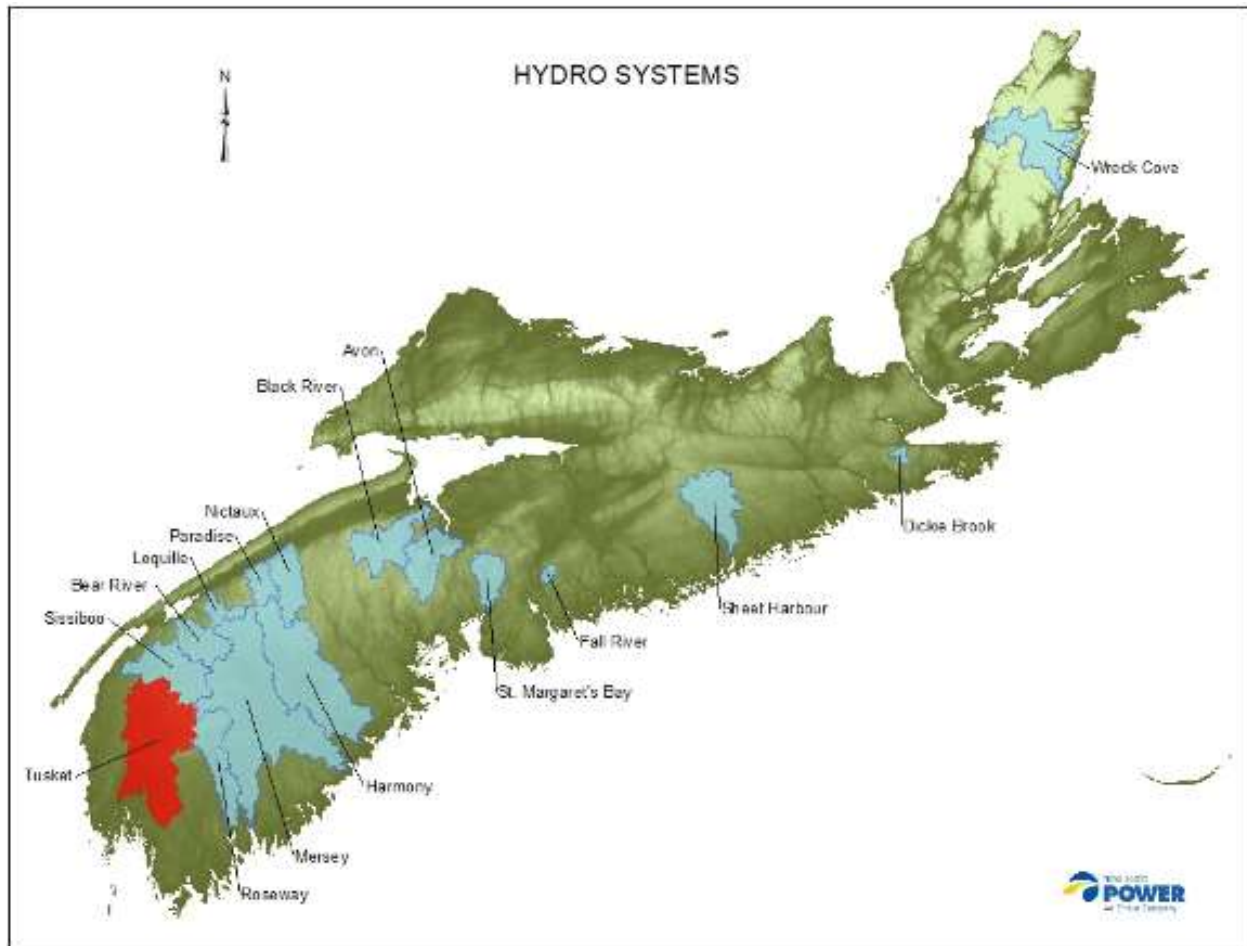


Figure 1-1: Location of Tusket Hydro System



Figure 1-2: Site Plan Showing the Location of Tusket Powerhouse in Relation to the Tusket Main Dam.



Figure 1-3: General Arrangement of Tusket Powerhouse and Tidal Pond



Figure 1-4: Primary Inflow/Outflow Channels to/from Tidal Pool Area – See photos in Table 1-1

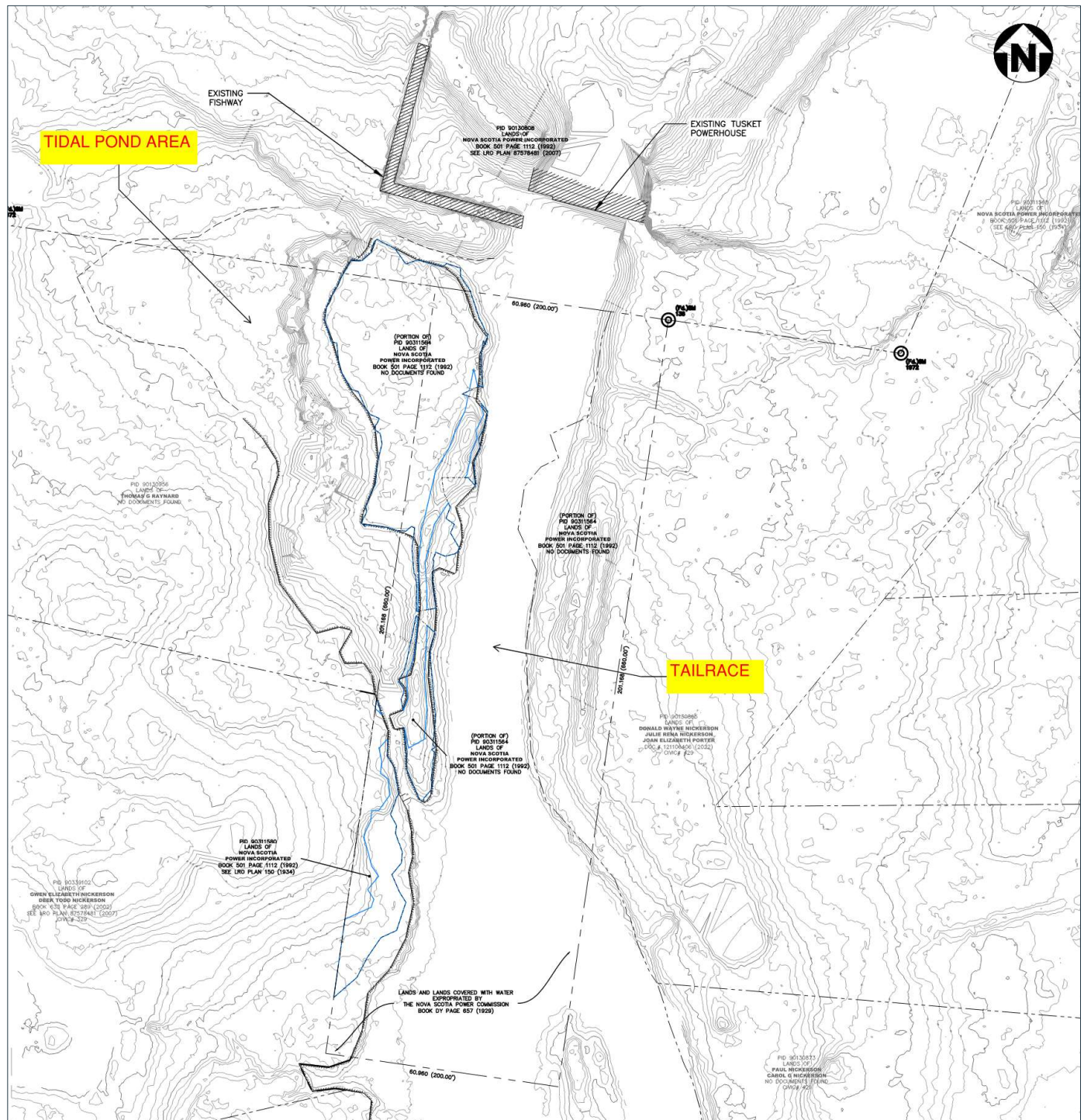
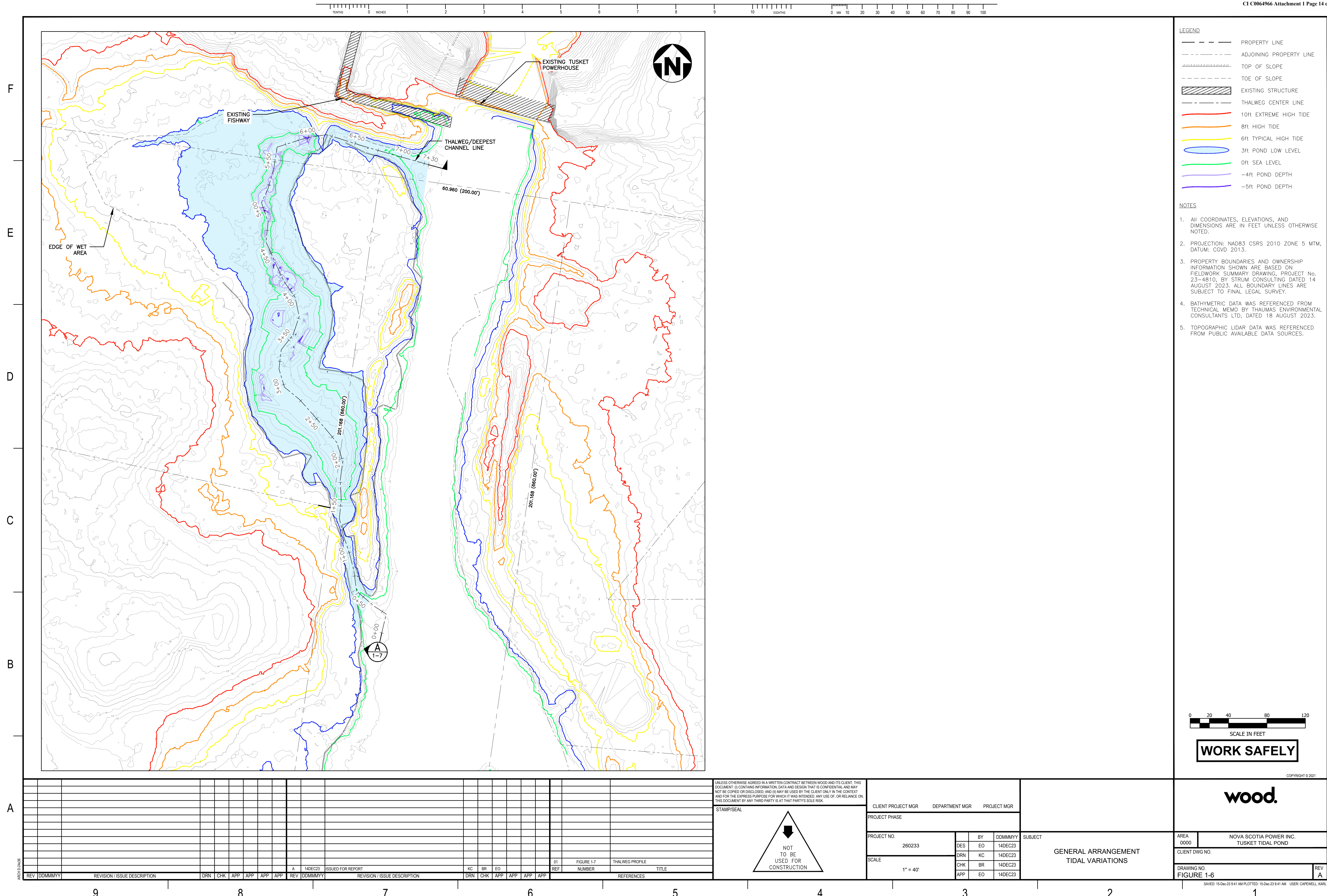


Figure 1-5: LiDAR Contours and Property Lines



F

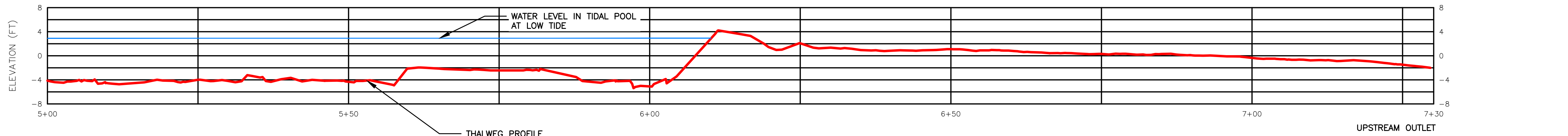
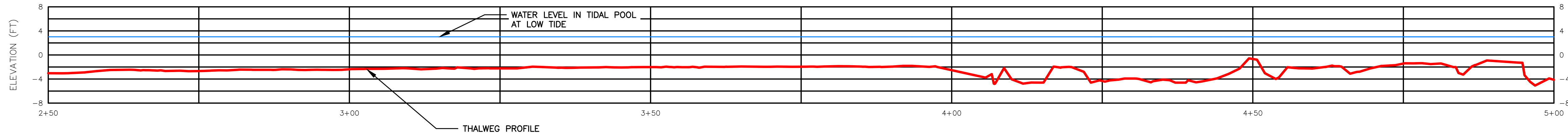
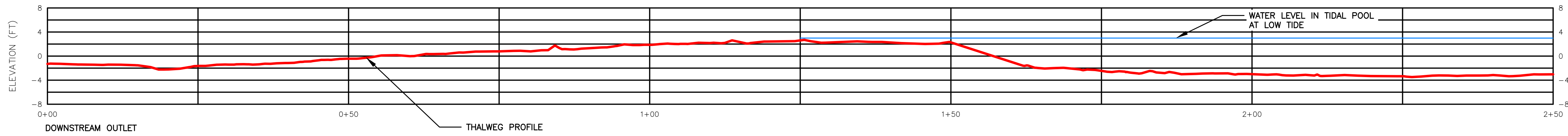
E

D

C

B

A



PROFILE
SCALE: 1" = 10'

A
1-6

NOTES

1. ALL ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
2. PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
3. BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
4. TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.



SCALE IN FEET

WORK SAFELY

COPYRIGHT © 2021

wood.

CLIENT PROJECT MGR DEPARTMENT MGR PROJECT MGR

PROJECT PHASE

PROJECT NO. 260233

SCALE 1" = 40'

DES	EO	DDMMYY
DRN	KC	14DEC23
CHK	BR	14DEC23
APP	EO	14DEC23

SUBJECT
GENERAL ARRANGEMENT
THALWEG PROFILE

AREA 0000 NOVA SCOTIA POWER INC. TUSKET TIDAL POND

CLIENT DWG NO.

DRAWING NO. FIGURE 1-7

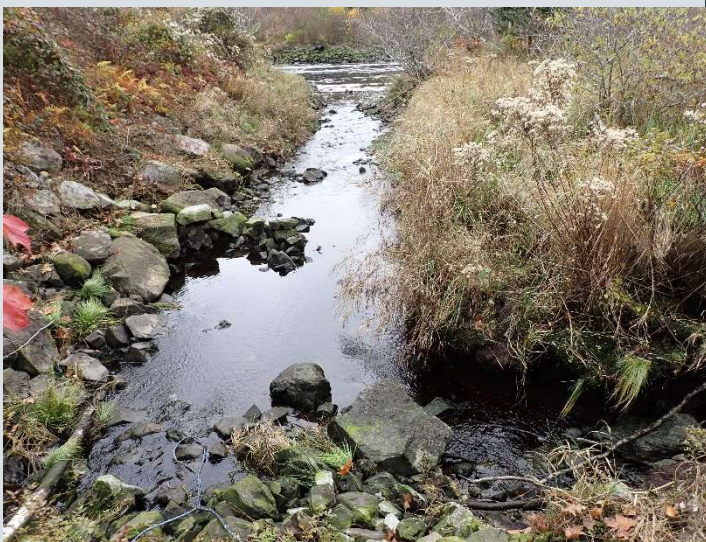
000 FILE: C:\USERS\KARL.CAPEWELL\DOCUMENTS\TUSKET TIDAL\FIGURE 1-7.DWG

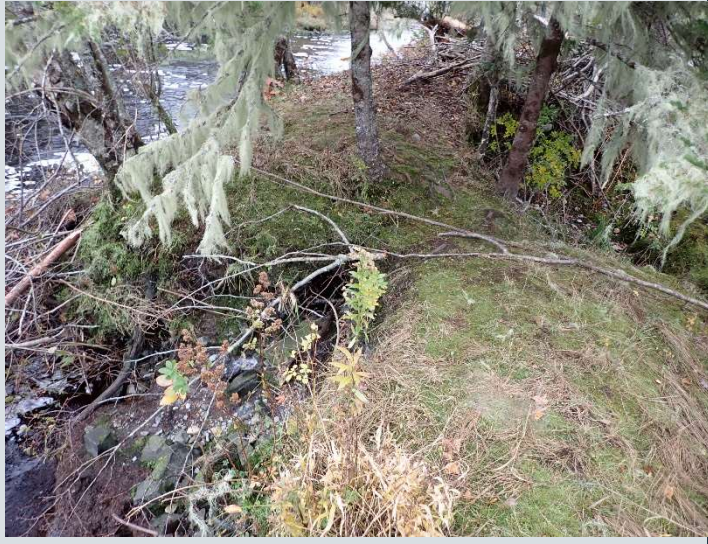
As previously noted, and shown in Figures 1-6 and 1-7, when the tidally influenced river water level drops below the +3 ft elevation, the tidal pool water level cannot drop any further (the blue line and blue-shaded area in Figure 1-6 illustrates the lowest the tidal pool water level can drop) due to the relatively high elevation of the two outlets from the tidal pond; one at the top end by the fishway, and one at the downstream end, both of which are at approximately the +3 ft elevation. This leaves a large tidal pool with water depths up to 8 feet deep and a series of deep pockets 7 feet deep during the low tide. Within the pond, the green line shown in Figure 1-6 is the zero-sea level elevation, the light purple lines are the -4 ft elevation, the dark purple lines are the -5 ft elevation pockets.

The high-water level in the tidal pond varies with the tide and the river flow combined, which makes predicting the highwater level on any particular day difficult at the tidal pond location. The high-water level varies between the 6 ft elevation (yellow line) on a typical tide and river flow, the 8 ft elevation (orange line) on a high tide with higher river flow, and the 10 ft elevation (red line) on extreme tide with very high river flow. Maximum water levels caused by very high tides and river flood conditions can raise the water level even higher.

The area between the blue and yellow lines in Figure 1-6 is grassed wetland. There is a line shown in Figure 1-6 running from the downstream end starting at Station 0+00 ft through the pond and out the upstream channel ending at Station 7+30 ft representing the thalweg or deepest part of the outlet channels and the pond. This section (profile) through the channels and tidal pond is shown in Figure 1-7, with the blue line at the +3 ft level representing the low pond water level and the grey line representing the bottom elevation. The outlet controls are at 1+50 ft at the downstream end and 6+25 ft at the upstream end where the blue line “low pond level” lines end. The bottom may be deeper than this as the pond likely has an accumulation of organics on the bottom from the wetland.

Table 1-1: Photos of Inflow/Outflow Channels to/from Tidal Pond Area

Identified inlet/ outlet locations	Location NAD83 (Approximate)	Nov 9, 2023, photos
1. Channel at upper end near fishway	43 52 55.296N 065 58 42.240W	
2.	43 52 55.314N 065 58 42.444W	

3.	43 52 54162N 065 58 41.124W	
4.	46 52 54.132N 065 58 40.860W	

5.	43 52 52.242N 065 58 42.306W	
6. Downstream channel outlet.	43 52 51.312N 065 58 41.640W	

1.3 Objective

The objective of this project is the provision of conceptual and detailed design for a suitable solution that will alleviate the potential for stranding fish in the Tusket Tidal Pond located to the right of the Tusket powerhouse tailrace. The remediation must prevent fish in the Tusket River from becoming stranded and dying during periods of low water and/or low dissolved oxygen.

