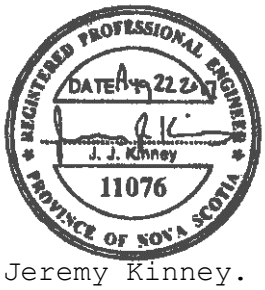
Specifications
Issued for Tender

Parks Canada Agency

Barrier Beach Groynes and Renourishment
Fortress of Louisbourg National Historic Site

Project No. 578
GEMTEC Eastern Joint Venture




Jeremy Kinney.
GEMTEC Limited

END

**DRAWING LIST**

Drawing No. C-1 Existing Conditions
C-2 Barrier Beach Stabilization
C-3 Typical Groyne Sections
C-4 Typical Beach Fill and Groyne Sections
C-5 Cleared Archaeology Areas

List of Appendices:
Appendix A Borehole Logs and Laboratory Analysis
Appendix B Basic Impact Analysis

END

PART 1 GENERAL

1.1 Work Covered By Contract Documents

.1 The Work in this Contract comprises improvements to the barrier beach. The work generally includes constructing two groynes and beach renourishment at the Fortress of Louisbourg National Historic Site, Nova Scotia.

.2 Hauling of material to the site may be done by land or by water. If work is to be done by water, it is to be done so only in areas indicated on the drawings.

**.3 A proposed temporary wharf would require Transport Canada approval pursuant to the *Navigation Protection Act*.**

.4 **The Contractor will submit, along with the tender package, a detailed construction plan indicating how they will proceed with the work, complete with drawings, indicating all pits and quarries to be used, and all haul and travel routes, whether by land or water.**

1.2 Contract Method

.1 Construct Work under a unit price contract.

1.3 Work by Others

.1 Co-ordinate work with that of other Contractors.

.2 Additional payments or schedule extensions due to work or scheduling conflicts with other Contractors will not be considered.

1.4 Work Sequence

.1 Construct Work in stages to accommodate continuous access to the Fortress of Louisbourg National Historic Site.

.2 Work locations and traffic management to be in accordance with the regulations having jurisdiction.

1.5 Contractor Use of Premises

.1 Limit use of premises for Work, to allow:
- .1 Work by other contractors.
- .2 Parks Canada usage.
- .3 Parks Canada will accommodate the Contractor with a location for their construction trailer.

.2 Storage areas and refueling for Contractor's equipment and materials shall be limited to areas shown on the drawings. Locations for equipment and materials storage areas shall be the responsibility of the Contractor.

.3 Disposal of waste materials shall be outside the Site Boundaries except as directed in these specifications. Locations and costs associated with waste disposal shall be the responsibility of the Contractor.

.4 Repair or replace portions of existing work, including but not limited to, removal of semi-permanent structures to facilitate access i.e. stair cases along trucking route, which have been altered during construction operations to match existing or adjoining work, as directed by Owners Representative.

1.6 Summary of Work

.1 The tasks associated with the reconstruction of the barrier beach improvements in the Fortress of Louisbourg National Historic Site are summarized as follows. Details of the requirements are provided in the project technical specifications and drawings.

.1 Provide and implement designated controls for traffic and environmental aspects of the work.
.2 Excavation where shown on drawings and disposal of excavation on-site.
.3 Compact and proof roll subgrade.
.4 Supply and place core fill and armour stone.
.5 Supply and place beach fill material.

1.7 Existing Services

.1 Establish location and extent of service lines in area of work before starting Work. Notify Owners Representative of findings.

.2 Protect, relocate or maintain existing active services.

1.8 Documents Required

.1 Maintain at job site, one copy each document as follows:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Change Orders.
.7 Other Modifications to the Contract.
.8 Field Test Reports.
.9 Copy of Approved Work Schedule.
.10 Health and Safety Plan and Other Safety Related Documents.
.11 Other documents as specified.
.12 Construction Schedule
.13 Environmental Control Plan (ECP)

END

PART 1 GENERAL

1.1 Access and Egress

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, in accordance with relevant municipal, provincial and other regulations.

1.2 Use of Site and Facilities

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

1.3 Alterations, Additions or Repairs

.1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 Existing Services

.1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 Provide for personnel, pedestrian and vehicular traffic. Provide for one lane of traffic during working hours and provide two lane traffic (where applicable)at the end of each working day.

.3 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 Special Requirements

.1 Work outside of normal working hours will require 48 hours written notice to the Departmental Representative. There are restrictions on working on nights, weekends or statutory holidays unless 48 hours written notice is given to the Departmental Representative and approved by Parks Canada.

.2 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

.3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.4 Keep within limits of work and avenues of ingress and egress.

.5 Traffic delays are to be limited to a five (5) minute maximum.

.6 The Contractor must not interfere with traffic on Route 22 with priority given to Fortress of Louisbourg bus traffic.

.7 Contractor must complete all construction on period site between October 20, 2017 and March 1, 2018.

.8 The Contractor must provide traffic control in accordance with Drawing C-1.

.9 No work, encroachment or construction vehicles are permitted outside of the cleared areas shown on the drawings.

PART 2 PRODUCTS

2.1
NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1

NOT USED

.1 Not Used.

END OF SECTION

END

Part 1 General

1.1 References

.1 General Conditions.

1.2 Prime Cost Sum

.1 Include in Contract Price a total of Prime Cost Sum of $80,000.

.2 The Contract Price, and not Prime Cost Sum, includes Contractor’s overhead and profit in connection with such prime cost sum.

.3 Prime Cost Sum provided for in the unit price table is not a sum due to the Contractor. Rather, payment will be made against it for miscellaneous work not included in the unit price table ordered under GC 6.1 of the General Conditions.

.4 Such work may include, but not limited to:
.1 Rock scaling, common excavation, drilling and installation of rock anchors, trees, shrubs and ground cover planting, archaeological protection, treatment of contaminated soil. within project site.

.5 Once a Prime Cost Sum has been agreed upon with Park, it shall be included as an item.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

PART 1 GENERAL

1.1 Measurement

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

1.2 Pay Items

.1 All items in this contract will be paid for by costs included in the Lump Sum Payment for costs not included in these items.

.2 Bid Item 1 – Sections 01 35 00.06, 01 35 43, 01 52 00, 10 14 53, 10 22 00, 26 05 00, 26 05 03 – Miscellaneous Items

.1 Terms of Payment: Lump Sum

.2 This Item includes:

.1 Mobilization and Demobilization for the project.

.2 Special Procedures for Traffic Control.

.1 Flag persons and traffic accommodation person(s)

.2 Provision, installation and maintenance of temporary traffic control devices, including detour signs, construction signage and electronic message boards.

.3 Provision and maintenance of detours.

.4 Vehicles, equipment, supplies, and additional manpower required by traffic accommodations persons.

.3 Environmental Procedures.

.1 Installation and general maintenance of all erosion control measures or as directed by Departmental Representative.

.2 Perform work in accordance with BIA for this project.

.4 Special Project Features Cultural Resource Protection.

.5 Testing and Quality Control.

.6 Construction Facilities.

.1 Construction Site Trailer.

.7 Temporary Barriers and Enclosures.

.8 Cleaning.

.9 Construction/Demolition Waste Management and Disposal.

.10 Traffic Signage.

.11 Weigh Scales

.1 A suitably installed and certified weigh scale.

.12 Common Work Results

.1 Insurance & Bonding

.2 Municipal Fees, Permits, etc.

.3 Mobilization

.4 Inspection & Testing

.5 Commissioning

.3 Bid Item 2 – Allowances Section 01 21 00

.1 Unit of Measurement: Lump Sum.

.4 Bid Item 3 Aggregate Materials – Section 31 05 16

.1 Unit of Measurement: cubic metre.

.2 Method of Measure: Number of cubic metres compacted in place as per the drawings or as directed by the Departmental Representative.

.5 Bid Item 4 – Section 31 23 33 – Excavating, Trenching, and Backfilling.

.1 Unit of Measurement: Cubic metre.

.2 Method of Measure: number of cubic metres excavated and subsequently hauled, placed, stockpiled, or removed from site, as per the drawings or as directed by the Departmental Representative.

.6 Bid Item 5 – Section 35 31 19 – Beach Fill

.1 Unit of Measurement: Cubic metre.

.2 Method of Measure: Number of cubic metres compacted in place as per the drawings or as directed by the Departmental Representative.

.7 Bid Items 6, 7, 8, and 9 – Section 35 31 19 – Groynes.

.1 Unit of Measurement: Tonnes.

.2 Method of Measure: Number of tonnes of material acceptably incorporated into the work as per the drawings or as directed by the Departmental Representative.

.8 All and any items not specifically included in the Measurement for Payment and Pay Item List are

considered incidental to the work and are to be included in the tendered price for the related work.

PART 2
Products 2.1 NOT USED

PART 3

Not Used

END

PART 1 GENERAL

1.1 Administrative

.1 The Contractor shall Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.

.2 The Contractor shall prepare agenda for meetings.

.3 The Contractor shall Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.

.4 The Contractor shall provide physical space and make arrangements for meetings.

.5 The Contractor shall preside at meetings.

.6 The Contractor shall record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 The Contractor shall Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants, affected parties not in attendance and the Departmental Representative.

.8 Representatives of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 Preconstruction Meeting

.1 Within 15 days after award of Contract, The Contractor shall request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 The Contractor shall establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include:

.1 Appointment of official representative of participants in the Work.
.2 Schedule of Work: in accordance with NSTIR Standard Specification.
.3 Schedule of submission of shop drawings, samples. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
.5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
.6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
.7 Owner provided products.
.8 Record drawings in accordance with Section 01 78 00 – Closeout Submittals.
.9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
.10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
.11 Monthly progress claims, administrative procedures, photographs, hold backs.
.12 Appointment of inspection and testing agencies or firms.
.13 Insurances, transcript of policies.

1.3 Progress Meetings

.1 During course of Work schedule progress meetings bi-weekly.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.

.3 Notify parties minimum 7 days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 4 days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.
.2 Review of Work progress since previous meeting.
.3 Field observations, problems, conflicts.
.4 Problems which impede construction schedule.
.5 Review of off-site fabrication delivery schedules.
.6 Corrective measures and procedures to regain projected schedule.
.7 Revision to construction schedule.
.8 Progress schedule, during succeeding work period.
.9 Review submittal schedules: expedite as required.
.10 Maintenance of quality standards.
.11 Review proposed changes for effect on construction schedule and on completion date.
.12 Other business.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 GENERAL

1.1 Definitions

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and

controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 Requirements

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to Departmental Representative within 10 working days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 Master Plan

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Departmental Representative will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 Project Schedule

.1 Develop detailed Project Schedule derived from Master Plan.

1.6 Project Schedule Reporting

.1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current weekly forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.7 Project Meetings

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 Execution

3.1 NOT USED

END

PART 1 GENERAL

1.1 Administrative

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 This section specifies general requirements and procedures for Contractor’s submissions of shop drawings, product data, samples and mock-ups to the Departmental Representative for review. Additional specific requirements for submissions are specified in individual sections.

.3 Do not proceed with Work until relevant submissions are reviewed by the Departmental Representative.

.4 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.5 Where items or information is not produced in SI Metric units, converted values are acceptable.

.6 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.7 Notify the Departmental Representative, in writing, at the time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review of submission.

.9 Make any changes which Departmental Representative may require consistent with Contract Documents and resubmit as directed by the Departmental Representative.

.10 Notify the Departmental Representative, in writing, when resubmitting, of any revisions other than those requested by the Departmental Representative.

1.2 Submission Requirements

.1 Coordinate each submission with requirements of work and Contract Documents.
Individual submissions will not be reviewed until all related information is available.

.2 Allow 7 days for Departmental Representative's review of each submission.

.3 Adjustments made on submissions by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.4 Make changes in submissions as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.5 Accompany submissions with transmittal letter, in duplicate, containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.
- .6 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.7 After Departmental Representative's review, distribute copies.

1.3 Shop Drawings

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Where necessary or requested by the Departmental Representative, submit drawings stamped and signed by professional engineer registered or licensed in the Province of Nova Scotia.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed.

Indicate cross references to design drawings and specifications.

.4 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.5 Cross-reference shop drawing information to applicable portions of Contract Documents.

1.4 Product Data

.1 Product data: manufacturers catalogue sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products.
- .1 Submit electronic copies of product data.
- .2 Sheet size: 215 x 280 mm, maximum of 3 modules.
- .3 Delete information not applicable to project.
- .4 Supplement standard information to provide details applicable to project.
- .5 Cross-reference product data information to applicable portions of Contract Documents.

1.5 Samples

.1 Samples: examples of materials, equipment, quality, finishes, workmanship.

.2 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.6 Test Reports

.1 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product of system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within 3 years of contract award for project.

1.7 Certificates

.1 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

1.8 Manufacturer's Instructions

.1 Submit electronic copies of manufacturer instructions.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

1.9 Review

.1 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, electronic copies will be returned and fabrication and installation or Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.2 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.10 Photographic Documentation

.1 Submit electronic copy of colour digital photography in jpg format, fine resolution, monthly with progress statement as directed by Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints:

.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: as directed by Departmental Representative.

.1 Upon completion of: excavation, foundation, grading services before concealment, or as directed by Departmental Representative.

1.11 Certificates and Transcripts

.1 Immediately after award of Contract, submit Letter of Good Standing from Workers Compensation Board of Nova Scotia.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 GENERAL

1.1 References

.1 Nova Scotia Department of Transportation and Infrastructure Renewal.

.1 Temporary Workplace Traffic Control Manual (most recent version)

.2 Manual of Uniform Traffic Control Devices for Canada (MUTCD-C) – (most recent version)

1.2 Description

.1 This section specifies requirements and procedures for traffic regulation to ensure protection of work and safety of public to satisfaction of Departmental Representative.

1.3 Flag persons to Be Instructed

.1 Contractor shall ensure that only employees who are in possession of a valid accreditation issued by the Provincial Traffic Authority of Nova Scotia are assigned to this project.

PART 2 Products

2.1 Traffic Control Devices

.1 Barricades, signs, delineators, warning lights, electronic message board, flag person’s paddles and other devices shall be in strict accordance with the Nova Scotia Temporary Workplace Traffic Control Manual.

.2 Signs, barricades, delineators and flag persons paddles shall be as new and reflectorized to show same shape and colour by night as by day.

.3 Signs to be written or symbolic.

.4 All detour, lane restriction, traffic control and speed restriction signs required at an individual repair site must be in place before any road excavation at that site commences.

2.2 Traffic Control Plan

.1 Contractor to provide a traffic control plan to meet the requirements of the traffic pattern restrictions shown on Drawing C-1.

.2 Submit plan a minimum 2 weeks before start of construction. Do not begin construction until traffic plan is approved by Owner.

.3 Traffic plan to be stamped by a professional engineer registered in the Province of Nova Scotia, and with expertise in traffic control.

PART 3 EXECUTION

3.1 General

.1 Conduct operations as to create a minimum of inconvenience to traffic.

.2 Provide and maintain access to and from properties adjacent to work area.

.3 Provide traffic control through use of flag persons.

.4 Continue using traffic control persons or approved traffic signal system during period between end of working day and start of next work shift when only one lane open to traffic.

.5 At least one week prior to commencing work, submit to Departmental Representative a traffic control signing plan. This layout shall indicate the quantity, spacing and detail of signs, to be used during construction for each work area site (including adjustments for various stages of work). Work shall not commence until Departmental Representative has approved layout.

.6 Accommodating Traffic and hours of work shall be as noted in Section 01 14 00.

.7 Take into account the effect of steep grades and curved alignment present in the work area when planning and executing traffic control measures.

3.2 Protection of Public Traffic

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.

.2 When working on travelled way:
- .1 Place equipment in position to minimize interference and hazard to travelling public.
- .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
- .3 Do not leave equipment on travelled way overnight.

.3 Close lanes of road only after receipt of written approval from Departmental Representative.
- .1 Before re-routing traffic erect suitable signs and devices to Work Area Traffic Control Manual.

.4 Keep travelled way graded, free from pot holes and of sufficient width for required number of lanes of traffic.
- .1 Provide 7 m wide minimum temporary roadway for traffic in two-way sections through Work and on detours.
- .2 Provide 5 m wide minimum temporary roadway for traffic in one-way sections through Work and on detours.

.5 Provide graveled detours or temporary roads as directed by Departmental Representative to facilitate passage of traffic around restricted construction area:
- .1 Grade for detour in accordance with Section 31 24 13 - Roadway Embankments.
- .2 Place and compact granular sub-base in accordance with Section 32 11 16.01 - Granular Sub-base.
- .3 Place and compact granular base in accordance with Section 32 11 23 - Aggregate Base Courses.

3.3 Traffic Interruptions

.1 Provide electronic message boards at both ends of the Route 22 work area to provide public traffic information for the ongoing construction.

.2 Period and timing of any traffic Interruptions greater than 5 minutes must have prior approval of the Departmental Representative.

3.4 Detours

.1 Construct and maintain detour roads as may be required up to a maximum of 10% grade.

3.5 Signs and Barricades

.1 Provide, erect and maintain necessary barricades, suitable and sufficient flashing warning lights, danger signals and other signs.

.2 Placement and erection of signs, barricades, delineators and warning lights and other devices to be in strict accordance with Nova Scotia Temporary Workplace Traffic Control Manual.

.3 Remove or cover signs which do not apply to existing conditions.

.4 Check devices daily for damage, legibility and correct positioning. Repair, replace or reposition as required or as directed by Departmental Representative.

3.6 Speed Zones

.1 Speed zone signing within a construction zone shall be:

.1 50 km/h when no construction is under way.

.2 20 km/h when construction is under way on the roadway or construction traffic is crossing the roadway.

.2 There will be strict enforcement of the Speed limits by the RCMP, Environmental Protection Officer and Parks Canada Warden Service.

3.7 Traffic control persons

.1 Provide traffic control persons when:

.1 Traffic is required to pass working vehicles or equipment liable to block any portion of travelled way.

.2 It is necessary to initiate a one-way traffic system past or through construction area when traffic volumes are high, approach speed high and traffic signal system not used.

.3 Workers or equipment are employed on travelled way over brow of hill, around sharp curve or at any location where oncoming traffic would not have adequate advance warning of their presence.

.4 In high-speed, high-volume areas where temporary protection is required while other traffic control devices are being erected or taken down.

.5 Other traffic control devices not readily available.

.6 Complete protection for both workers and public is not provided by other means.

.2 Ensure traffic control persons are conversant with situation necessitating delay and are ready to explain reason and approximate duration to affected public.

.3 Ensure traffic control persons are neat in appearance, perform their duties in courteous and diligent manner and are aware of importance in protection of workers and general public.

.4 Equip each traffic control person with:

.1 Hard hat.

.2 Traffic control person's paddle consisting of a diamond shape, displaying a red stop sign on a white background facing in direction in which traffic is to stop. Reverse side shall be a yellow diamond. Paddle shall be reflectorized to show same shape and color by night as by day.

.3 Blaze red or blaze orange traffic control persons' vest or jacket. For flagging during hours of darkness, traffic control persons' vest or jacket shall have reflectorized vertical white stripes, at least two of which are visible on front and two on back of garment.

.4 For flagging during hours of darkness, a flashlight fitted with a red signalling baton of type similar to those used by Police.

.5 A means of communication for each team of traffic control persons (field telephones, two way radios, etc.) where two ends of a restricted section are not intervisible.

.5 Place RTAC TC-21 "Traffic control person" sign ahead of each traffic control person station. Where a single traffic control person is required to control a straight one-way section, place "Traffic control person" signs for both directions of travel.

.6 Ensure "Traffic control person" signs are covered or removed when flagging discontinued.

.7 Locate traffic control person stations no closer than 20 m from work area.

.8 Ensure traffic control persons are familiar with and follow standard flagging procedures:

.1 Give signals in clear precise manner to avoid confusion which may develop in mind of travelling public as to meaning of signals given.

.2 Stand in a safe position, preferably on centerline where traffic control person, paddle and other devices will be clearly visible and where traffic control person has unobstructed view of approaching traffic.

.3 To stop traffic in daylight, face approaching traffic and extend left arm horizontally across traffic lane with paddle held in upright position and with "Stop" side facing approaching traffic. For greater emphasis, raise right arm with open palm toward approaching traffic. In darkness, supplement paddle with flashlight, with red baton attached, held in right hand with arm extended

horizontally at right angle to approaching traffic.

.4 To slow traffic in daylight, extend left arm horizontally across traffic lane with paddle held in upright position and with yellow side facing approaching traffic. For emphasis extend right arm horizontally away from body with palm facing down, and move slowly up and down through a small arc at right angles to traffic. In darkness assume same position with flashlight, with red baton attached, held in right hand.

.5 If above procedure results in traffic slowing below required speed, traffic control person turns and faces across traffic lane and looks over right shoulder at traffic to be directed. In daylight, extend right arm and move arm in an elliptical manner corresponding to rotation and direction of vehicle wheels. Extend left arm forward across traffic lane, with paddle held upright and yellow side facing traffic to be directed. In darkness take same position but with flashlight, with red baton attached, in right hand.

.6 To keep traffic moving at prevailing speed limit, stand facing across traffic lane, extend right arm and move in an elliptical manner corresponding to rotation and direction of vehicle wheels. Lower paddle held in left hand behind traffic control person's leg farthest from approaching traffic. In darkness use flashlight, with red baton attached, in right hand.

.7 Signal to proceed or proceed slowly may also be given verbally after stopping traffic.

.8 Never use traffic control person's paddle to wave traffic on, or display in other than static position.

.9 Where two traffic control persons are working as a team at opposite ends of a restriction, one traffic control person shall be designated as Chief Traffic control person for purpose of coordinating traffic movements. Chief Traffic control person shall initiate changes in directional flow of traffic and determine duration of each cycle. Where visual signals are used between themselves to assign changes in traffic

movements, such signals shall be predetermined and not be such as to be mistaken as traffic flagging signals by public.

3.8 Traffic Accommodation Person

.1 The Contractor shall provide for services 24 hours per day.

.2 Major responsibilities of the traffic accommodation person:

.1 Maintain traffic control devices and signs during regular shutdown on weekends and at night throughout the week.

.2 Clean signs, flares, barricades, etc. used to control and accommodate traffic.

.3 Assist the travelling public the event of an emergency.

.4 Contact proper authorities in the event of an emergency, i.e., Contractor's Supervisor, Park Warden, and Departmental Representative.

END

PART 1 GENERAL

1.1 References

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Province of Nova Scotia
.1 Occupational Health and Safety Act (most recent version).

1.2 Definitions

.1 COSH: Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code.

.2 Competent Person: means a person who is:
.1 Qualified by virtue of personal knowledge, training and experience to perform assigned work in a manner that will ensure the health and safety of persons in the workplace, and;
.2 Knowledgeable about the provisions of occupational health and safety statutes and regulations that apply to the Work and;
.3 Knowledgeable about potential or actual danger to health or safety associated with the Work.

.3 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.

.4 PPE: personal protective equipment

.5 Work Site: where used in this section shall mean areas, located at the premises where Work is undertaken, used by Contractor to perform all of the activities associated with the performance of the Work.

1.3 Submittals

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit site-specific Health and Safety Plan prior to commencement of Work.

.1 Submit within 10 work days of notification of Bid Acceptance. Provide 3 copies.

.2 Departmental Representative will review Health and Safety Plan and provide comments.

.3 Revise the Plan as appropriate and resubmit within 5 work days after receipt of comments.

.4 Departmental Representative's review and comments made of the Plan shall not be construed as an endorsement, approval or implied warranty of any kind by Canada and does not reduce Contractor's overall responsibility for Occupational Health and Safety of the Work.

.5 Submit revisions and updates made to the Plan during the course of Work.

.3 Submit name of designated Health & Safety Site Representative and support documentation specified in the Safety Plan.

.4 Submit building permit, compliance certificates and other permits obtained.

.5 Submit copy of Letter in Good Standing from Provincial Workers Compensation or other department of labour organization.

.1 Submit update of Letter of Good Standing whenever expiration date occurs during the period of Work.

.6 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.7 Submit copies of incident reports.

.8 Submit WHMIS MSDS - Material Safety Data Sheets.

1.4 Compliance Requirements

.1 Comply with Occupational Health and Safety Act for Province of Nova Scotia, and Regulations made pursuant to the Act.

.2 Comply with Canada Labour Code - Part II (entitled Occupational Health and Safety) and the Canada Occupational Health and Safety Regulations (COSH) as well as any other regulations made pursuant to the Act.

.1 The Canada Labour Code can be viewed at: www.http://laws.justice.gc.ca/en/L-2/

.2 COSH can be viewed at: www.http://laws.justice.gc.ca/eng/SOR-86-304/ne .html

.3 In case of conflict or discrepancy between above specified requirements, the more stringent shall apply.

.4 Maintain Workers Compensation Coverage in good standing for duration of Contract. Provide proof of clearance through submission of Letter in Good Standing.

.5 Medical Surveillance: Where prescribed by legislation or regulation, obtain and maintain worker medical surveillance documentation.

1.5 Responsibility

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons and environment adjacent to the site to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by all workers, sub-contractors and other persons granted access to Work Site with safety requirements of Contract Documents, applicable federal, provincial, and local by-laws, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.6 Site Control and Access

.1 Control the Work and entry points to Work Site. Approve and grant access only to workers and authorized persons. Immediately stop and remove non-authorized persons.

.1 Departmental Representative will provide names of those persons authorized by Departmental Representative to enter onto Work Site and will ensure that such authorized persons have the required knowledge and training on Health and Safety pertinent to their reason for being at the site. However, Contractor remains responsible for the health and safety of authorized persons while at the Work Site.

.2 Isolate Work Site from other areas of the premises by use of appropriate means.

.1 Erect fences, hoarding, barricades and temporary lighting as required to effectively delineate the Work Site, stop non-authorized entry, and to protect pedestrians and vehicular traffic around and adjacent to the Work and create a safe environment.

.2 Post signage at entry points and other strategic locations indicating restricted access and conditions for access.

.3 Use professionally made signs with bilingual message in the 2 official languages or international known graphic symbols.

.3 Provide safety orientation session to persons granted access to Work Site. Advise of hazards and safety rules to be observed while on site.

.4 Ensure persons granted site access wear appropriate PPE. Supply PPE to inspection authorities who require access to conduct tests or perform inspections.

.5 Secure Work Site against entry when inactive or unoccupied and to protect persons against harm.

Provide security guard where adequate protection cannot be achieved by other means.

1.7 Protection

.1 Give precedence to safety and health of persons and protection of environment over cost and schedule considerations for Work.

.2 Should unforeseen or peculiar safety related hazard or condition become evident during performance of Work, immediately take measures to rectify situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

1.8 Filing of Notice

.1 File Notice of Project with pertinent provincial health and safety authorities prior to beginning of Work.

.1 Departmental Representative will assist in locating address if needed.

1.9 Permits

.1 Post permits, licenses and compliance certificates, at Work Site.

.2 Where a particular permit or compliance certificate cannot be obtained, notify Departmental Representative in writing and obtain approval to proceed before carrying out applicable portion of work.

1.10 Hazard Assessments

.1 Perform site specific health and safety hazard assessment of the Work and its site.

.2 Carryout initial assessment prior to commencement of Work with further assessments as needed during progress of work, including when new trades and subcontractors arrive on site.

.3 Record results and address in Health and Safety Plan.

.4 Keep documentation on site for entire duration of the Work.

1.11 Project / Site Conditions

.1 Following are potential health, environmental and safety hazards at the site for which Work may involve contact with:

.1 Known latent site and environmental conditions:

.1 Working near watercourse.

.2 Working on steep or uneven ground.

.3 Electrical safety required.

.4 Working with adverse weather conditions.

.5 Working near trench excavations.

.6 Working near Public traffic.

.7 Working near trees and overhead obstructions.

.8 Working near buried utilities.

.9 Working near heavy moving machinery.

.10 Winter conditions/icy surfaces.

.2 Facility on-going operations:

.1 The Contractor will co-operate with users of existing facilities. Maintain access to the existing park facilities and consult with the Departmental Representative for site access limitations.

.2 Should interference occur, take directions from Departmental Representative.

.3 Do not unreasonably encumber site with materials.

.4 Move stored products or equipment which interfere with operations.

.5 Comply with all regulations and authorities having jurisdiction over the work.

.2 Above items shall not be construed as being complete and inclusive of potential health and safety hazards encountered during Work.

.3 Include above items in the hazard assessment of the Work.

.4 MSDS Data sheets of pertinent hazardous and controlled products stored on site can be obtained from Departmental Representative.

1.12 Meetings

.1 Attend pre-construction health and safety meeting, convened and chaired by Departmental Representative, prior to commencement of Work, at time, date and location determined by Departmental Representative. Ensure attendance of:
- .1 Superintendent of Work
- .2 Designated Health & Safety Site Representative
- .3 Subcontractors

.2 Conduct regularly scheduled tool box and safety meetings during the Work in conformance with Occupational Health and Safety regulations.

.3 Keep documents on site.

1.13 Health and Safety Plan

.1 Prior to commencement of Work, develop written Health and Safety Plan specific to the Work. Implement, maintain, and enforce Plan for entire duration of Work and until final demobilization from site.

.2 Health and Safety Plan shall include the following components:
- .1 List of health risks and safety hazards identified by hazard assessment.
- .2 Control measures used to mitigate risks and hazards identified.
- .3 On-site Contingency and Emergency Response Plan as specified below.
- .4 On-site Communication Plan as specified below.
- .5 Name of Contractor's designated Health & Safety Site Representative and information showing proof of his/her competence and reporting relationship in Contractor's company.
- .6 Names, competence and reporting relationship of other supervisory personnel used in the Work for occupational health and safety purposes.

.3 On-site Contingency and Emergency Response Plan shall include:
- .1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.
- .2 Evacuation Plan: site plan layouts showing marshalling areas. Details on alarm notification methods, location of firefighting equipment and other related data.
- .3 Name, duties and responsibilities of persons designated as Emergency Warden(s) and deputies.
- .4 Emergency Contacts: name and telephone number of officials from:
  - .1 General Contractor and subcontractors.
  - .2 Pertinent Federal and Provincial Departments and Authorities having jurisdiction.
  - .3 Local emergency resource organizations.
- .5 Harmonize Plan with Facility's Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of PWGSC and Facility Management contacts.

.4 On-site Communication Plan:
- .1 Procedures for sharing of work related safety information to workers and subcontractors, including emergency and evacuation measures.
- .2 List of critical work activities to be communicated with Facility Manager which have a risk of endangering health and safety of Facility users.

.5 Address all activities of the Work including those of subcontractors.

.6 Review Health and Safety Plan regularly during the Work. Update as conditions warrant to address emerging risks and hazards, such as whenever new trade or subcontractor arrive at Work Site.

.7 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may

request re-submission of the Plan with correction of deficiencies or concerns.

.8 Post copy of the Plan, and updates, prominently on Work Site.

1.14 Safety Supervision

.1 Employ Health & Safety Site Representative responsible for daily supervision of health and safety of the Work.

.2 Health & Safety Site Representative may be the Superintendent of the Work or other person designated by Contractor and shall be assigned the responsibility and authority to:

.1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work

.2 Monitor and enforce Contractor's site-specific Health and Safety Plan.

.3 Conduct site safety orientation session to persons granted access to Work Site.

.4 Ensure that persons allowed site access are knowledgeable and trained in health and safety pertinent to their activities at the site or are escorted by a competent person while on the Work Site.

.5 Stop the Work as deemed necessary for reasons of health and safety.

.3 Health & Safety Site Representative must:

.1 Be qualified and competent person in occupational health and safety.

.2 Have site-related working experience specific to activities of the Work.

.3 Be on Work Site at all times during execution of the Work.

.4 All supervisory personnel assigned to the Work shall also be competent persons.

.5 Inspections:

.1 Conduct regularly scheduled safety inspections of the Work on a minimum biweekly basis. Record deficiencies and remedial action taken.

.2 Conduct Formal Inspections on a minimum monthly basis. Use standardized safety inspection forms. Distribute to subcontractors.

.3 Follow-up and ensure corrective measures are taken.

.6 Cooperate with Facility's Occupational Health and Safety representative should one be designated by Departmental Representative.

.7 Keep inspection reports and supervision related documentation on site.

1.15 Training

.1 Use only skilled workers on Work Site who are effectively trained in occupational health and safety procedures and practices pertinent to their assigned task.