1.4 Basis of Design / Design Criteria

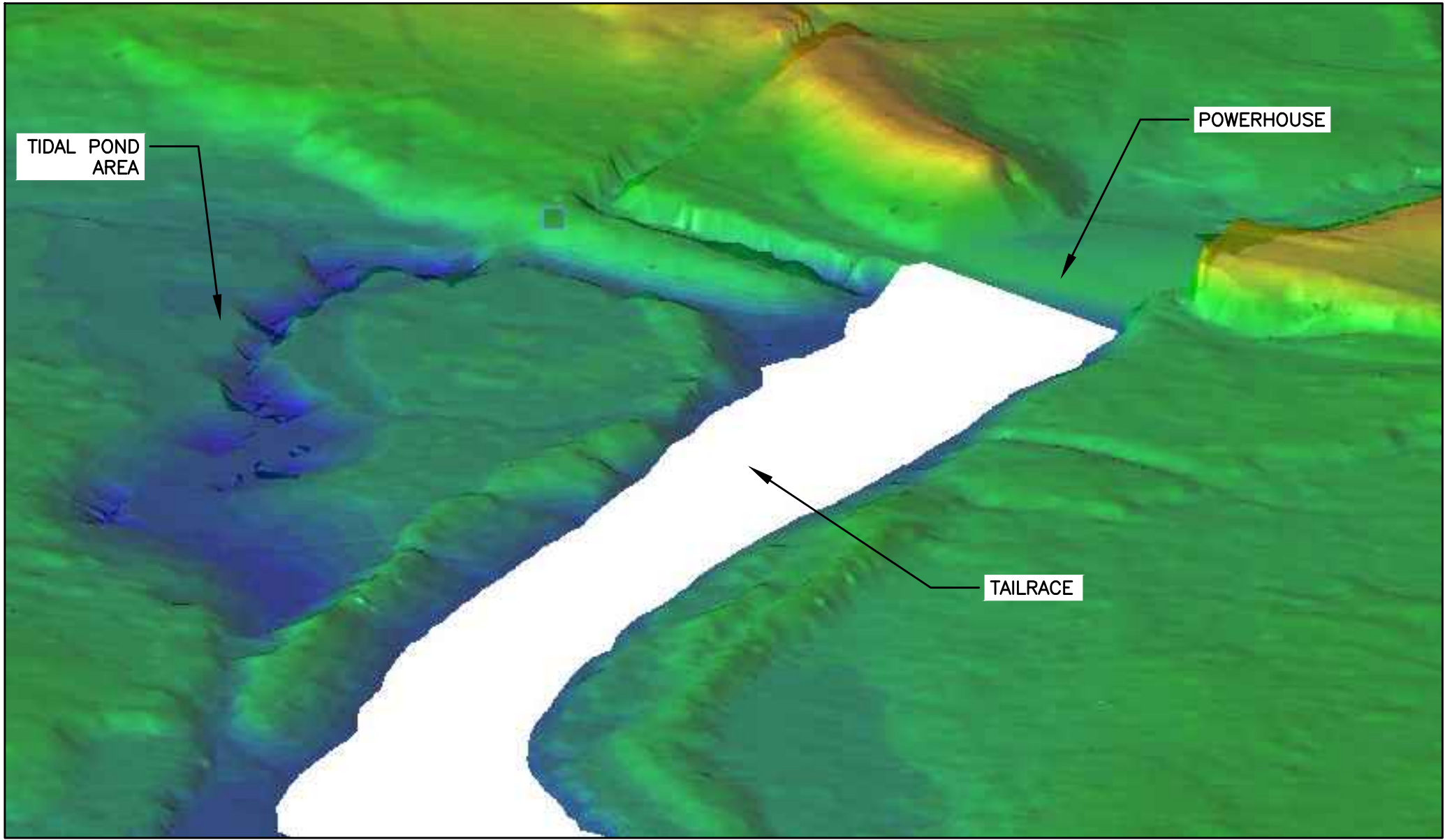
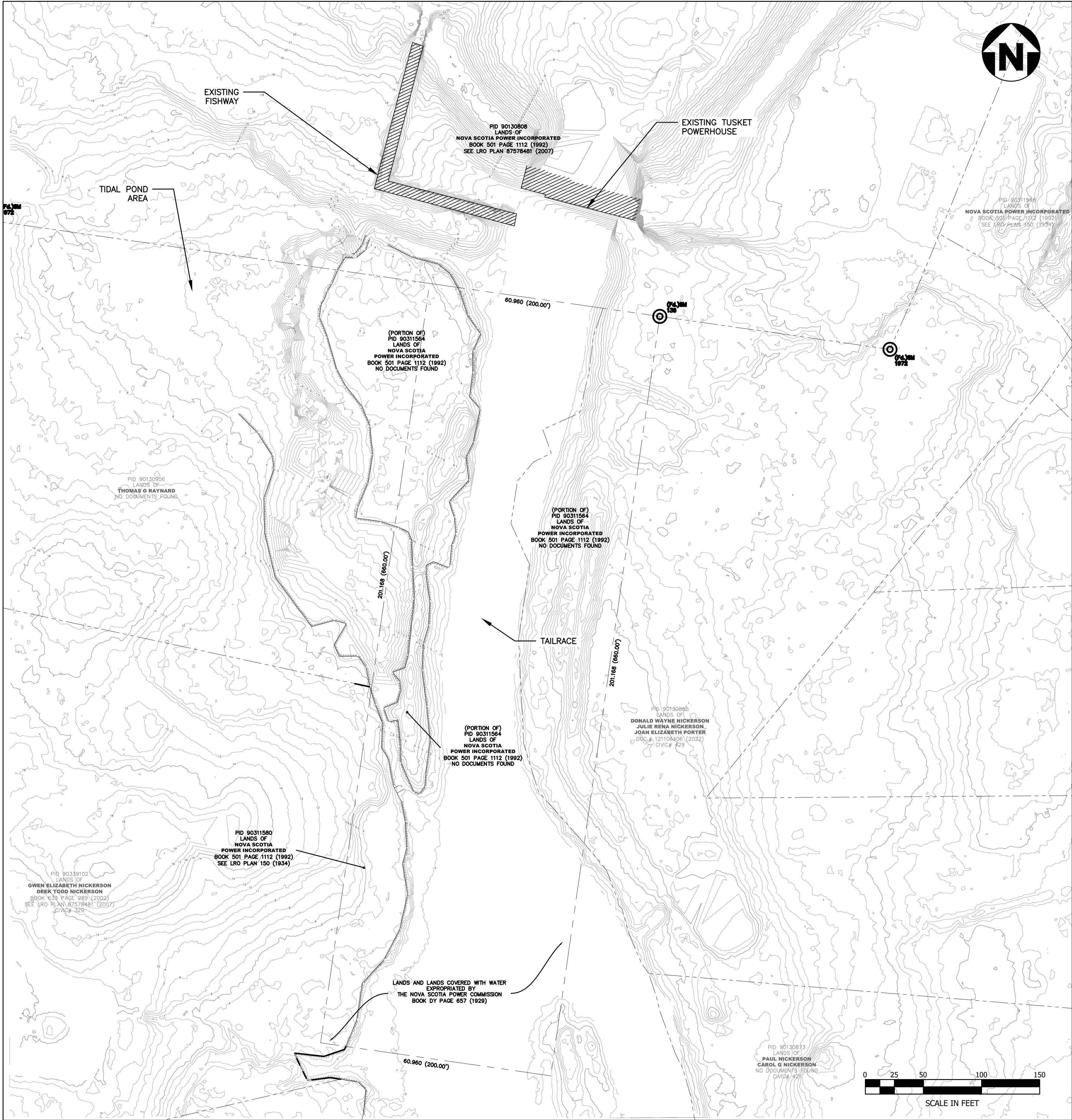
The concept design development work is based on a review of previous reports and documentation provided by NSPI, as well as the site inspection carried out by Wood on November 9, 2023, accompanied by NSPI personnel. The previous reports and documentation are noted in this report. No topographic field surveys or field geotechnical investigations were carried out as part of this work. The available provincial LiDAR data was used as the backdrop for the concept designs. The overall configuration of the existing site based on this LiDAR is shown on Drawing SK-001.

The remedial options presented in this report are intended to alleviate the potential for gaspereau stranding in the Tusket Tidal Pond located to the right of the Tusket powerhouse tailrace, while still allowing the Tusket powerhouse to operate effectively.

The following criteria were considered in developing the concept designs:

- Reliability of concept design at alleviating the potential for stranding gaspereau;
- Constructability;
 - Required installation by spring 2024 prior to gaspereau upstream migration (winter construction)
 - Limited access to construction area
 - Boggy area
 - Water control during construction
 - Availability of construction materials
- Reduced construction footprint to minimize impact on the site (environmental, archaeological);
- Potential for sediment runoff from construction site (proximity to watercourse);
- Long term maintenance requirements; and,
- Capital cost.

F
E
D
C
B
A



- LEGEND**
- PROPERTY LINE
 - ADJOINING PROPERTY LINE
 - TOP OF SLOPE
 - TOE OF SLOPE
 - EXISTING STRUCTURE
- NOTES**
1. ALL COORDINATES, ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
 2. PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
 3. PROPERTY BOUNDARIES AND OWNERSHIP INFORMATION SHOWN ARE BASED ON FIELDWORK SUMMARY DRAWING, PROJECT No. 23-4810, BY STRUM CONSULTING DATED 14 AUGUST 2023. ALL BOUNDARY LINES ARE SUBJECT TO FINAL LEGAL SURVEY.
 4. BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
 5. TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.

WORK SAFELY

COPYRIGHT © 2021

wood.

REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REF	NUMBER	TITLE
B	14DEC23	ISSUED FOR REPORT							KC	BR	EO									
A	21NOV23	ISSUED FOR REPORT							KC	BR	EO									

UNLESS OTHERWISE AGREED IN A WRITTEN CONTRACT BETWEEN WOOD AND ITS CLIENT, THIS DOCUMENT, IT CONTAINS INFORMATION, DATA AND DESIGN THAT IS CONFIDENTIAL AND MAY NOT BE COPIED OR DISCLOSED, AND (II) MAY BE USED BY THE CLIENT ONLY IN THE CONTEXT AND FOR THE EXPRESS PURPOSE FOR WHICH IT WAS INTENDED. ANY USE OF, OR RELIANCE ON, THIS DOCUMENT BY ANY THIRD PARTY IS AT THAT PARTY'S SOLE RISK.

STAMP/SEAL

NOT TO BE USED FOR CONSTRUCTION

CLIENT PROJECT MGR	DEPARTMENT MGR	PROJECT MGR
PROJECT PHASE		
PROJECT NO.	260233	BY DES EO 21NOV23
SCALE	1" = 50'	CHK DRN KC 21NOV23
		APP APP EO 21NOV23

SUBJECT	GENERAL ARRANGEMENT EXISTING CONDITIONS

AREA 0000	NOVA SCOTIA POWER INC. TUSKET TIDAL POND
CLIENT DWG NO.	
DRAWING NO. SK-001	REV B

2.0 Design Approach

2.1 General

The concept design options were grouped into two categories as follows:

- Options that prevent fish from entering the tidal pond area; and,
- Options that allow the fish to enter the tidal pond and leave when the tide recedes.

Modifying the operations of the hydro system to reduce the potential for fish stranding was also reviewed, but no effective options were identified as this is a tidally influenced river water level that floods the tidal pond.

The concept design options that were developed are presented in Section 3.

3.0 Concept Design Options

3.1 General

The concept design options presented in the following Sections were developed to meet the design criteria noted in Section 1.4. For the purposes of this report, options that prevent fish from entering the tidal pond area were designated with a "P", while options that allow fish to enter the tidal pond area were designated with an "A".

3.2 Option A-1: Block All Inflow to Tidal Pond to Typical High-Water Level, Except the Channel at Most Downstream End

3.2.1 Description

The plan and details of Option A-1 are shown on Drawing SK-002. This option consists of blocking off all the tidally influenced inflow / out flow sites along the berm on the right side of the tailrace channel, except for the one at the most downstream end (i.e. patching the berm at select locations so that all the flow on typical high tides enters and exits through the downstream end only).

The features of this option are:

- Regular tides and river levels will enter the tidal pond area, but levels may be lower than they currently are as the single entrance size will act as a tidal restriction and the other inlets will be closed.
- High tidally influenced water levels will still come over the berm in places.
- This maintains the wetland function and the narrow outlet channel would keep the outflow water depth deep enough and running long enough on the falling tide for fish to get out if needed, but not at low tide.
- Can use swamp mats on the grassed wetland area adjacent to the berm for construction equipment to access points that need closing off (inlets/outlets) or to slightly raise the berm in very low

sections.

3.2.2 Capital Cost Estimate and Construction Schedule

The cost estimates presented in this report are Class 5 cost estimates. Class 5 cost estimates are based on limited project definition, usually in the 0% to 2% range, and are intended to be used for concept screening and comparison purposes only. More detailed cost estimates based on greater project definition are recommended for feasibility or budget authorization purposes. The cost estimates presented here are in 2023 dollars, and do not include Owner's cost for project management, contract administration or cost of capital.

The estimated capital cost (Class 5 estimate) of Option A-1 is **\$200,000**. The work can be executed between January, 2024 and spring 2024.

3.2.3 Drawings

The drawing for Option A-1 is provided on the following page.

F

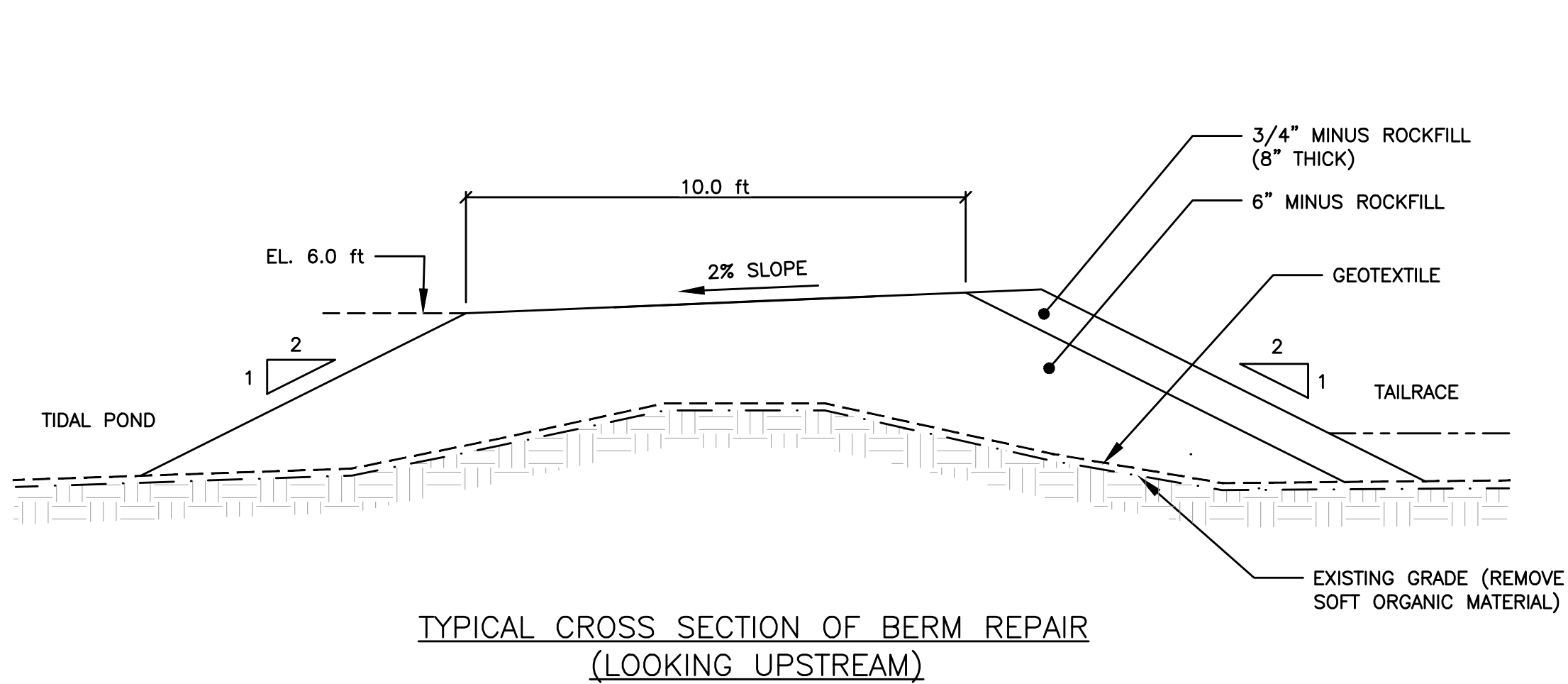
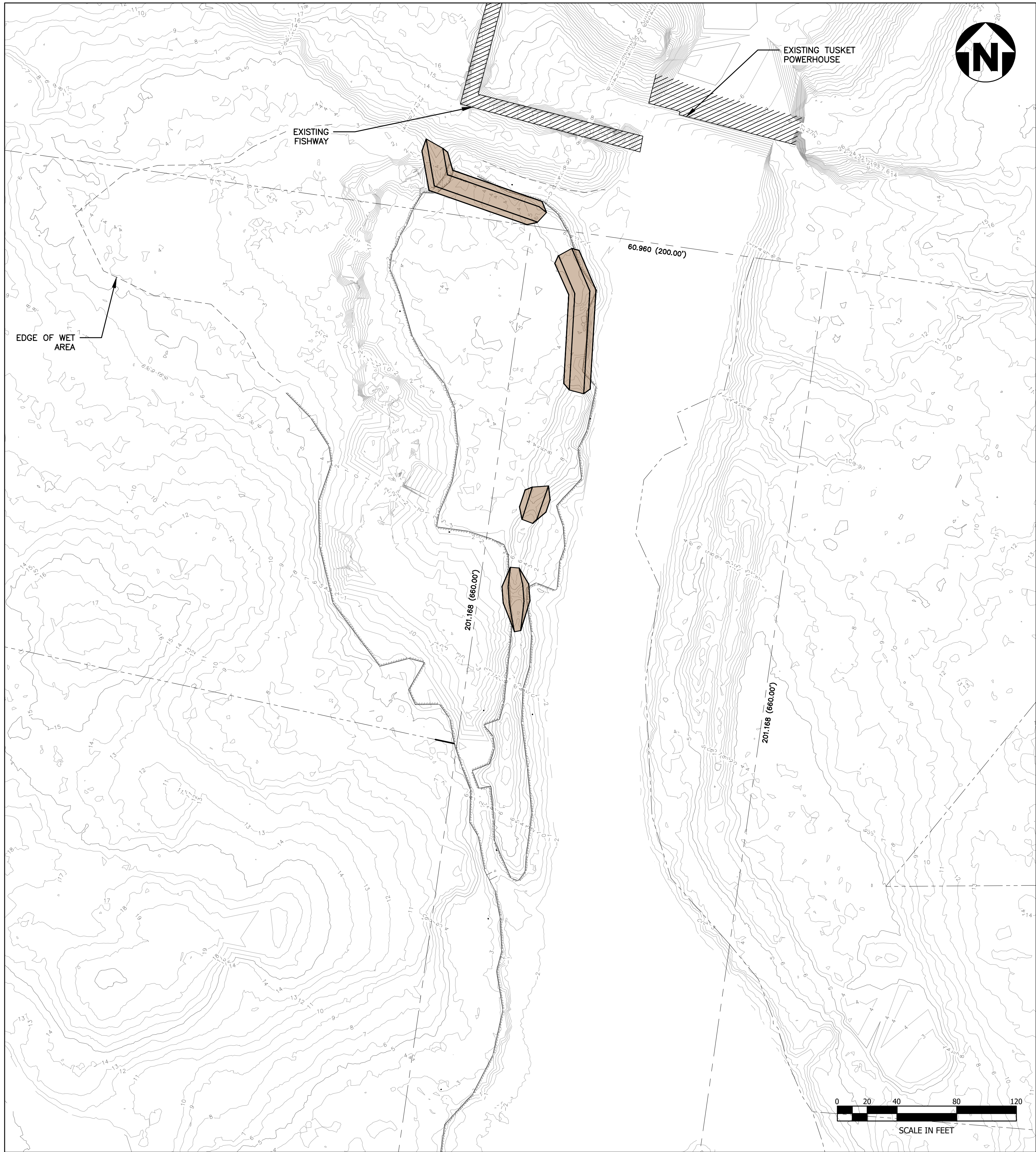
E

D

C

B

A



- LEGEND**
- PROPERTY LINE
 - ADJOINING PROPERTY LINE
 - TOP OF SLOPE
 - TOE OF SLOPE
 - EXISTING STRUCTURE
 - AREA OF BERM REPAIR
- NOTES**
- ALL COORDINATES, ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
 - PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
 - PROPERTY BOUNDARIES AND OWNERSHIP INFORMATION SHOWN ARE BASED ON FIELDWORK SUMMARY DRAWING, PROJECT No. 23-4810, BY STRUM CONSULTING DATED 14 AUGUST 2023. ALL BOUNDARY LINES ARE SUBJECT TO FINAL LEGAL SURVEY.
 - BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
 - TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.

OPTION A-1
• BLOCK ALL INFLOW TO TIDAL POND TO TYPICAL HIGH TIDE LEVEL, EXCEPT CHANNEL AT DOWNSTREAM END.

WORK SAFELY

COPYRIGHT © 2021

wood.

REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	REF	NUMBER	TITLE
B	14DEC23	ISSUED FOR REPORT	KC	BR	EO				KC	BR	EO								
A	21NOV23	ISSUED FOR REPORT	KC	BR	EO				KC	BR	EO								

UNLESS OTHERWISE AGREED IN A WRITTEN CONTRACT BETWEEN WOOD AND ITS CLIENT, THIS DOCUMENT, IT CONTAINS INFORMATION, DATA AND DESIGN THAT IS CONFIDENTIAL AND MAY NOT BE COPIED OR DISCLOSED, AND (II) MAY BE USED BY THE CLIENT ONLY IN THE CONTEXT AND FOR THE EXPRESS PURPOSE FOR WHICH IT WAS INTENDED. ANY USE OF, OR RELIANCE ON, THIS DOCUMENT BY ANY THIRD PARTY IS AT THAT PARTY'S SOLE RISK.

STAMP/SEAL

NOT TO BE USED FOR CONSTRUCTION

CLIENT PROJECT MGR	DEPARTMENT MGR	PROJECT MGR
PROJECT NO.	260233	BY DES EO 21NOV23
SCALE	1" = 40'	BY CHK BR 21NOV23
SUBJECT OPTION A-1 PLAN AND SECTIONS		

AREA 0000	NOVA SCOTIA POWER INC. TUSKET TIDAL POND
CLIENT DWG NO.	
DRAWING NO. SK-002	REV B

3.3 Option A-2: Same as Option A-1, but Provide an Additional 6 cfs Inflow.

3.3.1 Description

The plan and details of Option A-2 are shown on Drawing SK-003. As in Option A-1, this option consists of blocking off all the tidally influenced inflow / out flow sites along the berm on the right side of the tailrace channel, except for the one at the most downstream end (i.e. patching the berm at select locations so that all the flow on typical high tides enters and exits through the downstream end only). Plus provide an additional 6 cfs inflow to the tidal pond area all the time, or as the tide recedes during the gaspereau migration season. (The 6 cfs could be provided by a pump, siphon, or conduit through the dam). Resize the one remaining outlet to provide a suitable water depth for the fish to move down to the river throughout the low tide with the 6 cfs flow.

The features of this option are:

- Regular tides and river levels will enter the tidal pool area, but levels may be lower than they currently are as the single entrance size will act as a tidal restriction.
- High tidally influenced water levels will still come over the berm in places.
- This maintains the wetland function and the narrow channel would keep the outflow water depth deep enough and running long enough on the falling tide for fish to get out if needed.
- The 6 cfs through the downstream control outlet will maintain the low water level in the tidal pond approximately 1 ft higher than it currently is at low tide.
- The 6 cfs maintains a flow through the pond at low tide to provide oxygen for the fish that remain.
- The resized outlet will maintain a suitable water depth for the fish to move down to the river throughout the low tide with the 6 cfs flow.
- Can use swamp mats on the grassed wetland area adjacent to the berm for construction equipment to access points that need closing off (inlets/outlets) or to slightly raise the berm in very low sections.

3.3.2 Capital Cost Estimate and Construction Schedule

The estimated capital cost (Class 5 estimate) of Option A-2 is **\$340,000**. The work can be executed between January, 2024 and spring 2024.

3.3.3 Drawings

The drawing for Option A-2 is provided on the following page.

F

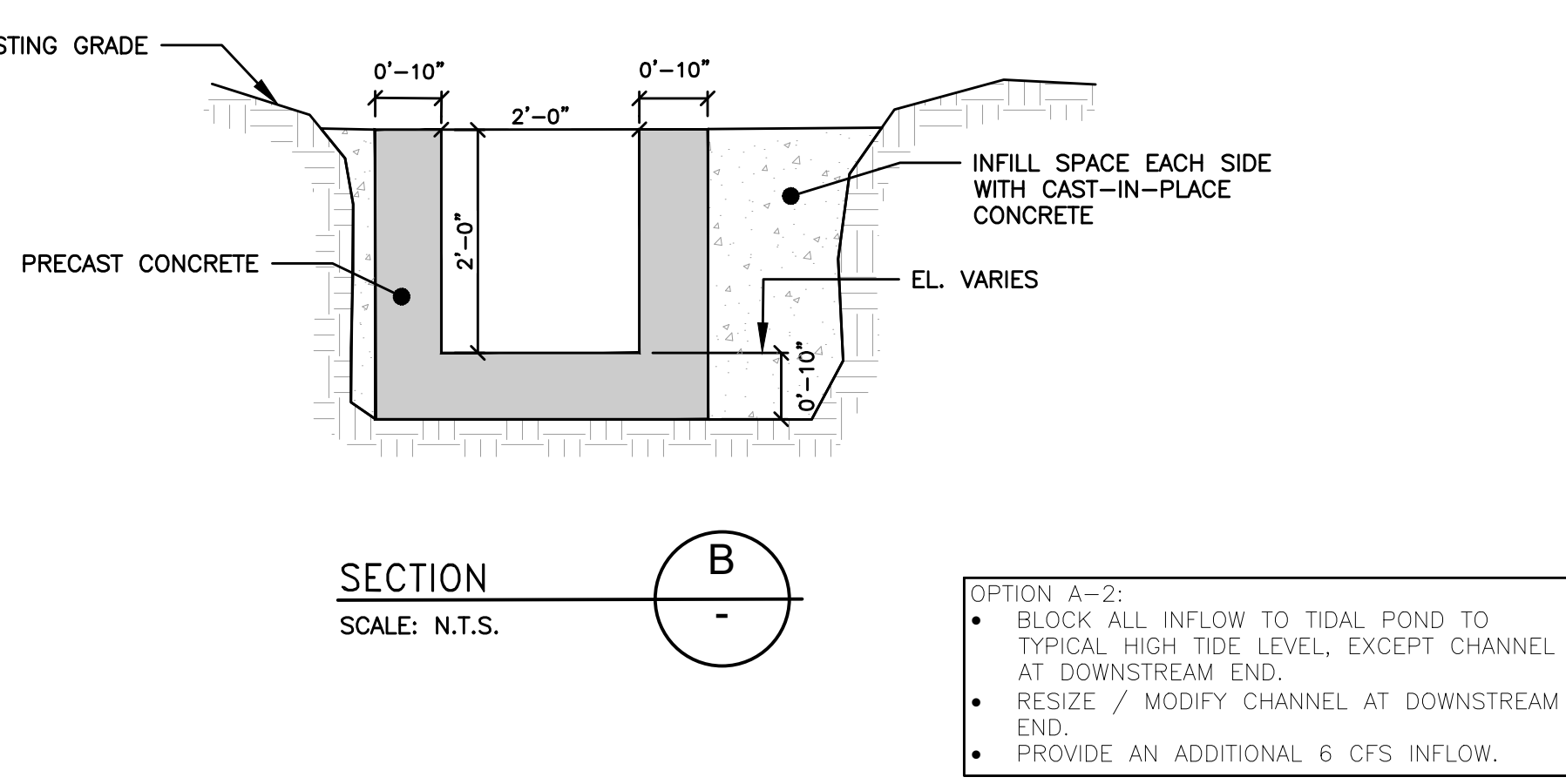
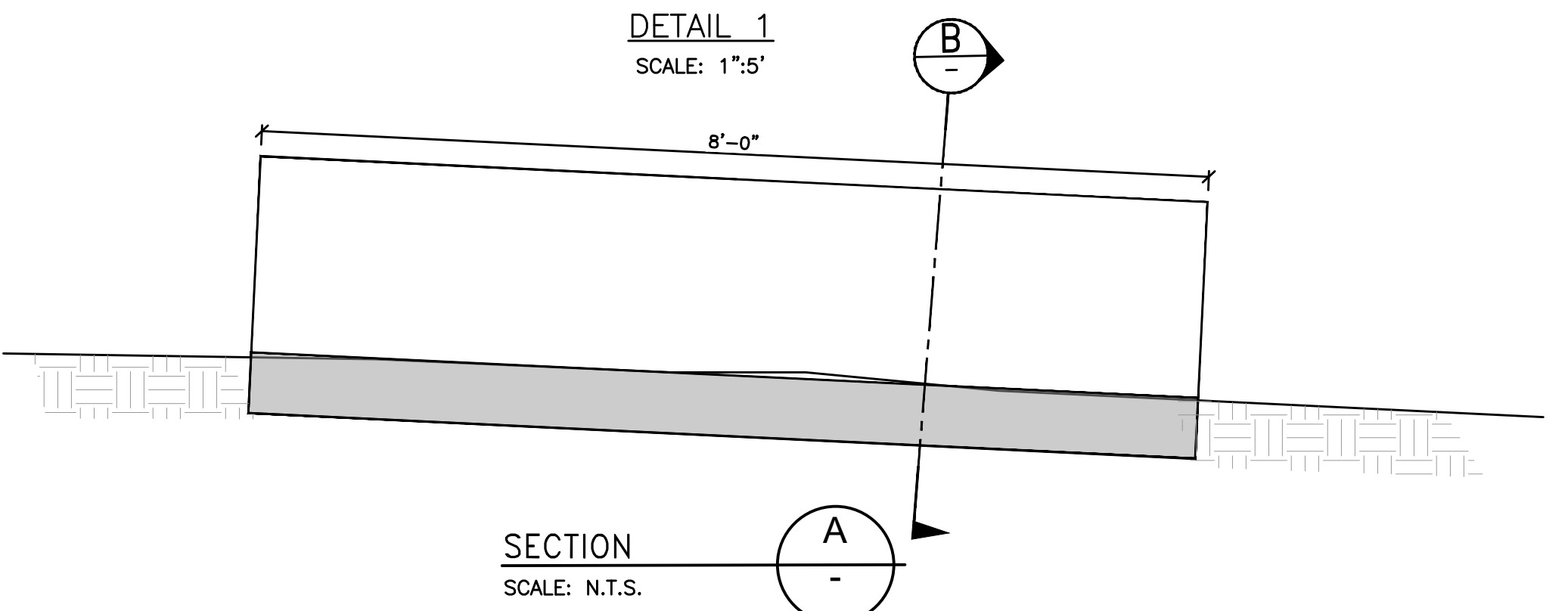
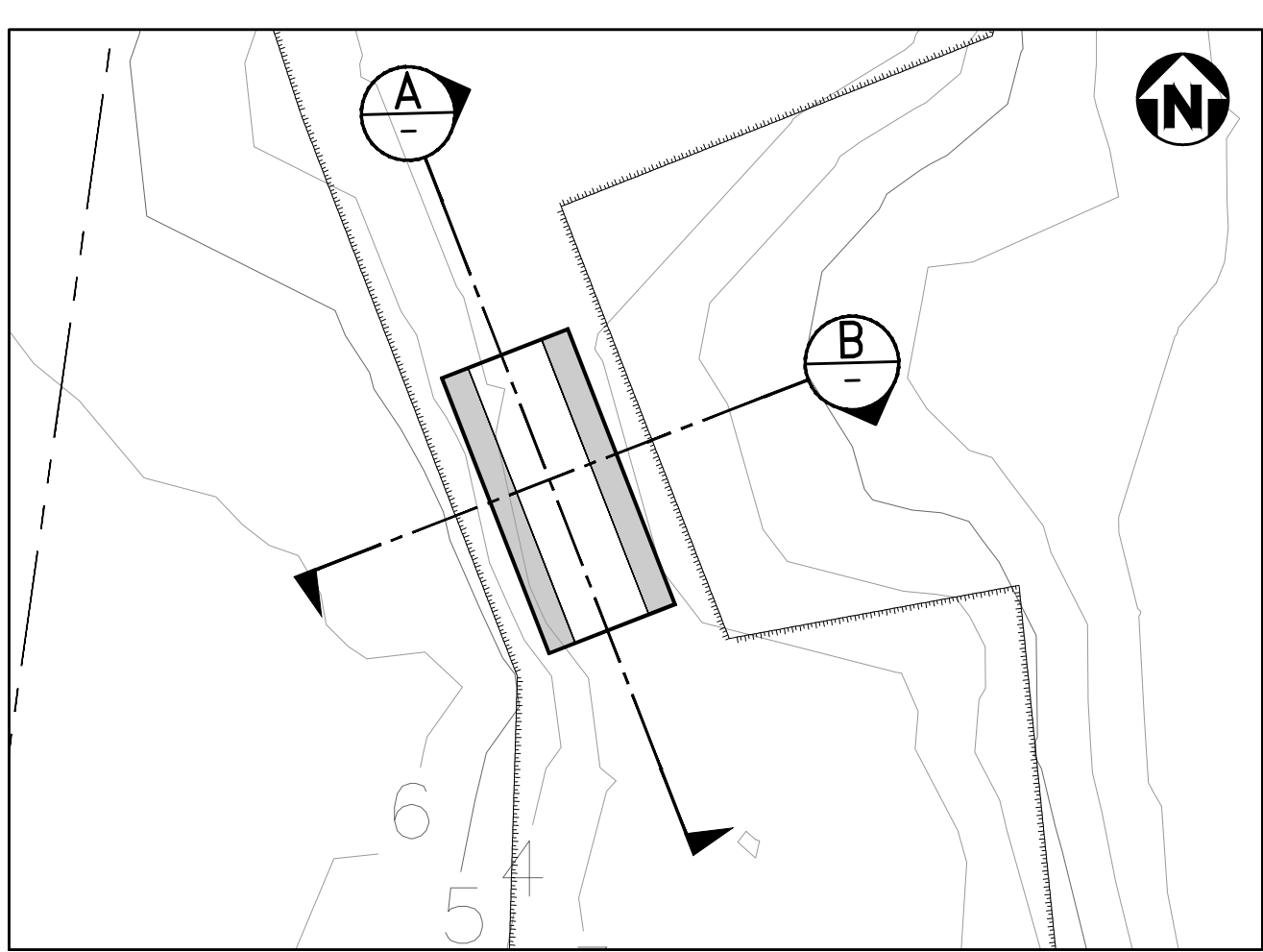
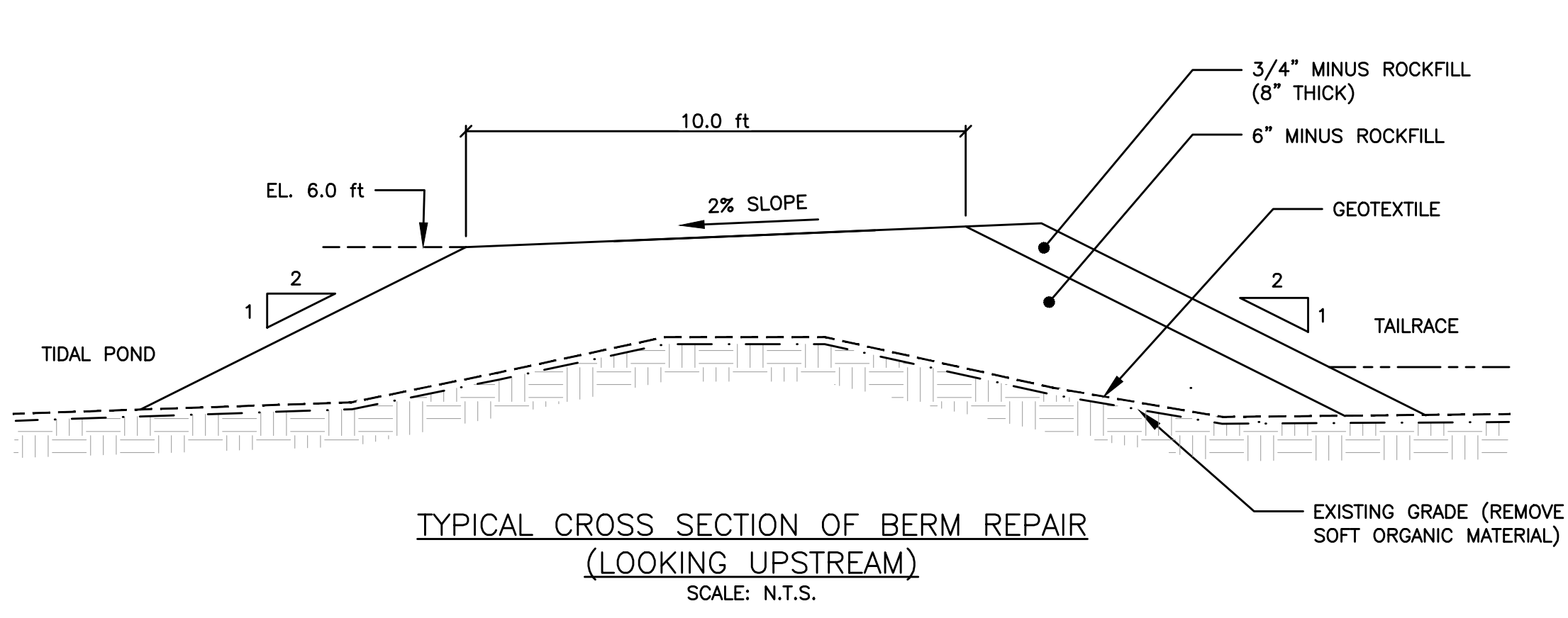
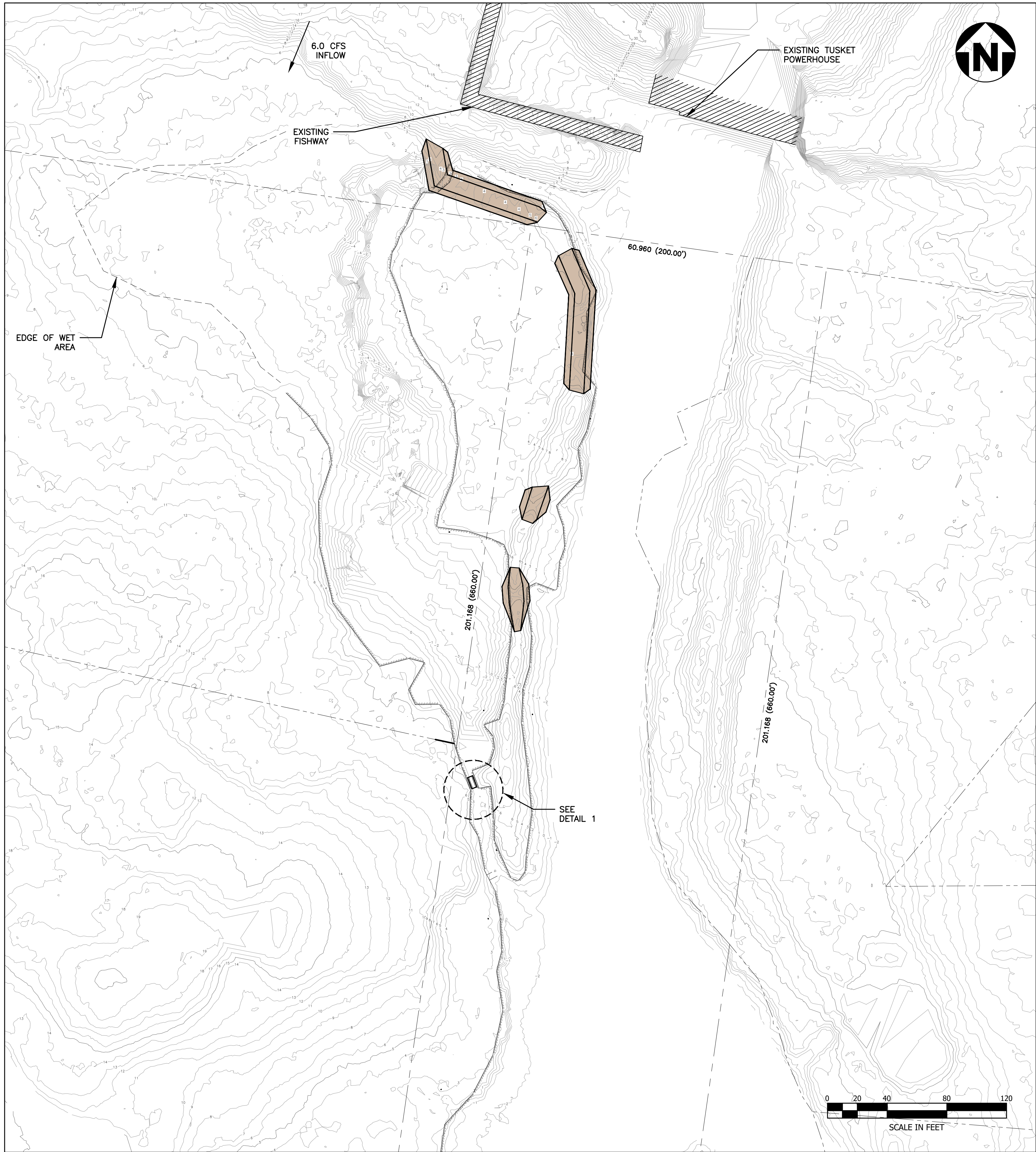
E

D

C

B

A



- LEGEND**
- PROPERTY LINE
 - ADJOINING PROPERTY LINE
 - TOP OF SLOPE
 - TOE OF SLOPE
 - EXISTING STRUCTURE
 - AREA OF BERM REPAIR
- NOTES**
- ALL COORDINATES, ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
 - PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
 - PROPERTY BOUNDARIES AND OWNERSHIP INFORMATION SHOWN ARE BASED ON FIELDWORK SUMMARY DRAWING, PROJECT No. 23-4810, BY STRUM CONSULTING DATED 14 AUGUST 2023. ALL BOUNDARY LINES ARE SUBJECT TO FINAL LEGAL SURVEY.
 - BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
 - TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.