.2 Maintain employee records and evidence of training received. Make data available to Departmental Representative upon request.

.3 When unforeseen or peculiar safety-related hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.16 Minimum Site Safety Rules

.1 Notwithstanding requirement to abide by federal and provincial health and safety regulations; ensure the following minimum safety rules are obeyed by persons granted access to Work Site:

.1 Wear appropriate PPE pertinent to the Work or assigned task; minimum being hard hat, safety footwear, safety vest, safety glasses and hearing protection.

.2 Immediately report unsafe condition at site, near-miss accident, injury and damage.

.3 Maintain site and storage areas in a tidy condition free of hazards causing injury.

.4 Obey warning signs and safety tags.

.2 Brief persons of disciplinary protocols to be taken for noncompliance. Post rules on site.

1.17 Correction of Compliance

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative will stop Work if non-compliance of health and safety regulations is not corrected in a timely manner.

1.18 Incident Reporting

.1 Investigate and report the following incidents to Departmental Representative:

.1 Incidents requiring notification to Provincial Department of Occupational Safety and Health, Workers Compensation Board or to other regulatory Agency.

.2 Medical aid injuries.

.3 Property damage in excess of $10,000.00,

.4 Interruptions to Facility operations resulting in an operational loss to a Federal Department in excess of $5000.00.

.2 Submit report in writing.

1.19 Hazardous

Products

.1 Comply with requirements of Workplace hazardous Materials Information System (WHMIS).

.2 Keep MSDS data sheets for all products delivered to site.
.1 Post on site.
.2 Submit copy to Departmental Representative.

.3 For interior work in an occupied Facility, post additional copy in one or more publicly accessible locations.

1.20 Blasting

.1 Blasting or other use of explosives is not permitted on site without prior receipt of written permission and instructions from Departmental Representative.

1.21 Confined Spaces

.1 Abide by occupational health and safety regulations regarding work in confined spaces.

.2 Obtain an Entry Permit in accordance with Part XI of the Canada Occupational Health and Safety Regulations for entry into an existing identified confined space located at the Facility or premises of Work.
.1 Obtain permit from Facility Manager
.2 Keep copy of permit issued.

.3 Safety for Inspectors:
.1 Provide PPE and training to Departmental Representative and other persons who require entry into confined space to perform inspections.
.2 Be responsible for efficacy of equipment and safety of persons during their entry and occupancy in the confined space.

1.22 Site Records

.1 Maintain on Work Site copy of safety related documentation and reports stipulated to be produced in

compliance with Acts and Regulations of authorities having jurisdiction and of those documents specified herein.

.2 Upon request, make available to Departmental Representative or authorized Safety Officer for inspection.

1.23 Posting of Documents

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on Work Site in accordance with Acts and Regulations of Province having jurisdiction.

.2 Post other documents as specified herein, including:
.1 Site specific Health and Safety Plan
.2 WHMIS data sheets

.3 Fire and Safety Requirements
.4 Special Procedures on Lockout Requirements

END

PART 1 GENERAL

1.1 Standard

.1 All work of this section shall comply with the requirement of the most recent version of the Nova Scotia Transportation and Infrastructure Renewal (NSTIR) Standard Specification Division 7, except as amended herein.

1.2 References

.1 Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specifications (most recent version):

.1 NSTIR Standard Specification Division 7- Environmental Protection.

.2 The Nova Scotia Environment Act and Regulations pursuant to the Act.

.3 The Erosion and Sedimentation Control Handbook for Construction Sites.

.4 TIR Environmental Management Program Manual.

.5 CWRS Erosion and Sediment Control Course and binder.

.2 Canadian Environmental Assessment Act (most recent version).

1.3 Pre-Construction Mitigation

1. Departmental Representative will ensure that all on-site subcontractors and suppliers are fully informed of all avoidance, mitigation and contingency measures as described in the Basic Impact Assessment and federal regulatory authorizations, and that this information is issued to all staff.

2. Prior to construction, all Contractor employees and subcontractor employees will be required to attend an environmental briefing session. This session will highlight operating conditions, environmental mitigation, and guidelines in the Basic Impact Assessment and conditions of regulatory authorizations. It will be made clear at this briefing that personnel who ignore

conditions in the regulatory authorizations and/or Basic Impact Assessment may be removed from the project.

3. The Contractor will be responsible to brief all subcontractors or crew who miss the above briefing session about relevant portions of the Basic Impact Assessment and conditions of regulatory authorizations that pertain to their activity and ensure their work conforms to the requirements.

4. Conditions presented in the Basic Impact Assessment will be considered part of the Contract Document. Failure to comply with or observe the conditions in the Basic Impact Assessment may result in the work being suspended pending rectification of the problem.

5. The Environmental Assessment Officer (EAO) assigned to the project is to ensure that the mitigative measures detailed in the Basic Impact Assessment and regulatory authorizations are adequately carried out and to provide additional mitigation for unforeseen impacts on site. Failure to respond to Environmental concerns may result in a "stop work" order being issued by the Superintendent until such time the issue has been resolved.

6. The Contractor will adhere to all mitigation set out in the Basic Impact Assessment.

7. Contingency and response plans will be detailed and submitted prior to construction, as described in the Basic Impact Assessment.

1.4 Fires

.1 Fires and burning of rubbish on site is not permitted.

1.5 Disposal of Wastes

.1 Dispose of waste material in designated waste disposal area.

.2 Remove and dispose of containers and waste fluids associated with vehicle maintenance in a provincially approved waste disposal site outside the park.

.3 Disposal of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers is prohibited. Dispose of all waste materials at Provincially approved waste disposal site outside the park boundary. Littering is prohibited.

.4 To the maximum extent possible, divert waste cardboard, plastic and metal products from landfill to appropriate recycling facilities.

1.6 Drainage

.1 Provide temporary drainage and pumping required to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.7 Site Clearing and Plant Protection

.1 Exercise special care to protect trees, shrubs and vegetation within contract limit lines outlined on drawings or as directed by Departmental Representative.

.2 Protect roots of designated trees to drip line during excavation and site grading to prevent disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.3 Minimize stripping of topsoil and vegetation, especially in the vicinity of stream banks

.4 Restrict tree removal to areas indicated or designated by Departmental Representative.

.5 When, in the opinion of the Departmental Representative/Park Environmental Protection Officer (EPO), negligence on the part of the Contractor

results in unnecessary damage or destruction of vegetation, or other environmental or aesthetic features within or beyond the staked or designated work area, the Contractor shall be responsible, at its expense, for the complete restoration including the replacement of trees, shrubs, grass, etc. to the satisfaction of the Departmental Representative.

1.8 Erosion and Sediment Control

.1 All measures necessary to minimize erosion and the mitigation of sediment shall be provided as required or as directed by the Departmental Representative.

.2 Labour, equipment and materials to be provided and will be considered as incidental to the work, except for payment items specifically identified in the unit price table.

1.9 Work Adjacent To Waterways

.1 The Contractor is required to install, inspect and maintain in good working order temporary erosion, siltation and pollution control features, as directed by Departmental Representative. These devices are to be removed in proper manner upon completion of the project.

.2 Unless otherwise permitted do not use waterway beds for borrow material.

.3 Unless otherwise permitted do not dump excavated fill, waste material or debris in waterways.

.4 Do not skid logs or construction materials across waterways.

.5 Do not operate construction equipment in waterways.

.6 Works performed in and around waterways will be carried out in accordance with regulations of authorities having jurisdiction.

.7 Cuts and fills adjacent to waterways are to be stabilized, and ditch run-outs constructed to prevent entry of silt into waterways. In vicinity of stream banks, maintain as much of the existing vegetation as possible.

.8 On conclusion of construction, debris must be disposed of to prevent its entry into waterways and stream beds.

1.10 Pollution Control

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.4 All equipment, vehicles and plant used on site must be in good operating condition and leak free. The Departmental Representative reserves the right to have the Contractor immediately remove from the site, any deficient equipment, vehicles, etc.

.5 There will be Canadian Park Service Environmental Protection Officers on site to undertake overall environmental surveillance of this project.

1.11 Vehicular Movements

.1 Restrict movement of vehicles and equipment to existing disturbed areas (access roads, borrow pits, disposal areas and right-of-ways).

1.12 Storage and Handling of Fuels And Dangerous Fluids

.1 Locate fuel storage facility outside Park and minimum of 100 m from any water body. Any fuel storage

tankage (s) used shall be of adequate double-walled safety construction and shall be enclosed by an impermeable containment dyking system with a volume capacity equal to at least 110% of fuel storage tank (s)' fuel storage capacity. Any spillage and/or ponded fuel shall be immediately recovered and placed in secure containers. When no longer required, the fuel storage area shall be cleaned up to satisfaction of the Departmental Representative and any fuel contaminated soil removed to the nearest approved industrial waste disposal site.

.1 Fueling of vehicles or equipment will not be permitted within 100 m of any water body.

.2 Exercise care in handling of fuels to minimize potential for fuel spills. Report immediately any fuel spills to Departmental Representative. Contractor is responsible for any cleanup or repair resulting from any spills.

.3 Supply and maintain on site emergency response material to contain spills and minimize environmental damage, i.e. absorbent material, to the approval of Departmental Representative. Disposal of all contaminated material as per Clause 1.4 of this section.

1.13 Refueling

.1 All refueling of equipment shall be undertaken at the designated refueling area (as indicated on Drawing C-1).

1.14 Erosion Control

.1 Sediment fences and ditch erosion control structures shall be constructed in roadside ditches or at culvert inverts prior to any excavation as directed by Departmental Representative.

.2 To minimize run-off, work on slopes, including temporarily stored materials, which may affect water bodies will be curtailed during periods of heavy rainfall, as directed by the Departmental Representative.

.3 Provide and maintain a project and site specific Erosion and Sediment Control (ESC) Plan.

1.15 Environmental Protection Plan

.1 The Contractor is required to submit a plan showing all pollution control measures and sediment control measures that will be used to fulfill the requirements of the Environmental Protection Section and Basic Impact Assessment attached to this document. This plan will be reviewed by the Departmental Representative and the Environmental Protection Officer prior to start of construction activities.

END

PART 1 – GENERAL

1.1 Mandatory Site Meeting

.1 Contractor wishing to tender on this project must attend a site meeting where project scope and construction details and restrictions will be reviewed.

.2 Failure to attend at this meeting will result in rejection of the tender.

.3 Tenders shall be advised that the date and time for the meeting is 1:30 p.m. local time, October 4, 2017 at the Administration Boardroom, Fortress of Louisbourg.

.4 A signed “Certificate of Site Visit” on the form provided herein shall accompany the Contractor’s Tender submission.

1.2 National Parks Act

.1 The requirements and regulations made under the National Parks Act shall apply to this project.

.2 A copy of this Act may be obtained by contacting the Departmental Representative.

1.3 Heritage “Period”

.1 Contractors wishing to tender on this project shall be aware that the work proposed under this Contract involves construction within a site constructed to a “period” design.

1.4 Archeological Status

.1 Fortress of Louisbourg is designated as a National Historic Site.

.2 In areas where cultural resources are observed, the Staff Archeologist will direct that the Contractor load and transport the excavated material to a designated soil storage area for later

screening. The Contractor shall follow all instructions received from the Archeology Department in this regard. The Contract price shall include allowances to load and transport excavated material to the soil storage areas.

.3 The Staff Archeologist and Park Warden's service assigned to this project shall have authority to suspend work on this project in the event that directions and specifications are not followed or when there is a threat to resources.

1.5 Pre-Construction Mitigation

.1 The Contractor must be firmly aware that he/she are working in a National Historic Site setting with its emphasis on cultural and natural resource protection.

.2 The Basic Impact Assessment containing two sets of mitigations, one set for cultural resource protection and one set for natural resource protection, will be read in its entirety and mitigation will be followed as described.

.3 The National Parks Act and Historic Parks Regulations will be followed during all phases of construction. The Acts and Regulations can be made available for review at the Fortress of Louisbourg Warden's Office.

.4 Louisbourg protects a large and complex archeological site. These archeological resources will be respected and maintained in accordance with Parks Canada Cultural Resources Guidelines.

.5 A field meeting with Project Archeologist, Contractor, Project Liaison Officer, and Departmental Representative will be scheduled prior to construction.

.6 Departmental Representative will ensure that all on-site subcontractors and suppliers are fully informed of all information in the Basic Impact Assessment and that this information is issued to all staff.

.7 Fencing and barricades are not to be moved or removed unless otherwise stated by Project Archeologist.

.8 Prior to construction, all Contractor employees and subcontractor employees will be required to attend an environmental briefing session. This session will highlight operating conditions, archeological mitigation, and guidelines in the Basic Impact Assessment. It will be made clear at this briefing that personnel who ignore conditions in the screening may be removed from the project.

.9 Prior to commencement of work, the Project Manager will be provided with a work schedule from the contractor.

.10 The Contractor, will be responsible to brief all subcontractors or crew who miss the above briefing session about relevant portions of the Basic Impact Assessment that pertain to their activity and ensure their work conforms to the Basic Impact Assessment.

.11 Conditions presented in the Environmental screening will be considered part of the Contract Document. Failure to comply with or observe the screening may result in the work being suspended pending rectification of the problem.

.12 The Environmental Assessment Officer (EAO) assigned to the project is to ensure that the mitigative measures detailed in this Basic Impact Assessment are adequately carried out and to provide additional

mitigation for unforeseen impacts on site. Failure to respond to Environmental concerns may result in a "stop work" order being issued by the Superintendent until such time the issue has been resolved.

.13 The Project Archeologist is authorized to order a work stoppage in the event of immediate impact to cultural resources.

.14 The Contractor will adhere to all mitigation set out in the Environmental Screening.

.15 The Project Archeologist will be kept informed of project scheduling and notified of changes to the schedule at all times.

.16 All equipment operators will be trained and familiar with cultural resources.

.17 An emergency response plan resulting from any petroleum and/or chemical spills will be detailed and submitted.

.18 All vehicle traffic is restricted to existing roadways or as indicated on project plans. Any deviation from the identified corridor requires archeological and Park Warden's service review. A field visit will be conducted with the Contractor, and the Contractor's surveyor and Project Archeologist for locational confirmation and all areas proposed for construction will be marked with stakes prior to the commencement of work.

.19 A Certified Surveyor will mark in the field the travel corridor and construction corridor. Locational confirmation will be provided to archaeology prior to commencement of work. All surface modifications are restricted to the identified construction corridor and will be surveyed and marked in the field.

.20 When surveillance archeology is required the archeologist will oversee all excavation and shall stop the work when cultural resources are identified to assess the nature and significance of the resources, to record and/or remove the archeological resources encountered, and/or to determine mitigation actions if the resources are to remain in situ.

.21 Archeology will be contacted immediately if archeological resources are encountered.

.22 To mitigate damage to cultural resources encountered during construction the Contractor will undertake additional measures at the direction of the Surveillance Archeologist. They may include geotextile, protective covering, and any materials associated with stabilization and preservation of resource integrity.

.23 Any artifacts or items of historical significance uncovered or found during construction or maintenance, and their associated archeological records, shall revert back to Canada.

1.6 Construction Mitigation

.1 Archeological surveillance is required along construction corridor where outlined in the Basic Impact Assessment. Changes to project plans may require archaeological surveillance not specified in the Basic Impact Assessment.

.2 Parking will be permitted in designated areas as directed.

.3 Confine all work actively within the limits specified and outlined in construction plans.

.4 When negligence on the part of the Contractor results in damage or destruction of cultural resources beyond the staked or designated work area, the Contractor shall

be responsible, at his/her expense, for complete archaeological assessment and recording of the cultural resource impact to the satisfaction of the project Archaeologist and complete restoration or rehabilitation to the satisfaction of the Engineer.

.5 Access to work areas will be via routes approved in advance.

.6 When negligence on the part of the Contractor results in damage or destruction of cultural resources beyond the staked or designated work area, the Contractor shall be responsible, at his/her expense, for complete archaeological assessment and recording of the cultural resource impact to the satisfaction of the Project Archaeologist and complete restoration or rehabilitation to the satisfaction of the Engineer.

.7 Excavations will not be permitted beyond the identified corridor approved by archeology.

.8 All surface modifications are restricted to the identified corridors. Construction corridors are to be accurately located by field survey by the Contractor prior to commencement of work operations.

.9 When the construction corridor includes culturally sensitive zones, travel, excavation and/or other activities may be restricted with the culturally sensitive zones so that cultural resources are not impacted. The project archaeologist will define the boundaries for known culturally sensitive zones and identify where travel, excavation, or other activities may be carried out. These boundaries must be clearly staked out.
If conditions are suitable, the project archaeologist may also identify mitigation measures that will allow for travel,

excavation and/or other activities to be carried out within the sensitive zones.

.10 Notify PCA and Engineer should any contamination be encountered during the work.

.11 If any artifacts, cultural resources or structural features are located during construction activities, all work will stop in that area until the surveillance archeologist reviews the findings.

.12 All construction equipment is restricted to the existing roadway surfaces and identified corridors, so that cultural resources outside of the construction area are not damaged.

.13 No storage of gasoline, chemicals and/or associated products will be allowed on-site. Refueling of on-site equipment shall be by on-line approved equipment. Approved jerry cans and containment to store fuel for water pumps will be permitted.

.14 Sufficient emergency equipment shall be readily available to contain and cleanup spills. There will be a fuel spill kit located at all storage facilities and at intervals along construction corridor.

.15 Report immediately any spills to Archeology and Warden’s Office. See resource conservation mitigating measures for reporting procedures and notifications.

.16 The Contractor is responsible for responding immediately to any spill to minimize environmental damage and for any clean-up or rehabilitation resulting from any spills to an approved level.

.17 Maintain emergency response equipment on site to deal with potential accidental events.

.18 No material will be split or left on the ground. (Ex., bolts, plastic, grease).

.19 All landscape disturbed by construction will be returned to its preconstruction standards, unless otherwise advised.

.20 All equipment and materials associated with the project will be removed after the job is completed. A final inspection will be done.

.21 All stakes identifying corridors will be maintained along the identified alignment.

.22 Removal and/or changes made to the fencing will require Park Warden and Archeological approval.

.23 Office, work stations and all associated work buildings including portable sanitary facilities, for workers will be located within the identified travel corridor in an area specified by archeology.

.24 All supplies, material and equipment will be restricted to the identified corridor.

.25 Stock piling (i.e. gravel, pipe, geotextile, plywood and associated materials) is restricted to the identified corridor and approved locations

.26 Water bodies are not to be altered and water levels are not to be changed during construction, unless directed by Departmental Representative.

.27 Filtration systems due to sub-excavation will be located in those areas identified on construction plans and will require archeological approval if changes are required.

.28 Backfill material is to be distinct from the surrounding matrix by 600 mm wide strip of geotextile to be placed at edges of trench prior to backfilling. Where cultural

resources form part of the surrounding matrix, the culturally sensitive area will be fully lined with geofabric prior to backfilling.

.29 The horizontal extent of disturbance and undisturbed strata for trenches will be recorded (outer boundary of excavation trench) by the Contractor. The locational data must be provided in northing and easting (eg. N 5088673.329, E 734175.481) referenced to UTM NAD 83 Zone 20, vertical datum CGVD28, to an accuracy of ± 2 cm. The spatial data is to be submitted with associated metadata in SHP format and compatible with ARCMAP. Drawings will be converted to CGVD2013 at end of project.

1.7 Definitions

.1 Archeology: A set of theories, methods and techniques for the study of human behavior from material remains of past activities. Other sorts of evidence, such as documents, are used when available, but archeology deals with the recovery and analysis of physical evidence from on or below the surface of the ground and underwater. Archeological techniques are designed to recover the spatial and chronological relationships (i.e., artifacts, soil layers and structural features that make up archaeological features). It is these relationships that form the essential basis for understanding archeological evidence.

.2 Archeological Site: While most of the sites will be subsurface or submerged; this is not a universal or necessary condition because a built heritage site and an archeological site exist in a continuum, and the inclusion of a given site in one category, or the other, may be somewhat arbitrary. For the purpose of this document, an archeological site is a surface vestige, or the subsurface, or submerged remains of human activity at

which an understanding of these activities and the management of these resources can be achieved through the employment of archeological techniques. Some sites, such as L'Anse aux Meadows, Port au Choix and Kitwanga, will be primarily dependent upon archeological approaches. Others, including Louisbourg, the Fortifications of Quebec, Lower Fort Garry and the Chilkoot Trail, represent "hybrid" categories in which built heritage and archeological techniques merge.

.3 Archeological Artifact: An object, a component of an object, a fragment, or shred of an object that was for or used by humans; a soil, botanical, or other sample of archeological investigation of a site.

.4 Archeological Records: Notes, drawings, photographs, plans, computer databases, reports and any other audio-visual records related to the archeological investigation of a site.

.5 Archeological Collection: Archeological artifacts and associated archeological records.

.6 Archeological Resource: An archeological site and its associated archeological collection.

1.8 Relics and Antiquities

.1 Comply with CEAA Basic Impact Assessment (current screening).

.2 All surface modifications are restricted to the identified corridor which shall be clearly delineated in the field by the Contractor prior to commencement of work operations.

.3 The locational data for setting out of work must be provided in northing and easting (eg. N 5088673.329, E 734175.481) referenced to UTM NAD 83, vertical datum CGVD28 and CGVD2013, to an accuracy of ± 2 cm.

.4 Any artifact or items of historical significance uncovered during construction or maintenance and their associated archeological records, shall revert to Canada.

1.9 National Parks Act

.1 For projects located within boundaries of National Park, perform work in accordance with National Parks Act.

_____END_____

PART 1 GENERAL

1.1 References and Codes

.1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Perform Work in accordance with the BIA for this project

.3 Meet or exceed requirements of:
- .1 Contract documents.
- .2 Specified standards, codes and referenced documents.

1.2 National Parks Act

.1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park or within National Historic Sites.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 GENERAL

1.1 Inspection

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 Independent Inspection Agencies

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work for Quality Assurance (QA) testing only. Cost of such services (QA testing) will be borne by Departmental Representative. The contractor shall be responsible for Quality Control (QC) testing to ensure that all materials used meet the physical, production and placement requirements of this specification. Cost of such services will be borne by Contactor.

.2 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.3 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to the owner. Pay costs for retesting and reinspection.

1.3 Access to Work

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.4 Procedures

.1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 Rejected Work

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or reexecute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract

Documents, amount of which will be determined by Owner.

1.6 Reports

.1 Submit 4 copies of inspection and test reports to Departmental Representative.

.2 Provide copies to subcontractor of work being inspected or tested or manufacturer or fabricator of material being inspected or tested.

1.7 Tests and Mix Designs

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 GENERAL

1.1 Access

.1 Provide and maintain adequate access to project site.

.2 Build and maintain temporary roads during period of work. Parks Canada must approve prior to their use, any proposed temporary roads within the Park.

.3 Upon completion of contract work, rehabilitate any temporary roads to the satisfaction of the Departmental Representative.

.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

.5 Clean roads and parking areas where used by Contractor's equipment or employees' vehicles.

1.2 Departmental Representative’s Site Office

.1 Contractor to provide Departmental Representative’s office trailer/space. Minimum office trailer/space size is 3.0 m x 12.5 m.

.2 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.

.3 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.

.4 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10% upward light component.

.5 Contractor to arrange and pay for fax machine, internet connection and photocopier in Departmental Representative’s office for its exclusive use. Long distance calls placed on this phone and fax will be

paid by Departmental Representative. Paper for photocopier and fax to be paid for by Departmental Representative.

.6 Contractor to equip office with two 1 m x 2 m tables, one 1 m x 2 m drafting table, 4 chairs, 6 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.

.7 Upon completion of the Contract; all equipment and furniture provided by the Contractor shall be returned to it.

.8 Supply of the Departmental Representative's office, supplies and services will be incidental to the work.

1.3 Site Signs

.1 Project Identification Site Signs:

.1 Provide 2 project identification site signs comprising foundation, framing, and 1200 x 2400 mm signboard as detailed and as described below

.1 Framework & Battens: Select Structural White Spruce, Douglas Fir or Western Red Cedar, dressed 4 sides.

.2 Signboard: 19 mm Medium Density Overlaid Douglas Fir Plywood to CSA 0121-M1978.

.3 Paint: alkyd type, without silicone additives. Primer to CGSB1-GP-189M+Amdt-Aug-84, enamel to CGSB 1-GP-59M+Amdt-Aug-84.

.4 Fasteners: hot-dip galvanized steel nails.

.5 Vinyl sign face: printed project identification, self adhesive, vinyl film overlay, supplied by Departmental Representative .

.2 Locate project identification signs as directed by Departmental Representative and construct as follows:

.1 Erect framework, and attach signboard to framing as indicated.

.2 Paint all surfaces of signboard and framing with one coat primer and two coats enamel. Colour white on signboard face, black on other surfaces.

.3 Apply vinyl sign face overlay to painted signboard face in accordance with installation instruction supplied.

.3 Safety and Instruction Signs and Notices:

.1 Signs and notices for safety and instruction shall be in both official languages Graphic symbols shall conform to CAN3-Z321-77.

.2 Maintenance and Disposal of Site Signs:

.1 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

.2 No separate payment to be made for Project Identification Site Signs. Cost shall be deemed incidental to work.

1.4 Sanitary Facilities

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.1 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.5 Parking

.1 Parking space for work force will be limited to the construction limits for each area under construction.

1.6 Removal of Temporary Facilities

.1 Remove temporary facilities from site when directed by Departmental Representative.

1.7 Contractor’s Camp

.1 The Contractor will not be permitted to set up a camp within the Fortress of Louisbourg National Historic Site.

.2 Applicable Provincial and/or Municipal regulatory permits for camp(s) outside the Park must be obtained and copies forwarded to Superintendent, the Fortress of Louisbourg National Historic Site.

1.8 Measurement for Payment

.1 Unless specifically stated otherwise, items under this section not to be measured for payment but are considered incidental to Contract.

END

PART 1 GENERAL

1.1 Installation and Removal

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.2 Hoarding

.1 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.3 Guard Rails and Barricades

.1 Provide secure, rigid guard rails and barricades around deep excavations.

.2 Provide as required by governing authorities.

1.4 Access to Site

.1 Provide and maintain access roads, as may be required for access to Work.

1.5 Public Traffic Flow

.1 Provide and maintain competent signal flag operators, traffic signals, signage, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.6 Fire Routes

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.7 Protection for Off-Site and Public Property

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.8 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 NOT USED

END

PART 1 GENERAL

1.1 References

.1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.

.2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.3 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 Quality

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental

Representative based upon requirements of Contract Documents.

.5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 Storage, Handling and Protection

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer’s instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer’s seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store sheet materials on flat, solid supports and keep clear of ground. Slope to shed moisture.

.5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.4 Transportation

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative. Unload, handle and store such products.

1.5 Manufacturer's Instructions

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and reinstallation at no increase in Contract Price or Contract Time.

1.6 Quality of Work

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.7 Co-ordination

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 Remedial Work

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.9 Existing Utilities

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

Part 1 General

.1 Owner’s identification of existing survey control points and property limits as identified on the drawings.

1.1 Qualifications of Surveyor

.1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Departmental Representative.

1.2 Survey Reference Points

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Departmental Representative.

.4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.3 Survey Requirements

.1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes and berms.

1.4 Existing Services

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.5 Location of Equipment and Fixtures

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.6 Records

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 Record locations of maintained, re-routed and abandoned service lines.

1.7 Action and Informational Submittals

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform to Contract Documents.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 GENERAL

1.1 References

.1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC) - ID: R0202D, Title: General Conditions "C", In Effect as Of: May 14, 2004.

1.2 Project Cleanliness

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.4 Where temporary gravel haul roads meet asphalt pavement, maintain asphalt in a clean state, free from dust, mud, and debris. Sweeping of the asphalt may be required.

.5 Clear snow and ice from access to site or facilities of the work, bank/pile snow in areas **approved by Departmental Representative**.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Provide suitable on-site containers for collection of waste materials and debris.

.8 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.9 Dispose of waste materials and debris outside the limits of the National Park at a location/facility approved by the Authority having jurisdiction.

.10 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

1.3 Final Cleaning

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris other than that caused by Owner or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.9 Remove dirt and other disfiguration from exterior surfaces.

1.4 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 NOT USED

.

END

PART 1 GENERAL

1.1 Waste Management Goals

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's waste management plan and goals.

.2 Accomplish maximum control of solid construction waste.

.3 Protect environment and prevent environmental pollution damage.

1.2 References

.1 Definitions:

.1 Class III: non-hazardous waste - construction renovation and demolition waste.

.2 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices.

.3 Demolition Waste Audit (DWA): relates to actual waste generated from project.

.4 Inert Fill: inert waste - exclusively asphalt and concrete.

.5 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.8 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
.2 Returning reusable items including pallets or unused products to vendors.

.10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
.11 Separate Condition: refers to waste sorted into individual types.
.12 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
.13 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.
.14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
.15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan information acquired from Waste Audit.

1.3 Documents

.1 Post and maintain in visible and accessible area at job site, one copy of following documents:
.1 Waste Reduction Workplan.

1.4 Action and Informational Submittals

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prepare and submit following prior to project start-up:

.1 1 copy and 1 electronic copy of completed Waste Reduction Workplan (WRW).

.3 Prepare and submit on weekly basis, throughout project or at intervals agreed to by Departmental Representative the following:
- .1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.
- .2 Written bi-weekly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.

1.5 Waste Reduction Work Plan (WRW)

.1 Prepare and submit WRW at least 10 days prior to project start-up.

.2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations.

.3 WRW should include but not limited to:
- .1 Applicable regulations.
- .2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
- .3 Destination of materials identified.
- .4 Methods to collect, separate, and reduce generated wastes.
- .5 Location of waste bins on-site.
- .6 Security of on-site stock piles and waste bins.
- .7 Protection of personnel, sub-contractors.
- .8 Clear labelling of storage areas.
- .9 Details on materials handling and removal procedures
- .10 Recycler and reclaimer requirements.
- .11 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
- .12 Requirements for monitoring on-site wastes management activities.

.4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.5 Post WRW or summary where workers at site are able to review content.

.6 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project.

1.6 Storage, Handling and Protection

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Protect, stockpile, store and catalogue salvaged items.

.3 Separate non-salvageable materials from salvaged items. Transport and deliver nonsalvageable items to licensed disposal facility.

.4 Protect surface drainage, mechanical and electrical from damage and blockage.

.5 Separate and store materials produced during project in designated areas.

.6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.

.1 On-site source separation is recommended.

.2 Remove co-mingled materials to off site processing facility for separation.

.3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

.4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.7 Disposal of Wastes

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.

1.8 Scheduling

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 GENERAL

1.1 References

.1 Canadian Environmental Protection Act (CEPA)
  .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

1.2 Administrative Requirements

.1 Acceptance of Work Procedures:
  .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
    .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
    .2 Request Departmental Representative inspection.
  .2 Departmental Representative Inspection:
    .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
    .2 Contractor to correct Work as directed.
  .3 Completion Tasks: submit written certificates that tasks have been performed as follows:
    .1 Work: completed and inspected for compliance with Contract Documents.
    .2 Defects: corrected and deficiencies completed.
    .3 Work: complete and ready for final inspection.
  .4 Final Inspection:
    .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
    .2 When Work incomplete according to Departmental Representative, complete outstanding items and request reinspection.

1.3 Final Cleaning

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 GENERAL

1.1 Administrative Requirements

.1 Pre-warranty Meeting:
  .1 Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:
    .1 Verify Project requirements.
    .2 Review warranty requirements and manufacturer's installation instructions.

.2 Departmental Representative to establish communication procedures for:
  .1 Notifying construction warranty defects.
  .2 Determine priorities for type of defects.
  .3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 Format

.1 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.2 When multiple binders are used correlate data into related consistent groupings.
  .1 Identify contents of each binder on spine.

.3 Cover: identify each binder with type or printed title Project Record Documents'; list title of project and identify subject matter of contents.

.4 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.5 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.6 Text: manufacturer's printed data, or typewritten data.

.7 Drawings: provide with reinforced punched binder tab.
.1 Bind in with text; fold larger drawings to size of text pages.

1.4 Contents - Project Record Documents

.1 Table of Contents for Each Volume: provide title of project;
.1 Date of submission; names.
.2 Addresses and telephone numbers of Consultant and Contractor with name of responsible parties.
.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:
.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data.
.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's

instructions specified in Section 01 45 00 - Testing and Quality Control.