WORK SAFELY

COPYRIGHT © 2021

wood.

REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	REF	NUMBER	TITLE
B	A	14DEC23 ISSUED FOR REPORT							KC	BR	EO								
A		21NOV23 ISSUED FOR REPORT							KC	BR	EO								

UNLESS OTHERWISE AGREED IN A WRITTEN CONTRACT BETWEEN WOOD AND ITS CLIENT, THIS DOCUMENT (I) CONTAINS INFORMATION, DATA AND DESIGN THAT IS CONFIDENTIAL AND MAY NOT BE COPIED OR DISCLOSED, AND (II) MAY BE USED BY THE CLIENT ONLY IN THE CONTEXT AND FOR THE EXPRESS PURPOSE FOR WHICH IT WAS INTENDED. ANY USE OF, OR RELIANCE ON, THIS DOCUMENT BY ANY THIRD PARTY IS AT THAT PARTY'S SOLE RISK.

STAMP/SEAL

NOT TO BE USED FOR CONSTRUCTION

CLIENT PROJECT MGR	DEPARTMENT MGR	PROJECT MGR
PROJECT PHASE		
PROJECT NO.	260233	DES EO 21NOV23 DRN KC 21NOV23 CHK BR 21NOV23 APP EO 21NOV23
SCALE	1" = 40'	
SUBJECT	OPTION A-2 PLAN AND SECTIONS	

AREA 0000	NOVA SCOTIA POWER INC. TUSKET TIDAL POND
CLIENT DWG NO.	
DRAWING NO. SK-003	REV B

3.4 Option A-3: Same as Option A-2, Except Block All Inflow to Tidal Pond to Unusual High-Water Levels

3.4.1 Description

The plan and details of Option A-3 are shown on Drawing SK-004. This option consists of closing off all tidally influenced inflows to the tidal pond area, except at the most downstream end, by constructing a berm in the wetland adjacent to the right side of the existing treed berm that is high enough to keep out all but extreme high-water levels. Provide 6 cfs inflow to the tidal pond area as the tide recedes during the gaspereau migration season. (The 6 cfs could be provided by a pump, siphon, or conduit through the dam). Resize the one remaining outlet to provide a suitable water depth for the fish to move down to the river throughout the low tide with the 6 cfs flow. This is the same as Option A-2 except the berm is the full length and higher than most of the existing treed berm.

The features of this option are:

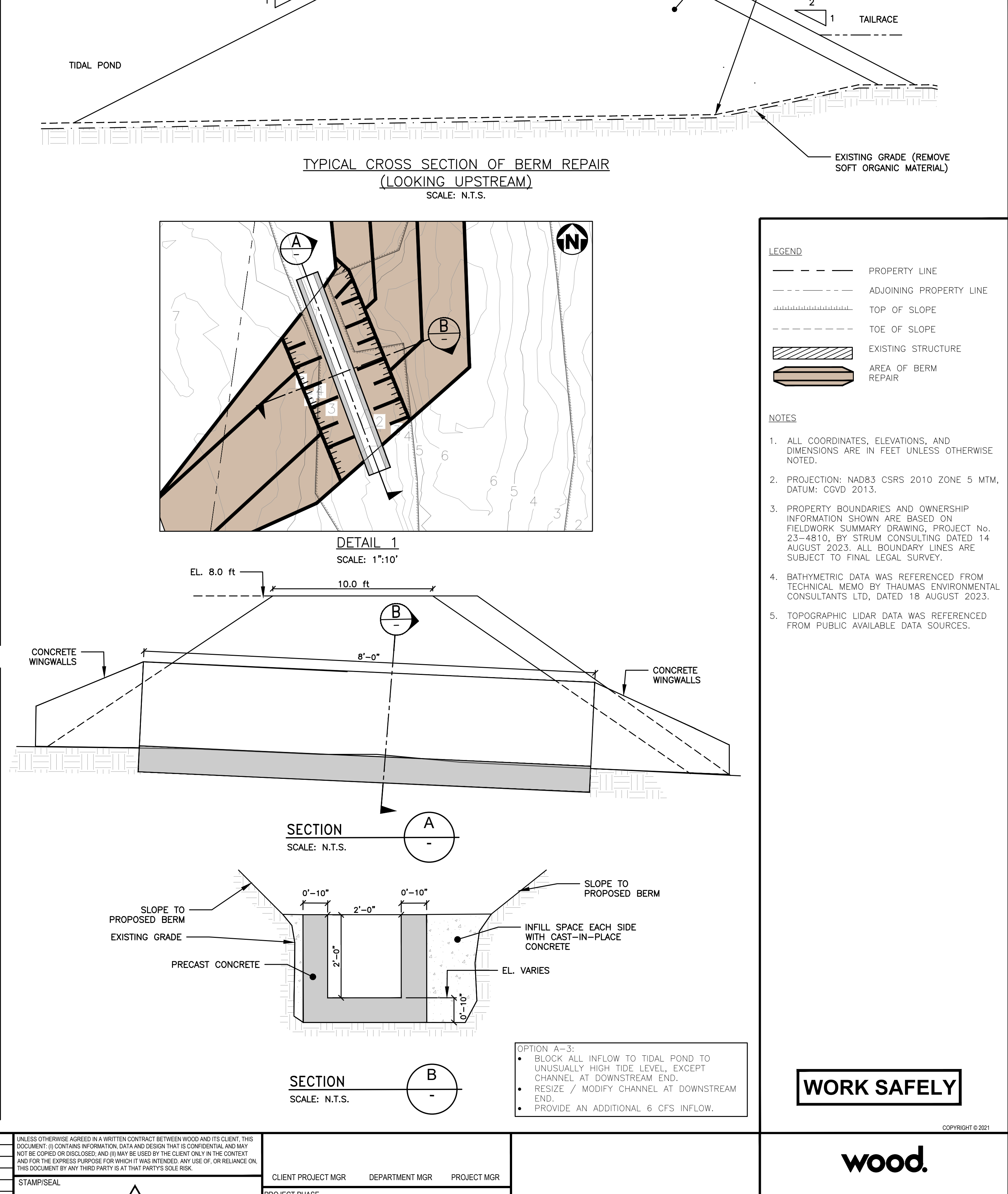
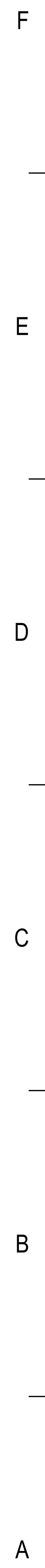
- Only extreme water levels will come over the berm.
- Regular tides and river levels will enter the tidal pond area, but levels may be lower than they currently are as the single entrance size will act as a tidal restriction.
- This maintains the wetland function and the narrow channel would keep the outflow water depth deep enough and long enough on the falling tide for fish to get out if needed.
- The 6 cfs through the downstream control outlet will maintain the low water level in the tidal pond approximately 1ft higher than it currently is during low tide.
- The 6 cfs maintains a flow through the pond at low tide to provide oxygen for the fish that remain.
- The resized outlet will maintain a suitable water depth for the fish to move down to the river throughout the low tide with the 6 cfs flow.
- Can use swamp mats on the grassed wetland area adjacent to the berm for construction equipment to access points that need closing off (inlets/outlets) or to raising of the berm in low sections.

3.4.2 Capital Cost Estimate and Construction Schedule

The estimated capital cost (Class 5 estimate) of Option A-3 is **\$510,000**. It will be challenging to execute the work between January, 2024 and spring 2024.

3.4.3 Drawings

The drawing for Option A-3 is provided on the following page.



9 | 8 | 7 | 6 | 5

4

3 2

1

3.5 Option A-4: Same as Option A-3, Except Provide Additional Entrance to Existing Fishway to Provide Upstream Passage Out of the Tidal Pond

3.5.1 Description

The plan and details of Option A-4 are shown on Drawing SK-005. This option is similar to Option A-3 and consists of closing off all tidally influenced inflows to the tidal pond area, except at the most downstream end, by constructing a berm in the wetland adjacent to the treed berm that is high enough to keep out all but extreme high-water levels. This option adds another fishway section and entrance from the tidal pond to the existing fishway by widening the corner pool to the right. Provide an additional 6 cfs inflow at the corner pool then through the fishway to the tidal pond area during the gaspereau migration season. (The 6 cfs could be provided by a pump, siphon, or conduit through the dam). Resize the one remaining outlet to provide a suitable water depth for the fish to move down to the river throughout the low tide with the 6 cfs flow provided by the fishway.

The features of this option are:

- Only extreme water levels will come over the berm.
- Regular tides and river levels will enter the tidal pool area, but levels may be lower than they currently are as the single entrance size will act as a tidal restriction.
- This maintains the wetland function and the narrow channel would keep the outflow water depth deep enough and long enough on the falling tide for fish to get out if needed.
- The drop from the corner pool of the existing fishway to the tidal pool low water level is approximately 9 ft, requiring 10 pools.
- The 6 cfs fishway flow maintains a flow through the pond at low tide to provide oxygen for the fish that remain.
- The resized outlet will maintain a suitable water depth for the fish to move down to the river throughout the low tide with the 6 cfs flow.
- Can use swamp mats on the grassed wetland area adjacent to the berm for construction equipment to access points that need closing off (inlets/outlets) or raising of the berm in low sections.

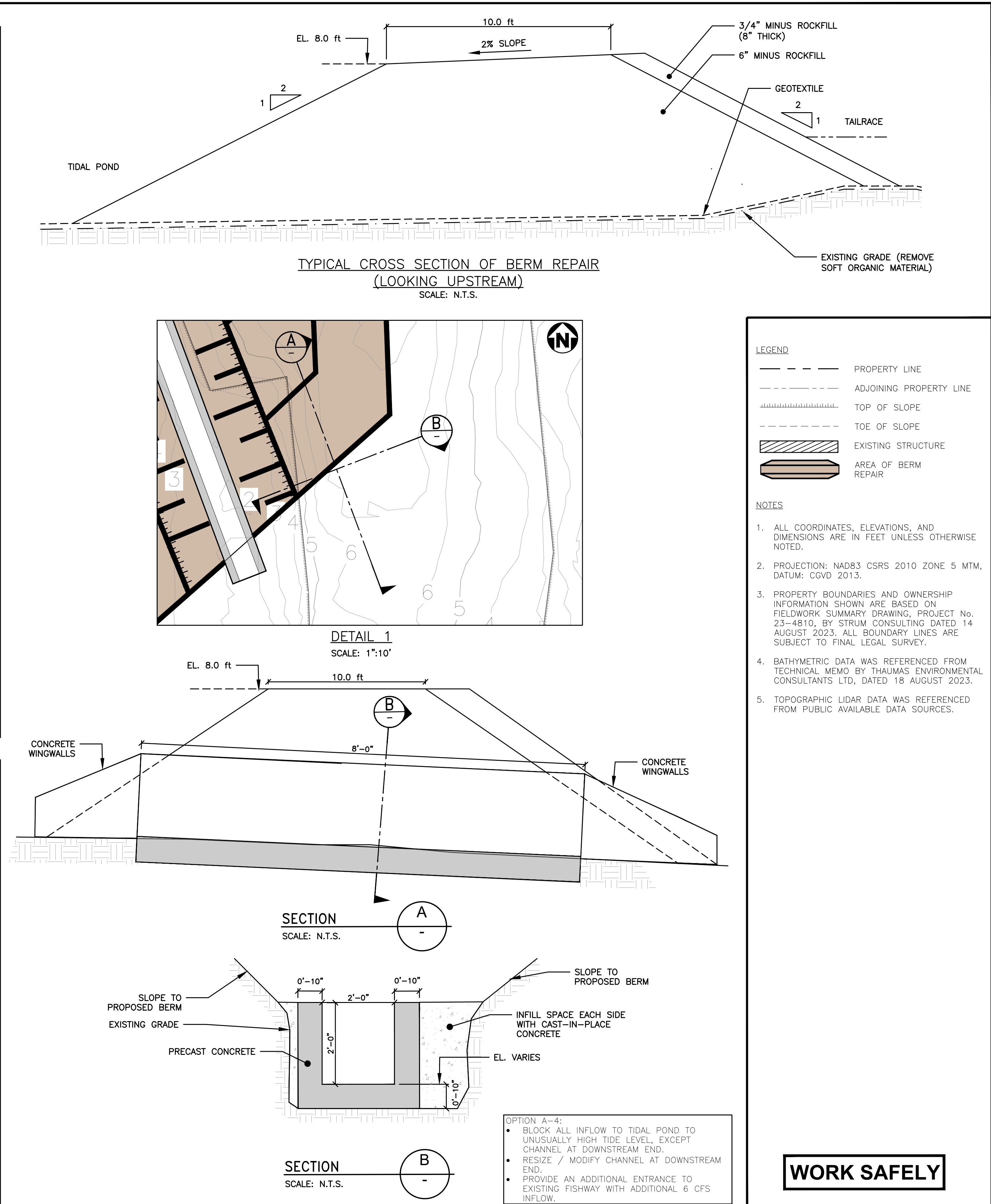
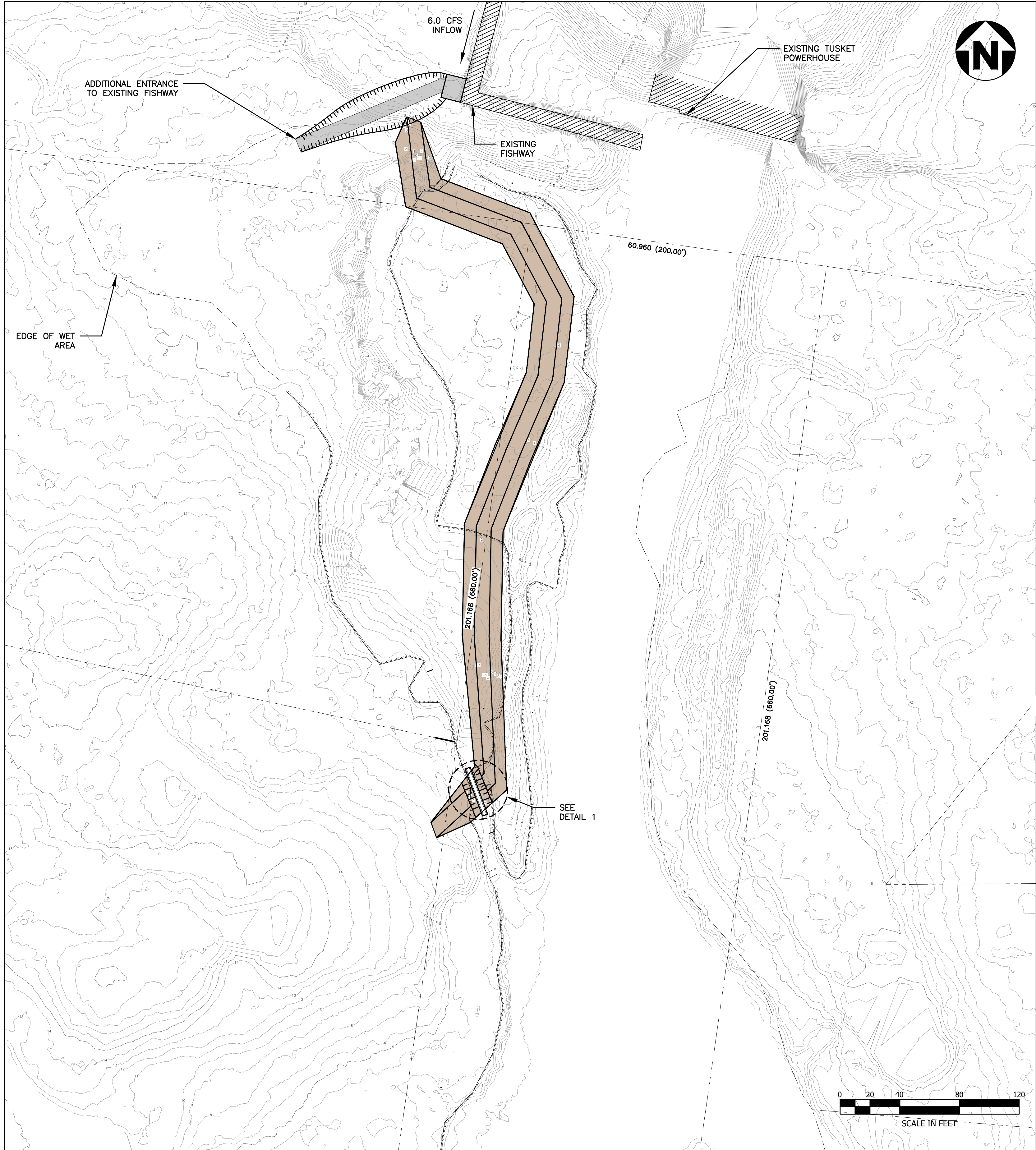
3.5.2 Capital Cost Estimate and Construction Schedule

The estimated capital cost (Class 5 estimate) of Option A-4 is **\$1,100,000**. It will be extremely challenging to execute the work between January, 2024 and spring 2024.

3.5.3 Drawings

The drawing for Option A-4 is provided on the following page.

F
E
D
C
B
A



- LEGEND**
- PROPERTY LINE
 - ADJOINING PROPERTY LINE
 - TOP OF SLOPE
 - TOE OF SLOPE
 - EXISTING STRUCTURE
 - AREA OF BERM REPAIR
- NOTES**
1. ALL COORDINATES, ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
 2. PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
 3. PROPERTY BOUNDARIES AND OWNERSHIP INFORMATION SHOWN ARE BASED ON FIELDWORK SUMMARY DRAWING, PROJECT No. 23-4810, BY STRUM CONSULTING DATED 14 AUGUST 2023. ALL BOUNDARY LINES ARE SUBJECT TO FINAL LEGAL SURVEY.
 4. BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
 5. TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.

WORK SAFELY

COPYRIGHT © 2021

wood.

REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	REF	NUMBER	TITLE
B	14DEC23	ISSUED FOR REPORT							KC	BR	EO								
A	21NOV23	ISSUED FOR REPORT							KC	BR	EO								

UNLESS OTHERWISE AGREED IN A WRITTEN CONTRACT BETWEEN WOOD AND ITS CLIENT, THIS DOCUMENT, IT CONTAINS INFORMATION, DATA AND DESIGN THAT IS CONFIDENTIAL AND MAY NOT BE COPIED OR DISCLOSED, AND (II) MAY BE USED BY THE CLIENT ONLY IN THE CONTEXT AND FOR THE EXPRESS PURPOSE FOR WHICH IT WAS INTENDED. ANY USE OF, OR RELIANCE ON, THIS DOCUMENT BY ANY THIRD PARTY IS AT THAT PARTY'S SOLE RISK.

STAMP/SEAL

NOT TO BE USED FOR CONSTRUCTION

CLIENT PROJECT MGR		DEPARTMENT MGR		PROJECT MGR	
PROJECT PHASE					
PROJECT NO.			BY	DDMMYY	SUBJECT OPTION A-4 PLAN AND SECTIONS
260233		DES	EO	21NOV23	
SCALE		DRN	KC	21NOV23	
1" = 40'		CHK	BR	21NOV23	
		APP	EO	21NOV23	

AREA 0000	NOVA SCOTIA POWER INC. TUSKET TIDAL POND
CLIENT DWG NO.	
DRAWING NO. SK-005	REV B

3.6 Option A-5: Same as Option A-4, Except Block All Inflow to Tidal Pond to Typical High-Water Level

3.6.1 Description

The plan and details of Option A-5 are shown on Drawing SK-006. This option consists of blocking off all the tidally influenced inflow / out flow sites along the berm on the right side of the tailrace channel, except for the one at the most downstream end (i.e. patching the berm at select locations so that all the flow on typical high tides enters and exits through the downstream end only). Provide an additional 6 cfs inflow at the corner pool, then through the fishway to the tidal pond area during the gaspereau migration season. (The 6 cfs could be provided by a pump, siphon, or conduit through the dam). Resize the one remaining outlet to provide a suitable water depth for the fish to move down to the river throughout the low tide with the 6 cfs flow.

The features of this option are:

- High tidally influenced water levels will still come over the berm in places.
- Regular tides and river levels will enter the tidal pool area, but levels may be lower than they currently are as the entrance size will act as a tidal restriction.
- This maintains the wetland function and the narrow channel would keep the outflow water depth deep enough and long enough on the falling tide for fish to get out if needed.
- The drop from the corner pool of the existing fishway to the tidal pool low water level is approximately 9 ft, requiring 10 pools.
- The 6 cfs through the downstream control outlet will maintain the low water level in the tidal pond approximately 1ft higher than it currently is at low tide.
- The 6 cfs fishway flow maintains a flow through the pond at low tide to provide oxygen for the fish that remain.
- The resized outlet will maintain a suitable water depth for the fish to move down to the river throughout the low tide with the 6 cfs flow.
- Can use swamp mats on the grassed wetland area adjacent to the berm for construction equipment to access points that need closing off (inlets/outlets) or to slightly raising of the berm in very low sections.

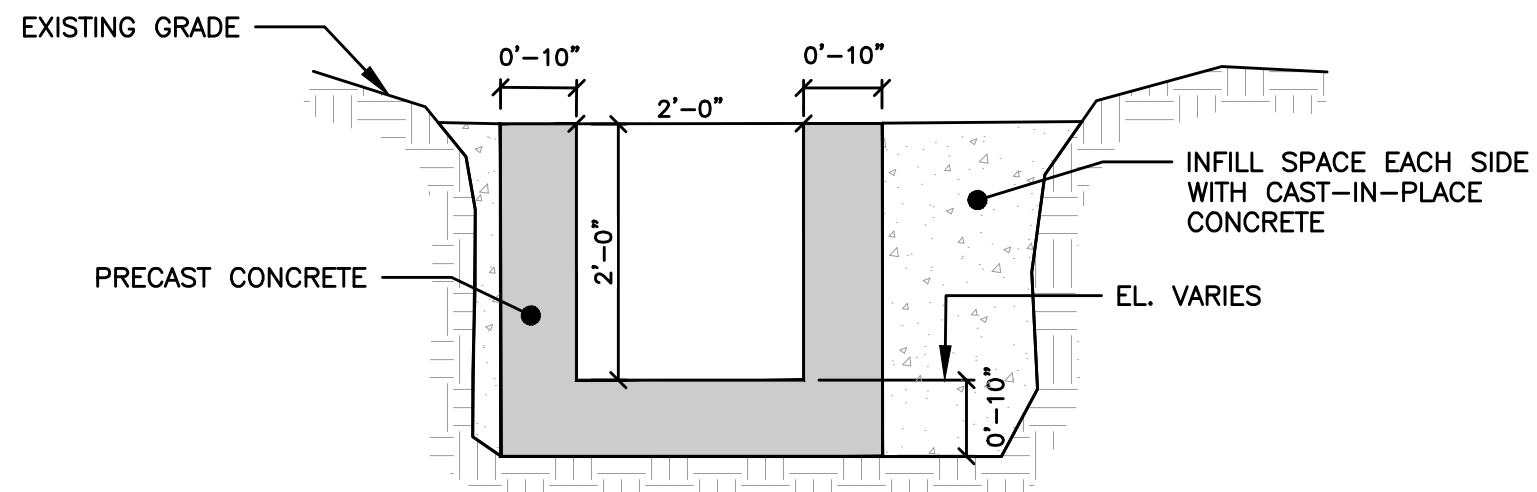
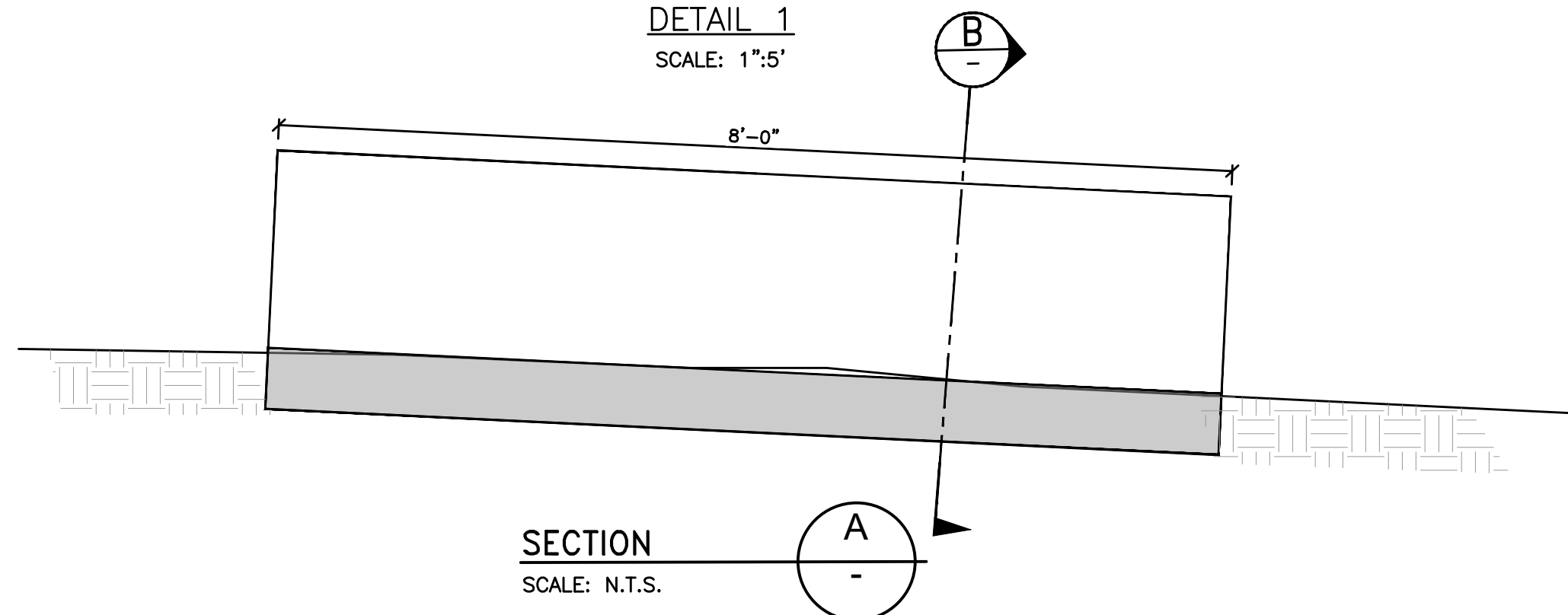
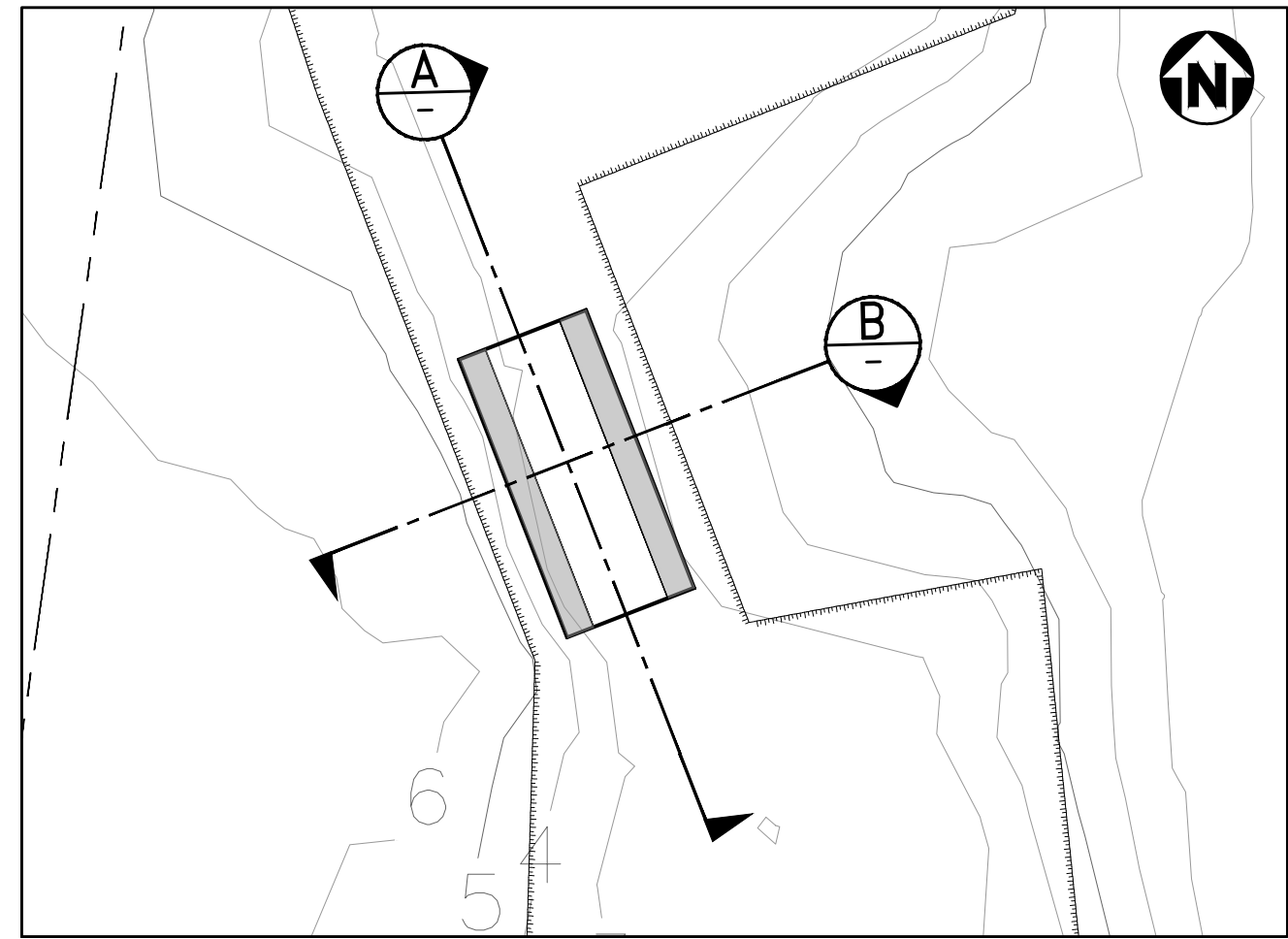
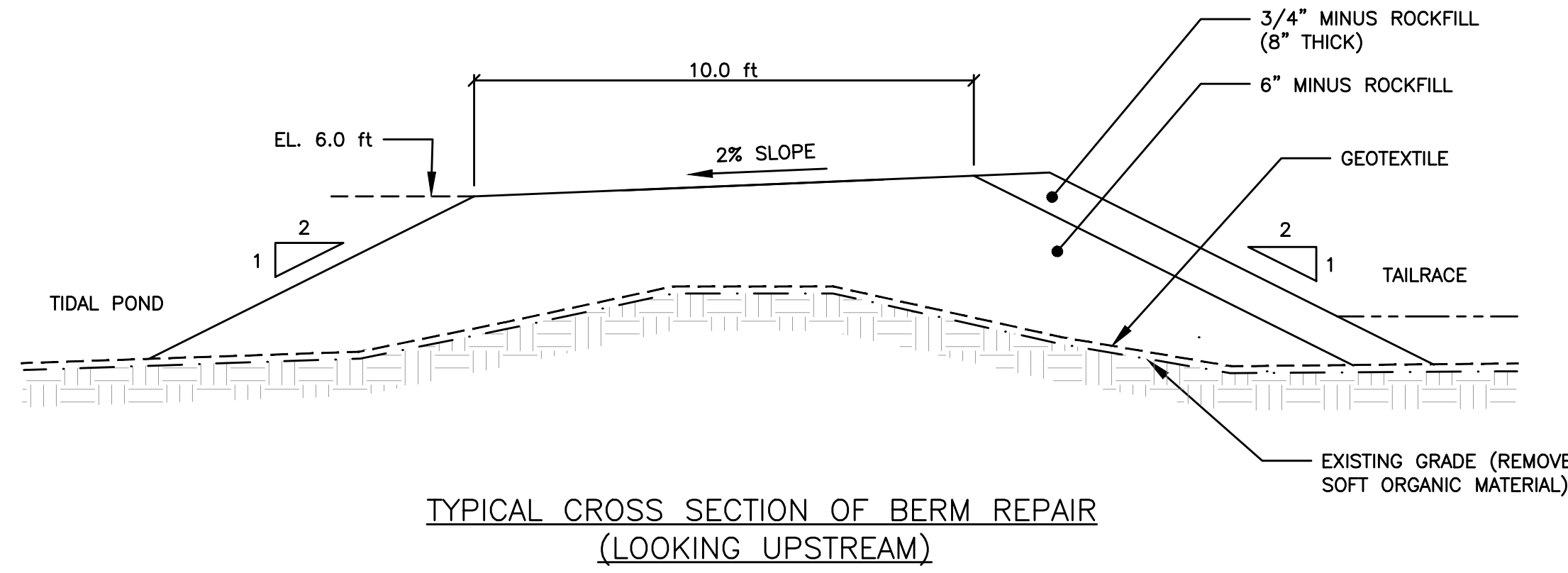
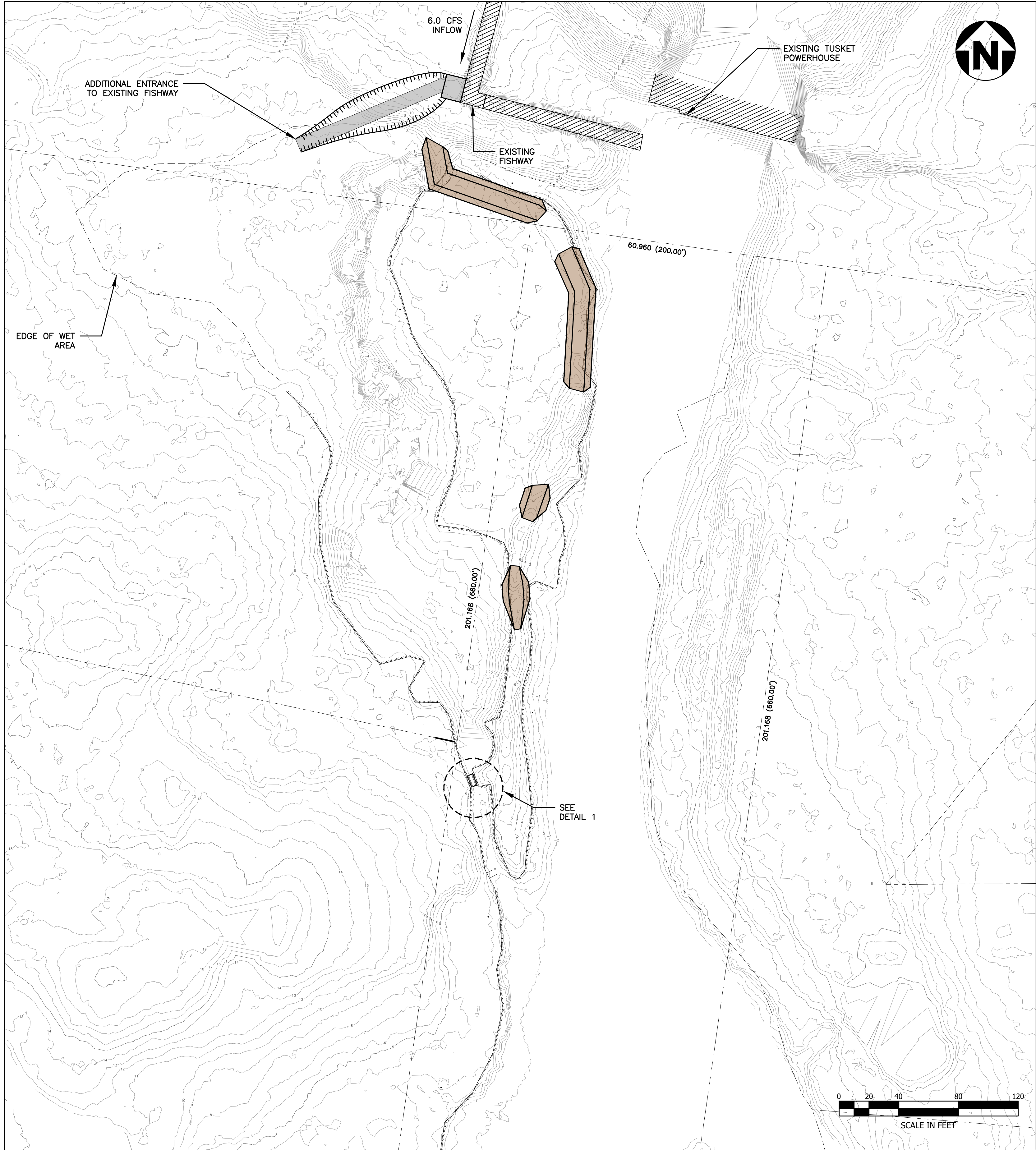
3.6.2 Capital Cost Estimate and Construction Schedule

The estimated capital cost (Class 5 estimate) of Option A-5 is **\$900,000**. It will be challenging to execute the work between January, 2024 and spring 2024.

3.6.3 Drawings

The drawing for Option A-5 is provided on the following page.

F
E
D
C
B
A



OPTION A-5:
• BLOCK ALL INFLOW TO TIDAL POND TO
TYPICAL HIGH TIDE LEVEL, EXCEPT CHANNEL
AT DOWNSTREAM END.
• RESIZE / MODIFY CHANNEL AT DOWNSTREAM
END.
• PROVIDE AN ADDITIONAL ENTRANCE TO
EXISTING FISHWAY WITH ADDITIONAL 6 CFS
INFLOW.

- LEGEND**
- PROPERTY LINE
 - ADJOINING PROPERTY LINE
 - TOP OF SLOPE
 - TOE OF SLOPE
 - EXISTING STRUCTURE
 - AREA OF BERM REPAIR
- NOTES**
- ALL COORDINATES, ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
 - PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
 - PROPERTY BOUNDARIES AND OWNERSHIP INFORMATION SHOWN ARE BASED ON FIELDWORK SUMMARY DRAWING, PROJECT No. 23-4810, BY STRUM CONSULTING DATED 14 AUGUST 2023. ALL BOUNDARY LINES ARE SUBJECT TO FINAL LEGAL SURVEY.
 - BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
 - TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.

WORK SAFELY

COPYRIGHT © 2021

wood.

NOVA SCOTIA POWER INC.
TUSKET TIDAL POND

CLIENT DWG NO.

DRAWING NO.

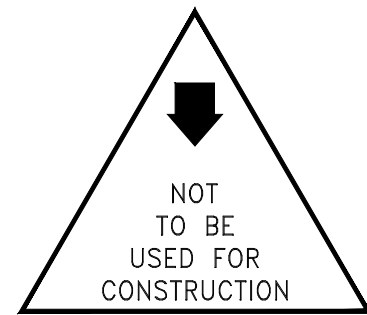
SK-006

NOVA SCOTIA POWER INC. TUSKET TIDAL POND

SAVED: 22-Nov-23 12:09 AM PLOTTED: 14-Dec-23 3:43 PM USER: CAPEWELL, KARL

UNLESS OTHERWISE AGREED IN A WRITTEN CONTRACT BETWEEN WOOD AND ITS CLIENT, THIS DOCUMENT: (i) CONTAINS INFORMATION, DATA AND DESIGN THAT IS CONFIDENTIAL AND MAY NOT BE COPIED OR DISCLOSED; AND (ii) MAY BE USED BY THE CLIENT ONLY IN THE CONTEXT AND FOR THE EXPRESS PURPOSE FOR WHICH IT WAS INTENDED. ANY USE OF, OR RELIANCE ON, THIS DOCUMENT BY ANY THIRD PARTY IS AT THAT PARTY'S SOLE RISK.

STAMP/SEAL



CLIENT PROJECT MGR DEPARTMENT MGR PROJECT MGR

PROJECT PHASE

PROJECT NO. 260233

SCALE 1" = 40'

DES EO 21NOV23

DRN KC 21NOV23

CHK BR 21NOV23

APP EO 21NOV23

SUBJECT

OPTION A-5
PLAN AND SECTIONS

REV B

3.7 Summary of Options A-1 to A-5

As shown in Sections 3.2 to 3.6, Options A-1 to A-5 have many similar features, with subtle differences. For convenience, Table 3-1 summarizes the key elements of each of these options.

Table 3-1: Summary of Options A-1 to A-5

Option	Tailrace Design Water Level	Downstream Outlet	Additional Upstream Fish Passage	Additional Flow Release	Estimated Capital Cost
A-1	Typical High	No change	No	No	\$200,000
A-2	Typical High	Modified for 6 cfs	No	6 cfs	\$340,000
A-3	Unusually High	Modified for 6 cfs	No	6 cfs	\$510,000
A-4	Unusually High	Modified for 6 cfs	Yes	6 cfs	\$1,100,000
A-5	Typical High	Modified for 6 cfs	Yes	6 cfs	\$900,000

3.8 Option P-1: Block All Inflow to Tidal Pond to Unusual High-Water Levels, and Place Hung Culvert with an Aboiteau Gate on Downstream End and Raise the Berm

3.8.1 Description

The plan and details of Option P-1 are shown on Drawing SK-007. This option consists of closing off all tidally influenced inflows to the tidal pond area, except at the most downstream end, by constructing a berm in the wetland adjacent to the existing treed berm that is high enough to keep out all but extreme water levels. Construct an aboiteau at the downstream outlet in the tidal pond.

The features of this option are:

- Only extreme water levels will come over the berm.
- This maintains the wetland function with flow from the small watershed above through the wetland, with no tidally influenced flooding.
- Prevents migrating fish from entering the tidal pond.
- Can use swamp mats on the grassed wetland area adjacent to the berm for construction equipment to access points that need closing off (inlets/outlets) or to slightly raising of the berm in very low sections.