1.5 As -Built Documents and Samples

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.
- .1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
- .1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.
- .1 Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 Recording Information on Project Record Documents

.1 Record information on set of black line opaque drawings, provided by Departmental Representative.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress.
.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
.1 Measured depths of elements of foundation in relation to finish first floor datum.
.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.4 Field changes of dimension and detail.
.5 Changes made by change orders.
.6 Details not on original Contract Drawings.
.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:
.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 Provide digital photos, if requested, for site records.

1.7 Equipment and Systems

.1 For each item of equipment and each system include description of unit or system, and component parts.
.1 Give function, normal operation characteristics and limiting conditions.

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
.1 Include regulation, control, stopping, shut-down, and emergency instructions
.2 Include summer, winter, and any special operating instructions.

.3 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.4 Provide servicing and lubrication schedule, and list of lubricants required.

.5 Include manufacturer's printed operation and maintenance instructions.

.6 Include sequence of operation by controls manufacturer.

.7 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.8 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.9 Include test and balancing reports as specified in Section 01 45 00 - Testing and Quality Control.

.10 Additional requirements: as specified in individual specification sections.

1.8 Materials and Finishes

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
.1 Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END

## PART 1 GENERAL

### 1.1 References

.1 Measurement Canada

.2 Weights and Measurement

### 1.2 Action and Information Submittals

.1 Submit proof of certification of scales.

## PART 2 PRODUCTS

### 2.1 Materials

.1 Weigh scale to be of the size to safely weigh loads pertinent to the project.

## PART 3 EXECUTION

### 3.1 Installation

.1 Weigh scale to be located at a location suitable for project use. Weigh scales not to be located on Fortress of Louisbourg National Historic Site Property.

.2 The foundation and ramp for the scale shall be adequate to support the largest load to be scaled without movement or deflection in the foundation or weighbridge. The scale shall be installed so as to prevent the ramp from binding against the scale platform. Each ramp shall be constructed straight and to the same elevation as the scale platform for a distance equal to at least the length of the platform.

.3 The scale shall be kept level and must be able to withstand loads up to the device capacity without movement or deflections. If ground or weather conditions cause movement or deflection, operations shall be suspended. Shims and other means of height adjustment shall be made of any suitable material that resists compression at least as well as the main support structure, and shall fill the entire void area

under the level stands or load cell bases to ensure that the scale remains stable and level under normal conditions of use of the scale.

3.2 Operation

.1 An operator will direct the operation of the scale and issue weigh tickets showing gross, tare and net weight for each load of material. The tare weight shall be established when hauling begins on a project, and thereafter as frequently as directed by the Departmental Representative.

.2 The scale platform and mechanism shall be kept clean and maintained free of gravel, mud, snow, ice or other deleterious materials.

3.3 Scale House

.1 The Contractor shall provide a scale house meeting the following minimum requirements:

.1 A minimum work area of 2.5 m by 1.8 m with a minimum height clearance of 2.1 m, containing a functional desk and chair.

.2 A minimum room temperature of 20°C, and adequate ventilation.

.3 Sufficient lighting to the level of intensity and of the quality defined by the standards for the type of Structure defined and the Work being performed.

.4 An approved and maintained first-aid kit mounted on the wall at an accessible location on the interior house.

.2 The Contractor shall provide a safe means of access to and egrass from the scale house.

.3 All roads leading to the scale house shall be maintained so as to provide a safe passage for vehicles, and dust control shall be maintained within 30 metres of the scale house.

.4 The Contractor shall provide toilet facilities in close proximity to the scale house for the weigher.

END

PART 1 GENERAL

1.1 References

.1 Manual of Uniform Traffic Control Devices for Canada (MUTCD-C) – (most recent version).

.2 CSA International
.1 CAN/CSA O80 Series-[08], Wood Preservation.

.3 .1 Nova Scotia Temporary Workplace Traffic Control Manual.

1.2 Action And Informational Submittals

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.

1.3 Delivery, Storage And Handling

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground and in accordance with manufacturer's recommendations.
.2 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

PART 2 PRODUCTS

2.1 Materials

.1 Sign posts shall be as specified in the Parks Canada Identity Program Exterior Signage Standards and Guidelines Section 5 Material and Fabrication specifications.

.2 Fasteners: bolts, nuts, washer and other hardware for roadside signs to be as specified in the Parks Canada Identity Program Exterior Signage Standards and Guidelines Section 5 Material and Fabrication specifications.

Part 3 EXECUTION

3.1 Installation

.1 Sign support:
  .1 Erect posts plumb and square to details as indicated.

  .2 Wooden post installation:
    .1 Excavate post holes to as indicated on the Contract Drawings. Compact bottom of hole to provide firm foundation. Set post in sono tube, pour concrete and backfill surrounding area in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.

  .3 Aluminum post installation:
    .1 Excavate post holes to as indicated on the Contract Drawings. Compact bottom of hole to provide firm foundation. Set post in sono tube, pour concrete and backfill surrounding area in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.

.2 Signboard:
  .1 Fasten signboards to supporting posts and brackets as indicated.

3.2 Correcting Defects

.1 Correct defects, identified by Departmental Representative. Correct angle of signboard and adjust for optimum performance during night conditions to approval of Departmental Representative.

3.3 Cleaning

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  .1 Carefully dismantle and salvage wood, aluminum and steel materials.
  .2 Deliver salvaged materials to location specified by Departmental Representative.

3.4 Protection

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by traffic signage installation and salvage Operations.

END

PART 1 GENERAL

1.1 Related Requirements

.1 Section 35 31 19 – Beach Fill
.2 Section 35 31 23 - Groynes

1.2 References

.1 Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specifications(most recent version):
  .1 NSTIR Standard Specification where applicable.

1.3 Action and Informational Submittals

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples:
  .1 Allow continual sampling by Departmental Representative during production.
  .2 Provide Departmental Representative with access to source and processed material for sampling.
  .3 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.
  .4 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary.
  .5 Provide area for Departmental Representative lab trailer and make necessary provisions for water and electric power for the duration of the work.

PART 2 PRODUCTS

2.1 Materials

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.

.2 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
- .1 Screenings produced in crushing of quarried fill.

.3 Coarse aggregates satisfying requirements of applicable section to be produced from crushed fill.

.4 Granular Sub-Base material Type 2: in accordance with Section 31 05 16 - Aggregate Materials and the following requirements:
- .1 Crushed rock.
- .2 Granular Sub-Base shall not consist of sandstone.
- .3 Gradations to be within limits specified in NSTIR Division 3, Section 2, Table 3.2.1 when tested to ASTM C136 and ASTM C117.
- .4 Other properties as follows:
  - .1 Fractured particles, one face: to NSTIR Division 3, Section 2, Table 3.2.2.
  - .2 Micro-Deval: NSTIR Division 3, Section 2, Table 3.2.3.
  - .3 L.A. Abrasion: to ASTM C131, Maximum 40%.
  - .4 Plasticity Index: to ASTM D4318, Maximum 3.

2.2 Source Quality Control

.1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 2 weeks minimum before starting production.

.2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.

.3 Advise Departmental Representative 2 weeks minimum in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 EXECUTION

3.1 Preparation

.1 Aggregate source preparation:
- .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as approved by authority having jurisdiction.
- .2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.
- .3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
- .4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.
- .5 Trim off and dress slopes of waste material piles and leave site in neat condition.
- .6 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.

.2 Processing:
- .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.3 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.

.4 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.

.5 Stockpiling:
- .1 Stockpile aggregates in accordance with the requirements of NSTIR Standard Specifications, Division 3, Section 2.
- .2 Stockpile aggregates in sufficient quantities to meet project schedules.
- .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
- .4 Do not use intermixed or contaminated materials.
- .5 Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
- .6 Aggregate acceptance shall be based on sampling and testing in accordance with the requirements of NSTIR Standard Specifications, Division 3, Section 2.
- .7 Handling of aggregates produced outside the specified requirements of NSTIR Standard Specifications, Division 3, Section 2 may be rejected at the departments discretion.
- .8 Stockpile locations are to be designated by Departmental Representative and the base shall be above the high water mark.

3.2 Cleaning

.1 Leave Work area clean at end of each day.

.2 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.3 Unused aggregates are the property of the Contractor.

END

PART 1 GENERAL

1.1 Related Requirements

.1 Section 31 23 33 – Excavating, Trenching and Backfilling
.2 Section 35 31 19 – Beach Fill
.3 Section 35 31 23 - Groynes

1.2 References

.1 Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specifications (most recent version)

PART 2 PRODUCTS

2.1 Not Used

PART 3 EXECUTION

3.1 Temporary Erosion And Sedimentation Control

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control drawings and sediment and erosion control plan, specific to site, that complies with the requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 Preparation of Grade

.1 Verify that grades are correct and notify Departmental Representative if discrepancies occur. Do not begin work until instructed by Departmental Representative.

.2 Grade area only when soil is dry to lessen soil compaction.

.3 Grade soil with scrapers establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

3.4 Cleaning

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END

PART 1 GENERAL

1.1 Related Sections

.1 Section 31 23 33 - Excavation, Trenching and Backfilling.

1.2 References

.1 American Society for Testing and Materials (ASTM)
  .1 ASTM 698-91 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m).
  .2 Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification (most recent version).
    .1 NSTIR Standard Specifications – Division 2, Section 10, Rough Grading.

1.3 Existing Conditions

.1 Establish precise field location of underground services before commencing work.

.2 Known underground and surface utility lines and buried objects are as indicated on site plan for guidance only.

.3 Refer to dewatering in Section 31 23 33 - Excavating Trenching and Backfilling.

.4 Refer to drainage requirements.

1.4 Protection

.1 Protect existing fencing, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

## PART 2 PRODUCTS

### 2.1 Materials

1. Fill material: in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Departmental Representative.

## PART 3 EXECUTION

### 3.1 Grading

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to follow depths indicated on details.

.3 Prior to placing fill over existing ground, scarify surface to depth of 150mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.4 Compact filled and disturbed areas to as follows:
85% under landscaped areas.
As specified or detailed for other areas of site.

.5 Do not disturb soil within branch spread of trees or shrubs to remain.

### 3.2 Testing

.1 Inspection and testing of soil compaction will be carried out by testing laboratory. Costs of tests will be paid by Departmental Representative except as indicated under Section 01 45 00, Testing and Quality Control.

3.3 Surplus Material

.1 Remove surplus material and material unsuitable for fill, grading or landscaping as directed by Departmental Representative.

END

PART 1 GENERAL

1.1 Related Requirements

.1 Section 01 33 00 – Submittal Procedures.
.2 Section 01 35 43 – Environmental Procedures.
.3 Section 31 05 16 – Aggregate Materials.

1.2 General Requirements

.1 The Work under this section shall include the supply of labour, supervision, materials, equipment, and transportation necessary to complete excavation and backfill as shown on the Contract Drawings, per the Specifications, and as directed by the Departmental Representative, complete in every respect.

.2 Generally, the Work includes but is not necessarily limited to the following:
.1 Foundation excavations.
.2 Dewatering.
.3 Backfilling of select materials.
.4 Compacting fill materials.
.5 Removal from site all excavated materials except for material required for backfilling and grading.

1.3 Measurement Procedures

.1 Work performed under this Section will be incidental to Work in other Sections.

1.4 References

.1 Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specifications (most recent version):
.1 NSTIR Standard Specification Division 2 Earthwork.

.2 Excavation limit as shown on the Plans and Details.

1.5 Definitions

.1 Excavation class: one class of excavation will be recognized; common excavation.

.1 Common excavation: excavation of materials of whatever nature, which are not included under definitions of fill excavation.

.2 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.3 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 Table:

| Sieve Designation | % Passing |
|---|---|
| 2.00 mm | 100 |
| 0.10 mm | 45 – 100 |
| 0.02 mm | 10 - 80 |
| 0.005 mm | 0 - 45 |

.3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

1.6 Action and Informational Submittals

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality Control: in accordance with Section 01 45 00 – Testing and Quality Control:

.1 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.

.2 Submit to Departmental Representative written notice when bottom of excavation is reached.

.3 Preconstruction Submittals:
.1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
.2 Submit records of underground utility locates, indicating: clearance record from utility authority.

.4 Samples:
.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
.2 Inform Departmental Representative at least 2 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
.3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.
.4 Ship samples prepaid to Departmental Representative, in tightly closed containers to prevent contamination and exposure to elements.

1.7 Quality Assurance

.1 Health and Safety Requirements:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.8 Waste Management And Disposal

.1 Separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Divert excess materials from landfill to local facility for reuse as directed by Departmental Representative.

1.9 Existing Conditions

.1 Examine Borehole Logs available in attached appendix A.

.2 Buried services:
- .1 Before commencing work establish location of buried services on and adjacent to site.
- .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
- .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
- .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
- .5 Prior to beginning excavation Work, notify applicable Departmental Representative and authorities having jurisdiction establish location and state of use of buried utilities and structures. Departmental Representative to clearly mark such locations to prevent disturbance during Work.
- .6 Confirm locations of buried utilities by careful test excavations.
- .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
- .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such Work to be paid by Departmental Representative.
- .9 Record location of maintained, re-routed and abandoned underground lines.
- .10 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:
- .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

.3 Where required for excavation, cut roots or branches as directed by Departmental Representative in accordance with Section 31 11 00 – Clearing and Grubbing.

1.10 Archeological Resources

.1 See Section 01 35 50, Special Project Features: Cultural Resource Protection.

1.11 Protection of Existing Features

.1 Existing buried utilities, services and structures:

.1 Size, depth and location of existing utilities, services and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify applicable owner or authorities having jurisdiction, establish location and state of use of buries utilities, services and structures. Clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities and services by careful test excavations.

.4 Maintain and protect from damage, water, sewer, electric, telephone and storm sewers, communications and other utilities, services and structures encountered as indicated. Obtain direction of Departmental Representative before moving or otherwise disturbing utilities, services or structures.

.5 Submit plans and details to show how existing utilities and services are to be maintained and protected while completing trench excavations and installing new

services and utilities in the immediate area.

.6 Record location of maintained, re-routed and abandoned underground utilities and services.

.7 Repair all services, utilities and structures damaged during construction to the satisfaction of the Departmental Representative using new materials equivalent in manufacture, class, size and shape to the existing. The cost of all repair work shall be borne by the Contractor.

.2 Existing buildings and surface features:

.1 Conduct, with Departmental Representative, condition survey of existing buildings, lawns, sea wall, service poles, wires, pavement, survey bench marks and monuments which may be affected.

.2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress. In the event of damage, immediately make repair to approval of Departmental Representative.

.3 Where excavation necessitates root or branch cutting, do so only as approved by Departmental Representative.

.4 All surface modifications are restricted to the identified corridors. Construction corridors to be accurately located by field survey by the Contractor prior to commencement of work operations.

.5 All vehicle traffic is restricted to existing roadways or as indicated in project plans. Any deviation from the identified corridor requires Archeological review. A field visit will be scheduled with Contractor for locational confirmation and all areas of proposed construction will be marked in the field with orange flagging tape prior to commencement of work.

.6 The locational data for all encountered services and utilities that are to remain in service and all newly installed utilities and services must be provided in northing and easting (eg. N 5088673.329,

E 734175.481) referenced to UTM NAD 83 Zone 20, vertical datum CGVD28 and CGVD2013, to an accuracy of ± 2 cm. This locational information with metadata is to be provided on disk in a SHP, DWG, DXF format which is compatible with ARCMAP.

.7 Louisbourg protects a large and complex archeological site. These archeological resources will be respected and maintained in accordance with Parks Canada Cultural Resources Guidelines.

PART 2 PRODUCTS

2.1 Materials

.1 Backfill material: refer to Sections:

35 31 19 – Beach Fill
35 31 23 - Groynes

PART 3 EXECUTION

3.1 Site Preparation

.1 Remove obstructions from surfaces to be excavated within limits indicated.

3.2 Preparation/ Protection

.1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.4 Protect buried services that are required to remain undisturbed.

3.3 Stockpiling

.1 Stockpile fill materials in areas designated by Departmental Representative.
  .1 Stockpile granular materials in manner to prevent segregation.
  .2 Protect fill materials from contamination.
  .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.4 Cofferdams, Shoring, Bracing and Underpinning

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements and Health and Safety Act for the Province of Nova Scotia.
  .1 Where conditions are unstable, Departmental Representative to verify and advise methods.

.2 Obtain permit from authority having jurisdiction for temporary diversion of water course.

.3 Construct temporary Works to depths, heights and locations as directed by Departmental Representative.

.4 During backfill operation:
  .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
  .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.

.5 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.6 Upon completion of substructure construction:
  .1 Remove cofferdams, shoring and bracing.
  .2 Remove excess materials from site and restore watercourses as directed by

Departmental Representative.

3.5 Dewatering and Heave Prevention

.1 Keep excavations free of water while Work is in progress.

.2 Provide for Departmental Representative's review and approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cutoffs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in a manner not detrimental to public and private property, or portion of Work completed or under construction.
.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.6 Excavation

.1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.

.2 Excavate to lines, grades, elevations and dimensions as directed by Departmental Representative.

.3 Remove obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.

.4 Excavation must not interfere with bearing capacity of adjacent foundations.

.5 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.6 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.7 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.8 Restrict vehicle operations directly adjacent to open trenches.

.9 Dispose of surplus and unsuitable excavated material as directed by the Departmental Representative.

.10 Do not obstruct flow of surface drainage or natural watercourses.

.11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.12 Notify Departmental Representative when bottom of excavation is reached.

.13 Obtain Departmental Representative approval of completed excavation.

.14 Remove unsuitable material from trench bottom including those that extend below

required elevations to extent and depth as directed by Departmental Representative. Any additional excavation greater than 2.0 metres below grade will require archaeological supervision in accordance with Section 01 35 50.

.15 Correct unauthorized over-excavation as follows:
.1 Fill under areas with Gravel Borrow (NSTIR Standard Specification Division 3 – Granular Materials, Section 1 – Gravel Borrow compacted to not less than 95 % of corrected Standard Proctor maximum dry density.

.16 Hand trim, make firm and remove loose material and debris from excavations.
.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

3.7 Backfilling

.1 Do not proceed with backfilling operations until completion of following:
.1 Departmental Representative has inspected and approved installations.
.2 Departmental Representative has inspected and approved of construction below finish grade.
.3 Inspection, testing, approval, and recording location of underground utilities.
.4 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.
.2 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 300mm.

3.8 Restoration

.1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.

.2 Replace topsoil as directed by Departmental Representative.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate roadbed disturbed by excavation to thickness, structure and elevation which existed before excavation with aggregate material.

.5 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 35 43 - Environmental Procedures

.3 Section 31 23 33 – Excavating, Trenching and Backfilling

1.2 References

.1 Nova Scotia Department of Transportation and Infrastructure Renewal, Highway Construction and Maintenance Standard Specifications.

.2 Nova Scotia Watercourse Alteration Specifications.

1.3 Environmental Protection Plan

.1 Provide Environmental Protection Plan in accordance with Section 01 35 43 – Environmental Procedures.

1.4 Submittals

.1 Provide shop drawings, in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 – PRODUCTS

2.1 General

.1 Use sediment barriers to keep sediment on site. Consider sediment barriers as temporary perimeter controls to intercept sediment laden sheet flow runoff before it enters the watercourse or as it leaves the construction site.

.2 Construct flow checks across roadside drainage ditches throughout cut sections and adjacent to inlets and outlets of culverts, and as directed by the Departmental Representative. Place flow checks to reduce the channel velocity, promote the deposition of suspended sediment, and to provide a trap for sediment material.

2.2 Materials

.1 Straw barriers: straw bales to be dry, firm, tightly tied in at least two places, show no evidence of straw or tie decay and be free of sediment. They are

to be of standard agriculture dimensions, approximately 600mm x 600mm x 1200mm.

.1 Stakes: of sufficient strength to satisfy control measure performance and maintenance requirements. Stakes to be 1.2m in length.

.2 Silt fence barriers: construct silt fence barriers of silt fence geotextile supported on stakes. Geotextile used for silt fence shall be woven Class 1 geotextile, having a minimum width of 900mm. The maximum filtration opening size (FOS) shall be 840µm.

.1 Stakes: of sufficient strength to satisfy control measure performance and maintenance requirements. Stakes to be 1.5m in length.

PART 3 – EXECUTION

3.1 General

.1 Supply, install and maintain temporary erosion and sedimentation control features where required and in accordance with Environmental Protection Plan. Do not remove control features until authorized by Departmental Representative.

.2 Fires and burning of rubbish on site is not permitted.

3.2 SEDIMENT CONTROL BERMS

.1 Construct sediment control items to the cross sections shown, using materials indicated on the Drawings. Locate where indicated unless otherwise directed by Departmental Representative.

3.3 SILT FENCE

.1 Install silt fence in the locations directed.

.2 Install extra 50 x 75 x 1200 mm long posts midpoints between supplied posts. Attach fence with roofing nails and roofing tins. Provide wood strapping along top of fence as shown.

.3 Excavate 150 x 150 mm trench along length of fence as indicated. Lay fabric bottom in trench and backfill with selected backfill material.

3.4 Straw Barriers

.1 Where straw bale barriers are to be installed on earth surfaces, place the bale in a trench measuring 750mm wide by 150mm deep at the location specified for the barrier. The bales will then be staked and the remaining trench space backfilled and compacted to existing grade.

.2 Where straw bale barriers are to be installed on sod, erosion control blanket or existing turf, place so that there are no gaps between the bales and the underlying cover.

.3 Do not place straw bale ties in contact with the ground. The ends of adjacent bales are to be placed tightly against one another to prevent gaps.

.4 Firmly secure in place each bale by two (2) stakes spaced 150mm from the end of each bale. Drive stakes flush with the top of bale.

.5 Maintain straw barriers such that bales remain firm intact and without decay.

.6 Include at each end of the barrier a 2m to 3m section, angled upstream to direct runoff to the main section of the barrier.

.7 Replace bales when they are no longer functioning or as directed by the Departmental Representative.

3.5 Maintenance

.1 Maintain erosion and sediment control features throughout the construction period. Repair damage to original condition.

.2 Remove accumulated sediment from behind sediment control items when and as directed by the Departmental Representative.

.3 Maintain vertical alignment of silt fence such that it is always plumb and straight.

.4 Remove sedimentation control features when directed by the Departmental Representative. Take care to avoid causing turbidity, and excessive re-suspension of particles when removing sediment control features.

END

PART 1 GENERAL

1.1 Related Requirements
NOT USED

.1 Not used.

1.2 References

.1 American Society for Testing and Materials International, (ASTM)
  .1 ASTM D 4491-99a, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  .2 ASTM D 4595-86(2001), Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  .3 ASTM D 4751-99a, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.2 Canadian General Standards Board (CGSB)

  .1 CAN/CGSB-4.2 No. 11.2-M89 (April 1997), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).

  .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.

.3 Nova Scotia Department of Transportation and Infrastructure Renewal Standard Specification (most recent version):
  .1 NSTIR Standard Specification Division 6 - Miscellaneous, Section 12 – Geotextiles.

1.3 Submittals

.1 Submit to Departmental Representative following samples at least 2 weeks prior to beginning Work.
  .1 Minimum length of 2 metres of roll width of geotextile.

1.4 Delivery, Storage And Handling

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat,

mud, dirt, dust, debris and rodents.

PART 2 PRODUCTS

2.1 Materials

.1 Physical properties: Non-woven fabric, Mass per unit area > 800 g/m2, Grab tensile strength (ASTM D 4632)> 1200 N, Grab elongation (ASTM D 4362)>50%, Puncture resistance (ASTM D 4833)>1000 N.

.2 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to CAN/CSA G164.

.3 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

PART 3 EXECUTION

3.1 Installation

.1 Place geotextile material, as indicated on drawings and as directed by Departmental Representative, by unrolling onto graded surface and retain in position with securing pins or fill.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

.3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.4 Overlap each successive strip of geotextile 300 mm over previously laid strip.

.5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.6 After installation, cover with overlying layer within 4 hours of placement.

.7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.

.8 Place and compact soil layers in accordance with Section 31 23 33 – Excavating, Trenching and

Backfilling.

3.2 Cleaning

.1 Remove construction debris from project site and dispose of debris in an environmentally responsible and legal manner.

3.3 PROTECTION

.1 Vehicular traffic not permitted directly on geotextile.

END

PART 1 - GENERAL

1.1 Description

.1 This section specifies requirements for the supply of beach fill material.

.2 Work under this section shall include the production, loading and stockpiling, transportation, and placement of the material.

1.2 References

.1 American Society for Testing and Materials (ASTM)
- .1 ASTM C117-95, Standard Test Method for Material Finer than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB - 8.1-88, Sieves, Testing, Woven Wire.
- .2 CAN/CGSB - 8.2-M88, Sieves, Testing, Woven Wire, Metric.

PART 2 - PRODUCTS

2.1 Materials

.1 Beach fill material shall be well rounded and the stone portion shall be of medium to high sphericity.

.2 Material of crushed or broken fill origin will not be acceptable.

.3 The material shall be free of: refuse, granular/angular material, loam, roots, organic matter, frozen material, inorganic clays of high plasticity, swelling clays, silts of low strength, organic clays, and clods.

.4 Los Angeles Abrasion (ASTM C131 OR C535) loss shall be 35% maximum.

.5 Grading of the beach fill shall be as follows:

| SIEVE SIZE | % Passing |
|---|---|
| 150 mm | 100 |
| 80 mm | 60 - 85 |
| 56 mm | 30 - 60 |
| 28 mm | 10 - 20 |
| 14 mm | 0 - 5 |
| 0.80 mm | 0 - 5 |

.6 Material when tested by the Freeze/Thaw Test Method in accordance with MTO LS-614 shall have a Freeze/Thaw loss not greater than 15%.

.7 Absorption, 2% maximum as determined by ASTM C127 test procedure.

.8 Sulphate Soundness Determination, maximum 12% by ASTM C88-73.

PART 3 - EXECUTION

.1 Should stockpiling be required, the location to be used for stockpiling shall be agreed on with the Owner.

3.2 QA/QC Program

.1 General

.1 The Contractor is responsible for, and shall establish and maintain, Quality Control for all beach fill production, hauling and placement under this contract to ensure compliance with the specifications.

.2 The Engineer may perform Quality Assurance activities at the site, with the support of the Contractor’s personnel and equipment. These activities are intended to provide independent observations of conformance to the requirements of this section, and in no way relieve the Contractor of his

responsibilities for the Quality Control and in-place requirements.

.2 Excavated Materials:

.1 Beach materials are to be excavated from designated excavation areas only, as noted in the Contract Drawings.

.2 Excavated materials are expected to consist of clean, fine to medium sand, and with some coarse sand, cobbles and boulders, occasional fine gravel and traces of fines. Advise Engineer immediately if other materials are encountered.

.3 Contractor shall arrange for grain size distribution (GSD) tests to be undertaken on samples of excavated beach materials at a rate of approximately one sample every 5,000 $m^3$. Engineer may require additional GSD tests if test results or observations of excavated materials indicate that additional tests are required. Samples shall be taken in areas representative of borrow material, and shall be selected by the Engineer.

.4 Offsite Quality Assurance activities will be performed by the Engineer, with the support of the Contractor's personnel and equipment. These activities are intended to provide independent observations of conformance to the requirements of this section prior to shipment of material to the site, and in no way relieve the Contractor of his responsibilities for Quality Control and in-place requirements.

3.3 Submittals

.1 At least two weeks prior to the commencement of beach excavation operations, the Contractor shall submit his intended construction procedures to the Engineer. These procedures shall contain the following information as a minimum:

.1 Details of the intended beach fill excavation, stockpiling, transport and placement methods, including sequencing and coordination with work associated with the rubblemound structures.

.2 Survey control and verification survey procedures.

.3 Proposed source(s) for imported beach fill materials.

END

PART 1 - GENERAL

1.1 Related Work

.1 Refer to other Specification Sections for related information.

.2 Refer to Section 01 33 00 for submittal requirements.

1.2 Reference Standards

.1 All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications or publications:

- .1 ASTM C88, Test Methods for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM C127, Test Method for Specific Gravity and Absorption of Coarse Aggregate.
- .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- .4 ASTM C535, Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- .5 ASTM D5312, Test Method for Evaluation of Durability of Fill for Erosion Control Under Freezing and Thawing Conditions
- .6 ASTM D5313, Test Method for Evaluation of Durability of Fill for Erosion Control Under Wetting and Drying Conditions

1.3 Submissions

.1 Product Data/Samples:

- .1 Provide samples of materials proposed for the work.

.2 Methodology:

- .1 Provide methodologies for carrying out the work.

1.4 Source Sampling

.1 Inform the Departmental Representative of proposed source of materials and provide access for sampling at least 2 weeks prior to commencing work.

.2 Provide test results from the quarry supporting specified requirements.

1.5 Existing Conditions

.1 It is important that Contractors intending to bid on work visit the site and ascertain the conditions of the site. Bidder to advise the Departmental Representative prior to going to site. The bidder must ascertain what preparatory work will be required for the following:

.1 Condition and widths of the existing roadways on the site
.2 Proximity of archaeological artifacts to roadway.
.3 Preparation, maintenance and removal of temporary roadways to and on the groynes for the use of trucks, excavators, draglines, etc.

.2 The land surrounding the site is the property of Her Majesty the Queen in the Right of Canada and the contractor will exercise extreme care to prevent damage to the land.

1.6 Haul Routes

.1 Refer to drawings for designated haul routes.

.2 No other access routes will be permissible.

1.7 Measurement for Payment

.1 Core fill and Armour stone will be measured in accordance with Section 01 10 10.

.2 Excavation below low normal tide will be measured in accordance with Section 01 10 10. The Contractor will perform a pre-excavation survey of the area to the satisfaction of the Departmental Representative to be used for calculating excavated quantities in combination with the cross section survey as they apply.

.3 Prices will include the entire cost of supplying and placing the material in the work, rough grading as necessary, the leveling and finish grading of the listed materials, taking soundings, producing cross sections, diving inspections all as shown on the drawings, and as specified.

.4 Transportation of material and any excavation and preparation of existing material will not be measured for payment but will be considered incidental to the work as bid items for supply armour (transport) and excavated material.

.5 Making good to the satisfaction of the Departmental Representative, any damage to existing structures, roads, or work surfaces will be considered incidental to the work.

.6 Do not mix different categories of material in the same truckload. Only one class of material will be weighed for payment at any given time. If fills of markedly different sizes are present, the Departmental Representative reserves the right to weigh such fills separately for payment. There will be no additional payment for weighing individual stone units which do not meet the category of material listed for the truckload.

.7 Incidental to the work will be weight receipts from a certified scale provided by the contractor for each load of material delivered to the site. The weight receipts are to be in triplicate, one copy for the contractor, one copy for the quarry(s) and one copy for the Departmental Representative. Receipts from the quarry and the site are to be matched prior to request for payment.

.8 Layout and survey control, including cross sections during placement, will constitute a lump sum for measurement purposes.

.9 Supply of all traffic control devices and personnel shall not be measured for payment.

.10 No separate payment will be made for geotextile.

PART 2 - PRODUCTS

2.1 Armour Stone

.1 General

.1 All stone shall be dense, hard, sound, close-grained, durable quarried fill, free of overburden material, and highly resistant to weathering and disintegration under freezing/thawing and wetting/drying conditions and shall be of a quality to ensure permanence of the structure in the climate in which it is to be used.

.2 All stone shall be free from detrimental cracks, seams and other defects that tend to increase deterioration from natural causes or cause breakage in handling and/or placing. Stone with high argillaceous or shale content is more susceptible to weathering, abrasion, thin bedding, close fracturing and other undesirable fill properties and will not be accepted.

.3 The stone shall be free from damage as a result of blasting during production. Blast damage is a significant cause of rejection of stone. Blast cracks that have the potential of causing more than 10% loss of weight of an individual stone, if the crack opens in service, are not acceptable. Stones with minor cracking may be reworked at the Contractor's option, with cracked portions being removed by jacking or other suitable method. The remaining stone, if within the gradation limits, may be re-evaluated for acceptance.

.4 Miscellaneous stone materials excavated from the site may be suitable for reuse in the new structures if they meet the requirements for gradation, quality and shape specified herein. Reuse of excavated stone materials requires the approval of the Engineer.