It is noted an aboiteau structure may require frequent inspection and cleaning, and will require periodic upgrades due to address normal aging of the structure.

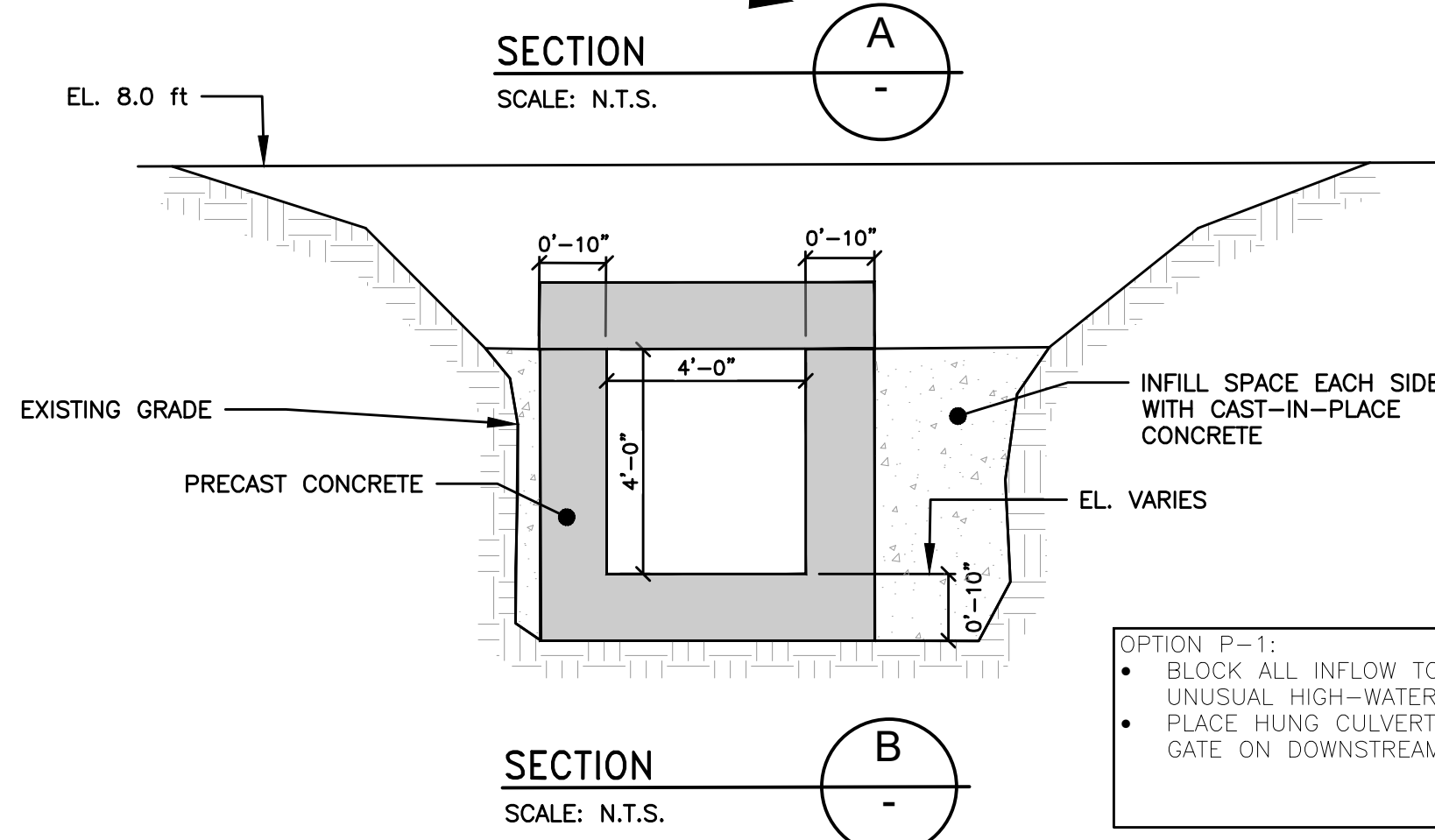
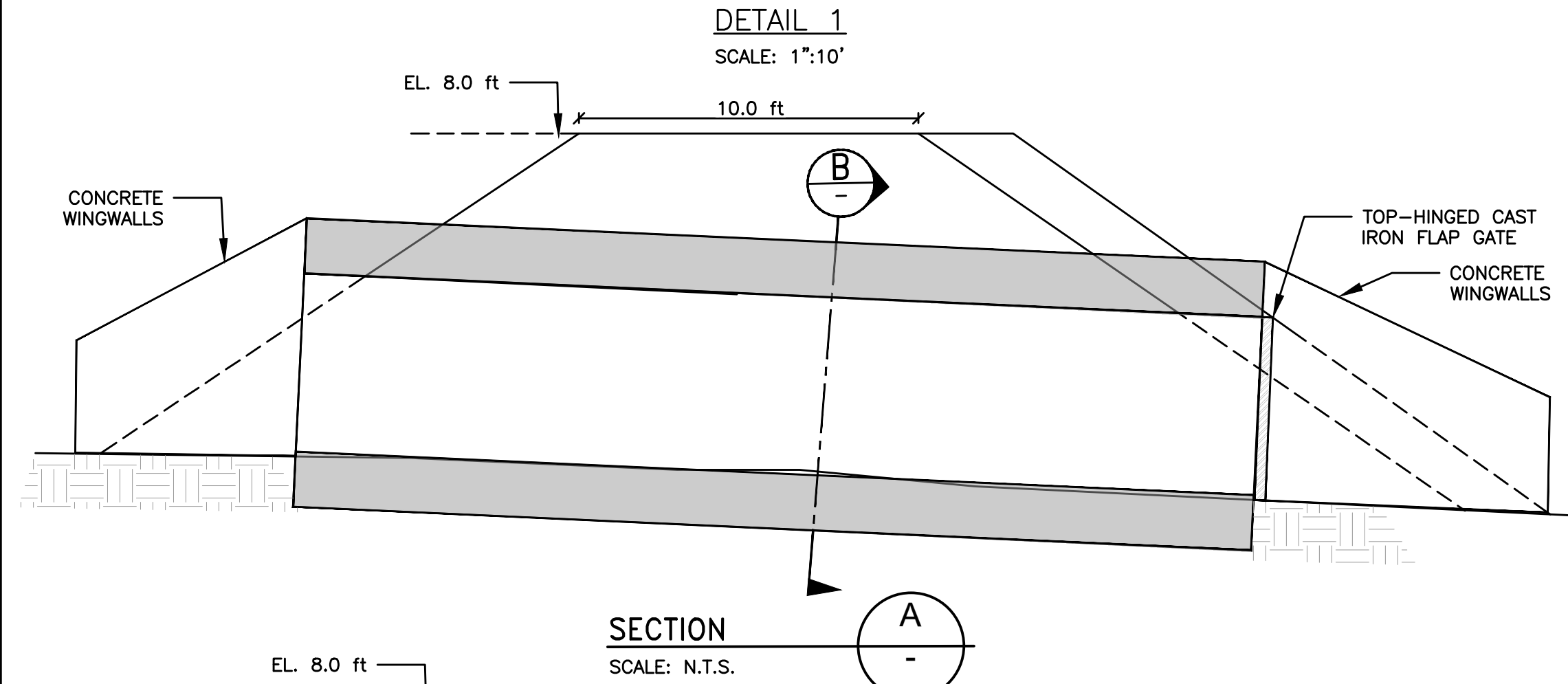
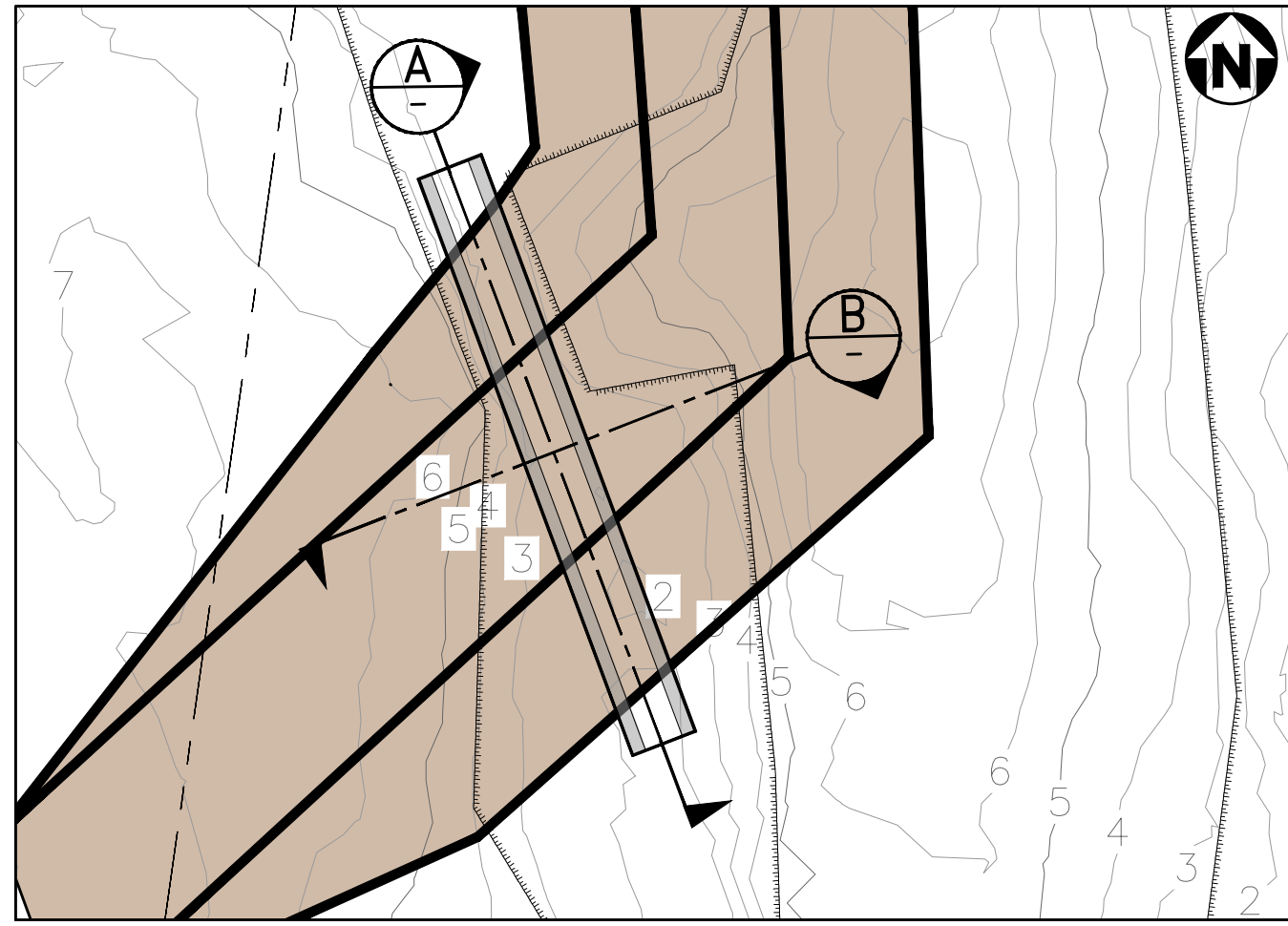
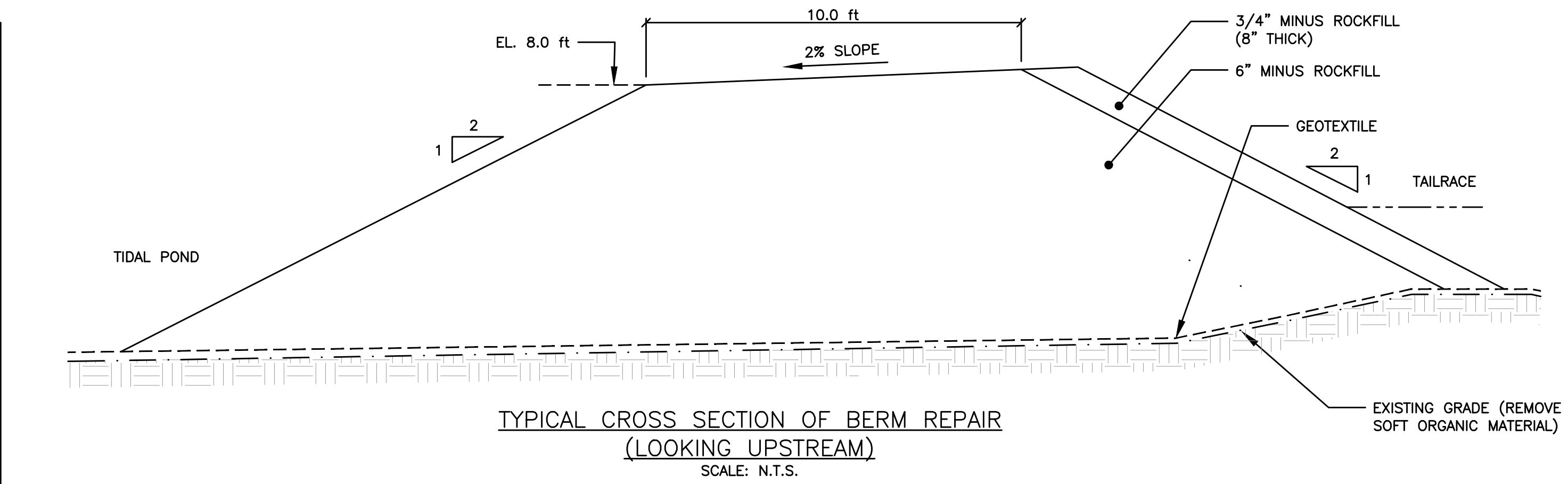
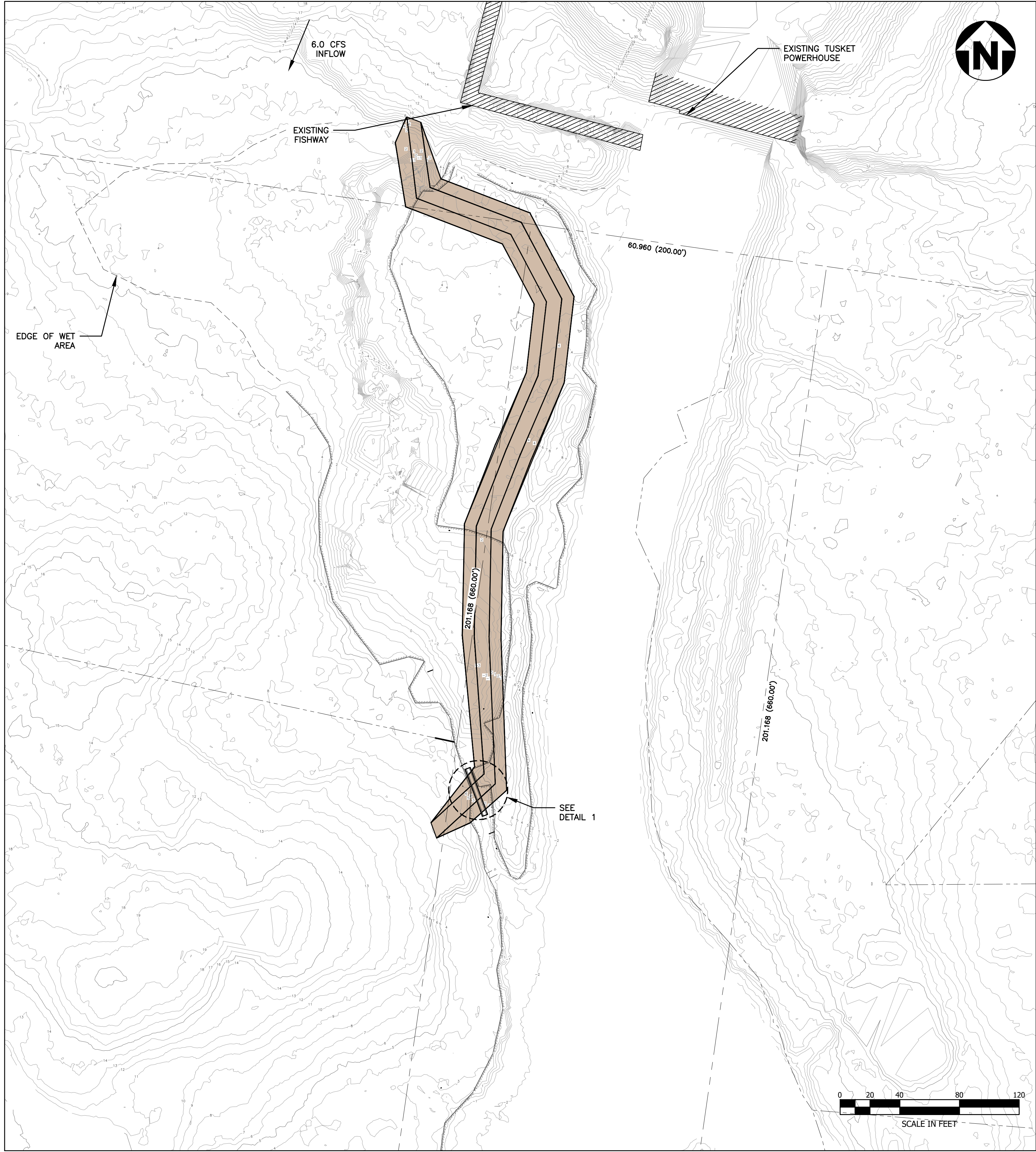
3.8.2 Capital Cost Estimate and Construction Schedule

The estimated capital cost (Class 5 estimate) of Option P-1 is **\$650,000**. It will be extremely challenging to execute the work between January, 2024 and spring 2024.

3.8.3 Drawings

The drawing for Option P-1 is provided on the following page.

F
E
D
C
B
A



OPTION P-1:
• BLOCK ALL INFLOW TO TIDAL POND TO UNUSUAL HIGH-WATER LEVELS.
• PLACE HUNG CULVERT WITH AN ABOITEAU GATE ON DOWNSTREAM END.

- LEGEND**
- PROPERTY LINE
 - - - - - ADJOINING PROPERTY LINE
 - ===== TOP OF SLOPE
 - TOE OF SLOPE
 - ===== EXISTING STRUCTURE
 - ===== AREA OF BERM REPAIR
- NOTES**
1. ALL COORDINATES, ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
 2. PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
 3. PROPERTY BOUNDARIES AND OWNERSHIP INFORMATION SHOWN ARE BASED ON FIELDWORK SUMMARY DRAWING, PROJECT No. 23-4810, BY STRUM CONSULTING DATED 14 AUGUST 2023. ALL BOUNDARY LINES ARE SUBJECT TO FINAL LEGAL SURVEY.
 4. BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
 5. TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.

WORK SAFELY

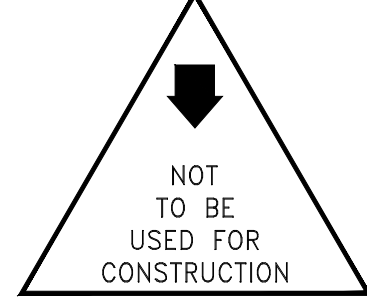
COPYRIGHT © 2021

wood.

REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	REF	NUMBER	TITLE
B	A	14DEC23																	
		21NOV23																	
		ISSUED FOR REPORT																	
		ISSUED FOR REPORT																	

UNLESS OTHERWISE AGREED IN A WRITTEN CONTRACT BETWEEN WOOD AND ITS CLIENT, THIS DOCUMENT, IT CONTAINS INFORMATION, DATA AND DESIGN THAT IS CONFIDENTIAL AND MAY NOT BE COPIED OR DISCLOSED, AND (II) MAY BE USED BY THE CLIENT ONLY IN THE CONTEXT AND FOR THE EXPRESS PURPOSE FOR WHICH IT WAS INTENDED. ANY USE OF, OR RELIANCE ON, THIS DOCUMENT BY ANY THIRD PARTY IS AT THAT PARTY'S SOLE RISK.

STAMP/SEAL



CLIENT PROJECT MGR	DEPARTMENT MGR	PROJECT MGR
PROJECT PHASE		
PROJECT NO.	260233	BY: DES EO 21NOV23
SCALE	1" = 40'	CHK: DRN KC 21NOV23
		APP: CHK BR 21NOV23

SUBJECT

OPTION P-1
PLAN AND SECTIONS

AREA

0000

CLIENT DWG NO.

DRAWING NO.