.2 Stone Quality/Durability Tests

.1 Stone materials to be used in Work shall be tested for quality/durability during

quarry start-up and production operations at the Contractor's expense.

.2 The following fill durability test specifications must be met or exceeded by all stone materials:

| Description | Test Method | Acceptance Criteria |
|---|---|---|
| Specific Gravity | ASTM C127 | minimum 2.65 |
| Absorption | ASTM C127 | maximum 2% |
| LA Abrasion | ASTM C131 | maximum 20% loss after 500 revolutions |
| MgSO4 Soundness | ASTM C88 | maximum 10% loss after 5 cycles |

.3 If these test results suggests borderline or questionable material, the following additional tests shall be conducted:

| Description | Test Method | Acceptance Criteria |
|---|---|---|
| Freeze-Thaw | ASTM D5312 max. | 0.5% loss after 40 cycles |
| Wet-Dry | ASTM D5313 max. | 0.5% loss after 80 cycles |

.4 Test samples of the proposed stone shall be obtained by the Contractor at his own expense. Samples selected for testing shall be representative of material formations in the quarry to be used for this project. The Engineer must be present for and agree upon the selection of all test samples prior to shipment. The Engineer may personally select all samples if he so elects.

.5 The samples shall be shipped or delivered by the Contractor, at his expense, to a suitable testing facility.

.6 The Contractor is responsible for allowing sufficient time for the testing to be completed such that there are no delays in the start of construction. .7 Previous test results for stone materials quarried from the same area (ie. the same working face and fill unit) of the quarry

may be accepted at the discretion of the Engineer.

.7 Submit stone quality test results at least one week prior to shipment of stone to site.

.3 Gradation and Shape Requirements:

.1 Material meeting the gradation and shape requirements listed below shall be placed in the work at the locations as shown on the Contract Drawings. Gradation limits are in-place requirements. Adjustments in production, transportation and placement methods shall be made as necessary to assure final placed materials are within specified ranges. Stone shall be well graded, and shall not exhibit gap grading or scalping from individual size ranges.

.2 Armour Stone

.1 All armour stone (A1 and A2) shall be angular in shape, with the ratio of maximum to minimum dimensions (aspect ratio) not exceeding 2.5.

**.2 A1 armour stone shall range in weight from 3 to 6 tonnes, with a median stone weight (W50) of 4.5 tonnes.**

**.3 A2 armour stone shall range in weight from 1.5 to 3 tonnes, with a median stone weight (W50) of 2 tonnes.**

2.2 Core Fill

.1 The source of core fill shall be a high quality blasted material from an approved quarry meeting the physical requirements of Armour Stone.

.2 Core Fill

.1 All core Fill shall be angular in shape, with the ratio of maximum to minimum dimensions (aspect ratio) not exceeding 3.

.2 Core fill shall be well graded and fall within the following gradation limits:

| Stone Weight (kg) | Percent (%) Less Than by Weight | |
|---|---|---|
| | Fine (Upper) Limit | Coarse (Lower) Limit |
| 10 | 5 | - |
| 50 | 35 | 0 |
| 75 | 50 | 15 |
| 200 | 100 | 60 |
| 400 | - | 100 |

2.3 Bedding Layer

.1 The source of bedding layer Material shall be a high quality blasted material from an approved quarry meeting the physical requirements of armour stone.

.2 Bedding Layer

.1 All bedding layer material shall be angular in shape, with the ratio of maximum to minimum dimensions (aspect ratio) not exceeding 3.

.2 Bedding layer stone, nominally 1 to 75 kg, shall be well graded and fall within the following gradation limits:

| Weight (kg) | Percent (%) Less Than by Weight | |
|---|---|---|
| | Fine (Upper) Limit | Coarse (Lower) Limit |
| 1 | 5 | - |
| 5 | 35 | 0 |
| 10 | 60 | 15 |
| 30 | 100 | 50 |
| 75 | - | 100 |

.3 Bedding layer material shall consist of clean, hard, sound, durable stone, free or organic or other deleterious materials, having a density of not less than 2.65 t/m3

.1 Bedding layer material when tested by the Micro-Deval Test Method in accordance with MTO LS-618, shall have a Micro-Deval loss not greater than 35%.
.2 When tested by the Freeze/Thaw Test Method in accordance with MTO LS-614 shall have a Freeze/Thaw loss not greater than 15%.
.3 Absorption, 2% maximum as determined by ASTM C127 test procedure.
.4 Sulphate Soundness Determination, maximum 12% by ASTM C88-73.

**PART 3 – EXECUTION**

3.1 Preparation

.1 Take and record soundings of the area in advance of the groynes construction.

.2 It is expected that upon placement of the core fill and bedding layers, the existing marine deposits in the extents of the groynes will either fully or partially displace outwards under the weight of the core and subsequent layers.
.1 Assure the core and subsequent layers are placed in such a way that the marine deposits can displace outwards away from the stone placement as the groynes are constructed.
.2 Placement/removal of any excavated material as per the direction of the PCA Departmental Representative.

.3 Assure throughout the stone placement that the new groyne structure is stable and safe for equipment, workers and material loads.

.4 Take no risks and be aware that marine sediments under the new work may displace or may settle in a non-uniform manner.

.5 Excavation for groynes must be excavated to lines and grades shown on the drawings.

.6 Any excavated material shall be hauled to a disposal site approved by the departmental representative.

3.2 Placement

.1 Submit proposed access to construct, methods of material placement, and construction sequence for review and consideration prior to starting work.

.2 The contractor may build a working surface (out of core fill material only)to provide access for construction equipment. Any additional stone material required to build the working surface must be removed to the satisfaction of the Departmental Representative.

.3 Core fill material shall be placed according to the following:

.1 Place material to lines, grades and dimensions indicated on the plan. Harbour bottom should be free from kelp, debris, snow, ice, etc.

.2 Execute work in such a manner to protect material from storm wave action or tidal erosion damage. Replacement of material lost due to storm or erosion damage will be the responsibility of the Contractor.

.3 Do not extend core fill or bedding layer material for groynes more than 10 metres beyond armour protection.

.4 Material may be placed by end dumping. However, Contractor shall note that due to the side slopes of the groynes that mechanical placing of the material will be necessary to produce the slopes and shapes required.

.5 Grades, lines, dimensions, slope and quantity, to be captured by a licensed surveyor and digitally presented for review and approval by the Departmental Representative before proceeding with overlaying layers.

.4 Armour Stone layers shall be placed according to the following:

.1 Place each Armour stone layer to lines, grades and dimensions indicated on the

plans.

.2 Place each Armour stone individually using mechanical means to the lines, grades and dimensions shown on the plans. Do not dump units into place. Commence placement at toe of slope and proceed up the slope towards the crest. Place each stone so that it is stable, secure on slope and supported by units below. Control placement of stone so as to produce a uniform and continuous cover over the underlying layer.

.3 Handle Armour stone with care. Do not damage units during placement. Replace damaged or broken units at no additional cost to the contract.

.4 For all materials, grades, lines, dimensions, slopes and quantity of stones to be reviewed and approved by the Departmental Representative before proceeding with the overlying layer.

.5 Replacement or resetting of Armour material lost or displaced due to storm will be the responsibility of the contractor with no additional cost to the contract.

.6 Choose stones and place them in such a way that the whole structure will be bonded and consolidated to as great an extent as nature of fill will allow. Fills should vary in size so they don’t create steep slopes when placing the grade lines as indicated on the drawings.

.7 Armour stone is to be mechanically placed so as to knit together with adjacent stones.

3.3 Tolerances

.1 Armour stone layers to be within 150mm of lines and grades shown.

.2 Core fill layer to be within 100mm of lines shown.

3.4 Protection

.1 Take into account anticipated weather conditions and degree of exposure of site in setting requirements for protection.

.2 Schedule and carry out construction so that the core layers are never built any longer than 10.0m out before they are protected by armour.

.3 The Contractor should note that the work site is subject to water level variations due to tidal action and that the top of core fill may be submerged by times during the construction season depending on the tide cycle.

.4 The Contractor will be responsible to replace any materials lost due to storms, tidal erosion or by their own activities.

3.5 Cross Sections

.1 During construction the Contractor shall submit digital cross-sections compiled by a licenced surveyor to the Departmental Representative showing the following:
.1 Cross-sections as-built at stations every 10 metres along the groynes slopes.

.2 After construction is complete and before the Final Certificate of Completion will be paid, Contractor to submit detailed as-built survey plan to Departmental Representative to show that contract grades and elevations have been achieved. Provide an electronic file of the cross-sections and two sets or prints. Divers will be required to assist with the survey for elevations required below the low water level. The following minimum requirements to be met:
.1 Cross-sections every 10 meters along the centerline of the groynes and at every grade change along the centerline.
.2 All survey work to be in meters referenced to monument shown on drawings.

3.7 Temporary Navigational Buoys

.1 The Contractor is to maintain appropriate temporary buoys to mark the position of the outer end of the groynes.
.2 The Contractor shall coordinate the buoy selection and installation with the local harbor authority.

.3 The Contractor is responsible for all costs associated with the supply, installation and removal of all temporary navigational buoys.

3.8 Excavation and Placement QC/QA Program

.1 Quality Control (QC) Program.

.1 The Contractor is responsible for, and shall establish and maintain, Quality Control for all work performed at the job site to assure compliance with the specifications.

.2 The Contractor shall maintain records of all Quality Control tests, surveys, inspections, and corrective actions, and shall submit copies to the Departmental Representative.

.3 The Contractor shall handle, transport and shore materials to ensure that stockpiles are not contaminated with other soils and materials and to limit the segregation of material sizes.

.4 The Contractor shall provide range poles, marker buoys, templates, batter boards and/or any other means of guidance and control as necessary to excavate/place materials to the required lines and grades within the specified tolerances.

.5 The Contractor shall maintain temporary vertical and horizontal control monuments in the immediate vicinity of the work being performed.

.6 The Contractor shall provide and install a water level staff gauge, with stilling tube if necessary, to allow Contractor and Departmental Representative to read water levels at any time during the project. Number staff gauge in 0.05 m increments and provide gradation marks every 0.05 m. Install staff gauge such that water level can be read directly. Staff gauge type and location must be approved by the Departmental Representative.

.7 The Contractor shall perform construction surveys as necessary to perform the work required by the Contract Documents. Equipment and methods by which

construction surveys are performed at the Contractor's option, and shall be consistent throughout the project.

.2 Quality Assurance (QA) Activities:

.1 In addition to the QC program and construction surveys, the Contractor shall perform verification surveys as the work progresses to verify that lines, grades and thicknesses for the completed work are within the specified tolerances. Verification surveys shall be performed with a total station survey instrument and range pole – mounted prism; surveyor's level, range pole and surveyor's tape, tag line and sounding basket; or other methods that are consistent with the requirements of this section and subject to the approval of the Departmental Representative. Range poles, if used, shall be fitted with a flat, durable, 0.3 metre diameter base. The Contractor shall provide personnel and other equipment necessary to adequately and safely perform verification surveys.

.2 Verification surveys shall be conducted by the Contractor in the presence of the Departmental Representative unless waived by the Departmental Representative.

.3 Survey excavated areas upon completion of excavation work. The same survey methods and survey line locations will be used for both pre- and post-construction surveys.

.4 Survey beach and dune fill areas upon completion of placement and grading operations. The same survey methods and survey line locations will be used for both pre- and post-construction surveys.

.5 All verification surveys shall be referenced to the monument shown on the drawings.

.6 Before any fill placement over the existing grade, excavated grade or previously placed material , surveys of the existing grade, excavated grade or

previously placed material must be verified by Departmental Representative.

.7 Approval of a cross-section shall not constitute final acceptance.

END

PART 1 GENERAL

1.1 Related Requirements

.1 Section 01 35 43 – Environmental Procedures

1.2 Environmental Requirements

.1 Operation of construction equipment in water is prohibited. Only the bucket/boom shall enter the water as necessary during sub sea work. Tracks of the excavator, as well as all other equipment on site shall be clear of water at all times.

.2 Use borrow material from watercourse beds only after receipt of written approval from Departmental Representative.

.3 Design and construct temporary crossings to minimize environmental impact to watercourse.

.4 Constructing temporary crossings of watercourses where spawning beds are indicated is prohibited.

.5 Dumping excavated fill, waste material, or debris in watercourse or wetland is prohibited.

1.3 References

.1 U.S. Environmental Protection Agency (EPA) / Office of Water.

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.4 Action and Informational Submittals

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Sustainable Design Submittals:

.1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005 and authorities having jurisdiction.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Existing Conditions

.1 Maintain existing flow pattern in natural watercourse systems.

.2 In natural systems maintain existing riffle pool and step pool patterns.

3.2 Site Clearing and Plant Protection

.1 Temporary Erosion and Sedimentation Control:
- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.2 Minimize disturbance to vegetated buffer zones and protect trees and plants on site and adjacent properties where indicated.

.3 Wrap trees and shrubs adjacent to construction work, storage areas and trucking lanes in burlap.

.4 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
- .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.5 Leave cuttings from trees and other vegetation on site as brush piles to allow for natural degradation.

.1 Secure large piles with degradable materials to prevent interference with watercourse.

.6 Remove only trees that may offer future blockage problems as instructed by Departmental Representative.

.7 Leave roots mass and stumps in place.

.8 Maintain temporary erosion and pollution control features installed under this contract.

3.3 Drainage

.1 Pumping water containing suspended materials into watercourse is prohibited.

.2 Establish fill chute spillways to accommodate safe surface water entry to watercourse as directed by Departmental Representative.

3.4 Site Restoration

.1 Establish vegetated buffer zones with suitable vegetation to minimum 3 m along edge of watercourse banks as determined by Departmental Representative.

.2 Plant vegetation natural to area, suitable for application without requirement for fertilizers, pesticides and other chemicals.

.3 Control stream bank erosion in lower section of watercourse with irregular shaped riprap underlain with non-toxic filter cloth of size determined by Departmental Representative.

.4 Control stream bank erosion in upper section of watercourse by planting suitable vegetation as directed by Departmental Representative].

.1 Ensure planting occurs within 7 days after work on watercourse is complete.

END

# Appendix A

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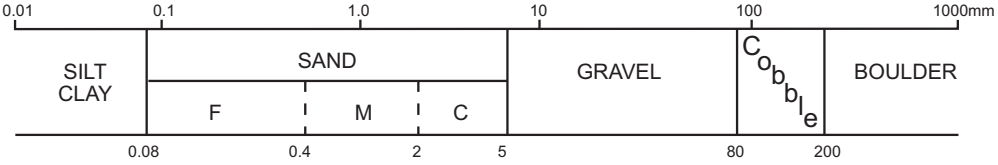
FREDERICTON, MONCTON, BATHURST, GRAND FALLS, SAINT JOHN, NB

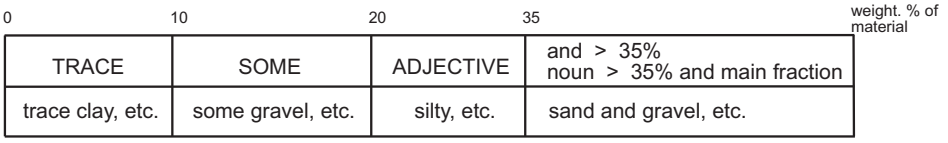
# DESCRIPTIVE TERMS- BOREHOLE/TEST PIT LOG

## SOILS

### GRAIN SIZE




### DESCRIPTIVE TERMINOLOGY




| TRACE | SOME | ADJECTIVE | and > 35%<br>noun > 35% and main fraction |
|---|---|---|---|
| trace clay, etc. | some gravel, etc. | silty, etc. | sand and gravel, etc. |

### COMPACTNESS gravels, sands, tills

| N, RANGE | 0 - 4 | 4 - 10 | 10 - 30 | 30 - 50 | > 50 |
|---|---|---|---|---|---|
| DENSITY | V. LOOSE | LOOSE | MEDIUM | DENSE | V. DENSE |

### CONSISTENCY silt, clay

| S, KPa | < 12.5 | 12.5 - 25 | 25 - 50 | 50 - 100 | 100 - 200 |
|---|---|---|---|---|---|
| CONSISTENCY | V. SOFT | SOFT | MEDIUM | STIFF | V. STIFF |

## ROCK

| RQD | OVERALL QUALITY | FRACTURE SPACING |
|---|---|---|
| 0 - 25 | VERY POOR | VERY CLOSE 20 - 60 mm |
| 25 - 50 | POOR | CLOSE 60 - 200 mm |
| 50 - 75 | FAIR | MODERATE 200 - 600 mm |
| 75 - 90 | GOOD | WIDE 600 - 2000 mm |
| 90 - 100 | EXCELLENT | VERY WIDE 2 - 6 m |

| COMP. STR. MPa | 1 - 5 | 5 - 25 | 25 - 50 | 50 - 100 | 100 - 250 |
|---|---|---|---|---|---|
| DESCRIPTION | V. WEAK | WEAK | MODERATE | STRONG | V. STRONG |

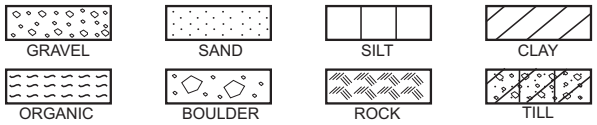
## SAMPLE TYPES (location to scale on log)

| | | | |
|---|---|---|---|
| S | SPLIT TUBE | G | SHOVEL |
| T | SHELBY TUBE | H | CARVED BLOCK |
| P | PISTON | K | SLOTTED |
| F | AUGER | V | IN SITU VANE |
| W | WASH | NR | NO RECOVERY |

## ROCK CORES

A(30mm); B(41mm); N(54mm)

## LOG SYMBOLS




## WELL SYMBOLS


N - standard penetration test; blows by 475 J drop hammer to advance Std. 50mm O.D. split tube sampler 0.3m

RQD - percent of core consisting of hard, sound pieces in excess of 100mm long (excluding machine breaks)

RECOVERY - sample recovery expressed as percent or length

S - shear strength , kPa; vane ⊕ ; penetrometer ■; unconfined ○ ; Uc unconfined compressive strength

Sr - shear strength, remoulded; vane ⊗ ; penetrometer □

Dd - dry density; $t/m^3$

W - natural moisture content, percent ✳

PL - plastic limit, percent ⊢

LL - liquid limit, percent ⊣

ND - non detect, total petroleum hydrocarbons (TPH) not detected in soil

Groundwater Level ▼ ; Seepage ▽

Revised Oct, 2009

BHDESCRM-2009.CDR

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-1 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 15/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 1.30 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | SAMPLE No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | 1 | S | 17 | 0 | | **GRAVEL** Medium light brown to grey sandy gravel, some cobbles, trace silt, moist |
| | | | | | | 0.60 (0.70) |
| | 2 | S | 18 | 250 | | - rounded to subrounded gravel and cobbles<br>- cobbles at ground surface |
| 1 | | | | | | **SAND** |
| | | | | | | 1.20 (-0.10) Medium brown silty sand with gravel, some shell fragments, wet |
| | 3 | S | 20 | 150 | | - fine to coarse grained sand<br>- rounded to subangular gravel |
| | | | | | | **SAND** |
| 2 | 4 | S | 29 | 430 | | Medium brown to greyish brown silty sand with gravel, wet |
| | | | | | | 2.40 (-1.10) - rounded to subangular gravel |
| | 5 | S | 63 | 560 | | **SAND** Very dense light grey sand with silt and gravel, wet |
| 3 | 6 | S | 54 | 430 | | - angular to subrounded gravel<br>- fine to coarse grained sand<br>- trace cobble clasts below 3.0 m |
| | 7 | S | 52 | 450 | | |
| 4 | | | | | | 4.30 (-3.00) |
| | | | | | | **End of Borehole at 4.3 m** |
| | | | | | | - groundwater seepage encountered at 0.6 m during drilling; influenced by tides |

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-2 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 15/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 3.90 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | SAMPLE No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | 1 | S | 12 | 150 | | **FILL** Medium brown sand with gravel, some cobbles, trace silt, moist - fine to coarse grained sand - rounded to subrounded gravel |
| 0.60 | | | | | | 3.30 |
| 1 | 2 | S | 11 | 280 | | **FILL** Medium dark brown sand with silt and gravel, moist - rounded to subangular gravel |
| 1.50 | | | | | | 2.40 |
| 2 | 3 | S | 12 | 400 | | **SAND** Very dense brown silty sand with gravel, moist - difficult drilling, possible cobbles |
| | 4 | S | 71 | 75 | | |
| 2.70 | | | | | | 1.20 |
| 3 | 5 | S | 11 | 50 | | **SAND** Medium dark brown to dark grey silty sand with gravel, wet - trace organics and small pieces of glass in SS7 |
| | 6 | S | 19 | 75 | | |
| 4 | 7 | S | 13 | 300 | | |
| 4.30 | | | | | | -0.40 |
| | | | | | | **End of Borehole at 4.3 m** |

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-3 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 15/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 3.90 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa (0, 25, 50, 75, 100)
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits ($w_P$, $w$, $w_L$)
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
(0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100)

| DEPTH m | SAMPLE No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | 1 | S | 15 | 280 | | **FILL** Medium to loose brown to greyish brown silty sand with gravel, moist - angular to rounded gravel |
| 1 | 2 | S | 6 | 300 | | |
| | | | | | | 1.20 / 2.70 |
| | 3 | S | 29 | 250 | | **SAND** Medium greyish brown silty sand with gravel, moist - angular to subrounded gravel - trace cobble clasts below 1.8 m |
| 2 | 4 | S | 26 | 280 | | |
| | 5 | S | 26 | 300 | | 3.00 / 0.90 |
| 3 | 6 | S | 12 | 120 | | **SAND** Medium to very loose brown silty sand with gravel, wet - rounded to subangular gravel |
| 4 | 7 | S | 4 | 100 | | 4.30 / -0.40 |
| | 8 | S | 8 | 180 | | **SAND** Very loose to loose brown to black silty sand, trace to some gravel, wet - trace shell fragments in SS9 |
| 5 | 9 | S | 2 | 250 | | |
| | 10 | S | 5 | 150 | | 5.80 / -1.90 |
| 6 | 11 | S | 3 | 360 | | **ORGANIC SAND** Very loose to medium black silty sand with organics, trace pieces of wood, wet |
| | | | | | | 6.40 / -2.50 |
| | 12 | S | 5 | 530 | | **ORGANIC SAND** Very loose to medium black to dark grey silty sand layered with organics, wet |
| 7 | 13 | S | 4 | 410 | | |
| 8 | 14 | S | 11 | 560 | | |
| | 15 | S | 11 | 600 | | |
| | | | | | | 9.00 / -5.10 |
| 9 | | | | | | 9.10 / -5.20 **GRAVEL** Medium grey sandy gravel with silt, wet |
| | | | | | | **End of Borehole at 9.1 m** - groundwater seepage encountered at 3.5 m during drilling; influenced by tides |

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-4 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 15/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 4.30 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | SAMPLE No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | 1 | S | 9 | 25 | | **FILL** Loose brownish grey silty sand with gravel, some cobbles, moist |
| | | | | | | 0.60 / 3.70 |
| | 2 | S | 20 | 130 | | **FILL** Medium brownish grey silty gravel with sand, moist - angular to subrounded gravel |
| 1 | | | | | | 1.20 / 3.10 |
| | 3 | S | 11 | 330 | | **SAND** Medium to loose brown to grey silty sand with gravel, moist - rounded to subangular gravel |
| 2 | 4 | S | 24 | 200 | | |
| | 5 | S | 9 | 250 | | |
| | | | | | | 3.00 / 1.30 |
| 3 | 6 | S | 25 | 200 | | **SAND** Medium greyish brown to grey silty sand with gravel, moist - fine to coarse grained sand - rounded to subangular gravel |
| | 7 | S | 17 | 0 | | |
| 4 | | | | | | 4.30 / 0.00 |
| | | | | | | **End of Borehole at 4.3 m** - groundwater seepage encountered at 4.3 m during drilling; influenced by tides |

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-5 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 16/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 3.50 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | SAMPLE No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | | | | | | **COBBLES** Poorly graded cobbles |
| | | | | | | 0.90 2.60 |
| 1 | 1 | S | 14 | 150 | | **SAND** Medium to loose greyish brown silty sand with gravel, moist - angular to subrounded gravel |
| 2 | 2 | S | 26 | 200 | | |
| | 3 | S | 10 | 380 | | |
| | | | | | | 2.90 0.60 |
| 3 | 4 | S | 7 | 50 | | **SAND** Loose to medium brown to black to greyish brown silty sand with gravel, wet - angular to subrounded gravel - trace organics in SS5 - cobble encountered at 3.8 m |
| | 5 | S | 40 | 150 | | |
| 4 | 6 | S | 28 | 250 | | |
| | | | | | | 4.60 -1.10 |
| | | | | | | **GRAVEL** Very dense brown silty gravel with sand, wet - angular to subangular gravel |
| 5 | 7 | S | 50+ | 280 | | 5.20 -1.70 |
| | | | | | | **End of Borehole at 5.2 m** - groundwater seepage encountered at 3.0 m during drilling; influenced by tides |

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-6 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 16/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 3.40 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | S | 5 | 50 | | **SAND** Loose brown sand with gravel, some cobbles, moist | |
| | | | | | 0.60 | | 2.80 |
| 1 | 2 | S | 23 | 360 | | **SAND** Medium greyish brown silty sand with gravel, moist - rounded to subangular gravel | |
| | 3 | S | 12 | 180 | | | |
| 2 | 4 | S | 15 | 150 | | | |
| | | | | | 2.40 | | 1.00 |
| | 5 | S | 17 | 230 | | **SAND** Medium grey silty sand with gravel, wet | |
| | | | | | 3.00 | | 0.40 |
| 3 | 6 | S | 7 | 75 | | **SAND** Loose greyish brown sand, some gravel, wet - fine to coarse grained sand | |
| | | | | | 3.70 | | -0.30 |
| | 7 | S | 9 | 250 | | **SAND** Loose to medium brown to greyish brown silty sand with gravel, wet - angular to subrounded gravel - some gravel below 4.9 m | |
| 4 | 8 | S | 5 | 300 | | | |
| | 9 | S | 13 | 150 | | | |
| 5 | | | | | 5.40 | | -2.00 |
| | 10 | S | 8 | 100 | | **ORGANIC SAND** Loose to dense silty sand with organics, wet - some gravel and thin organic layers in SS11 | |
| | 11 | S | 38 | 410 | | | |
| 6 | | | | | 6.70 | | -3.30 |
| | 12 | S | 50+ | 130 | 6.80 | **GRAVEL** Very dense brown to greyish brown silty gravel, some sand, wet - very angular clasts | -3.40 |
| | | | | | | **End of Borehole at 6.8 m** - groundwater seepage encountered at 2.9 m during drilling; influenced by tides | |

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-7 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 16/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 1.20 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | SAMPLE No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | 1 | S | 17 | 300 | 0.15 | **GRAVEL** 1.05<br>Poorly graded gravel at surface |
| | | | | | 0.60 | **SAND** 0.60<br>Medium brown to greyish brown sand with gravel, very moist to wet<br>- fine to coarse grained sand<br>- rounded to subangular gravel |
| 1 | | | | | 1.10 | 0.10 |
| | 2 | S | 49 | 450 | | **COBBLES**<br>**GRAVEL**<br>Dense grey to greyish brown silty gravel with sand, wet |
| 2 | | | | | 2.00 | - angular to subangular gravel -0.80 |
| | 3 | S | 84 | 510 | | **GRAVEL**<br>Very dense greyish brown to reddish brown silty gravel, trace sand, wet<br>- angular gravel |
| 3 | | | | | 3.00 | -1.80 |
| | | | | | | **End of Borehole at 3.0 m**<br>- groundwater seepage encountered at 0.3 m during drilling; influenced by tides |

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-8 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 16/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 0.60 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | SAMPLE No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | 1 | S | 13 | 300 | | **SAND** Medium to loose greyish brown to brown silty sand with gravel, trace cobbles, moist to wet - rounded to subangular gravel - trace organics at tip of SS2 |
| 1 | | | | | | |
| | 2 | S | 9 | 300 | | |
| 2 | | | | | | 2.10 -1.50 **GRAVEL** Very dense grey to greyish brown silty gravel with sand, wet - angular to subangular gravel - difficult drilling |
| | 3 | S | 69 | 360 | | |
| 3 | 4 | S | 35 | 300 | | 3.40 -2.80 **GRAVEL** 3.70 Dense reddish brown silty gravel to clayey gravel with sand, wet - angular gravel 3.10 **End of Borehole at 3.7 m** - groundwater seepage encountered at 0.6 m during drilling; influenced by tides |

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# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-9 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 16/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 1.90 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION |
|---|---|---|---|---|---|---|
| 0 | 1 | S | 42 | 150 | | **SAND** Dense greyish brown silty sand with gravel, moist - sand, gravel, and cobbles at surface |
| 1 | | | | | | 1.20 0.70 |
| | 2 | S | 7 | 100 | | **SAND** Loose brown to greyish brown sand with gravel, wet |
| | | | | | | 1.80 0.10 |
| 2 | | | | | | **SAND** Very loose grey silty sand, wet |
| | 3 | S | 1 | 150 | | |
| | | | | | | 3.00 -1.10 |
| 3 | | | | | | **SAND** Loose to medium dark grey silty sand, wet - trace 50 mm organic layers in SS4 - some subangular gravel in SS5 |
| 4 | 4 | S | 4 | 410 | | |
| 5 | 5 | S | 16 | 450 | | |
| | | | | | | 5.50 -3.60 |
| | | | | | | **End of Borehole at 5.5 m** - groundwater seepage encountered at 0.6 m during drilling; influenced by tides |

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

# BOREHOLE LOGS

| | | | |
|---|---|---|---|
| Client | Parks Canada Agency | Proj No. 4088.27 | BOREHOLE BH16-10 |
| Project | Barrier Beach and Quay Wall Storm Protection | Date Drilled 17/11/2016 | Page 1 of 1 |
| Location | Fortress of Louisbourg National Historic Site, Nova Scotia | | |
| Ground Level, m 1.80 | Datum: Geodetic | Logged By WS | |

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits $w_P$ $w$ $w_L$
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

| DEPTH m | No | TYPE | N (RQD) | REC (mm) | LOG | DESCRIPTION | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | S | 19 | 180 | | 0.10 **GRASS** | 1.70 |
| | | | | | | **FILL** Medium to dense dark brown to brown silty sand with gravel, trace rootlets, moist - angular to subrounded gravel | |
| 1 | 2 | S | 32 | 230 | | 1.20 | 0.60 |
| | 3 | S | 27 | 410 | | **SAND** Medium grey to greyish brown silty sand with gravel, moist to wet | |
| | | | | | | 1.80 | 0.00 |
| 2 | 4 | S | 10 | 300 | | **GRAVEL** Loose brown silty gravel with sand, wet | |
| | | | | | | 2.30 - angular to rounded gravel | -0.50 |
| | 5 | S | 62 | 430 | | **SAND** Very dense to medium grey to greyish brown sand with silt and gravel, wet - rounded to subangular gravel | |
| 3 | 6 | S | 14 | 150 | | | |
| | 7 | S | 45 | 300 | | 3.80 | -2.00 |
| 4 | | | | | | **SAND** Dense greyish brown sand with silt and gravel to gravel with sand, wet - subrounded to angular gravel | |
| | 8 | S | 60 | 450 | | | |
| 5 | 9 | S | 48 | 600 | | | |
| | | | | | | 5.50 | -3.70 |
| | 10 | S | 21 | 250 | | **SAND** Medium grey sand with silt and gravel, wet - rounded to subrounded gravel | |
| 6 | | | | | | 6.10 - fine to coarse grained sand | -4.30 |
| | 11 | S | 16 | 300 | | **GRAVEL** Medium grey silty gravel with sand, wet | |
| | | | | | | 6.70 - rounded to subangular gravel | -4.90 |
| | | | | | | **End of Borehole at 6.7 m** - groundwater seepage encountered at 1.8 m during drilling; influenced by tides | |

# Appendix B

**Parks Canada Agency**

# Basic Impact Analysis (BIA)

## Fortress of Louisbourg Erosion and Flood Protection Project

Fortress of Louisbourg National Historic Site of Canada
Louisbourg, Nova Scotia

Photo: Michael Wambolt, DFO (June 2017)

August 2017
CBFU2017-003

# Table of Contents

# Parks Canada Basic Impact Analysis

## 1. INTRODUCTION

Pursuant to Section 67 of the *Canadian Environmental Assessment Act* 2012 (CEAA 2012), the Parks Canada Agency (PCA) is legally accountable to ensure a project is only carried out on federal lands and waters that it manages when a determination has been made that the project is not likely to cause significant adverse environmental effects. Impact analysis (IA) is a tool that enables PCA to systematically, efficiently and proactively evaluate a project to ensure it is as well designed as possible to avoid or reduce adverse effects. IA also supports PCA in achieving its mandate to protect and present nationally significant examples of Canada's natural and cultural heritage, and foster public understanding, appreciation and enjoyment.

PCA's IA process examines how a project may lead to direct adverse effects on natural resources and cultural resources, as well as indirect effects (those resulting from an impact on natural resources) to characteristics of the environment important to key visitor experience; health and socioeconomic conditions of Indigenous and non-Indigenous peoples; and Indigenous peoples' current use of lands and resources for traditional purposes.

Following review of the Parks Canada Directive on Impact Assessment and the scope of work associated with the Fortress of Louisbourg Erosion and Flood Protection Project, it was determined that a Basic Impact Analysis (BIA) provides the appropriate level of assessment. This BIA has been developed to address requirements under Section 67 of CEAA 2012.

### *Project Title & Location*

Fortress of Louisbourg Erosion and Flood Protection Project
Fortress of Louisbourg National Historic Site of Canada
Cape Breton, Nova Scotia

### *Proponent Information*

Audrey Buchanan – Asset Manager
Cape Breton Field Unit
902-733-3520 / audrey.buchanan@pc.gc.ca

### *Proposed Project Dates*

| | |
|---|---|
| Planned commencement | 2017-10-23 |
| Planned completion | 2019-07-31 |

### *Internal Project File #*

CBFU2017-003

## 2. PROJECT DESCRIPTION

The objective of the Fortress of Louisbourg Erosion and Flood Protection Project is to minimize the risk of flooding at the Fortress of Louisbourg National Historic Site (FLNHS) in Cape Breton, Nova Scotia (Figure 1), by fortifying flood protection infrastructure at the site, and reducing coastal erosion and the retreat of the barrier beach. Sea level rise combined with increasing storm intensity and frequency are

elevating flood potential at FLNHS. These measures will protect park infrastructure, cultural and archaeological resources, and ecologically sensitive areas.

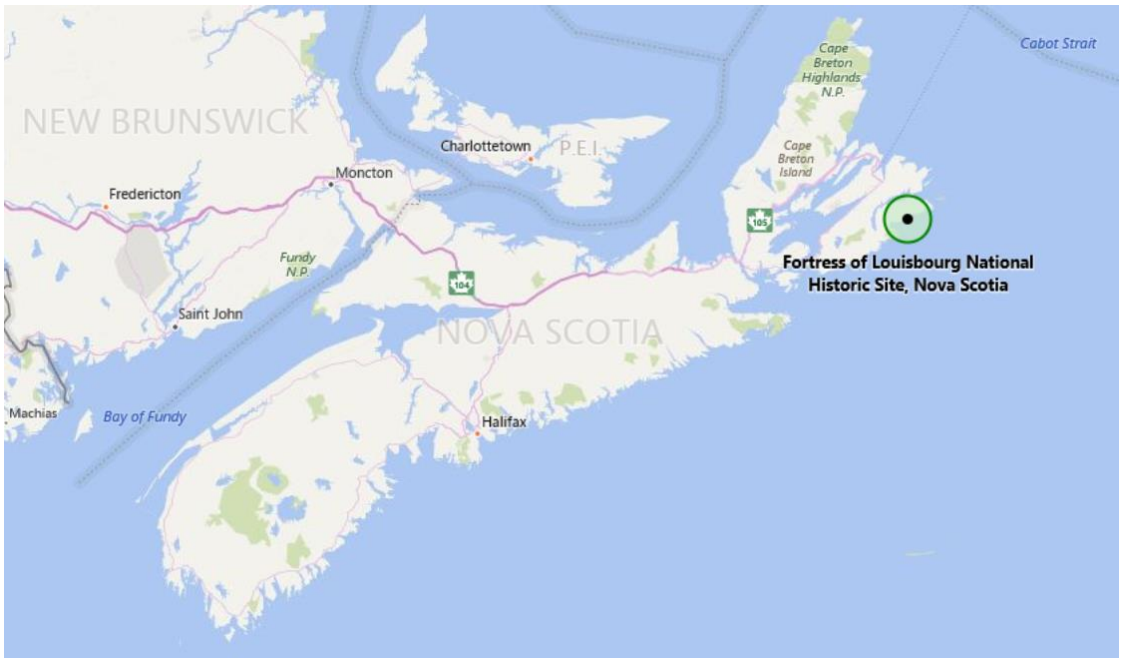



*Figure 1. Fortress of Louisbourg National Historic Site Location*

The Grand Étang Barrier Beach, which protects the northeast shoreline, is eroding due to wave overtopping and sediment over wash. It is retreating at a rate of 0.39 m/a and, as described below, is threatening to breach. Although attempts have been made in recent years to protect the barrier by placing sand along the berm, this material has been not substantial enough to remain in place and has been transported and deposited along the Quay Wall.

> *"The barrier beach encloses a large pond and is one of the most fragile features along the coast of the park. Here, the irreversible nature of till erosion is clear and has reduced the width of the barrier to critical limits. Cusping is evident in the shoreface of the boulder beach that could lead to a catastrophic breaching of the barrier in storm conditions. Already, quantities of beach boulders have been washed over the berm at its eastern section and hence are no longer contributing to beach protection… Unless a program is developed to protect the shoreline along the Grand Étang barrier beach we expect that the beach will be breached in the relatively near future." (CBCL Limited, 2010)*

*Photo 1. Eroding Barrier Beach (Atlantic Ocean to left, Grand Étang Pond to right) (Gemtec, March 2017).*

Much of the reconstructed fortress drains directly through the existing cales (openings), which are vulnerable to surge tides and sea level rise. While the Quay Wall, which protects the site's northern shoreline, is stable and well-constructed, flooding does occur during storms, particularly at the location of the Corps de Garde sewage treatment facility. The potential for the barrier beach to breach also presents flooding and erosion threats to the ecologically-sensitive Grand Étang Pond, and to the reconstructed buildings and cultural resources behind the Grand Étang.

*Photo 2. Corps de Garde sewage treatment facility (stone building on the right) (Gemtec, March 2017).*

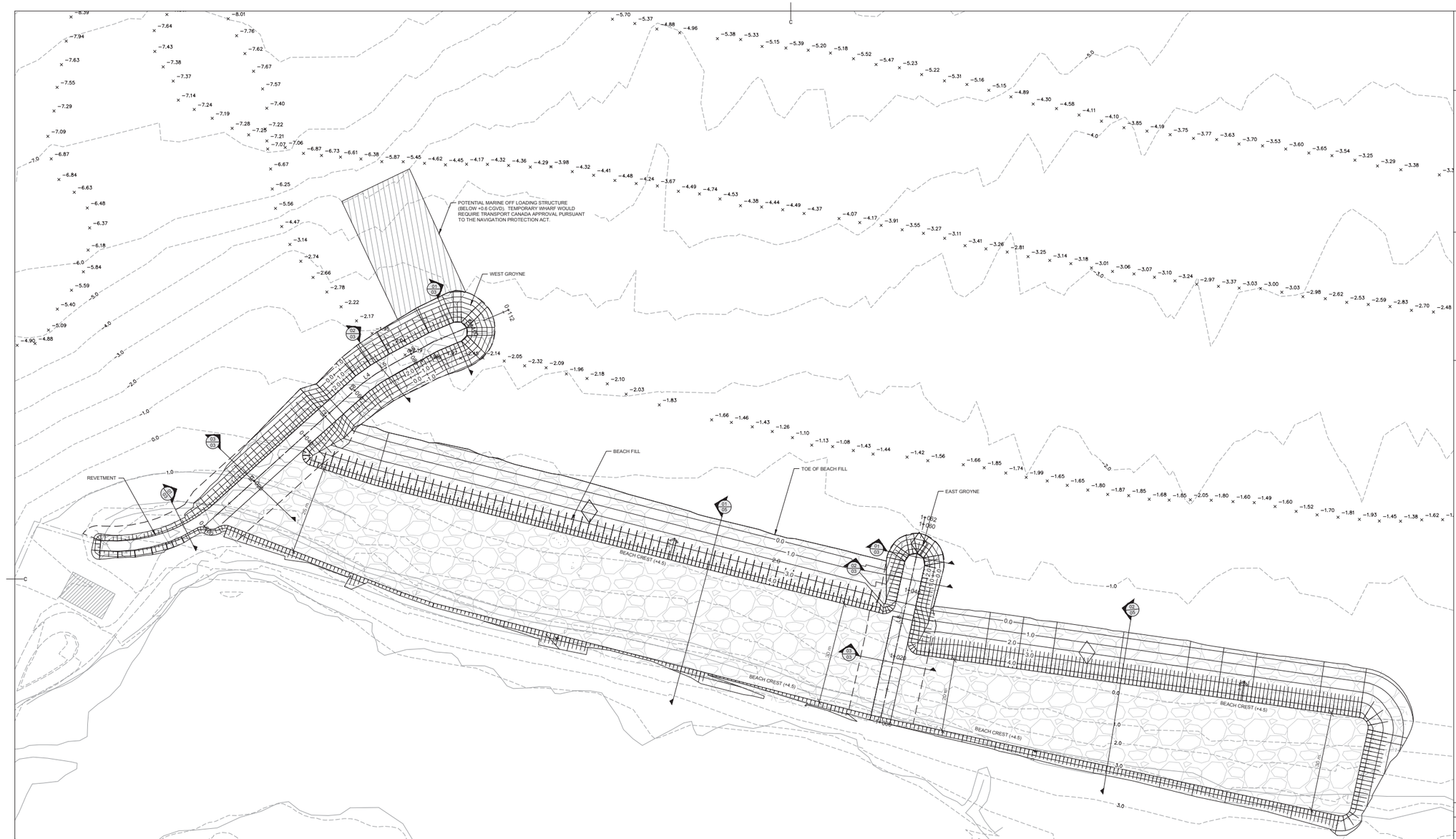
*Photo 3. Quay Wall Cale (Gemtec, March 2017).*

The Project involves stabilizing the barrier beach through beach nourishment supported by two groynes - an intermediate (east) groyne and a terminal groyne at the west end of the beach (Figure 2) (Barrier Beach engineering design drawings are provided in Appendix A), and increasing the height of the Quay Wall by 1 m and closing off the open cales by extending the wall across the cale openings (Figure 3) (Quay Wall engineering design drawings are provided in Appendix B). The Project will minimize flood risk and protect existing heritage resources and natural ecosystem features, and will support positive visitor experiences and public health and safety.

***Project Location***

The Project is located in the Cape Breton Regional Municipality, Nova Scotia, within the Fortress of Louisbourg National Historic Site (FLNHS) (~45.894562, -59.980182). FLNHS is a reconstruction of one of North America's busiest 18$^{th}$ century seaports. Founded by the French in 1713, it fell under siege twice to the British before being demolished in the 1760s. Reconstruction of part of the Fortress of Louisbourg began in the 1960s, and today the site includes streets, houses, shops, restaurants and barracks, "inhabited" from July to September by authentically-clad animators reenacting typical day-to-day activities from the 1700s, such as soldiers' drills, music and dance, children's games, kitchen gardens and recipes. Visitors can take part in activities such as rum tasting, cannon or musket firing, or camp overnight or sleep in a period house. The Fortress of Louisbourg offers five walking trails including the Lighthouse Trail, which is the site of the first lighthouse in Canada.

The Grand Étang Barrier Beach is located to the northeast of the Fortress and extends 350 m along the northeastern shore of the site, between the corner of the quay walls at the Pièce de la Grave and the shores of Rochefort Point (Figure 4). The rocky islands of Battery Island, Rocky Island and Green Island lie to the east. The Quay Wall is located at the north of the Fortress, extending approximate 625 m along the site's northern shore (Figure 5).




| Line Table: EAST AND WEST GROYNES | | | | |
|---|---|---|---|---|
| Line # | Length | Direction | Start Point (E,N) | End Point (E,N) |
| L1 | 39.736 | N47° 53' 33.66"E | (734094.6326,5086786.1045) | (734124.1121,5086812.7482) |
| L2 | 17.758 | N48° 05' 25.04"E | (734124.1121,5086812.7482) | (734137.3273,5086824.6095) |
| L3 | 5.426 | N48° 14' 51.78"E | (734137.3273,5086824.6095) | (734141.3753,5086828.2228) |
| L4 | 5.127 | N54° 13' 07.71"E | (734141.3753,5086828.2228) | (734145.5344,5086831.2204) |
| L5 | 6.287 | N59° 29' 48.81"E | (734145.5344,5086831.2204) | (734150.9510,5086834.4114) |
| L6 | 13.068 | N61° 44' 05.25"E | (734150.9510,5086834.4114) | (734162.4613,5086840.6000) |
| L7 | 24.245 | N66° 57' 03.87"E | (734162.4613,5086840.6000) | (734184.7704,5086850.0922) |
| L8 | 62.111 | N12° 26' 04.91"E | (734294.8587,5086728.0125) | (734308.2328,5086788.6661) |

SCALE : 1:500

0m 10m 20m 30m 40m 50m

0 10 20mm 40 60 80 100 120 140 160 180 200mm

17/03/10 (10:56) 1545-6.1_A.dwg

PWGSC B1 (2004)

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

Baird
W.F. Baird & Associates
Coastal Engineers Ltd.

NOTES:

1. ELEVATIONS SHOWN ARE GEODETIC CGVD'28, AND ARE REFERENCED TO N.S.C.M. 201666 AT AN ELEVATION OF 13.478 m. COORDINATES REFER TO NAD83 REFERENCE SYSTEM.
2. THE OFFSET FROM CHART DATUM (CD) TO GEODETIC DATUM CGVD'28 IS 0.91 M (I.E., 0.91 M CD = 0.0 M COVD'28).

PRELIMINARY FOR INFORMATION ONLY

| revisions | | date |
|---|---|---|
| A | ISSUED FOR 99% SUBMISSION | JUNE 2017 |

project / projet

BARRIER BEACH
GROYNES AND RENOURISHMENT
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin

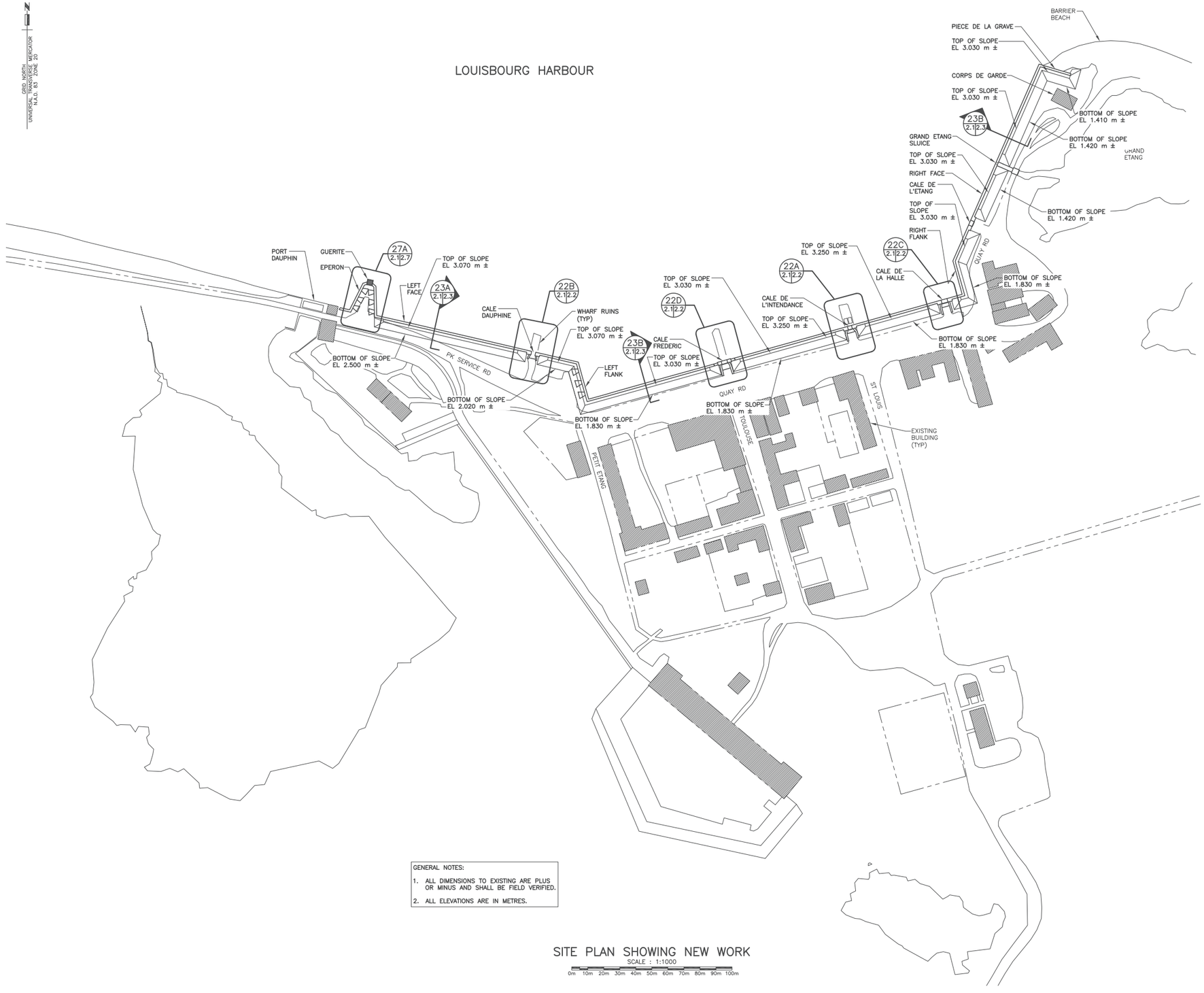
Figure 2
BARRIER BEACH STABILIZATION

designed JJK — conçu
date MARCH 22, 2017
drawn JJK — dessiné
date MARCH 22, 2017
approved CK — approuvé
date MARCH 22, 2017
Tender — Soumission
AB
Parks Project Manager — Administrateur de projets Parcs
project number — no. du projet
578
drawing no. — no. du dessin
C-2

E-DRM/GDD-E: C-2

GRID NORTH
UNIVERSAL TRANSVERSE MERCATOR
N.A.D. 83 ZONE 20

# LOUISBOURG HARBOUR




GENERAL NOTES:

1. ALL DIMENSIONS TO EXISTING ARE PLUS OR MINUS AND SHALL BE FIELD VERIFIED.
2. ALL ELEVATIONS ARE IN METRES.

## SITE PLAN SHOWING NEW WORK

SCALE : 1:1000

0m 10m 20m 30m 40m 50m 60m 70m 80m 90m 100m

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

PRELIMINARY FOR INFORMATION ONLY

| revisions | | date |
|---|---|---|
| B | ISSUED FOR INFORMATION | June 7 2017 |
| A | ISSUED FOR 33% SUBMISSION | Mar 10 2017 |

project / projet

QUAY WALL IMPROVEMENTS
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin

Figure 3
SITE PLAN SHOWING NEW WORK
Quay Wall

| | | |
|---|---|---|
| designed | RSD | conçu |
| date | MARCH 10, 2017 | |
| drawn | JKL, PJN | dessiné |
| date | MARCH 10, 2017 | |
| approved | RSD | approuvé |
| date | MARCH 10, 2017 | |
| Tender | | Soumission |
| PWGSC Project Manager | | Administrateur de projets TPSGC |
| project number | | no. du projet |
| | ———— | |
| drawing no. | | no. du dessin |
| | 2.1 | |

17/06/07 (15:51) 1545-2.1_B.dwg

PWGSC B1 (2004)

E-DRM/CDD-E:

Material for the groynes will be supplied from established rock quarries, and rounded beach fill (cobble) will be sourced from borrow pits, likely located within 20 km of the site. Backfill material for the Quay Wall will be supplied from established pits and by reusing existing fill.

Material will either be trucked or barged to the Project site. Transport by truck would involve a fleet of tandem trucks or trailers hauling material from the pit/quarry. A roadway (Quay Road) currently exists within the Project area and is accessed via the existing Toulouse Road and Fortress Service Road (Appendix A, Drawing C-1). These roadways will provide truck and equipment entrance/exit to the Project area. No additional roadways will be constructed. In the unlikely event that barging is required, an off-loading facility would be constructed using piles and floating wharfs.

The laydown and refuelling areas will be located along the Quay Road near the Corps de Garde sewage treatment plant (Appendix A, Drawing C-1).

As part of the Barrier Beach component, annual maintenance dredging will occur in front of the Quay Wall at the corner to the east of Frederic Gate. Excavation/dredging will also be required at the seaward face of the Quay Wall (Figure 3).

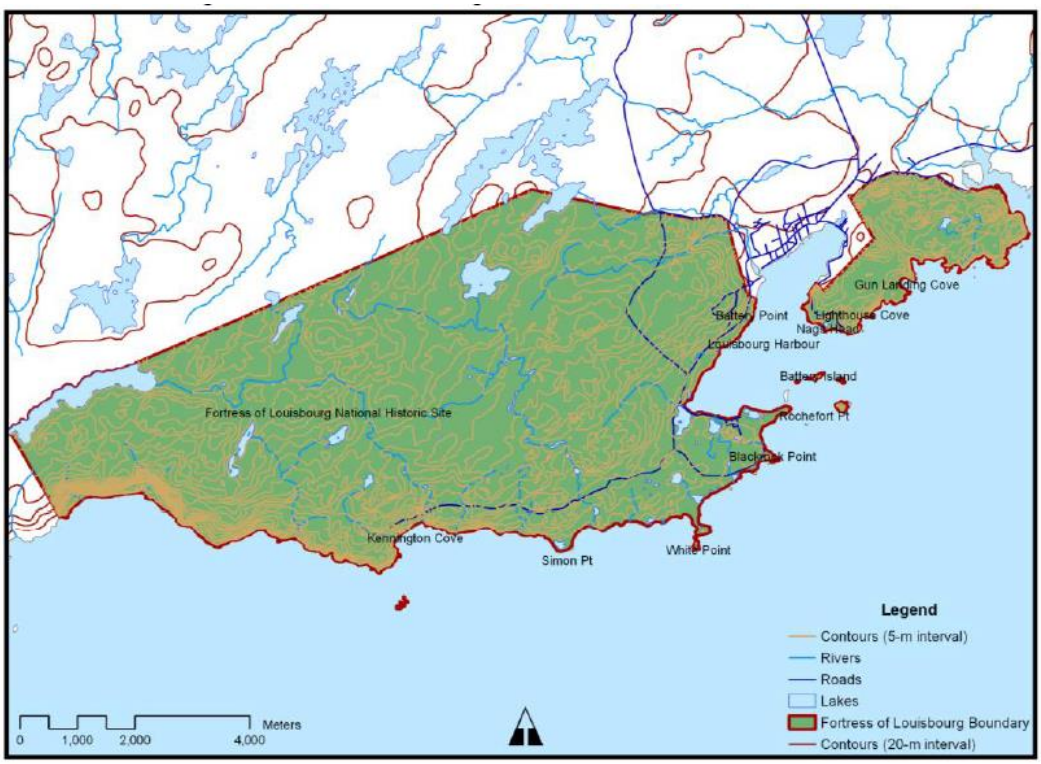



*Figure 4. Fortress of Louisbourg National Historic Site, Grand Étang Barrier Beach*

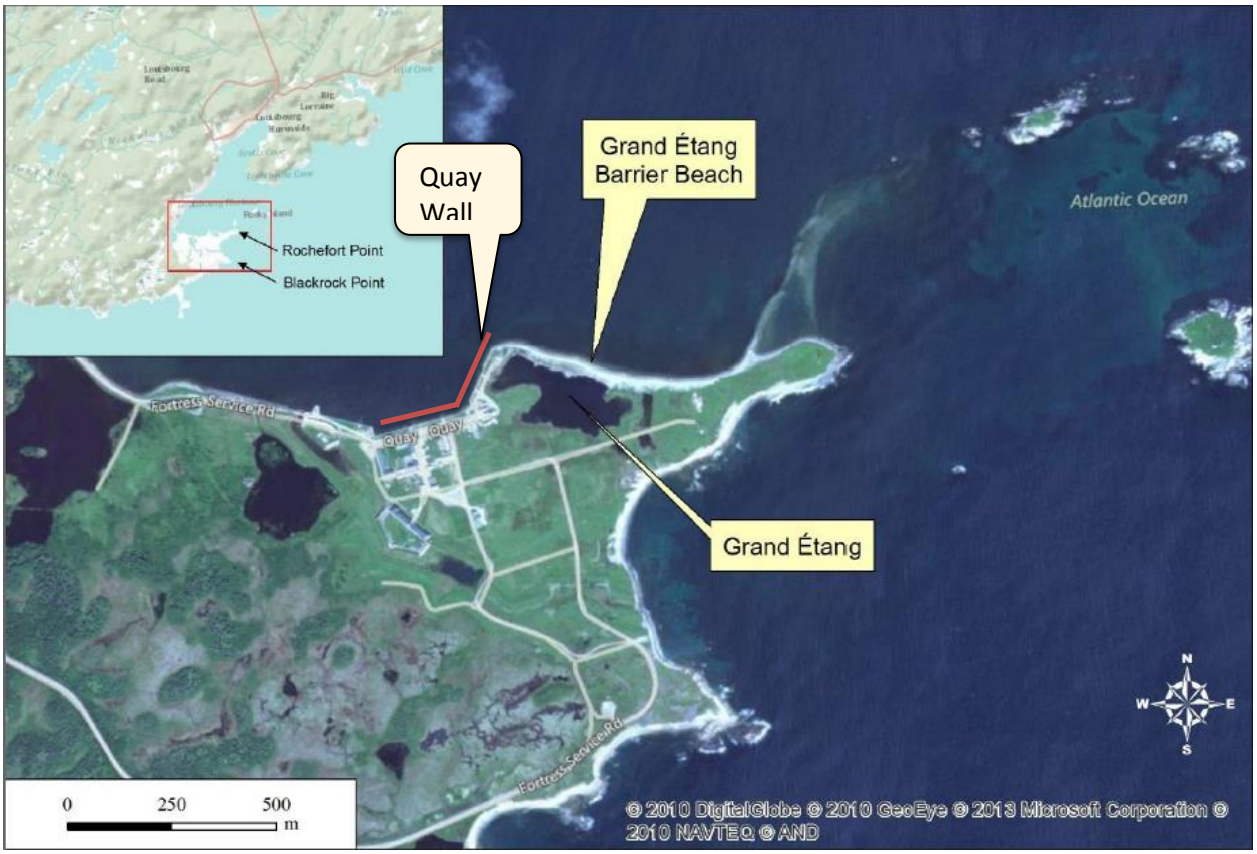



*Figure 5. Quay Wall and Grand Étang Barrier Beach*

*Photo 4. Sediment deposited along the Quay Wall (Gemtec, March 2017).*

***Project Phases and Activities***

The Project consists of two main components, each with site preparation/staging and construction phases:

1) Barrier Beach Component - groyne construction, Barrier Beach nourishment, and dredging sediment at the eastern corner of the Quay Wall.
2) Quay Wall Component - increasing the height of the Quay Wall, closing off the cale openings, and replacing the existing sluice gate at the outlet of Grand Étang Pond.

There is no active operational phase, as the project components are passive structures. Maintenance activities will be minimal, and consist of reshaping/topping up beach material and/or armour, and securing sheathing on the Quay Wall. These activities would be conducted as necessary following severe storms.

The Barrier Beach structures are not anticipated to be decommissioned, as the beach stabilization has been designed to facilitate natural integration within the landscape, with further infilling occurring along the shoreline over time through natural sediment deposition. The Quay Wall is not planned to be decommissioned, should this become necessary, decommissioning activities would be conducted in accordance with best management practices (standard at the time of decommissioning).

***Barrier Beach Component***

Site preparation/staging for the Barrier Beach component consists of the following activities:

- Place temporary protection (jersey barriers) along the preferred access route, as required.
- Mobilize equipment to the site using the preferred access route. Equipment will include excavators, dozers, rock/dump trucks, compaction equipment and pick-up trucks.
- Should barging of materials be required, additional equipment will include pile-driving equipment and floating plant marine equipment consisting of barges, scows, small tugs, excavators and/or cranes.
- Set up a refuelling/laydown area (~10 m X 30 m) and additional laydown area (~20 m X 40 m) along the Quay Road.
- Install erosion and sediment control for the land-based work area.
- Although not currently part of the project, the contractor may determine that a piled temporary wharf (~150 m X 10 m) will be constructed to the north of the west groyne, to enable offloading of material by barge, equipment/worker access and off-hours storage. There may be a requirement for further regulatory applications for this Project component.

Construction of the Barrier Beach component consists of the following activities:

- Import fill material to the site, including granular core and armour stone (17,000 t) and rounded beach fill (43,500 $m^3$). Beach cobble will range in diameter from 0-150 mm. Armour stone (A1 and A2) will be angular in shape, with an aspect ratio (width to height) not exceeding 2.5. A1 armour stone will range in weight from 3 to 6 tonnes, with a median stone weight (W50) of 4.5 tonnes. A2 armour stone will range in weight from 1.5 to 3 tonnes, with a median stone weight (W50) of 2 tonnes.

- Materials will be transported to site on an ongoing basis throughout construction. Minimal stockpiling is anticipated, with stockpiles located within the groyne/beach footprint.
    - Trucking option – approximately 70-90 tandem truck loads per day would be required (8-10 trucks per hour) over the four-month construction period.
    - Barging option – assuming 200 tonnes per barge load, approximately 520 barge loads would be required.
- Excavate along the shoreline (~2,300 $m^3$) between the east end of the Quay Wall and Station 0+000 of the West groyne, to enable construction of new armoured revetment slope. Clean material will be placed above the ordinary high-water mark (OHWM) and incorporated into the Barrier Beach, and will be covered with at least 1.5 m of imported beach fill material, as the dredged sediment is expected to be finer than the imported fill. A sediment sampling and testing program is currently underway to confirm that the materials meet the CCME sediment quality guidelines for the Protection of Environment and Human Health in agricultural, residential/parkland, and commercial/industrial applications, and the Atlantic RBCA Version 2.0 Tier 1 Risk Based Screening Levels (RBSLs).
- Place core and armour stone material for the west groyne (~ 20 m X 105 m) and east groyne (~17 m X 55 m):
    - Trucking option - material will be placed at the shore by truck or excavator to cover the entire impacted area, then material pulled back by dozer to build up the layers of armour.
    - Barging option - material may be placed directly in the water via excavator or crane.
- Conduct annual maintenance dredging of ~1,500 $m^3$ of sediment from along the face of the Quay Wall from an area below OHWM of ~1,023 $m^2$. Clean dredged material will be deposited on Barrier Beach above OHWM, and covered with at least 1.5 m of imported beach fill material, as the dredged sediment is expected to be finer than the imported fill. A sediment sampling and testing program is currently underway to confirm that the materials meet the CCME sediment quality guidelines for the Protection of Environment and Human Health in agricultural, residential/parkland, and commercial/industrial applications, and the Atlantic RBCA Version 2.0 Tier 1 Risk Based Screening Levels (RBSLs).
- Place 43,500 $m^3$ cobble beach fill material (~350 m X 30 m areal extent):
    - Trucking option – material will be placed at the shore by truck or excavator and pushed into place by dozer.
    - Barging option - material may be placed directly in the water, and pulled back to the beach via excavator or dozer. The tracked portion of the machine will stay above water. Note that DFO's preference is to minimize potential adverse effects to fish and fish habitat by avoiding in-water staging, and that the impact of in-water staging would require separate assessment, and could increase the Project footprint and require separate regulatory authorizations.
- Remove temporary wharf (if constructed).
- Remove equipment from work site using the preferred access route.
- Remove temporary protection (jersey barriers) from along the access route.