SK-007

REV

B

3.9 Option P-2: Infill the Tidal Pond Area to the Level of the Grasses in the Wetland (No Open Standing Water Visible) and Patch the Berm

3.9.1 Description

The plan and details of Option P-2 are shown on Drawing SK-008. This option consists of infilling the entire tidal pond area to the level of the existing wetland grasses (approximate El. 3.0 ft), such that there is no open standing water visible and no channel for flow. Slope the infilled area to drain to the top end channel adjacent to the existing fishway. This option includes blocking off all the tidally influenced inflow / outflow sites along the existing treed berm except for the channel adjacent to the existing fishway (i.e. patching the berm at select locations so that all the flow on typical high tides enters and exits through the upstream channel). The wetland will flood on mid tidal levels and higher.

The features of this option are:

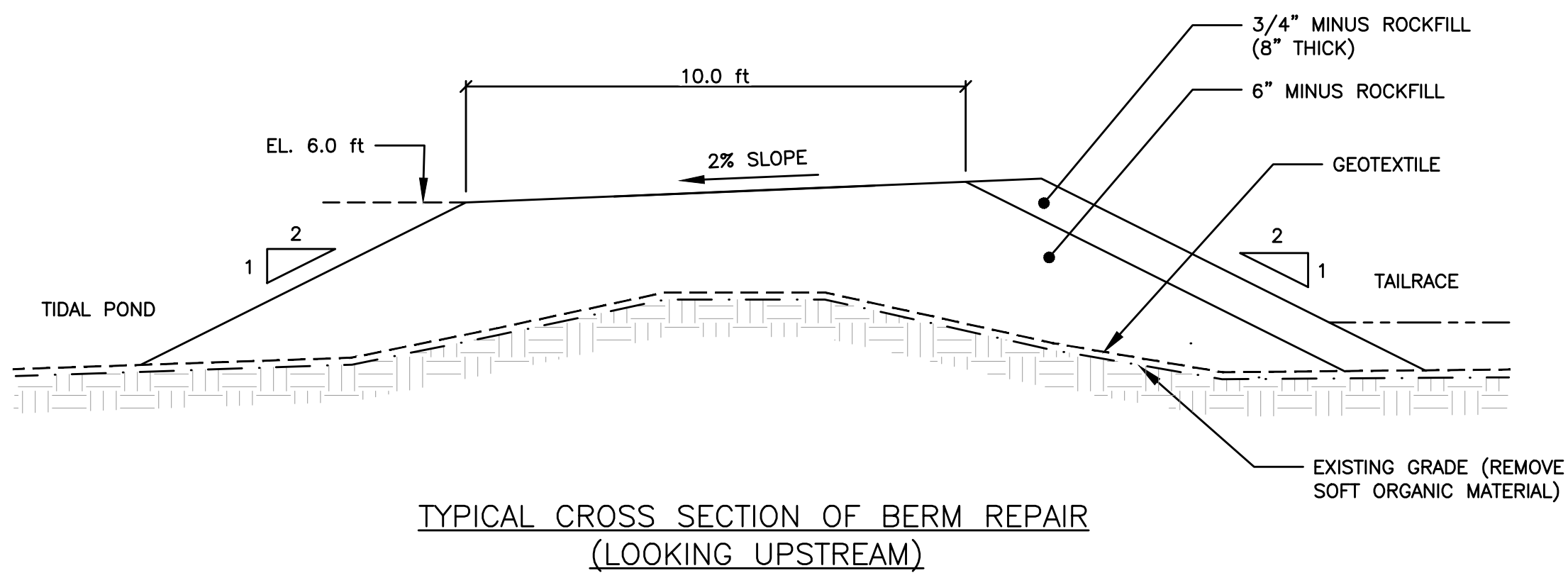
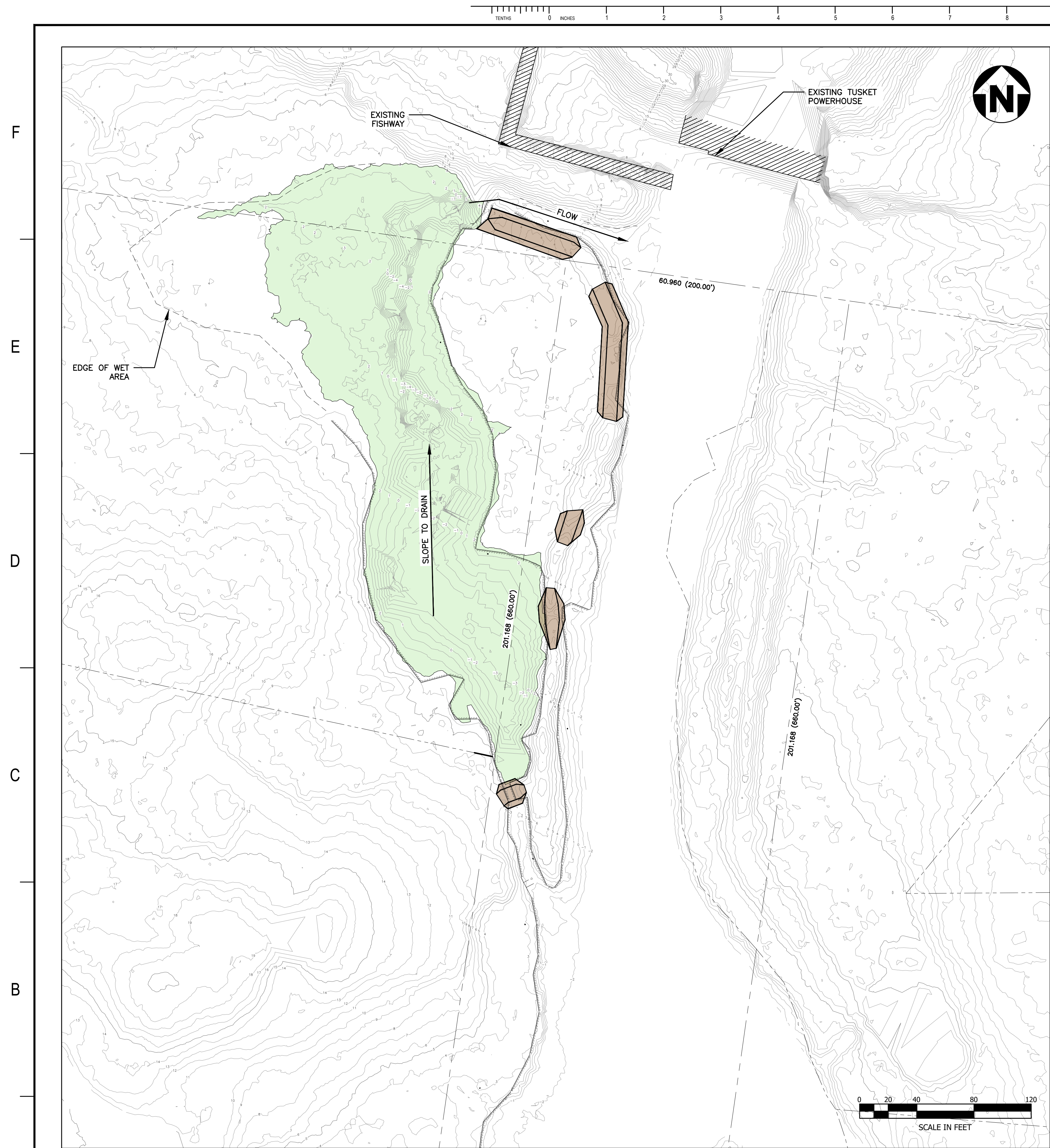
- This option turns the entire area into a grassed wetland with no open water at low tide.
- The surface water drainage from the tidal pond area would increase the attraction flow near the entrance to the existing fishway.
- Only extreme water levels will come over the berm; all flow in and out is in the channel near the fishway.
- This maintains the wetland function with no open water at low tide and does not leave open water for fish. Those entering on mid to high tides will leave as the water level falls and they contact the grasses as they do in wetlands adjacent to natural tidal areas.
- Maintain a watercourse channel across the north side of the tidal pond exiting through the channel adjacent to the fishway.

3.9.2 Capital Cost Estimate and Construction Schedule

The estimated capital cost (Class 5 estimate) of Option P-2 is **\$950,000**. It will be extremely challenging to execute the work between January, 2024 and spring 2024.

3.9.3 Drawings

The drawing for Option P-2 is provided on the following page.



- LEGEND**
- PROPERTY LINE
 - ADJOINING PROPERTY LINE
 - TOP OF SLOPE
 - TOE OF SLOPE
 - EXISTING STRUCTURE
 - AREA OF BERM REPAIR
 - FILL TO EL. 3.0 ft AT DOWNSTREAM END AND SLOPE TO DRAIN AT 0.5%
- NOTES**
- ALL COORDINATES, ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
 - PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
 - PROPERTY BOUNDARIES AND OWNERSHIP INFORMATION SHOWN ARE BASED ON FIELDWORK SUMMARY DRAWING, PROJECT No. 23-4810, BY STRUM CONSULTING DATED 14 AUGUST 2023. ALL BOUNDARY LINES ARE SUBJECT TO FINAL LEGAL SURVEY.
 - BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
 - TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.

OPTION P-2

- BLOCK ALL INFLOW TO TIDAL POND TO TYPICAL HIGH TIDE LEVEL, EXCEPT CHANNEL AT UPSTREAM END ADJACENT TO EXISTING FISHWAY.
- INFILL TIDAL POND TO THE LEVEL OF THE GRASSES IN THE WETLAND, APPROX. EL. 3.0 FT (NO OPEN STANDING WATER VISIBLE AT LOW TIDES) AND SLOPE TOWARD THE CHANNEL AT UPSTREAM END.

WORK SAFELY

REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	APP	REV	DDMMYY	REVISION / ISSUE DESCRIPTION	DRN	CHK	APP	APP	APP	REF	NUMBER	TITLE
B	14DEC23	ISSUED FOR REPORT							KC	BR	EO								
A	21NOV23	ISSUED FOR REPORT							KC	BR	EO								

UNLESS OTHERWISE AGREED IN A WRITTEN CONTRACT BETWEEN WOOD AND ITS CLIENT, THIS DOCUMENT, IT CONTAINS INFORMATION, DATA AND DESIGN THAT IS CONFIDENTIAL AND MAY NOT BE COPIED OR DISCLOSED, AND (II) MAY BE USED BY THE CLIENT ONLY IN THE CONTEXT AND FOR THE EXPRESS PURPOSE FOR WHICH IT WAS INTENDED. ANY USE OF, OR RELIANCE ON, THIS DOCUMENT BY ANY THIRD PARTY IS AT THAT PARTY'S SOLE RISK.

STAMP/SEAL

NOT TO BE USED FOR CONSTRUCTION

CLIENT PROJECT MGR		DEPARTMENT MGR		PROJECT MGR	
PROJECT PHASE					
PROJECT NO.			BY	DDMMYY	SUBJECT OPTION P-2 PLAN AND SECTIONS
260233		DES	EO	21NOV23	
		DRN	KC	21NOV23	
SCALE		CHK	BR	21NOV23	
1" = 40'		APP	EO	21NOV23	

wood.

AREA 0000 NOVA SCOTIA POWER INC. TUSKET TIDAL POND

CLIENT DWG NO.

DRAWING NO. SK-008

REV B

SAVED: 14-Dec-23 3:51 PM PLOTTED: 14-Dec-23 4:09 PM USER: CAPEWELL, KARL

3.10 Option P-3: Infill the Tidal Pond Area to the Level of the Tree Line (Top of Existing Berm)

3.10.1 Description

The plan and details of Option P-3 are shown on Drawing SK-009. This option consists of infilling the entire tidal pond area to the level of the tree line (top of existing berm, approximate El. 6.0 ft) and sloping it to drain to the channel at the top end of the area adjacent to the existing fishway.

The features of this option are:

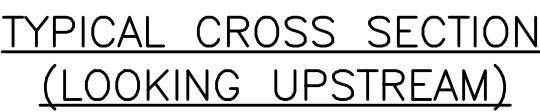
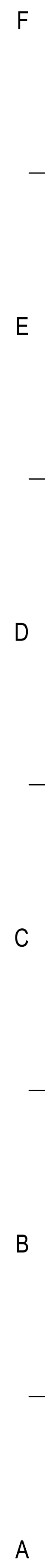
- The watercourse and surface water drainage from the tidal pond area would increase the attraction flow near the existing fishway.
- The tidal pond area would only be occasionally flooded as a high floodplain.
- The wetland function is gone, and the area becomes a treed flood plain.
- The watercourse channel would remain along the north side of the tidal pond from the watershed above.

3.10.2 Capital Cost Estimate and Construction Schedule

The estimated capital cost (Class 5 estimate) of Option P-3 is **\$1,250,000**. It will be extremely challenging to execute the work between January, 2024 and spring 2024.

3.10.3 Drawings

The drawing for Option P-3 is provided on the following page.



- NOTES**
1. ALL COORDINATES, ELEVATIONS, AND DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
 2. PROJECTION: NAD83 CSRS 2010 ZONE 5 MTM, DATUM: CGVD 2013.
 3. PROPERTY BOUNDARIES AND OWNERSHIP INFORMATION SHOWN ARE BASED ON FIELDWORK SUMMARY DRAWING, PROJECT No. 23-4810, BY STRUM CONSULTING DATED 14 AUGUST 2023. ALL BOUNDARY LINES ARE SUBJECT TO FINAL LEGAL SURVEY.
 4. BATHYMETRIC DATA WAS REFERENCED FROM TECHNICAL MEMO BY THAUMAS ENVIRONMENTAL CONSULTANTS LTD, DATED 18 AUGUST 2023.
 5. TOPOGRAPHIC LIDAR DATA WAS REFERENCED FROM PUBLIC AVAILABLE DATA SOURCES.

COPYRIGHT © 2021

				REV B	C:\USER\SKADI_CAD\MELI\DOCUMENTS\TITUSSET TINA\ISK_008.DWG
--	--	--	--	----------	--

SAVED: 14-Dec-23 3:54 PM PLOTTED: 14-Dec-23 4:10 PM USER: CAPEWELL, KAR



CLIENT PROJECT MGR		DEPARTMENT MGR		PROJECT MGR	
PROJECT PHASE					
PROJECT NO. 260233			BY	DDMMYY	
		DES	EO	21NOV23	
SCALE 1" = 40'		DRN	KC	21NOV23	
		CHK	BR	21NOV23	
		APP	EO	21NOV23	

OPTION P-3
PLAN AND SECTIONS

[illegible]

3.11 Summary of Key Considerations and Functionality of Each Option

Options A-1 and A-2

The first options A-1 and A-2 were intended to provide designs that would minimize the ecological impact to the tidal pond and wetland, minimize permitting with just a minor watercourse alteration, no HADD, no or minimal wetland loss needing NSECC wetland permitting, and minimal archaeological disturbance, as this permitting process and likely associated offsetting requirements can take studies and time to complete, and the impacts may not be necessary.

The second consideration is the work must be done before April 1, 2024, considering this is winter work. The work can only be done when the tidally influenced river water is lower than the pond level and the work areas must be stabilized before the tide and river flows re-flood the work site each day. There is also limited access to the work area for trucks and machinery.

Options A-3 to A-5

Options A-3 to A-5 require more disturbance of the wetland function and fish habitat and will take more, permitting time and also have a higher risk of siltation than Options A-1 and A-2.

For all A options

The idea of putting the outlet at the downstream end is to maintain the health of the tidal pond's water quality by having a flow through the full area during low tide. The watercourse flow only in Option A-1 was considered to be too low in dry periods, so adding an additional 6 cfs of water to supplement the watercourse flow (both at the top end) in Options A-2 to A-5 ensures a continuous flow throughout the pond and a water depth at the outlet of at least 1ft deep, enough for the fish to exit at the lowest flow throughout the low tide.

Options P-1 to P-3

Options P-1 to P-3 involve the loss of the wetland function partially or fully, and partially or fully prevent fish access.

3.12 Other Options Considered

1. The option of widening the inlet / outlet by removing a length of the berm (up to 40ft long) was considered. In this option, the fish would still enter the tidal pool area as the tide rose, and move back out through a wider opening as the tide fell. A narrower, deeper naturalized channel could be built to concentrate the outflow to a depth suitable for the downstream passage, but this would be more complex to build and would do the same thing as the control structure proposed in Options A-2 to A-5. The challenge is how to move the berm materials and to stabilize the work site on every tide to avoid releasing silt into the water. If the berm was removed down to the level of the grassed wetland elevation (3ft elevation) this would also leave the pond intact at low tide with no outlet at low tide that the fish could swim out. Some of the lower base of the berm would have to remain or the wetland and all that organic soil would wash out into the river with the tides. If the berm elevation remained at the 3ft level of the wetland grasses, there would still be some fish trapped in the pond at low tide as in Option A-

1. Without digging down through the tidal pool area to join all the deep pockets shown in Figure 1-7, fish would still get trapped during low tide by the shallow outflow exit. It is not feasible to dig through the wetland and tidal pool area to join all the deep pockets due to the level of disturbance, the depth of the channel and the need to stabilize the work site between tides. It is also not clear how deep the pond is below the organic material on the bottom.
2. An option of constructing two outlets; one at the downstream end as proposed in the A options, and a second one at the upstream end by the fishway was considered. Both outlets would need a structure to concentrate the low flow, providing a depth of water sufficient for the fish to swim out during low tide. This would mean supplying additional flow to the tidal pond to run both exits. In dry springs, such as in 2023, there was barely enough water to run the two fishways, the downstream bypass, and the required main river flows. Therefore, the additional flow may not be available in low flow years. The distance to the downstream exit (475 ft) is not very long and the water depth throughout the pond at low tide provides good access to this downstream outlet. With two flows there will be paired back eddies in the pond which will not provide a good directional cue to all the fish for finding the exit. Completely blocking the upstream exit by the fishway will stop that flow which currently competes with the attraction flow from the fishway during falling and low tides as the two are very close together.
3. An option of just having the upstream outlet by the fishway open was considered. This outlet would need a structure and additional flow, similar to Options A-2 to A-5 to maintain fish out passage during low tide. This flow adjacent to the fishway attraction flow would compete with the fishway, similar to what the existing outlet does, making it harder for fish to find the fishway. Also, having all the inflow into the tidal pond at the upstream end at low tide would result in the current in the tidal pond only flowing along the upstream side of the pond (not mixing with the rest of the pond area), leaving the rest of the pond as standing water which would warm during low tide. If the pond was full of fish, it could lose oxygen. It is best to have a flow through the entire length of the tidal pond at low tide.

4.0 Pros and Cons, and Additional Risks

Each of the options was reviewed against the criteria described in Section 1.4. Table 4-1 summarizes the pros and cons of each of the suggested concept design options, and potential risks (both during implementation and in the long term) associated with each option.

The following criteria were considered in developing the concept designs, and evaluating them:

- Reliability of concept design at alleviating the potential for stranding gaspereau
- Constructability;
 - Required installation by spring 2024 prior to gaspereau upstream migration (winter construction)
 - Limited access to construction area
 - Boggy area
 - Water control during construction

- Availability of construction materials
- Reduced construction footprint to minimize impact on the site (environmental, archaeological);
- Potential for sediment runoff from construction site (proximity to watercourse);
- Long term maintenance requirements; and,
- Capital cost.

Table 4-2 provides a simplified, high-level visual summary matrix of the information presented in Table 4-1.

Table 4-1: Pros, Cons and Potential Risks – Concept Design Options

Description	Pros	Cons	Potential Risks
Option A-1: Block All Inflow to Tidal Pond to Typical High-Water Level, Except Channel at Most Downstream End	<u>Fish access and risk of stranding</u> A single outlet will provide a single stronger current for the fish to follow when falling back. Lower risk of a fish kill than the existing conditions due to slower rate of the falling water level and one current flow to follow to deeper outlet.	Fish still access this habitat in high numbers. This is a dead end for migration with minor spawning potential.	There may not be enough water on the end of the falling tide and low tide to keep the water depth in the outlet high enough for downstream passage of fish. Minimum 6 inches. With potentially a lot of fish in shallow waters there is a risk of increased predation and a potential fish kill. But the risk is lower than the current situation.
	<u>Constructability</u> Possible to do with limited access, limited time, and winter construction conditions. Material is readily available. No cofferdam required. Short construction period	None	Working with tidal influence water levels flood in the site. Limits work time to low tide or use cofferdam.
	<u>Construction footprint</u> Reduced construction footprint to minimize impact on the site both environmentally and archaeologically		Low risk of rock and gravels carried to sites with mats on the grassed wetland which will be removed when work is complete

Description	Pros	Cons	Potential Risks
	No loss of trees on the berm Less disturbance to the wetland ecology or potential archaeological as there is only infill in eroding and low areas that are already disturbed areas. Mats used for access over grass wetlands will be removed so maintains wetland function and area.		
	<u>Potential for sediment runoff</u> Low		Low
	<u>Long term maintenance</u> Potential for erosion on inlet /outlets in berm and outlet channel over time or during high-water levels	Berm will overtop quite often in high tide / high flow events	Potential risk of erosion of berm which needs to be mitigated in berm patch design
	<u>Capital cost</u> Lowest initial capital cost of options reviewed.		
Option A-2: Block All Inflow to Tidal Pond to Typical High-Water Level, Except Channel at Most Downstream End, and Provide 6 cfs Inflow.	<u>Fish access and risk of stranding</u> Same as Option A-1 but the additional 6 cfs input and a control structure at the outlet will ensure enough water depth	Fish still access this habitat in high numbers. This is a dead end for migration	With potentially a lot of fish in shallow waters there is a risk of increased predation.