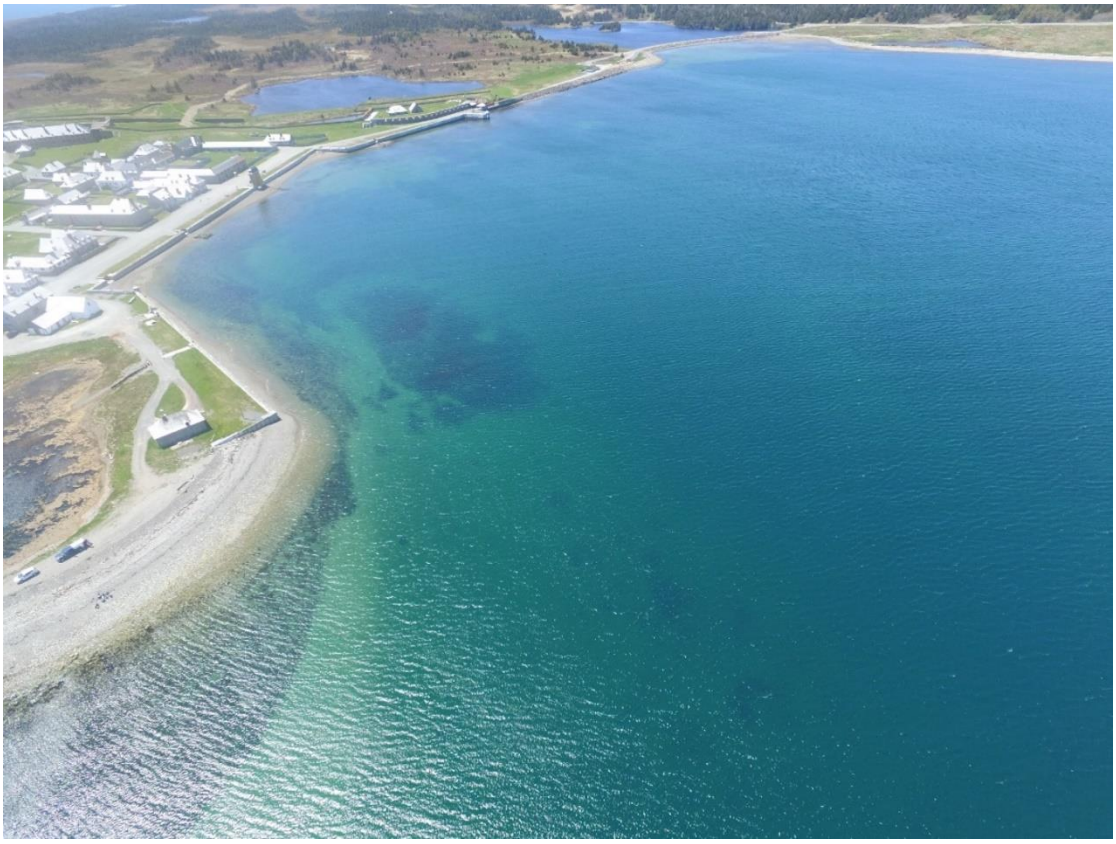


*Photo 5. View of Quay Wall (note deposited sediment) (DFO, June 2017).*

***Quay Wall Component***

Site preparation/staging for the Quay Wall component consists of the following activities:

- Place temporary protection (jersey barriers) along the preferred access route, as required.
- Mobilize equipment to the site using the preferred access route. Equipment to include excavators, rock/dump trucks, cranes to lift concrete panels, concrete trucks for wall extension, roller and plate tamper, flatbed trucks for material delivery, and pick-up trucks.
- Set up a refuelling/laydown area (~10 m X 30 m) and additional laydown area (~20 m X 40 m) along the Quay Road. Equipment laydown area will extend across the beach crest as required (refuelling to be conducted only in the area as identified in Appendix A, Drawing C-1).
- Install erosion and sediment control for the work area, including silt curtains along the north face of the wall.
- Import construction material (e.g., steel, planking, piping) and fill material to site, and stockpile as needed.

Construction of the Quay Wall component consists of the following activities:

- Replace the existing sluice gate with a new sluice gate and pumping station behind the existing close-faced piles at the east end of the Quay Wall, at the outlet of Grand Étang Pond.
- Use land-based excavators to dredge ~2,000 $m^3$ of infill from in front of the Quay Wall (thicknesses ranging from 0.16-0.95 m), to a depth of approximately chart datum. The areal

extent of new dredging below OHWM is ~2,531 $m^2$. The excavators will either operate from behind the Quay Wall, or will operate on the beach at low tide only. No equipment will be permitted to track through the water.

- Stockpile dredged material to be incorporated as backfill in a berm to be constructed behind the Quay Wall (above OHWM), to maintain the current viewscape from the fortress.
- Remove all Quay Wall timber planking, framing, posts, steel framing, nails and anchor rods embedded in concrete, as well as cheek walls, fieldstone, cheek wall footings and timber decking at cales.
- Install steel sheet piling and riprap (diameters ranging from 150 mm to 500 mm) at base of wall, to reinforce the Quay Wall and provide scour protection.
- Construct the 1 m wall extension with cast-in-place concrete.
- Place steel frame, nailer, and plank to the existing wall for the wall extension.
- To manage surface water runoff, excavate and construct an open 3:1 grass-sloped swale running parallel to the Quay Wall between the wall and the Fortress, extending the length of the wall to the sluice gate. The swale will be ~ 0.5 m deep and 2.4 m wide at top of cut, and will flow east into two catch basins equipped with sump pumps at Frederic Gate and adjacent to the existing sluice gate.
- Install new tidal gates in 3 cale entrances to drain daily surface runoff. Install pumps at the tidal gates, to be used in extreme conditions when surge tides block the tidal gates.
- Trench for waterline and electrical services, and backfill to subgrade using imported granular material (Type 1 Gravel or similar). Compact backfill using a roller or plate tamper.
- Raise the site grade on the land side of the wall by 1 m (berm) to maintain sightlines, using a mixture of salvaged dredge material and imported fill (common fill or Type 2 Gravel equivalent). Top with hydroseed or sod.
- Install pumping stations at the cale Frederic and Grand Étang sluice gate.
- Remove temporary erosion and sediment control works when the site is stabilized.
- Remove equipment from work site using the preferred access route.
- Remove temporary protection (jersey barriers) from along the access route.

Hazardous materials are limited to cast-in-place concrete, concrete wash water, and fuels, lubricants and other fluids associated with operation of trucks, heavy machinery and equipment.

***Project Timing***

The Project is phased, where necessary, as all Project activities will be timed to avoid the peak tourist season at FLNHS.

Timing of the Barrier Beach component is planned as follows:

| | **Project Component** | **Timing** |
|---|---|---|
| **Staging** | Site preparation | October 2017 |
| **Construction** | Dredging along eastern corner of Quay Wall<br>Barrier Beach nourishment and groynes | November 1, 2017-March 31, 2018 |

Construction of the Quay Wall component will occur in the following phases:

| | Project Component | Timing |
|---|---|---|
| **Phase 1** | East end of Quay Wall and sluice gate | April 1-July 1, 2018 |
| **Phase 2** | Middle section of Quay Wall | October-December 2018 |
| **Phase 3** | West end of Quay Wall | March-July 2019 |

***Regulatory Requirements***

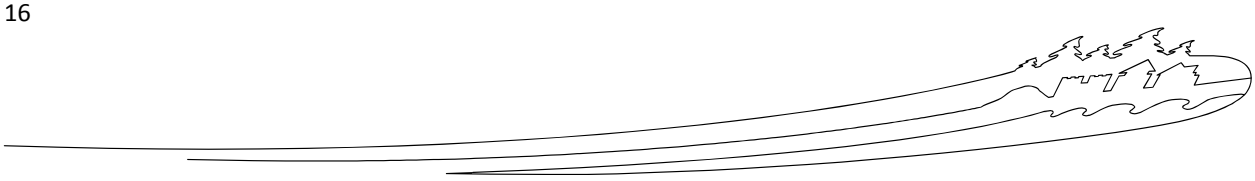
As the Project proponent, PCA is the lead Federal Authority. Transport Canada (TC) and Fisheries and Oceans Canada (DFO) also have regulatory roles, as follows:

- *Navigation Protection Act* (NPA; R.S.C., 1985, c. N-22): Transport Canada (TC) has a regulatory role to assess the potential for Project-related works, undertakings or activities to interfere with the navigation of vessels, which may require authorization pursuant to Section 6 or Section 9 of the Act. Effects of the Project on navigation are taken into consideration only for indirect effects (i.e., resulting from a change in the environment affecting navigation). Adverse indirect effects from this project are not likely. Direct effects on navigation are not considered in this impact assessment, as any measures necessary to mitigate direct effects will be included as conditions of the *Navigation Protection Act* approval.
- *Fisheries Act* (R.S.C., 1985, c. F-14): Fisheries and Oceans Canada (DFO) has a regulatory role to consider the potential for Project-related works, undertakings or activities to result in serious harm to fish and fish habitat, which may require authorization pursuant to subsection 35(2)(b) of the Act. PCA is undertaking numerous measures to avoid and/or mitigate potential serious harm to fish that could result from the Project; nevertheless, it is likely that the project will result in residual serious harm. PCA will work with DFO to develop an appropriate Offsetting Plan for DFO approval; the plan will include measures to offset the residual serious harm to fish. To accommodate collaboration and development of an Offsetting Plan, PCA will submit a Letter of Intent with the application for authorization under the *Fisheries Act*, committing PCA to offsetting the residual serious harm within a specified timeframe.

In addition to the legislation described above, the following Acts are particularly relevant to the Project:

- *Fisheries Act*: Prohibited to deposit or permit the deposit of a deleterious substance of any type in water frequented by fish, or in any place under any conditions where the deleterious substance, or any other deleterious substance that results from the deposit of the deleterious substance, may enter such water.
- *Canadian Environmental Protection Act* (CEPA; S.C. 1999, c. 33): Pollution prevention planning provisions.
- *Species at Risk Act* (SARA; S.C. 2002, c. 29): Prohibited to kill, harm, harass, capture, take, possess, collect, buy, sell or trade a federal species that is classified as extirpated, endangered or threatened under the Act, or to damage or destroy the residence of such a species.
- *Migratory Birds Convention Act* (MBCA; S.C. 1994, c. 22), Migratory Birds Regulations: Forbidden to disturb, destroy or take a nest or egg of a migratory bird; or to be in possession of a live





migratory bird, or its carcass, skin, nest or egg, except under authority of a permit. Additionally, no person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.

## 3. EXISTING ENVIRONMENT

The following section summarizes the existing physical, biological and cultural environment at the FLNHS.[1]

The FLNHS encompasses approximately 6,000 hectares of land and contains valuable cultural and ecological resources. Louisbourg Harbour and the Atlantic Ocean border the site. The modern town of Louisbourg is located northeast of the reconstructed town site and contains both residential and commercial buildings. The Fortress of Louisbourg was designated a NHS in 1928.

The lands found within FLNHS are characterized by undulating to strongly rolling topography. Soil series commonly found within the park include Thom, Mira, and Arichat. The moderately-well drained Thom soil series is derived from a greyish brown sandy loam fill. The Mira soil series is associated with Thom, however it has imperfect drainage. The poorly drained mineral soils that characterize the Arichat soil series can be found interspersed with the Thom and Mira soil series. The rocky and rugged coastline contains cliffs that average 15 m in height. Kennington Cove has the only sandy beach found within the park. The Grand Étang Barrier Beach is one of the most fragile features along the coastline of FLNHS.

Water resources are abundant within the FLNHS. There are six lakes on site (Mathieson, Kelly, Cavanagh, Munroe, Spectacle, and Twelve Mile), as well as several inland ponds. The Kelly Lake watershed, which borders the site, forms the water supply source for the community of Louisbourg and the NHS. Lagoons are found near the reconstructed Fortress of Louisbourg. Drainage occurs through the three major streams found on site (Kennington Cove, Gerard, and Landing Cove Brooks). Several smaller, unnamed streams drain the uplands. Approximately 10% of the site is comprised of wetlands, most of which are bogs.

Stormwater runoff from the FLNHS reconstructed townsite either drains into the Grand Étang Pond, which empties into the Atlantic Ocean through the sluiceway, or empties directly through the Quay Wall cales. Cape Breton Highlands National Park Ecologist has noted that the Grand Étang Pond supports three-spined stickleback (*Gasterosteus aculeatus*) and various frog species (Archie Doucette, PCA, pers. comm., June 22, 2017).

[1] Except where noted otherwise, the existing environment information is drawn from PCA's Special Events in the National Historic Sites of Canada in Cape Breton, Replacement Class Screening Report (Parks Canada, 2011).

*Photo 6. Grand Étang Barrier Beach and Grand Étang Pond (DFO, June 2017).*

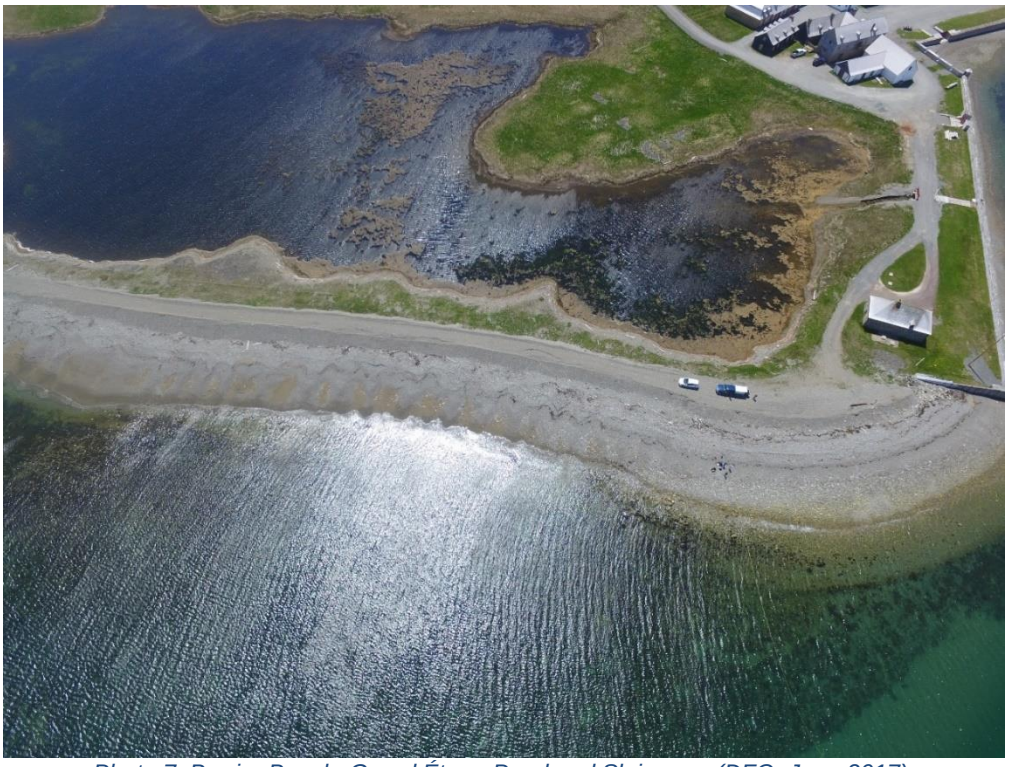


*Photo 7. Barrier Beach, Grand Étang Pond and Sluiceway (DFO, June 2017).*

Terrestrial vegetation on site is predominately boreal forest, dominated by balsam fir and white spruce. Ten rare plant species were identified within the FLNHS in 1996; the Atlantic Canada Conservation Data Centre (ACCDC) lists the following nine as rare throughout their range in Nova Scotia (all are believed to be secure globally): Narrow or Willow-leaved dock (*Rumex salicifolius* var. *triangulivalvis*), Dwarf blueberry (*Vaccinium boreale*), Swedish Cornel (*Cornus suecica*), Spurred gentian (*Halenia deflexa* var. *brentoniana*), Bog bedstraw (*Galium labradoricum*), Bog rush (*Juncus stygius* var. *americanus*), Howe Sedge (*Carex atlantica* var. *capillacea*), Blue sedge (*Carex livida*), and Northern Bur-reed (*Sparganium hyperboreum*).

Fauna at FLNHS is consistent with species found throughout Cape Breton, Nova Scotia. A 1996 survey identified birds on site including the Red-breasted nuthatch (*Sitta Canadensis*), White-winged crossbill (*Loxia leucoptera*), Boreal chickadee (*Poecile hudsonica*), Dark-eyed junco (*Junco hyemalis*), and Golden-crowned kinglet (*Regulus satrapa*). The inventory also identified the presence of several bird species at risk as ranked by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), however none were recorded as breeding in the park. Observed species included those of special concern such as the Harlequin duck (*Histrionicus histrionicus*), Long-billed curlew (*Numenius americanus*), and Peregrine Falcon (*Falco peregrinus anatum*), and an endangered Loggerhead shrike (*Lanius ludovicianus migrans*), which was most likely a migrant or vagrant.

Twenty-seven species of mammals were identified at FLNHS including the American beaver (*Castor canadensis*), Lynx (*Lynx canadensis*), Bobcat (*Lynx rufus*), White-tailed deer (*Odocoileus virginiana*), and Snowshoe hare (*Lepus americanus*). No rare or endangered mammals were identified within the FLNHS.

The Garter snake (*Thamnophis sirtalis*), Green snake (*Opheodrys vernalis*), and Northern red-bellied snake (*Storeria occipitomaculata*) were observed during the survey. Amphibians found within the FLNHS included the Green frog (*Rana clamitans*), Pickerel frog (*Rana palustrus*), Leopard frog (*Rana pipiens*), Spring peeper (*Hyla crucifer*), Wood frog (*Rana sylvatica*), American toad (*Bufo americanus*), Eastern red-backed salamander (*Plethodon cinereus*), and Yellow-spotted salamander (*Ambystoma maculatum*). No rare or endangered reptiles or amphibians have been identified.

Consistent with most marine ecosystems, the marine area at the Barrier Beach site consists of a supratidal (spray) zone, an intertidal zone and a subtidal zone. The supratidal zone is not found at the Quay Wall site, as the wall provides blunt transition from marine to terrestrial habitat. In June 2017, DFO captured drone aerial photography and underwater videography at the proposed Project area. A diverse, rich and productive community of intermixed macrophytes species was observed in the surveyed area, including Kelp (*Saccharina latissima*), Sea Lettuce (*Ulva lactuca*), Knotted Wrack (*Ascophyllum nodosum*), Bladder Wrack (*Fucus vesiculosus*), Spiral Wrack (*Fucus spiralis*), Green Thread Seaweed (*Rhizoclonium riparium*), Green Rope Seaweed (*Arcrosiphonia spp.*) and Irish Moss (*Chondrus crispus*).

*Photo 8. Intertidal zone and macrophytes along Barrier Beach (DFO, June 2017).*

A recent ACCDC report for the Project area (Appendix C) shows that three fish species have been observed within 5 km of the Project area: Brook Trout (*Salvelinus fontinalis*), Alewife (*Alosa pseudoharengus*), and Atlantic Salmon (*Salmo salar*). Brook Trout is a freshwater fish and is not likely to be found within the Project area. Other studies have found that Rainbow Smelt (*Osmerus mordax*) and American Eel (*Anguilla rostrata*) are also present within the waters around FLNHSC (Jacques Whitford, 1996). Sand dollars (*Echinarachnius parma*) and a flounder (*Paralichthyidae*) were observed in the DFO videography, and lobster fishers were observed adjacent to the Project area when the video was collected.

It is anticipated that a variety of other saltwater fishes may frequent the Project area, such as: Atlantic Cod (*Gadus morhua*), Haddock (*Melanogrammus aeglefinus*), Atlantic Halibut (*Hippoglossus hippoglossus*), Atlantic Herring (*Clupea harengus*), Atlantic Mackerel (*Scomber scombrus*) and swordfish. Cartilaginous fish such as sharks, skates and stingrays also live in the saltwater around Cape Breton. Shark species include the Spiny Dogfish (*Squalus acanthias*), Blue Shark (*Prionace glauca*) and Basking Shark (*Cetorhinus maximus*) (Parks Canada, 2017). DFO lists several bivalve shellfish species within the Cape Breton region, including: Bar Clam (*Spisula solidissima*), Bay Quahog (*Mercenaria mercenaria*), Razor Clam (*Ensis directus*), Soft Shell Clam (*Mya arenaria*), Mussels (*Mytilus edulis*), Oysters (*Ostreidae spp.*), and Scallops (*Pectinidae spp.*).

In general, the project area contains a productive marine environment with several varying habitat types. The subtidal zone at Barrier Beach provides the most active ecosystem. In general, this zone provides a productive feeding area that supports a dynamic food web. Regular input of nutrients from the tidal cycle

and debris along the shoreline are found within this zone to allow for the success of phytoplankton, zooplankton, macrophytes, and low trophic level organisms in the area. Several species of primary consumers (e.g., Molluscs, Urchins) are sustained by foraging on macrophytes found in this zone. Sand dollars will roam the sandy substrate to feed on sediments and micro-invertebrates that inhabit the interstitial spaces between substrate particles, as evidenced by abundant sand dollars in the underwater videography.

It is likely that juvenile and adult fish frequent this area to graze on underwater vegetation in the absence of the rough wave action that is typically found closer to shore. Predator fish (e.g., Salmon, Flounder) and crustaceans will prey on the foragers in the area, and the abundance of macrophytes will provide shelter for prey species and important nursery and rearing habitat for juveniles. The Project area does not present ideal spawning habitat for most fish species expected in the area. Several fish species are anadromous species (e.g., Salmon, Alewife, Rainbow Smelt), while other species (e.g., Cod, Halibut, Haddock, Mackerel) typically spawn in pelagic (deep water) habitats. The area may provide spawning areas for Herring (intertidal zone with kelp and seagrass).

Louisbourg Harbour supports an active fishing community year-round, with fisheries including groundfish (halibut, haddock), crustaceans (lobster, crab), and molluscs (scallop, sea urchin) (John Drolet, former Louisbourg Harbourmaster, pers. comm., April 7, 2017). The lobster fishing season in Lobster Fishing District 17 (the district containing Louisbourg Harbour) begins in mid-May and ends in mid-July.

Eskasoni and Membertou are the First Nation communities most likely to utilize the marine waters around Louisbourg (pers. comm. Shannan Murphy, DFO). It is understood that these communities would be fishing primarily for snow crab and lobster, and that while lobster is present within the Project area, it is unlikely to support snow crab populations. There may also be a rock crab fishery in the area, and potential for a sea urchin fishery (pers. comm. Shannan Murphy, DFO).

The FLNHS Commemorative Integrity Statement (PCA, 1997) provides details on the cultural resource inventory on site. The historic place consists of the site itself, part of the modern town of Louisbourg, the harbour, and the coastal and immediate hinterland areas. Level I cultural resources on site include *in situ* archaeological resources (both terrestrial and underwater), 98% of the archaeological collection, and the cultural landscapes which consist of the battlefield sites, unreconstructed portions of townsite, the Fauxbourg and North Shore, and cemeteries, roads and trails. The museum building, caretaker's house, 19$^{th}$ and 20$^{th}$ century archaeology sites, 2% of the archaeological collection, monuments, cemeteries from after 1768, and the cultural landscapes associated with the 19$^{th}$ and 20$^{th}$ centuries comprise the Level II cultural resources. The curatorial collection contains both Level I and Level II resources.

The Fortress of Louisbourg welcomed 94,130 visitors in 2016, a 12.25% increase over 2015. Most visitors come from Canada (primarily Ontario, Québec and Atlantic Canada), followed by the United States (primarily eastern US) and then Europe (primarily England, Germany and France). The Fortress of Louisbourg is open year-round, with full services available in peak season, some on-site services in the shoulder seasons, and no services in the low season.

## 4. VALUED COMPONENTS LIKELY TO BE AFFECTED

Potential interactions between the Project and the surrounding environment have been identified through a review of Project-related activities and in consideration of the environmental setting.

The Project has potential to affect the following Valued Components (VCs):

- Biophysical Environment
    - Atmospheric Resources
    - Soil and Landforms
    - Water Resources (Surface and Marine)
    - Fish and Fish Habitat
    - Vegetation
    - Wildlife
- Cultural Resources
    - Cultural Landscapes
    - In-situ Cultural Resources
- Visitor Experience
    - Visitor Access, Services and Recreational Opportunities
    - Viewscapes and Soundscapes
    - Visitor Safety
    - Essence of Place

## 5. EFFECTS ANALYSIS

The following sections describe potential Project-related effects to the identified Valued Components.

### *Atmospheric Resources*

Ambient noise levels may temporarily increase over background levels during operation of Project-related machinery and vehicles, and from construction activities such as offloading/placement of materials and installation of steel sheet piling. Ambient air quality may decrease in the immediate Project area due to dust and fumes associated with vehicle traffic and offloading/placement of fill and other construction materials.

### *Soil and Landforms*

Truck traffic and heavy equipment operation may result in soil erosion, compaction and settling, and changes in stability may result along the site access route and at the staging/laydown and refuelling areas. Soil erosion could result in loss of soils, especially when precipitation events result in site runoff. The laydown/refuelling areas have been previously cleared and are currently vacant, and minimal soil disturbance is expected during the set-up and use of these areas.

### *Water Resources (Surface and Marine)*

Water quality may decrease immediately adjacent to the Project site, due to resuspension of solids/sediments and turbidity during dredging, sluice gate replacement, and in-water works such as placement of materials (e.g., fill, armour stone, riprap) and Quay Wall construction (e.g., removal of existing and installation of replacement materials). Turbidity could also increase due to placement of fill

materials in the aquatic environment and runoff of soils and fines into the aquatic environment, especially during precipitation events.

The creation of the drainage swale and the berm along the Quay Wall may result in modifications to surface drainage patterns, potentially altering overland flow inputs, quantity and quality in the immediate marine environment. The replacement sluice gate is designed to function in the same way as the current sluice gate, therefore no changes in timing, duration and/or frequency of flow into and out of Grand Étang Pond are anticipated.

*Photo 9. Grand Étang Pond draining through entrance of sluiceway (Gemtec, March 2017).*

***Fish and Fish Habitat***

The Project may result in direct mortality of fish (particularly of sessile invertebrates) through crushing or burial during dredging and/or placement of fill. Additionally, the placement of fill material and the resuspension and settlement of sediment in the water column may result in benthic smothering and further loss of sessile species.

Dredging and placing materials in the marine environment may result in direct injury to or mortality of marine flora and fauna. Increased turbidity and resuspended sediments within the surrounding waters may result in benthic smothering and loss of sessile and slow-moving species, fish injury (e.g., damage to gills) and a temporary decrease in aquatic habitat quality by reducing dissolved oxygen supply and/or reducing sunlight penetration to macrophyte populations. Placement of fill and use of equipment in the marine environment may introduce or increase the presence of invasive species, which could affect fish health and species composition.

The high quality of the macrophyte habitat could be adversely affected through long-term shading associated with the potential temporary jetty or through physical damage and removal from in-water staging associated with this option. Ambient noise and vibrations during construction, such as installation of steel sheet piling, may cause temporary discomfort to some marine wildlife and potential for noise

related injury to fish at close range (5 m). It is anticipated that fish will temporarily remove themselves from the area while the increased noise emission is occurring.

Fish habitat will be destroyed and/or altered through the placement of materials (cobble, fill, riprap and armour stone) for the groynes and beach nourishment, and new dredging will alter the fish habitat along the Quay Wall. The productive, rich and diverse macrophyte beds are high quality fish habitat, therefore placement of fill on this habitat type is considered habitat destruction, while the placement of cobble on the cobble beach is considered temporary alteration.

The placement of core fill and armour stone for the two groyne structures will result in fish habitat destruction of approximately 1,920 $m^2$, and the placement of beach cobble between the two groynes and extending east along the Barrier Beach will result in additional habitat destruction of 5,200 $m^2$ (Appendix D, Figure 2). Note that, should barging be required, the impact of in-water staging would require separate assessment, and could increase the Project footprint and require separate regulatory authorization.

The construction activities along the Quay Wall require dredging of an area below OHWM of approximately 3,554 $m^2$ (Appendix D, Figure 3), of which approximately 1,023 $m^2$ is maintenance dredging (dredged annually); the 2,531 $m^2$ of new dredging is considered permanent habitat alteration. Following dredging, riprap will be installed at the base of the Quay Wall (approximately 2,052 $m^2$), entirely within the dredge footprint (Appendix B).

Rocky sloped areas below the OHWM will be created through the placement of beach fill, riprap and armour stone. These rocky side slopes provide useful surfaces and structures for algal attachment and interstitial spaces for juvenile lobster and other species. The groynes and beach fill will create side slopes beyond the existing cobble beach area of approximately 635 $m^2$ (1.5:1 slope) and 1,460 $m^2$ (3:1 slope), respectively, and the placement of riprap along the base of the Quay Wall will create side slopes of approximately 989 $m^2$ (1.5:1 slope), providing usable space for diverse marine species.

***Vegetation***

Truck traffic along the access route and operation of heavy equipment at the site could damage vegetation, and introduce or increase the presence of invasive vegetation species. No plant species at risk are known to be present in the Project area. Effects to marine vegetation are addressed in the Fish and Fish Habitat section.

***Wildlife***

Wildlife displacement and habitat avoidance may result due to increased sensory disturbance from human presence and Project-related truck traffic and equipment operation. Preparation of the refuelling and the staging/lay-down areas, vehicle and heavy equipment operation, and Quay Wall reconstruction activities, may result in damage to dens, nests or roosts and disruption or displacement of denning, nesting or roosting species. The Project area is not known to support or provide critical habitat for wildlife species at risk. Effects to marine wildlife are addressed in the Fish and Fish Habitat section.

***Cultural Landscapes***

The presence of modern construction equipment may result in aesthetic impacts to character-defining cultural landscapes at the historic site.

***In-situ Cultural Resources***

Construction activities may result in the displacement and/or destruction of in-situ archeological and cultural resources. A Cultural Resource Impact Analysis (CRIA) is currently underway to identify specific Project-related potential impacts to cultural resources.

***Visitor Access, Services and Recreational Opportunities***

Reduced site access will be necessary during staging/preparation and construction activities. Traffic delays may result during mobilization of heavy equipment and truck transportation of materials. The overall Project outcome of protecting the buildings, infrastructure and grounds against flooding during major storm events will result in a permanent increase in accessibility at the reconstructed site.

***Viewscapes and Soundscapes***

Visitors may be temporarily exposed to ambient noise, fumes and dust during staging and construction activities. Temporary adverse effects on aesthetics and character-defining cultural and natural viewscapes may result due to Project-related activities such as transportation and stockpiling of construction materials, and the presence and operation of heavy equipment and machinery.

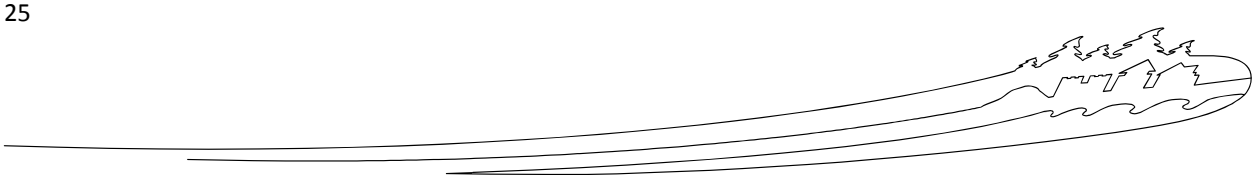
***Visitor Safety***

Transportation of materials and on-site staging and construction activities may present public safety concerns and risks in the immediate Project vicinity.

***Essence of Place***

The natural landscape present at Barrier Beach will be permanently altered by the presence of the groynes, which may result in a permanent, localized decrease in visitors' experience of essence of place. However, the overall Project outcome of protecting the buildings, infrastructure and grounds against flooding during major storm events will enable visitors to continue accessing, experiencing and enjoying the reconstructed site.