Description	Pros	Cons	Potential Risks
(Same as Option A-1, but Provide an Additional 6 cfs Inflow)	in the exit for fish to leave during low tide. A single outlet will provide a single stronger current for the fish to follow when falling back. Lower risk of a fish kill than the existing conditions or Option A-1 due to slower rate of the falling water level and one current flow to follow to deeper outlet which is maintained throughout the tide cycle by the 6 cfs.	with minor spawning potential. Fish will be attracted to the 6 cfs dead end flow.	The 6 cfs additional flow and the new control structure at the single downstream outlet will maintain the low water level in the pond approximately 1 ft higher (at El. 3.5 ft) than the current low water level at low tide. This will provide a full-time flow of water through the wetland pond, increase the pond volume, and maintain oxygen levels resulting in a <u>low</u> risk of a fish kill, much lower than Option A-1 that goes too low for fish passage at low tide.
	<u>Constructability</u> Possible to do with limited access, limited time, and winter construction conditions. Material is readily available. No cofferdam required. Short construction period	The 6 cfs will require a pump or a siphon from the headpond. Material for siphons may have a lead time. Cast-in-place concrete or other suitable option will be required to fill void around pre-cast concrete outlet structure	Working with tidal influence water levels flood in the site. Limits work time to low tide.
	<u>Construction footprint</u> Reduced construction footprint to minimize impact on the site		Low risk of rock and gravels carried to sites with mats on the

Description	Pros	Cons	Potential Risks
	both environmentally and archaeologically. No loss of trees on the berm Less disturbance to the wetland ecology or potential archaeological as there is only infill in eroding and low areas that are already disturbed areas. Mats used for access over grass wetlands will be removed so maintains wetland function and area.		grassed wetland which will be removed when work is complete
	<u>Potential for sediment runoff</u> Low		Low
	<u>Long term maintenance</u> Potential for erosion on inlet /outlets in berm and outlet channel over time or during high-water levels	Berm will over top quite often in high tide high flow events Siphon will require periodic inspection and, possibly, priming. Pump will require maintenance and re-fueling.	Potential risk of erosion of berm which needs to be mitigated in berm patch design. Siphon loses its prime or pump fails.
	<u>Capital cost</u> Second lowest initial capital cost of options reviewed.		

Description	Pros	Cons	Potential Risks
Option A-3: Block All Inflow to Tidal Pond to Unusual High-Water Levels, Except Channel at Most Downstream End, and Provide 6 cfs Inflow (Same as Option A-2, Except Block All Inflow to Tidal Pond to Unusual High-Water Levels)	<u>Fish access and risk of stranding</u> Same as Option A-2, however the additional 6 cfs input and a control structure at the outlet will ensure enough water depth in the exit for fish to leave during low tide. A single outlet will provide a single stronger current for the fish to follow when falling back. Lower risk of a fish kill than the existing conditions or Option A-1 but the same as Option A-2 due to slower rate of the falling water level and one current flow to follow to deeper outlet which is maintained throughout the tide cycle by the 6 cfs.	Fish still access this habitat in high numbers. This is a dead end for migration with minor spawning potential. Fish will be attracted to the 6cfs dead end flow.	With potentially a lot of fish in shallow waters there is a risk of increased predation. The 6 cfs additional flow and the new control structure at the single downstream outlet will maintain the low water level in the pond approximately 1 ft higher (at El. 3.5ft) than the current low water level at low tide. This will provide a full-time flow of water through the wetland pond, increase the pond volume, and maintain oxygen levels resulting in a <u>low</u> risk of a fish kill much lower than Option A-1 that will still go too low for fish passage at low tide, but the same as Option A-2. Less risk of the berm overtopping and bringing in more fish.
	<u>Constructability</u> Possible to do but with limited access, limited time, and winter		
	The 6 cfs will require a pump or a siphon from the headpond.	Working with tidal influence water levels flood in the site.	

Description	Pros	Cons	Potential Risks
	construction conditions, it will be challenging. Material is readily available. No cofferdam required.	Material for siphons may have a lead time. Cast-in-place concrete will be required to fill void around pre-cast concrete outlet structure. Significant amount of earthworks (raising berm) to be carried out in winter.	Limits work time to low tide. Poorer quality of work and increased risk of weather-related construction delays.
	<u>Construction footprint</u> Construction footprint will be minimized to limit impact on the site both environmentally and archaeologically.	This involves infilling part of the wetland on the inside of the existing berm so loss of wetland area. May not be possible to tie downstream end of dyke to high ground within NSPI property boundaries.	At risk or unique plants or wildlife habitat may be in the buried wetland area.
	<u>Potential for sediment runoff</u>	Higher potential for sediment runoff than other Options A-1 and A-2 since there is significantly more material involved and it is being placed on saturated grassed wetland. Will be difficult to avoid some localized turbidity.	Moderate

Description	Pros	Cons	Potential Risks
	<u>Long term maintenance</u> Lower long-term maintenance as the berm will not be over topped except potentially very extreme flow and tide conditions.	Siphon will require periodic inspection and, possibly, priming. Pump will require maintenance and re-fueling.	Siphon loses its prime or pump fails.
	<u>Capital cost</u> Lower long-term cost as less potential maintenance. In the mid-range of costs of options reviewed.	Higher cost	Additional cost due to weather-related delays.
Option A-4: Block All Inflow to Tidal Pond to Unusual High-Water Levels, Except Channel at Most Downstream End, Provide Additional Entrance to Existing Fishway to Provide 6 cfs Inflow (Same as Option A-3, Except Provide Additional Entrance to Existing Fishway to Provide Upstream Passage Out of the Tidal Pond)	<u>Fish access and risk of stranding</u> Same as Option A-3. The additional 6 cfs input now comes from a fishway and a control structure at the outlet will ensure enough water depth for fish to leave during low tide. Provides fish passage past the dam; this is no longer a dead end to migration. A single outlet will provide a single stronger current for the fish to follow when falling back. Lower risk of a fish kill than the		With potentially a lot of fish in shallow waters there is a risk of increased predation. The 6 cfs additional flow and the new control structure at the single downstream outlet will maintain the low water level in the pond approximately 1 ft higher (at El. 3.5 ft) than the current low water level at low tide. This will provide a full-time flow of water through the wetland pond, increase the pond volume, and maintain oxygen levels resulting in a low

Description	Pros	Cons	Potential Risks
	existing conditions or Option A-1 but the same as Options A-2 and A-3 due to slower rate of the falling water level and one current flow to follow to deeper outlet which is maintained throughout the tide cycle by the 6 cfs. Fish are not attracted to the 6 cfs flow dead end as in Options A-1 to A-3. The fishway is the main flow into the tidal pond to attract the fish as the tide falls so good entrance attraction conditions.		risk of a fish kill the same as Option A-2 and much lower than Option A-1 that will still go too low for fish passage at low tide and the same as Options A-2, and A-3. Less risk of the berm overtopping and bringing in more fish.
	<u>Constructability</u>	Constructing the additional entrance to the fishway during winter conditions will be extremely difficult. Cast-in-place concrete and earthworks will be required for the additional entrance to the fishway (difficult during winter conditions). Cofferdam at downstream toe may be required for	Working with tidal influence water levels flood in the site. Limits work time to low tide. Poorer quality of work and increased risk of weather-related construction delays.

Description	Pros	Cons	Potential Risks
		constructing the additional entrance to the fishway. From a schedule perspective, it will be difficult to have the additional entrance to the fishway ready for 2024 gaspereau upstream migration season. Cast-in-place concrete will be required to fill void around pre-cast concrete outlet structure. Significant amount of earthworks (raising berm) to be carried out in winter.	
	<u>Construction footprint</u> Construction footprint will be minimized to limit impact on the site both environmentally and archaeologically.	This involves infilling part of the wetland on the inside of the existing berm so loss of wetland area. Need to construct means of providing the 6 cfs inflow at the additional entrance only. May not be possible to tie downstream end of dyke to high ground within NSPI property boundaries.	At risk or unique plants or wildlife habitat may be in the buried wetland area and in the area of the additional entrance to the fishway.

Description	Pros	Cons	Potential Risks
	<u>Potential for sediment runoff</u>	Higher potential for sediment runoff than Options A-1 to A-3 since there is significantly more material involved and it is being placed on saturated grassed wetland. Also requires significant amount of earthworks to construct the additional entrance to the fishway. Will be difficult to avoid some localized turbidity.	Moderate
	<u>Long term maintenance</u> Lower long-term maintenance as the berm will not be over topped except potentially very extreme flow and tide conditions.	Additional entrance to the fishway will require cleaning, maintenance and monitoring.	
	<u>Capital cost</u>	Most expensive of Options A-1 to A-5, and second most expensive option reviewed.	Additional cost due to weather-related delays.
Option A-5: Block All Inflow to Tidal Pond to Typical High Tide Level, Except Channel at Most	<u>Fish access and risk of stranding</u> Same as Option A-4 but with more risk of berm overtopping		With potentially a lot of fish in shallow waters there is a risk of

Description	Pros	Cons	Potential Risks
Downstream End, Provide Additional Entrance to Existing Fishway with 6 cfs Inflow (Same as Option A-4, Except Block All Inflow to Tidal Pond to Typical High-Water Level)	in high tide high flow events. The additional 6 cfs input now comes from a fishway and a control structure at the outlet will ensure enough water depth for fish to leave during low tide. Provides fish passage past the dam this is no longer a dead end to migration. A single outlet will provide a single stronger current for the fish to follow when falling back. Lower risk of a fish kill than the existing conditions or Option A-1, but the same as Option A-2 due to slower rate of the falling water level and one current flow to follow to deeper outlet which is maintained throughout the tide cycle by the 6 cfs. Fish are not attracted to the 6 cfs flow dead end as in the above options. The fishway is the main flow into the tidal pond to attract the fish as the tide falls so good entrance attraction conditions.		increased predation. The 6cfs additional flow and the new control structure at the single downstream outlet will maintain the low water level in the pond approximately 1 ft higher, at 3.5ft elevation, than the current low water level at low tide. This will provide a full-time flow of water through the wetland pond, increase the pond volume, and maintain oxygen levels resulting in a low risk of a fish kill the same as A-2 and much lower than Option A-1 that will still go too low for fish passage at low tide and the same as A-2, and A-3. Lower risk as the fish will have upstream passage so not a dead end. Less risk of the berm overtopping and bringing in more fish.

Description	Pros	Cons	Potential Risks
	<u>Constructability</u>	Constructing the additional entrance to the fishway during winter conditions will be extremely difficult. Cast-in-place concrete and earthworks will be required for the additional entrance to the fishway (difficult during winter conditions). Cofferdam at downstream toe may be required for constructing the additional entrance to the fishway. From a schedule perspective, it will be difficult to have the additional entrance to the fishway ready for 2024 gaspereau upstream migration season. Cast-in-place concrete will be required to fill void around pre-cast concrete outlet structure. Need to construct means of providing the 6 cfs inflow at the additional entrance only.	Working with tidal influence water levels flood in the site. Limits work time to low tide. Poorer quality of work and increased risk of weather-related construction delays.

Description	Pros	Cons	Potential Risks
	<u>Construction footprint</u> Reduced construction footprint to minimize impact on the site both environmentally and archaeologically. No loss of trees on the berm Less disturbance to the wetland ecology or potential archaeological as there is only infill in eroding and low areas that are already disturbed areas. Mats used for access over grass wetlands will be removed so maintains wetland function and area.		Low risk of rock and gravels carried to sites with mats on the grassed wetland which will be removed when work is complete. At risk or unique plants or wildlife habitat may be in the area of the additional entrance to the fishway.
	<u>Potential for sediment runoff</u> Mats and carrying the rock and gravels reduced risk of sediment run off	Higher potential for sediment runoff due to significant amount of earthworks to construct the additional entrance to the fishway. Will be difficult to avoid some localized turbidity.	Moderate
	<u>Long term maintenance</u> Potential for erosion on inlet	Berm will over top quite often in	Potential risk of erosion of berm

Description	Pros	Cons	Potential Risks
	/outlets in berm and outlet channel over time or during high-water levels	high tide high flow events. Additional entrance to the fishway will require cleaning, maintenance and monitoring.	which needs to be mitigated in berm patch design.
	<u>Capital cost</u>	Second most expensive of Options A-1 to A-5, and fourth most expensive option reviewed.	Additional cost due to weather-related delays.
Option P-1: Block All Inflow to Tidal Pond to Unusual High-Water Levels, and Place Hung Culvert With an Aboiteau Gate on Downstream End	<u>Fish access and risk of stranding</u> Almost all fish will be prevented from entering the tidal pond area as it will no longer be tidal with only seepage through the berms. No chance of stranding gaspereau. If they do enter through the aboiteau or over the berm in high tides they can go out the single exit. Maintains freshwater wetland	Total loss of tidal-influenced wetland function.	High head difference on the berm so some leakage.
	<u>Constructability</u>	Constructing the aboiteau during winter conditions will be extremely difficult.	Working with tidal influence water levels flood in the site. Limits work time to low tide.

Description	Pros	Cons	Potential Risks
		Cast-in-place concrete and earthworks will be required for the aboiteau (difficult during winter conditions). Cofferdam at downstream toe may be required for constructing the aboiteau. From a schedule perspective, it will be difficult to have the aboiteau ready for 2024 gaspereau upstream migration season. Significant amount of earthworks (raising berm) to be carried out in winter.	Poorer quality of work and increased risk of weather-related construction delays.
	<u>Construction footprint</u> Construction footprint will be minimized to limit impact on the site both environmentally and archaeologically.	This involves infilling part of the wetland on the inside of the existing berm so loss of wetland area. May not be possible to tie downstream end of dyke to high ground within NSPI property boundaries.	At risk or unique plants or wildlife habitat may be in the buried wetland area and in the area of the aboiteau.
	<u>Potential for sediment runoff</u>	High potential for sediment	

Description	Pros	Cons	Potential Risks
		runoff since there is significant amount of material being placed on saturated grassed wetland. Also requires significant amount of earthworks to construct the aboiteau. Will be difficult to avoid some localized turbidity.	Moderate
	<u>Long term maintenance</u>	Potential for erosion at outlet of aboiteau. Aboiteau will require inspection and periodic cleaning.	Potential risk of erosion of berm which needs to be mitigated in berm patch design.
	<u>Capital cost</u> Less expensive than Options P-2 and P-3. In the mid-range of costs of options reviewed.	More expensive than Options A-1 to A-3.	Additional cost due to weather-related delays.
Option P-2: Infill the Tidal Pond Area to the Level of the Grasses in the Wetland (No Standing Water Visible)	<u>Fish access and risk of stranding</u> Fish will access the area on the rising tide but fall back out the single exit as the water level falls into the level of the grasses which gives the fish enough water depth to exit (as they do in grassland flood plains). No	Fish still access this habitat in high numbers. This is a dead end for migration with minor spawning potential. Some fish may not fall back on	Some risk of fish being hung up and dying, but risk is low. Some fish will remain in the channel and try to go up the watercourse but there is no habitat for them. Risk is low.

Description	Pros	Cons	Potential Risks
	open water at low tide for the fish to remain. The channel outlet at the upstream end will still need a control structure to ensure a depth of water is maintained as long as possible for fish to exit.	the falling tide	
	<u>Constructability</u>	Challenging when working in this tidally influenced area. Work could only be done during low tides and would have to be stabilized after each day. Significant quantity of infill material to be supplied, transported and placed during winter conditions. From a schedule perspective, it will be difficult to have the aboiteau ready for 2024 gaspereau upstream migration season.	Poorer quality of work and increased risk of weather-related construction delays. Risk of wash out of the wetland soils used for infill.
	<u>Construction footprint</u> Construction footprint will be minimized to limit impact on the site both environmentally	This involves infilling part of the wetland on the inside of the existing berm so loss of wetland	At risk or unique plants or wildlife habitat may be in the

Description	Pros	Cons	Potential Risks
	and archaeologically.	area.	buried wetland area. Partial loss of wetland function with the loss of open water.
	<u>Potential for sediment runoff</u>	High potential for erosion during construction and post-construction until vegetation becomes established on top of the infill.	Highest potential for sediment runoff of all options assessed.
	<u>Long term maintenance</u>	High maintenance requirements until vegetation becomes established on top of the infill.	High risk of failure
	<u>Capital cost</u>	Third most expensive option reviewed.	Additional cost due to weather-related delays.
Option P-3: Infill the Tidal Pond Area to the Level of the Tree Line (Top of Existing Berm)	<u>Fish access and risk of stranding</u> No fish access to the main area, just fish in the watercourse channel along the top side.		
	<u>Constructability</u> The area would have to be completely bermed off, and then infilled and land formed	Requires significant amount of material and erosion controls until vegetation becomes	Not possible to construct in time for upstream gaspereau migration period in 2024.

Description	Pros	Cons	Potential Risks
	and stabilized. The outlet at the upstream end would have to be built as a watercourse with fish habitat	established on top of the infill.	
<u>Construction footprint</u> Very large		This involves infilling all of the wetland on the inside of the existing berm.	At risk or unique plants or wildlife habitat may be in the buried wetland area. Full loss of wetland function
<u>Potential for sediment runoff</u>		Higher potential for sediment runoff than all other options except Option P-2.	Risk of sedimentation will require a good erosion control plan
<u>Long term maintenance</u>		Requires maintenance until vegetation becomes established on top of the infill.	High tidal flooding could erode the flood plain until it is fully established
<u>Capital cost</u>		Most expensive option reviewed.	Additional cost due to weather-related delays.

Table 4-2: High Level Summary Matrix of Concept Design Options

EVALUATION CRITERIA	OPTION							
	A-1	A-2	A-3	A-4	A-5	P-1	P-2	P-3
Fish Access and Risk of Stranding								
Constructability								
Construction Footprint								
Potential for Sediment Runoff								
Long Term Maintenance								
Capital Cost								

Legend:

Favourable compared to other options
Neutral compared to other options
Undesirable compared to other options

5.0 Conclusions and Recommendations

5.1 Conclusions

- 1) There are several options and different combinations of aspects of the options presented. The choice is basically between:
 - a) allowing the tidal pond area to continue as a wetland with the ecological benefits that such a wetland provides as a freshwater tidally-influenced wetland, or
 - b) shutting off the tidal influence losing some or all of the wetland function. We have not assessed the wetland for species at risk or unique species, but freshwater tidally-influenced wetlands of this scale are not common.
- 2) It is clear that, at times, large numbers of gaspereau enter the tidal pond area and are focused on moving upstream with even the small flow from the watercourse above the pond attracting them and discourages them from leaving as the tide falls. This occasionally results in too many fish in the pond, and they quickly use up all the oxygen and they die.
- 3) To prevent too many fish being in the pond, and quickly using up all the oxygen and dying, a low, continuous flow could be provided through the pond to supply oxygen and closing off the multiple inlet / outlets so there is enough depth of water for the fish to exit to the river at one location throughout the tidal cycle.
- 4) Another option to prevent too many fish being in the pond, and quickly using up all the oxygen and dying is to provide upstream passage out of the tidal pond which would contribute the needed for more upstream escapement at the site and reduce the delay in migration caused by the fish entering a dead end.
- 5) Another option to prevent fish kills in the tidal pond is to prevent the fish from going into the area by either creating a migration barrier at the outlet or infilling the wetland.
- 6) An archaeological survey of the area has not been done which means the project would be best done with the minimal footprint and focus on already disturbed areas.
- 7) Construction of any option is limited by the need to have it completed by April 2024 which means a short final detailed design stage including consultation and permits, and winter construction. This means the final option selected may have to be done in steps over a longer time period.

8) Estimated capital costs (Class 5) are as follows:

Option	Estimated Capital Cost
A-1	\$200,000
A-2	\$340,000
A-3	\$510,000
A-4	\$1,100,000
A-5	\$900,000
P-1	\$650,000
P-2	\$950,000
P-3	\$1,250,000

5.2 Recommendations

It is recommended to proceed with Option A-2:

Patch the berm to:

- Close off all existing inlet/ outlet channels except for the most downstream outlet
- Build-up the few lower areas on the existing berm
- Install a low control structure in the most downstream outlet to concentrate the low-level outflow to help maintain water depth at low tide
- Provide an additional 6 cfs flow through the pond during the gaspereau migration period so that the fish are kept alive and have an exit throughout the tidal cycle.

This would have no post construction impact on the wetland function, no or minimal potential to affect archaeological sites, and be able to be constructed during the 2023/24 winter with minimal risk to the environment and not require a detailed permitting process and possible offsetting for the loss of wetland function.