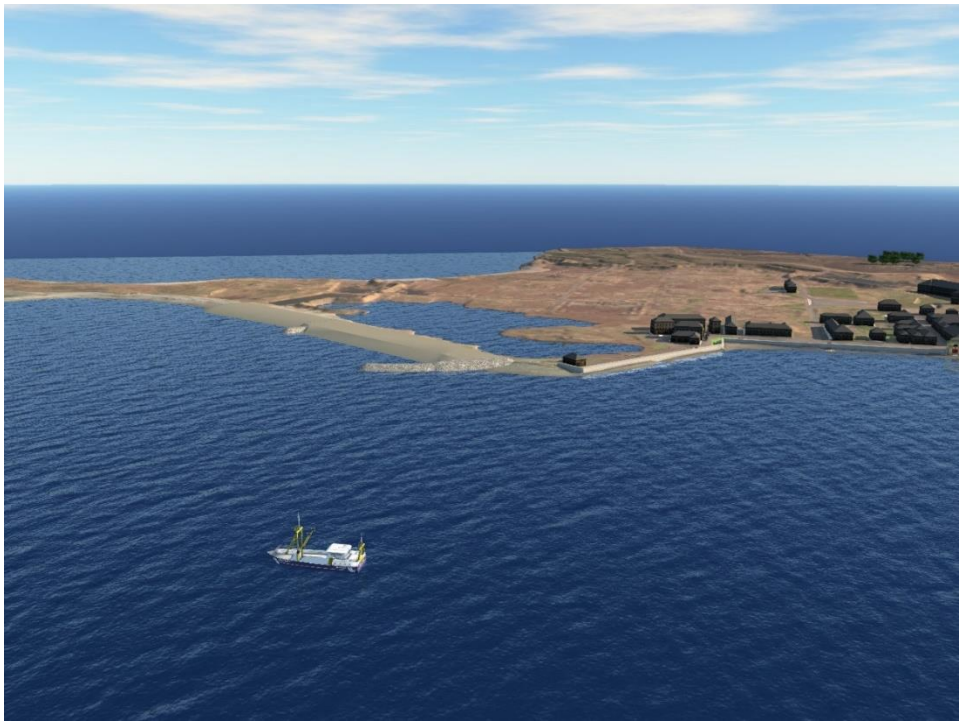


*Photo 10. 3-D rendering of completed Barrier Beach nourishment and groynes (PCA, 2017).*

## 6. MITIGATION MEASURES

The following sections describe measures to be implemented to avoid or mitigate potential Project-related adverse effects to the identified VCs.

The contractor is contractually obligated to adhere to the mitigation measures described herein. PCA shall be notified one week prior to Project initiation, and shall be present at the preconstruction meeting for the purposes of mitigation introduction. PCA will conduct periodic surveillance monitoring during Project staging and construction activities, to ensure that the mitigation measures are properly implemented and effective.

### *Protection and Response Plans*

The contractor shall:

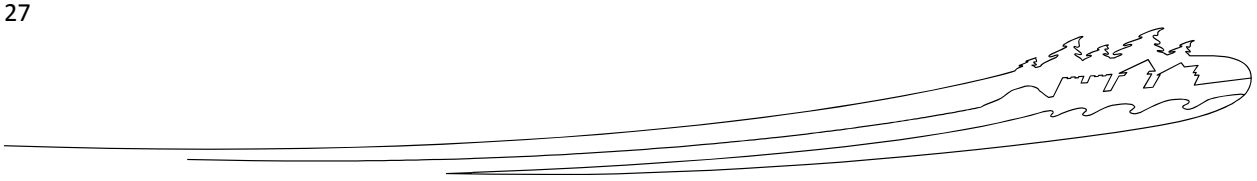
- Develop the below-noted Project-specific protection and response plans (as standalone plans or as subsets);
- Submit these plans to PCA for approval prior to commencing activities on site; and
- Communicate all related plans and content to truck drivers, machine operators, site supervisors, and all other onsite personnel.

Plans shall include:

- Environmental Protection Plan (EPP), including:
    - Project roles, responsibilities and contacts
    - Training, awareness and competency
    - Details for implementation of the mitigation measures outlined herein, including:

        - Protection of the biophysical environment and cultural resources
        - Prevention of releases into the environment
        - Managing unforeseen hazardous materials and wastes
        - Waste management/recycling of site-generated wastes
- Erosion and Sediment Control Plan (ESCP), including:
    - Project design and spatial concept of environmental sensitivities, including maps depicting:
        - Topography and natural features
        - Existing and anticipated erosion problems
        - Limits of specific Project areas and activities
    - Erosion prevention procedures
    - Sediment control measures and suitable locations, including specifications and typical drawings of sediment control structures
    - Detailed plans for in-water works including site isolation measures and project timelines
    - Water management plans (e.g., site control, required equipment and proposed dewatering locations)
    - Location of erosion and sediment control measure applications, and suitable additional materials to be stored on-site in case of failure of erosion and sediment control measures
    - Monitoring of prevention and control measures and corrective actions
    - Turbidity monitoring program, including initial visual observation to establish a baseline, and trigger levels relative to background conditions, both for adjusting operations to minimize turbidity and for work stoppage
    - Removal of non-biodegradable materials once site is stabilized
- Spill Response Plan, including:
    - List of products and materials considered or defined as hazardous or toxic to the environment and inclusion of associated Material Safety Data Sheets
    - Proper storage methods and locations
    - Required equipment on site
    - Fuelling procedures
    - Size, type and location of spill kits
    - Spill prevention procedures
    - Spill response (e.g., containment, clean-up, disposal of contaminated materials);
    - Spill reporting procedure
    - Emergency response contact list including contact information for reporting spills
- Health and Safety Plan, including:
    - Emergency response contact list
    - Emergency supplies and facilities/routes
    - Identification of hazards
    - Site access restrictions
    - Personal protective equipment requirements





- Emergency Response Plan (in accordance with the Canadian Standards Association publication: Emergency Preparedness and Response CAN/CSA-Z731-03 R2014) to address unplanned incidents (e.g., fires, significant storm events, major injuries), including:
    - Hazard identification/assessment
    - Emergency resources
    - Communication systems
    - Plan administration
    - Emergency response procedure
    - Communication of the procedure
    - Debriefing procedure

***Atmospheric Resources***

- Activities shall be conducted during normal business hours and in accordance with the local noise by-law.
- All vehicles and equipment shall be in good working order prior to use on site, with record of regular inspections and servicing.
- Vehicles and equipment shall be equipped with emission controls as applicable, maintained in good working condition, and operated within regulatory requirements.
- Excessive idling/running of vehicles and equipment shall be avoided.
- Airborne dust generation shall be avoided/minimized as applicable, through measures such as misting (on unpaved access roads, stockpiled fill and exposed areas), creating localized wind barriers, and covering stockpiled materials and truckloads with tarps (particularly during dry conditions).
- Soil/fill and other fine materials shall not be transported or offloaded under high wind conditions.
- The extent of disturbed areas must be minimized and, to the extent practicable, must not be left exposed over extended periods.

***Soil and Landforms***

- To ensure traffic does not deviate off previously-disturbed areas, jersey barriers will be installed along the identified access route (which follows existing roadways, and is one-way where road width does not easily facilitate two-way truck traffic).
- Backfilling shall be undertaken using approved materials with adequate soil compaction levels to avoid ground subsidence or sink holes.
- All exposed soils and temporary facilities shall be shaped or completed to the final grade, stabilized and re-vegetated with PCA-approved sod or hydroseed mix as soon as possible.
- PCA must review hydroseed mixtures prior to use.
- Hydroseeding shall not be carried out on hardened, crusted or eroded soils, or during windy conditions or heavy rainfall. Fertilizer and/or pesticides will not be applied.

- Hydroseeding shall be monitored and maintained from the time of application until vegetation is established as effective erosion and sediment control. Areas not receiving proper coverage and/or areas with bare spots must be repaired immediately.
- Erosion and sediment control measures shall be maintained until vegetation has been established and protection measures are no longer warranted.
- Reuse/recycling of construction and demolition waste materials will be considered, where available. Non-reusable/recyclable waste must be sorted and disposed of at an approved C&D facility. Any hazardous waste shall be disposed of off-site at a certified hazardous waste disposal facility.

***Water Resources (Surface and Marine)***

- Soil-disturbing activities must be avoided during periods with saturated soils, periods of high rainfall intensity, runoff, high winds or wet snow. Work shall be temporarily suspended when wet ground conditions contribute to erosion and sediment transport.
- Excavated/dredged material and debris must be stored in a stable area, above the OHWM or active floodplain, and 15 m from drainage features and/or the top of steep slopes. Sediment control measures must be installed to prevent runoff from entering water.
- Excavations must be backfilled and compacted as soon as practicable to reduce potential sedimentation events.
- Only clean material, relatively free of fines, overburden, debris or other substances deleterious to aquatic life, shall be placed in the water.
- Sediment traps must be installed as practicable to treat surface water runoff and prevent sediment from entering waterways. Accumulated sediment must be removed prior to dismantling erosion control devices.
- Temporary erosion and sediment control measures and runoff conveyance structures (of 100% biodegradable materials where possible, such as jute, sisal or coir fiber) shall be implemented as appropriate, to be detailed in the contractor's EPP/ESCP (e.g., silt fencing around the perimeters of work areas, straw bale or rock flow checks, temporary berms and grading, erosion prevention mats/covers).
- Properly installed sediment containment structures will be erected where deemed necessary and to the satisfaction of PCA. Every attempt shall be made to ensure erosion is effectively dealt with at source areas where it originates, such as effectively covering exposed areas or installing deflection (e.g., swales, berms) that divert downwash material away from receiving aquatic environments.
- Temporary erosion and sediment control measures shall be inspected daily and maintained in place until the site has been stabilized. Should erosion and sediment control structures not be functioning properly, all work in the area must cease until the problem has been remedied. Suitable material will be stored on-site to repair sediment control structures, as applicable.
- In-water work shall be conducted to the extent possible at lower tides/water levels.
- All dredging activities will be land-based; no machinery shall track through the water.

- Should a floating barge / vessel be used for any phase of the Project, the following must be adhered to:
    - Vessels should be compliant with all *Canada Shipping Act, 2001*, requirements for inspection, which includes certification of the vessel and adequate training and appropriate certificate of competency for the operators.
    - Ensure that all vessels will have procedures in place to ensure safeguards against marine pollution: awareness training of all employees, means of retention of waste oil on board and discharge to shore based reception facilities, capacity of responding to and clean-up of accidental spill caused by vessels involved in any particular project.
- Replacement of the sluice gate shall be conducted in the dry (e.g., at low tide, using cofferdams, or an alternative).
- To prevent weather-related adverse effects, daily, short and long –term weather forecasts shall be monitored, and the site (including equipment, materials, stockpiles) must be secured in advance of potential extreme weather conditions.
- In the event of a storm, the following will be implemented:
    - Work stoppages occur if conditions deem necessary;
    - Inspection of all sediment and erosion control structures prior to the storm;
    - Preventative maintenance of erosion and sediment control structures;
    - Highly erodible areas are covered and/or secured;
    - Critical erosion and sediment control structures will withstand the storm; and
    - Ensure availability of equipment, materials and operators that can be mobilized on short notice to create/repair berms, dams, diversion ditches, settling ponds, etc.
- Any plowed snow or snow clearing activities must be directed away from the edge of any waterbody. Snow must not be dumped into any water body or any environmentally sensitive area.
- No chemicals or cleaning agents shall be disposed of onsite, and no excavated fill, waste material or debris shall be deposited or allowed to enter a waterbody.
- Refuelling shall occur only in the designated refuelling area, on clearly-demarcated, well-compacted ground.
- The requirements of Workplace Hazardous Materials Information System (WHMIS) shall be complied with regarding use, handling, storage and disposal of hazardous materials, and labelling and the provision of material safety data sheets.
- All petroleum products, oils, lubricants, fuels, chemicals and hazardous materials will be stored in a secure designated shed or container area.
- See Soils and Landforms for additional applicable mitigation measures.

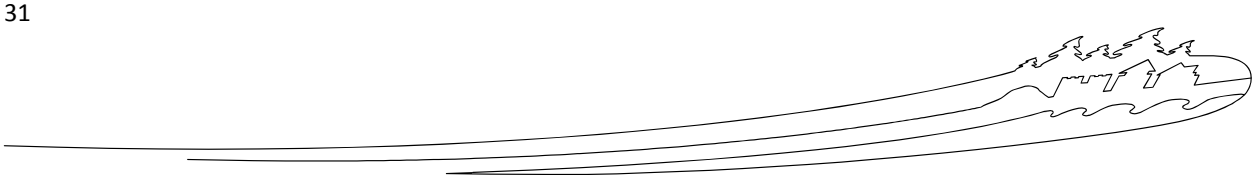
***Fish and Fish Habitat***

- A turbidity monitoring program shall be prepared and implemented for the duration of construction activities. Initial visual observation of turbidity shall be conducted to establish a baseline. The turbidity monitoring program must include trigger levels relative to background conditions, both for adjusting operations to minimize turbidity and for work stoppage. Should

turbidity levels or resuspended sediments exceed trigger levels, PCA shall be notified immediately, for PCA notification to DFO.

- Given the layout of Barrier Beach, turbidity curtains are not a feasible mitigation option; however, a floating containment boom may be utilized, if practicable.
- Marine-grade turbidity curtains must be installed along the Quay Wall prior to Quay Wall reconstruction (along the wall section where marine work is to occur), and must be anchored and weighted along their length to form a continuous barrier with adequate floatation at water surface. Turbidity curtains shall be inspected daily and maintained in place until marine construction (at a given wall section) is complete.
- Any equipment/tools operating in or near the water shall be inspected for leaks daily, and no equipment shall be left in the water for a prolonged period (e.g., overnight).
- All vehicles and equipment not in use shall be stored behind the Quay Wall and not on the beach area.
- Secondary containment measures shall be employed, such as collection/drip trays and berms lined with air and water-tight material such as plastic and a layer of sand, and double-lined fuel tanks.
- Drip trays will be placed under equipment parked on the beach and other porous / permeable areas.
- A drip tray must immediately be placed under any vehicle or equipment found to be leaking, and the vehicle / equipment must be removed from the site until properly repaired.
- Spill kits, including sorbents and booms, shall be maintained onsite and readily accessible at all times. Spill kits shall be provided at re-fuelling, lubrication, and repair locations that are capable of responding to 110 % of the largest potential spill. Site staff shall be informed of the location of the spill response kit(s) and be trained in its use.
- Any spill or leak of a deleterious substance must be immediately contained and cleaned up in accordance with regulatory requirements, and reported immediately to PCA (who will in turn report it to the 24-hour environmental emergencies reporting system, Maritime Provinces 1-800-565-1633).
- In the event of a major spill, all other work shall be stopped and all personnel dedicated to spill containment and clean-up.
- Used spill kits and any soil that has come into contact with a spilled or leaked fluid will be securely contained and removed offsite to a licensed facility.
- Construction waste must be stored in a large container to prevent scattering. Any floating or sinking debris must be removed immediately, to ensure protection of marine wildlife and habitat.
- If hazardous waste or potentially contaminated material is uncovered during excavation / dredging, work will stop and excavated materials will be secured onsite in a manner that prevents contamination of the surrounding environment, including leaching.
- Contaminated soils, dredge spoils and any other contaminated materials shall be securely contained and removed offsite to a licensed facility.





- To avoid the introduction of invasive aquatic/marine species, any equipment to be used in the water must be washed prior to use. Riprap, armour stone and fill material shall be sourced from local area borrow pits/quarries and shall not be taken from the bed or shore of any waterbody.
- As concrete leachate is alkaline and highly toxic to fish and other aquatic life, anti-leaching concrete should be used (per Parks Canada National Best Management Practices, Works In and Around Waterbodies (draft), February 22, 2017).
- All works involving the use of concrete/cement shall not deposit, directly or indirectly, sediments, debris, fresh concrete, concrete fines, concrete leachate, wash or contact water into or about any watercourse or waterbody.
- Concrete batching and cleaning of concrete equipment shall be conducted offsite only.
- Cast-in-place concrete materials must remain inside formed structures, and wash-down water from concrete delivery trucks, pumping equipment, and other tools and equipment must be contained and disposed of off-site in a location where it will not enter subsurface drains, waterbodies or storm drains. Water that has contacted uncured or partly-cured concrete will be prevented from entering (directly or indirectly) any watercourse or storm water system. Any water that contacts uncured or partly cured concrete will be isolated and held until the pH is between 6.5 and 8.0 pH.
- Complete isolation must be maintained of all cast-in-place concrete and grouting from fish bearing waters for a minimum of 48 hours if ambient air temperature is above 0$^{o}$C, and for a minimum of 72 hours if ambient air temperature is below 0$^{o}$C.
- No creosote-treated and/or pentachlorophenol pressure (PCPP) wood shall be used (or reused).
- Pressure treated wood shall only be utilized in accordance with PCA nationally-approved Guidelines for the Use, Handling and Disposal of Treated Wood (March 2009) (Appendix E).
- Only non-toxic, biodegradable form stripping agents are to be used.
- See Soil and Landforms and Water Resources for additional applicable mitigation measures.

***Vegetation***

- To ensure traffic does not deviate off previously-disturbed areas, jersey barriers will be installed along the identified access route (which follows existing roadways, and is one-way where road width does not easily facilitate two-way truck traffic).
- Disturbance to onsite vegetation shall be minimized by clearly demarcating the staging/laydown and refuelling areas.
- Vehicles and heavy equipment arriving on site must be checked prior to entering the site, and soil, organisms and plants removed.
- The site must be restored to its original (or an improved) condition, where possible. When construction in an area is complete, the contractor must repair and re-seed any damaged areas with a PCA-approved sod or hydroseed mix (per hydroseeding measures described in Soil and Landforms). The new berm behind the Quay Wall is to be vegetated with hardy native species (e.g., marram grass) as sections are completed.

***Wildlife***

- To avoid disruption and destruction to birds, nests and eggs, staging/construction activities shall be timed, where possible, to avoid the key nesting periods of migratory birds in the area (mid-April to end of August).
- Prior to commencing any activities between April 15 and August 31, a nest check must be undertaken. Should a nest be encountered, the area will be clearly staked or flagged and a buffer, established in consultation with and approved by the Canadian Wildlife Service, will be demarcated around the nest to avoid disturbing the area.
- Open excavations must be fenced/covered when workers are not present to minimize potential injury/entrapment of wildlife.
- Equipment and vehicles shall be equipped with proper noise emission controls and excessive idling/running of vehicles and equipment must be avoided.
- To ensure traffic does not deviate off previously-disturbed areas, jersey barriers will be installed along the identified access route (which follows existing roadways, and is one-way where road width does not easily facilitate two-way truck traffic).
- Concentrations of birds (waterfowl, seabirds and shorebirds) shall not be approached when accessing the Project site from water or land.
- Wildlife feeding, enticement or harassment is strictly prohibited.
- Wildlife attractants or any toxic materials that may pose a threat to local wildlife shall be stored in a secured building or animal-proof container.
- Food, garbage and any other odorous products shall be stored in wildlife-proof containers when workers are not immediately present. Refuse must be removed from the work site daily (unless secured garbage facilities exist at the work site).
- Should a species at risk be encountered, work shall cease and Environment and Climate Change Canada (ECCC) shall be contacted for advice regarding mitigation measures to be implemented to avoid destruction, injury, or interference with the species, residence and habitat.

***Cultural Landscapes***

- Project activities are scheduled to avoid the peak tourist season.
- The extent and duration of construction activities and associated disruptions shall be minimized.

***In-Situ Cultural Resources***

- The potential to adversely affect cultural resources has been substantially mitigated during Project design by minimizing the required excavation footprint and limiting excavation to the original excavation limits (based on 1968 construction photos), where practicable.
- PCA archeological surveillance shall be available during all identified phases of the work. Consultation with Cultural Resources personnel must occur prior to any work commencing. Arrangements are to be made through Cultural Resources A/Manager Maura McKeough (maura.mckeough@pc.gc.ca 902-733-3549).

- All construction activities shall take place within the PCA-approved locations, per the design drawings. Any deviation outside of this approved area must be pre-approved by PCA personnel.
- Should any in-situ cultural resources/archeological artifacts be uncovered during construction, work shall cease immediately and PCA archeology contacted – Cultural Resources A/Manager Maura McKeough (maura.mckeough@pc.gc.ca 902-733-3549).

***Visitor Access, Services and Recreational Opportunities***

- Project activities are scheduled to avoid the peak tourist season.
- The extent and duration of construction activities and associated disruptions shall be minimized.
- The contractor must ensure strict adherence to the posted construction speed limit (25 km/hr within FLNHS) at all times.

***Viewscapes and Soundscapes***

- Project activities are scheduled to avoid the peak tourist season.
- The extent and duration of construction activities and associated disruptions shall be minimized.
- Mitigation measures as described in the Biological Environment sections above (particularly for Atmospheric Resources) will also help minimize potential Project-related adverse effects to Viewscapes and Soundscapes.

***Visitor Safety***

- To minimize potential health and safety risks to the public, a temporary fence will be erected around active work areas (including the staging/laydown and refuelling areas) and there will be no unauthorized access to the work site.
- Signage in both official languages must be visible to alert the public to the activities, and to indicate that there is no unauthorized entry to the worksite.
- Barriers must be installed at the end of each working day to prevent entry to the temporary access road by pedestrians and vehicles.
- Potentially hazardous areas of the work site must be secured when workers are not immediately present.
- Human guides should be provided for all trucks backing up during Project activities.
- Requirements of all applicable health and safety legislation must be met or exceeded. Immediately attention shall be given to human health and safety concerns, including notification of emergency services, as required. Additional remedial measures will be implemented to prevent future incidents.

***Essence of Place***

- Project activities are scheduled to avoid the peak tourist season.
- The extent and duration of construction activities and associated disruptions shall be minimized.

## 7. ACCIDENTAL EVENTS AND MALFUNCTIONS

Accidental events or malfunctions could occur from improper vehicle and equipment maintenance, spills into terrestrial and/or aquatic environments, and structure or equipment malfunctions such as failure of sediment control mechanisms.

Accidental spills or leaks of potential hazardous materials (e.g., fuels/lubes, concrete, concrete wash water), or improper storage and disposal of construction materials, dredged/excavated sediment, demolished Quay Wall materials, and other waste and potential contaminants, have the potential to decrease water and soil quality in the Project area. Release of deleterious substances (e.g., toxins, pollutants, sediment) may cause injury or mortality to vegetation, wildlife and marine fauna, and degradation of fish habitat.

Many of the mitigation measures identified herein are contingency measures aimed at preventing or responding to accidental events, and diligent adherence to these mitigations will decrease the likelihood of occurrence and the extent of potential adverse effects.

## 8. PUBLIC/STAKEHOLDER ENGAGEMENT

To support the assessment of changes to socio-economic conditions as required under section 5(2) of CEAA 2012, PCA and DFO determined that public and stakeholder engagement would be appropriate, given the Project's extent, duration and visibility, and since fisheries, historical resources, and other socio-economic aspects could be affected.

PCA held a public open house/information session on May 3, 2017, to present and discuss a range of topics, including summer activities at the Fortress, Canada 150 celebrations, and the proposed Project components and activities; only three members of the public were in attendance.

A Project-focused open house was held on August 15, 2017, with 30 members of the public in attendance. Attendees were interested and engaged, participating fully in discussions and asking pertinent questions. Attendees raised issues of possible concern (e.g., trucking/barging of materials, viewscape from inside the fortress, finished look of the Quay Wall), however they seemed satisfied with PCA's answers, did not express concern or disagreement with the Project concept and potential effects, and seemed supportive of the Project.

PCA spoke directly with six of the nine fishers who operate out of Louisbourg Harbour, to describe the project, potential adverse effects, proposed mitigation and offsetting measures, and residual effects, and to solicit input and identify any concerns. In addition to one-on-one phone calls, PCA held a follow-up meeting on August 4, 2017 to view maps and design drawings and to discuss the project with the PCA Project Manager. None of the fishers raised any concerns with the proposed plans, nor indicated that they feel they will be adversely affected. It was generally noted that most fishing occurs outside of the Louisbourg Harbour. One fisher indicated that he supports installing rock and that he sees it as habitat improvement. No issues or concerns were raised by any of the fishers, who seemed generally appreciative of PCA bringing the project to their attention and soliciting their input.

## 9. INDIGENOUS CONSULTATION

PCA sent an early notification and Offer to Consult letter to the thirteen Nova Scotia First Nation Communities on April 11, 2017. No response was received. A follow-up letter, drafted in consultation with DFO and Transport Canada, was sent on June 30, 2017. Millbrook First Nation has advised in a letter dated July 19, 2017 that they have not identified any issues with the project and will not require

any further engagement. No responses have been received from the other Indigenous communities at the time of this submission.

The mitigation measures identified herein for biophysical and cultural resources will also help minimize the potential for Project-related indirect effects to established or potential Indigenous or Treaty rights.

**10. SURVEILLANCE**

Periodic environmental surveillance monitoring by qualified PCA personnel will be conducted, and may include site visits during different work activities, attending related meetings and briefings, evaluating effectiveness of mitigation measures and environmental protection controls, and consulting with staff and work crews during project completion.

Routine archeological surveillance will be conducted by qualified PCA personnel, which may include daily site visits while work is being completed (especially during excavation phases), evaluating effectiveness of mitigation measures related to protecting cultural/archeological resources, and regular consultation with work crews related to cultural resource protection.

DFO will conduct monitoring at the site both during and following construction, to confirm that the conditions of authorization have been met.

**11. FOLLOW-UP MONITORING**

Monitoring to evaluate the effectiveness of mitigation measures and assess restoration success will be conducted by qualified PCA staff following completion of each Project phase. Follow-up monitoring requirements related to cultural resources are at the discretion of PCA A/Manager Cultural Resources, Maura McKeough.

To confirm that offsetting measures have been effective in counterbalancing the serious harm to fish, monitoring and reporting conditions will be included as conditions of the *Fisheries Act* authorization.

**12. SARA NOTIFICATION**

Implementation of the Valued Component mitigation measures as described in this document will also minimize potential Project-related adverse effects to species at risk. No Project-related residual adverse effects to individuals, residences or critical habitat of a listed species at risk are anticipated, therefore completion of the SARA-Compliant Authorization Decision Tool and notification to the Minister(s) were not required.

**13. SIGNIFICANCE OF RESIDUAL ADVERSE EFFECTS**

Potential Project-related adverse environmental effects are, for the most part, temporary (only potentially occurring during Project staging and construction phases), localized (limited to the immediate Project area) and reversible over the short term. There is no active operational phase, as the Project components are passive structures, and maintenance activities will be minimal. The Barrier Beach structures are not anticipated to be decommissioned, rather integrated into the landscape through natural sediment deposition further infilling occurring along the shoreline.

The proposed work represents the smallest construction footprint below OHWM to provide the best engineering design to protect the structural integrity of the Barrier Beach and FLNHS infrastructure, and as described above, PCA is undertaking numerous measures to avoid and/or mitigate Project-related adverse effects to fish and fish habitat. Nevertheless, given the extent of the permanent Project

footprint below OHWM and the high ecological value of the impacted habitat, the Project is likely to result in residual adverse effects to fish and fish habitat.

Subsection 35(1) of the *Fisheries Act* (R.S.C., 1985, c. F-14) prohibits the carrying on of a work, undertaking or activity that may result in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery or to fish that support such a fishery. However, when serious harm to fish resulting from a project is unavoidable and cannot be fully mitigated, subsection 35(2) enables the Minister of Fisheries and Oceans to issue an authorization with terms and conditions.

The proponent of any such authorized work is required to offset residual serious harm to fish by undertaking actions to counterbalance the loss of fish habitat and any resulting fisheries productivity. The goal of offsetting is to maintain or improve the productivity of the commercial, recreational or Aboriginal fishery.

PCA has applied to DFO for subsection 35(2) authorization, and is currently working toward the development of an Offsetting Plan, in consultation with DFO, to fully offset the Project-related residual serious harm to fish. A Letter of Intent (wherein PCA commits to offsetting the residual serious harm) will be signed prior to the commencement of construction activities.

With the implementation of and adherence to the identified mitigation measures, and following implementation of DFO-approved offsetting measures to counterbalance residual serious harm to fish, the Project is not likely to cause significant adverse environmental effects.

## 14. CUMULATIVE EFFECTS

Project-related residual adverse effects are not anticipated to interact with residual adverse effects from other past, present or future projects such that cumulative adverse effects would result.

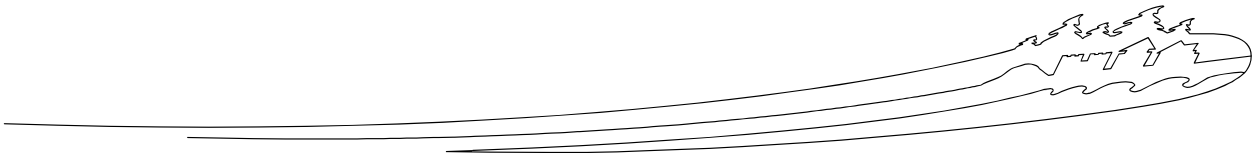
## 15. EXPERTS CONSULTED

In addition to the document signatories, the below-noted experts were consulted during development of the BIA, public and stakeholder engagement, Indigenous consultation, and Project permitting.

- Parks Canada Agency
    - Rebecca Duggan – Senior Archaeologist, Fortress of Louisbourg NHSC; rebecca.duggan@pc.gc.ca / 902-733-3532
    - James Bridgland – Park Ecologist, Cape Breton Field Unit; james.bridgland@pc.gc.ca / 902-285-3007
    - Maria O'Hearn – External Relations Manager, Cape Breton Field Unit; maria.o'hearn@pc.gc.ca / 902-733-3547
    - Coady Slaunwhite – Public Relations and Communications Officer, Cape Breton Field Unit; Coady.Slaunwhite@pc.gc.ca / 902-217-0861
    - Chris Bellemore – Partnership and Engagement Specialist, Cape Breton Field Unit; Chris.Bellemore@pc.gc.ca / 902-733-3526
    - David Ebert – Strategic Advisor, Cape Breton Field Unit; david.ebert@pc.gc.ca / 902-733-3558
- Fisheries and Oceans Canada

    - Mike Wambolt – A/Section Head, Fisheries Protection Program, Ecosystem Management Branch; michael.wambolt@dfo-mpo.gc.ca / 902-402-5851
- Transport Canada
    - Jennifer Daigle – Aboriginal Consultation Officer, Environmental Affairs and Aboriginal Consultation Unit, Atlantic Region; jennifer.daigle@tc.gc.ca / 506-871-5280
    - Virginia Drew – Officer, Navigation Protection Program, Atlantic Region; virginia.drew@tc.gc.ca / 709-772-3072
- Environment Canada
    - Suzanne Wade – Environmental Assessment Analyst, Environmental Stewardship Branch; Suzanne.Wade@canada.ca / 902-426-5035
- Nova Scotia Department of Natural Resources
    - Krista McLarty – Land Administration Division, Land Services Branch; Krista.McLarty@novascotia.ca / 902-424-8614





## 16. PARKS CANADA AGENCY DECISION

Taking into account implementation of mitigation measures outlined in the analysis, the project is:

☒ not likely to cause significant adverse environmental effects.

☐ likely to cause significant adverse environmental effects.

FOR SARA REQUIREMENTS:

☒ There are no residual adverse effects to species at risk and therefore the SARA-Compliant Authorization Decision Tool was not required

**OR**, the SARA-Compliant Authorization Decision Tool was used and determined:

☐ There is no contravention of SARA prohibitions

☐ Project activities contravene a SARA prohibition and CAN be authorized under SARA

☐ Project activities contravene a SARA prohibition and CANNOT be authorized

| | |
|---|---|
| Prepared by:<br>Tara Oak – Environmental Consultant | Date:<br>30 August 2017 |
| Recommended by:<br>Archie Doucette – Environmental Assessment Coordinator<br>Cape Breton Field Unit<br>x Archie Doucette | Date:<br>30 August 2017 |
| Recommended by:<br>Maura McKeough – A/Manager Cultural Resources<br>Cape Breton Field Unit<br>x | Date:<br>30 Aug 2017 |
| Recommended by:<br>Audrey Buchanan – Asset Manager<br>Cape Breton Field Unit<br>x | Date:<br>30 Aug 17. |
| BIA Approval:<br>Blair Pardy – Superintendent<br>Cape Breton Field Unit<br>x A/FWS | Date:<br>30 Aug/17 |

## 19. FISHERIES AND OCEANS CANADA DECISION

| | | |
|---|---|---|
| Project Title: | Fortress of Louisbourg Erosion and Flood Protection Project | |
| DFO File No.: | 17-HMAR-00031 | |
| Environmental Review Decision: | Taking into account the implementation of any mitigation measures that Fisheries and Oceans Canada considers appropriate, the project is not likely to cause significant adverse environmental effects and, as such, Transport Canada may exercise any power or perform any duty or function that would permit the project to be carried out in whole or in part. | |
| Recommended by: | Shannan Murphy<br>Fisheries Protection Biologist<br>Fisheries Protection Program<br>Ecosystem Management Branch<br>Maritimes Region<br>Fisheries and Oceans Canada | |
| Signature: | Shannan Murphy | Date: Aug. 31, 2017 |
| Mailing Address: | PO Box 1006<br>Dartmouth, Nova Scotia<br>B2Y 4A2 | |
| Tel: | 902-401-5094 | |
| Fax: | 902-426-1489 | |
| Email: | Shannan.Murphy@dfo-mpo.gc.ca | |
| Approved by: | Mark McLean<br>Manager<br>Fisheries Protection Program<br>Ecosystem Management Branch<br>Maritimes Region<br>Fisheries and Oceans Canada | |
| Signature: | Craig Hommel<br>for Mark McLean | Date: August 31, 2017 |
| Approved by: | Annette Daley<br>A/Regional Director, Ecosystem Management Branch<br>Maritimes Region<br>Fisheries and Oceans Canada | |
| Signature: | Wendy Williams | Date: aug31/17 |

## 20. TRANSPORT CANADA DECISION

| | | |
|---|---|---|
| Project Title: | Barrier Beach Shoreline Protection – Fortress of Louisbourg, NS | |
| TC File No.: | NEATS #43937 | |
| NPP File No.: | 8200-2017-200073 | |
| Environmental Review Decision: | Taking into account the implementation of any mitigation measures that Transport Canada considers appropriate, the project is not likely to cause significant adverse environmental effects and, as such, Transport Canada may exercise any power or perform any duty or function that would permit the project to be carried out in whole or in part. | |
| Recommended by: | J. Jason Flanagan<br>Senior Environmental Assessment Officer<br>Environmental Affairs and Aboriginal Consultation Unit | |
| Signature: | ---------- | Date: ---------- |
| Mailing Address: | 95 Foundry Street, Heritage Court<br>PO Box 42<br>Moncton, New Brunswick<br>E1C 8K6 | |
| Tel: | 506-227-8257 | |
| Fax: | 506-851-7542 | |
| Email: | jason.flanagan@tc.gc.ca | |
| Approved by: | J. Jason Flanagan<br>A/ Regional Manager<br>Environmental Affairs and Aboriginal Consultation Unit | |
| Signature: |  | Date: August 31, 2017 |

## 21. NATIONAL IMPACT ASSESSMENT TRACKING SYSTEM

The project must be registered in the Parks Canada National Impact Assessment Tracking System within the fiscal year the project took place. If the project is on hold, was cancelled, or was determined to be likely to cause significant adverse effects and did not go ahead, please indicate this information in the tracking system (see selections in the *Assessment Status/Decision* field).

☐ Project registered in tracking system

☒ Not yet registered (CEAA 2012 requires PCA submit a report to Parliament annually. EIAs must be entered in the tracking system **by the end of April** to enable reporting.

***Ensure that all required mitigation measures and conditions (e.g. follow-up monitoring requirements) are included in project permits and authorizations***

## 22. REFERENCES

CBCL Limited. March 2010. Geo-Engineering Research for Fortress of Louisbourg Coastal Conservation Plan Project, Final Report. Prepared for Public Works and Government Services Canada.

Jacques Whitford. 1996. Natural Resources Impact Study – Fleur-de-Lis Trail (Gabarus to Louisbourg). Prepared for Nova Scotia Department of Transportation and Communications.

Parks Canada. February 22, 2017. Parks Canada National Best Management Practices, Works In and Around Waterbodies – Draft.

Parks Canada. August 2011. Special Events in the National Historic Sites of Canada in Cape Breton, Replacement Class Screening Report.

Parks Canada. March 1997. Fortress of Louisbourg National Historic Site Commemorative Integrity Statement.

## 23. APPENDICES

A. Barrier Beach Design Drawings
B. Quay Wall Design Drawings
C. ACCDC Report
D. Project Footprints Below OHWM
E. Parks Canada Guidelines for the Use, Handling and Disposal of Treated Wood (March 2009)

# Appendix A – Barrier Beach Design Drawings

CONTAMINATED SOIL MAYBE PRESENT WITHIN THIS ZONE. SHOULD CONTAMINATED SOIL BE ENCOUNTERED IT SHOULD BE DISPOSED OF OFF SITE AT AN APPROVED FACILITY IN ACCORDANCE WITH SECTION 01 35 43 AND NSDOE.

SHOULD AN OFF LOADING FACILITY BE REQUIRED IT SHALL BE CONSTRUCTED WITHIN THE ZONE INDICATED AND SHALL BE A PILE TYPE STRUCTURE (INFILLING WILL NOT BE PERMITTED). OFF LOADING STRUCTURE, IF REQUIRED, SHALL BE DESIGNED BY AN ENGINEER AND STAMPED BY A PROFESSIONAL ENGINEER LICENSED TO PRACTICE IN THE PROVINCE OF NOVA SCOTIA. TEMPORARY WHARF WOULD REQUIRE TRANSPORT CANADA APPROVAL PURSUANT TO THE NAVIGATION PROTECTION ACT.

CONSTRUCTION AREA

CONTRACTOR TO PROVIDE TEMPORARY STRUCTURE FOR ACCESS TO BARRIER BEACH. TEMPORARY STRUCTURE (SPAN TO BE A MINIMUM OF 8.0 m) TO BE DESIGNED AND STAMPED BY A PROFESSIONAL STRUCTURAL ENGINEER, LICENSED TO PRACTICE IN NOVA SCOTIA. REMOVE AND REPLACE EXISTING STRUCTURE.

~1000 m³ OF EXCAVATION REQUIRED IN THIS AREA. MATERIAL TO INCORPORATED INTO THE BARRIER BEACH FILL ABOVE ELEVATION 0.6 CVGD

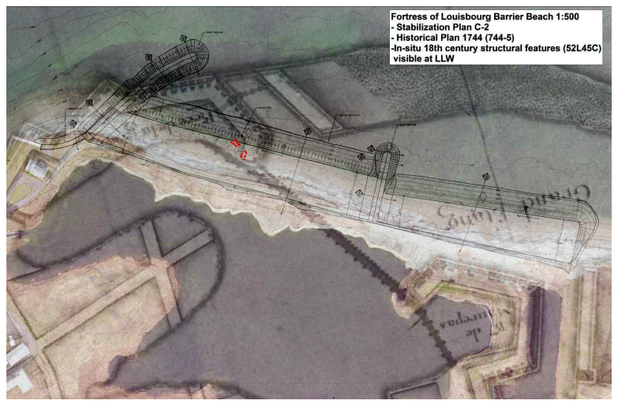
POTENTIAL LAY DOWN AREA

GRAND ETANG

POTENTIAL REFUELING /LAY DOWN AREA

ACCESS ROAD ONE WAY IN/OUT

ALL TRAFFIC FROM THIS POINT FORWARD IS TO BE ONE WAY TRAFFIC. CONTRACTOR TO PROVIDE TEMPORARY PROTECTION (IE. JERSEY BARRIERS) AS REQUIRED OR REQUESTED BY DEPARTMENTAL REPRESENTATIVE. CONTRACTOR TO ALSO PROVIDE PLAN FOR APPROVAL (SECTION 01 35 00.06) PRIOR TO ANY TRUCKING OPERATIONS.
TRAFFIC CONTROL TO BE PROVIDED TO ENSURE THAT NO MORE THAN A 5 MINUTE DELAY OCCURS AT ANY TIME.




KNOWN CULTURAL RESOURCE MAPPING (N.T.S.)

## GENERAL NOTES

1. ELEVATIONS SHOWN ARE GEODETIC, AND ARE REFERENCED TO N.S.C.M. 201666 AT AN ELEVATION OF 13.478m. COORDINATES REFER TO NAD83 REFERENCE SYSTEM.
2. ELEVATIONS ARE EXPRESSED IN METRES.
3. ALL DIMENSIONS ARE EXPRESSED IN MILLIMETERS UNLESS INDICATED OTHERWISE.
4. STATIONING EXPRESSED IN METRES.
5. VERIFY ALL ELEVATIONS AND DIMENSIONS OF EXISTING STRUCTURES AND FEATURES IN THE FIELD.

SCALE : 1:1500
0m 50m 100m 150m

LEGEND
ONE LANE / ONE WAY TRAFFIC
ONE LANE / TWO WAY TRAFFIC

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

Baird
W.F. Baird & Associates
Coastal Engineers Ltd.

PRELIMINARY FOR INFORMATION ONLY

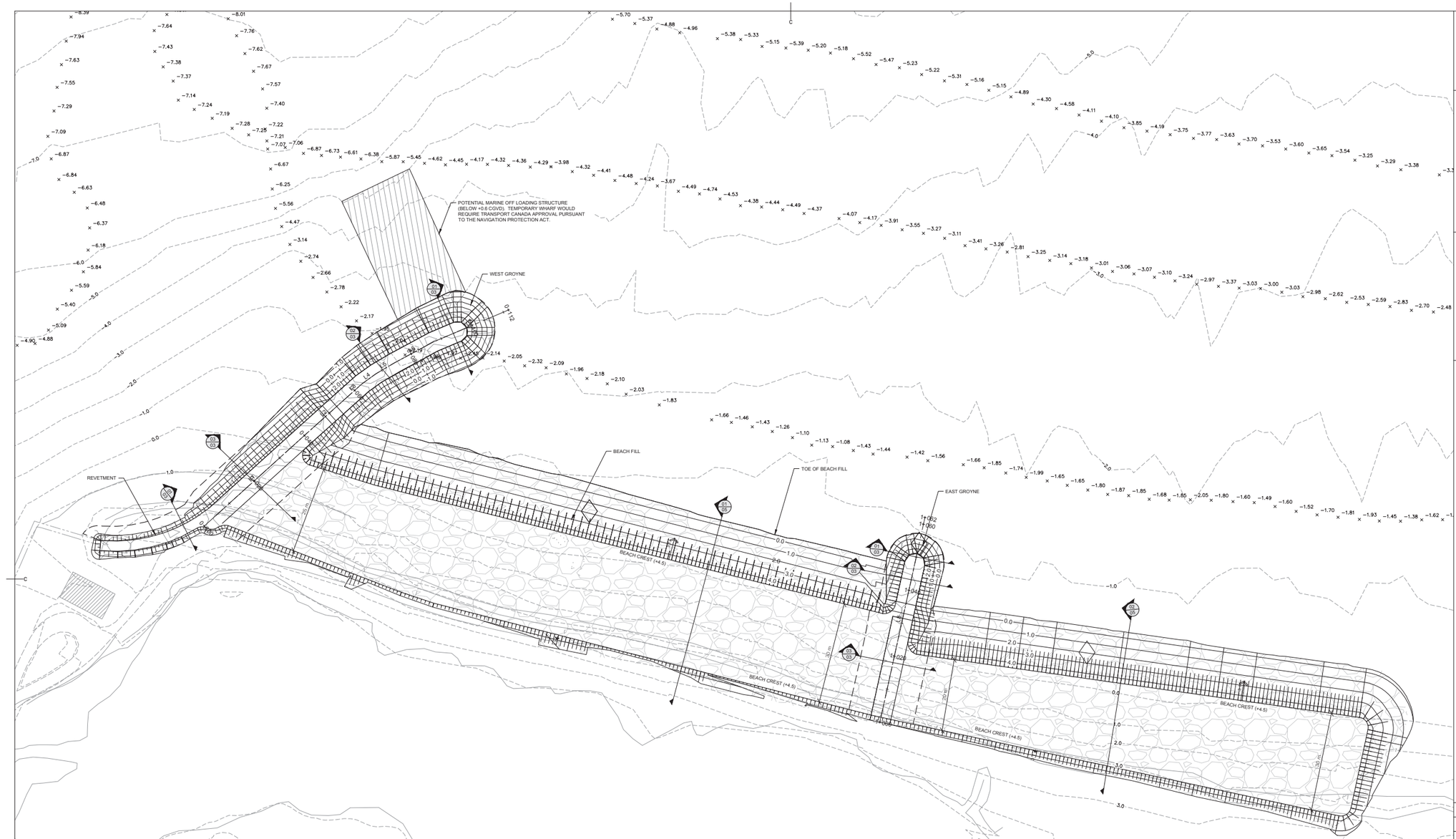
| revisions | | date |
|---|---|---|
| A | ISSUED FOR 99% SUBMISSION | JUNE 2017 |

project / projet
BARRIER BEACH
GROYNES AND RENOURISHMENT
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin
EXISTING CONDITIONS

designed JJK / conçu
date MARCH 22, 2017
drawn JJK / dessiné
date MARCH 22, 2017
approved CK / approuvé
date MARCH 22, 2017
Tender / Soumission
AB
Parks Project Manager / Administrateur de projets Parcs
project number / no. du projet
578
drawing no. / no. du dessin
C-1

17/03/10 (10:56) 1545-6.1_A.dwg
PWGSC B1 (2004)
E-DRM/GDD-E: C-1




| Line Table: EAST AND WEST GROYNES | | | | |
|---|---|---|---|---|
| Line # | Length | Direction | Start Point (E,N) | End Point (E,N) |
| L1 | 39.736 | N47° 53' 33.66"E | (734094.6326,5086786.1045) | (734124.1121,5086812.7482) |
| L2 | 17.758 | N48° 05' 25.04"E | (734124.1121,5086812.7482) | (734137.3273,5086824.6095) |
| L3 | 5.426 | N48° 14' 51.78"E | (734137.3273,5086824.6095) | (734141.3753,5086828.2228) |
| L4 | 5.127 | N54° 13' 07.71"E | (734141.3753,5086828.2228) | (734145.5344,5086831.2204) |
| L5 | 6.287 | N59° 29' 48.81"E | (734145.5344,5086831.2204) | (734150.9510,5086834.4114) |
| L6 | 13.068 | N61° 44' 05.25"E | (734150.9510,5086834.4114) | (734162.4613,5086840.6000) |
| L7 | 24.245 | N66° 57' 03.87"E | (734162.4613,5086840.6000) | (734184.7704,5086850.0922) |
| L8 | 62.111 | N12° 26' 04.91"E | (734294.8587,5086728.0125) | (734308.2328,5086788.6661) |

SCALE : 1:500

0m 10m 20m 30m 40m 50m

0 10 20mm 40 60 80 100 120 140 160 180 200mm

17/03/10 (10:56) 1545-6.1_A.dwg

PWGSC B1 (2004)

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

Baird
W.F. Baird & Associates
Coastal Engineers Ltd.

NOTES:

1. ELEVATIONS SHOWN ARE GEODETIC CGVD'28, AND ARE REFERENCED TO N.S.C.M. 201666 AT AN ELEVATION OF 13.478 m. COORDINATES REFER TO NAD83 REFERENCE SYSTEM.
2. THE OFFSET FROM CHART DATUM (CD) TO GEODETIC DATUM CGVD'28 IS 0.91 M (I.E., 0.91 M CD = 0.0 M CGVD'28).

PRELIMINARY FOR INFORMATION ONLY

| revisions | | date |
|---|---|---|
| A | ISSUED FOR 99% SUBMISSION | JUNE 2017 |

project / projet

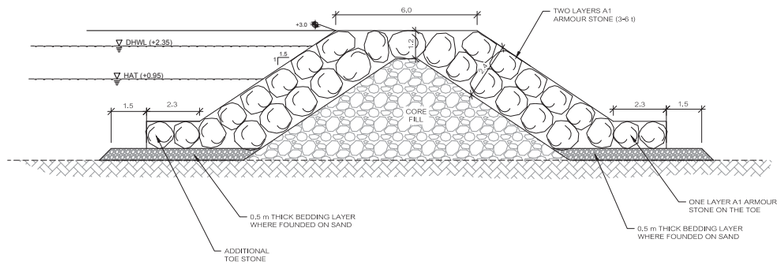
BARRIER BEACH
GROYNES AND RENOURISHMENT
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin

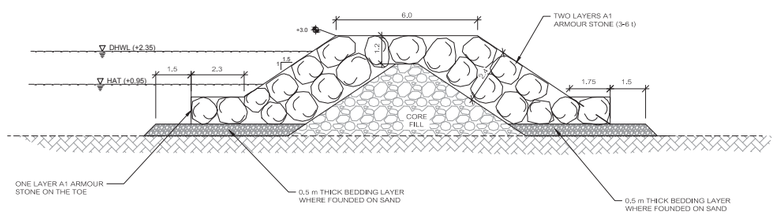
BARRIER BEACH
STABILIZATION

designed JJK / conçu
date MARCH 22, 2017
drawn JJK / dessiné
date MARCH 22, 2017
approved CK / approuvé
date MARCH 22, 2017
Tender / Soumission
AB
Parks Project Manager / Administrateur de projets Parcs
project number / no. du projet
578
drawing no. / no. du dessin
C-2

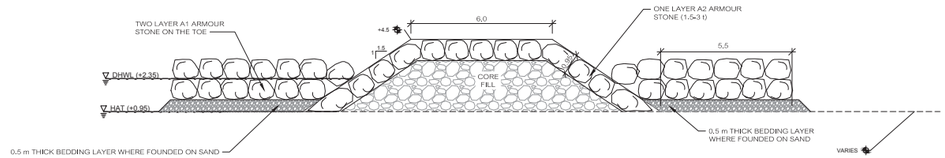
E-DRM/GDD-E: C-2



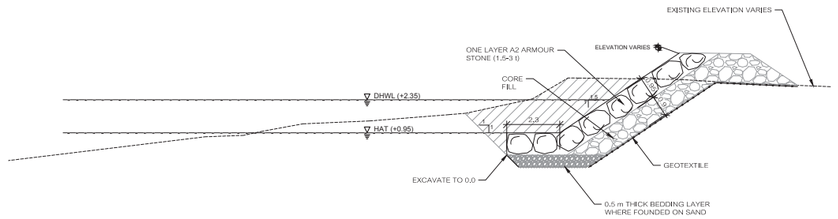

01/03 HEAD SECTION




02/03 TRUNK SECTIONS (+3,0)




03/03 ROOT SECTION (+4,5)




04/03 SHORELINE REVETMENT

SCALE : 1:100

0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m

0 10 20mm 40 60 80 100 120 140 160 180 200mm

17/03/10 (10:56) 1545-6.1_A.dwg

PWGSC B1 (2004)

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

Baird
W.F. Baird & Associates
Coastal Engineers Ltd.

NOTES:

1. ELEVATIONS SHOWN ARE GEODETIC CGVD'28, AND ARE REFERENCED TO N.S.C.M. 201666 AT AN ELEVATION OF 13.478 m. COORDINATES REFER TO NAD83 REFERENCE SYSTEM.
2. THE OFFSET FROM CHART DATUM (CD) TO GEODETIC DATUM CGVD'28 IS 0.91 M (I.E., 0.91 M CD = 0.0 M CGVD'28).

PRELIMINARY FOR INFORMATION ONLY

| revisions | | date |
|---|---|---|
| A | ISSUED FOR 99% SUBMISSION | JUNE 2017 |

project / projet

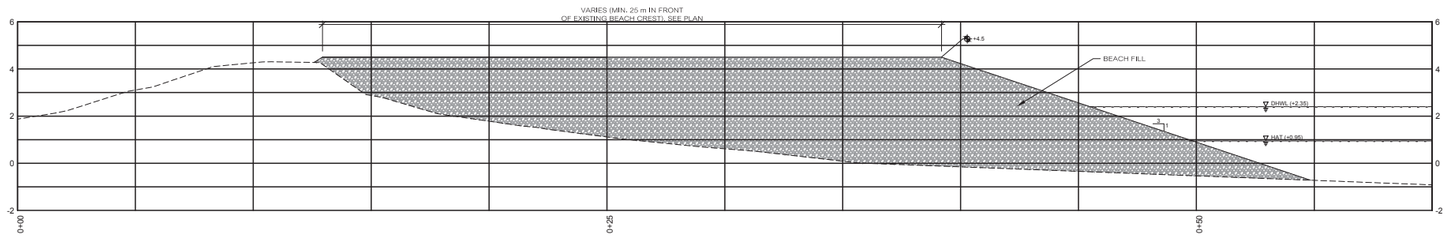
**BARRIER BEACH GROYNES AND RENOURISHMENT FORTRESS OF LOUISBOURG NATIONAL HISTORIC SITE LOUISBOURG, NS**

drawing / dessin

**TYPICAL GROYNE SECTIONS**

| | | |
|---|---|---|
| designed | JJK | conçu |
| date | MARCH 22, 2017 | |
| drawn | JJK | dessiné |
| date | MARCH 22, 2017 | |
| approved | CK | approuvé |
| date | MARCH 22, 2017 | |
| Tender | | Soumission |
| AB | | |
| Parks Project Manager | | Administrateur de projets Parcs |
| project number | | no. du projet |
| 578 | | |
| drawing no. | | no. du dessin |
| C-3 | | |

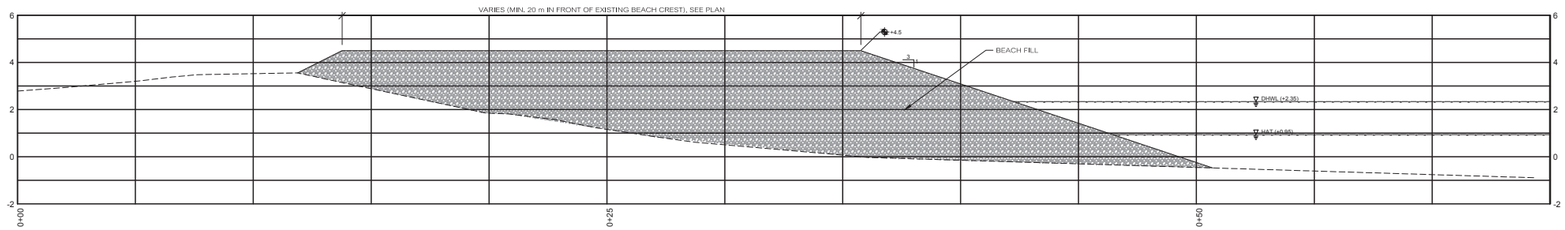
E-DRM/GDD-E: C-3




01/05 BEACH SECTION

SCALE : 1:100

0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m




02/05 BEACH SECTION

SCALE : 1:100

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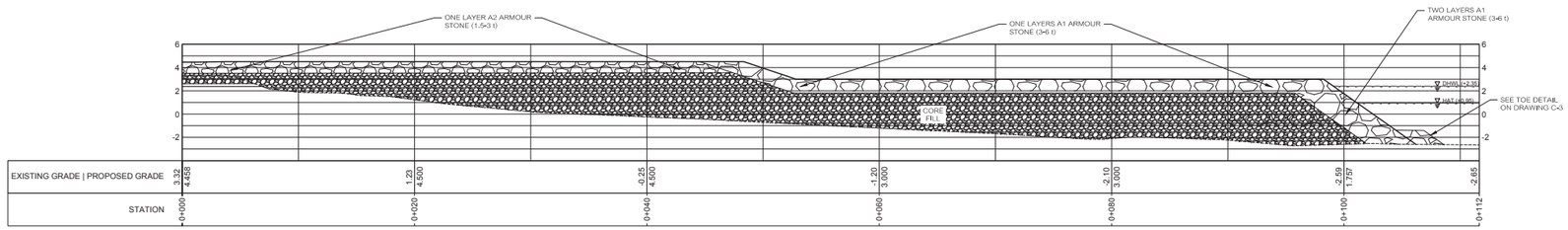
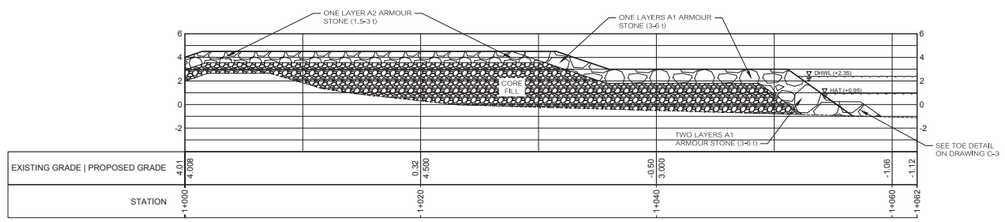



03/05 EAST GROYNE SECTION

SCALE : 1:200

0m 5m 10m 15m 20m 25m




04/05 WEST GROYN SECTION

SCALE : 1:200

0m 5m 10m 15m 20m 25m

0 10 20mm 40 60 80 100 120 140 160 180 200mm

Parks Canada Parcs Canada

GEMTEC EASTERN JV

Baird
W.F. Baird & Associates
Coastal Engineers Ltd.

NOTES:

1. ELEVATIONS SHOWN ARE GEODETIC CGVD'28, AND ARE REFERENCED TO N.S.C.M. 201666 AT AN ELEVATION OF 13.478 m. COORDINATES REFER TO NAD83 REFERENCE SYSTEM.
2. THE OFFSET FROM CHART DATUM (CD) TO GEODETIC DATUM CGVD'28 IS 0.91 M (I.E., 0.91 M CD = 0.0 M CGVD'28).

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| revisions | | date |
|---|---|---|
| A | ISSUED FOR 99% SUBMISSION | JUNE 2017 |

project / projet

**BARRIER BEACH
GROYNES AND RENOURISHMENT
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS**

drawing / dessin

**TYPICAL BEACH FIIL
AND GROYNES
SECTIONS**

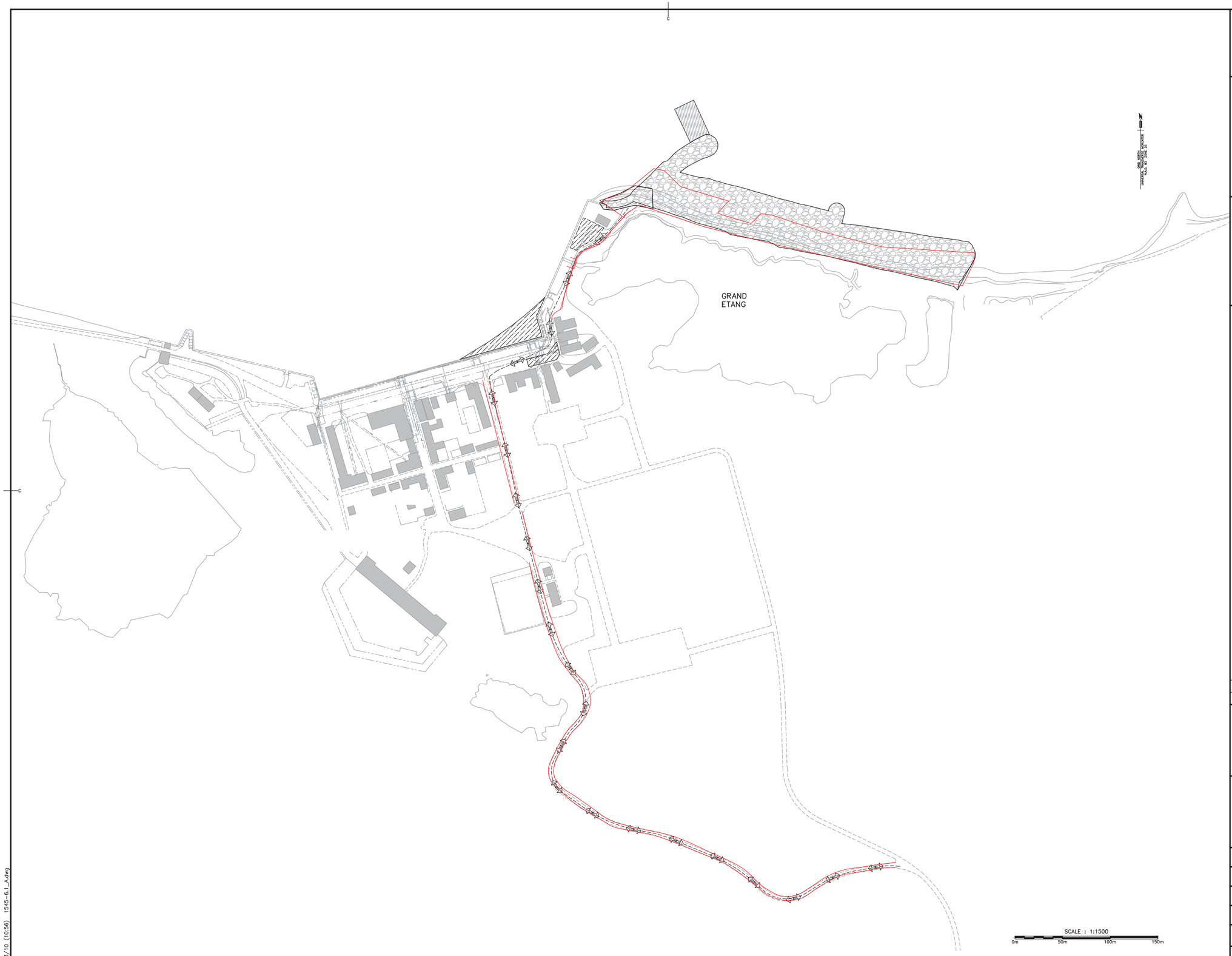
| | | |
|---|---|---|
| designed | JJK | conçu |
| date | MARCH 22, 2017 | |
| drawn | JJK | dessiné |
| date | MARCH 22, 2017 | |
| approved | CK | approuvé |
| date | MARCH 22, 2017 | |
| Tender | | Soumission |
| Parks Project Manager | | Administrateur de projets Parcs |
| project number | | no. du projet |
| | ——— | |
| drawing no. | | no. du dessin |

C-4

17/03/10 (10:56) 1545-6.1_A.dwg

PWGSC B1 (2004)

E-DRM/GDD-E: C-4




Parks Canada / Parcs Canada

GEMTEC EASTERN JV

Baird
W.F. Baird & Associates
Coastal Engineers Ltd.

LEGEND

CLEARED ARCHAEOLOGY AREAS

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FOR INFORMATION ONLY

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|---|---|---|
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project / projet

**BARRIER BEACH
GROYNES AND RENOURISHMENT
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS**

drawing / dessin

**CLEARED ARCHAEOLOGY AREAS**

| | |
|---|---|
| designed / conçu | JJK |
| date | MARCH 22, 2017 |
| drawn / dessiné | JJK |
| date | MARCH 22, 2017 |
| approved / approuvé | CK |
| date | MARCH 22, 2017 |
| Tender / Soumission | AB |
| Parks Project Manager / Administrateur de projets Parcs | |
| project number / no. du projet | 578 |
| drawing no. / no. du dessin | C–1 |

17/03/10 (10:56) 1545-6.1_A.dwg

PWGSC B1 (2004)

C
0 10 20mm 40 60 80 100 120 140 160 180 200mm

E-DRM/GDD-E: C–1

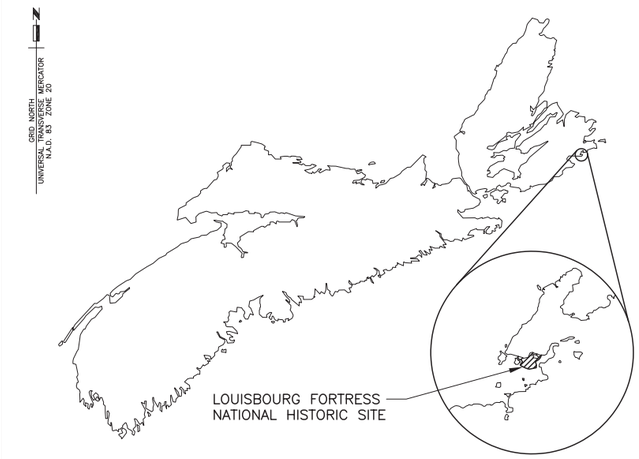
# Appendix B – Quay Wall Design Drawings

Parks Canada

Parcs Canada

# QUAY WALL IMPROVEMENTS
# FORTRESS OF LOUISBOURG
# NATIONAL HISTORIC SITE
## LOUISBOURG
## N.S.

PROJECT NO. R.000000.000




MAP OF NOVA SCOTIA

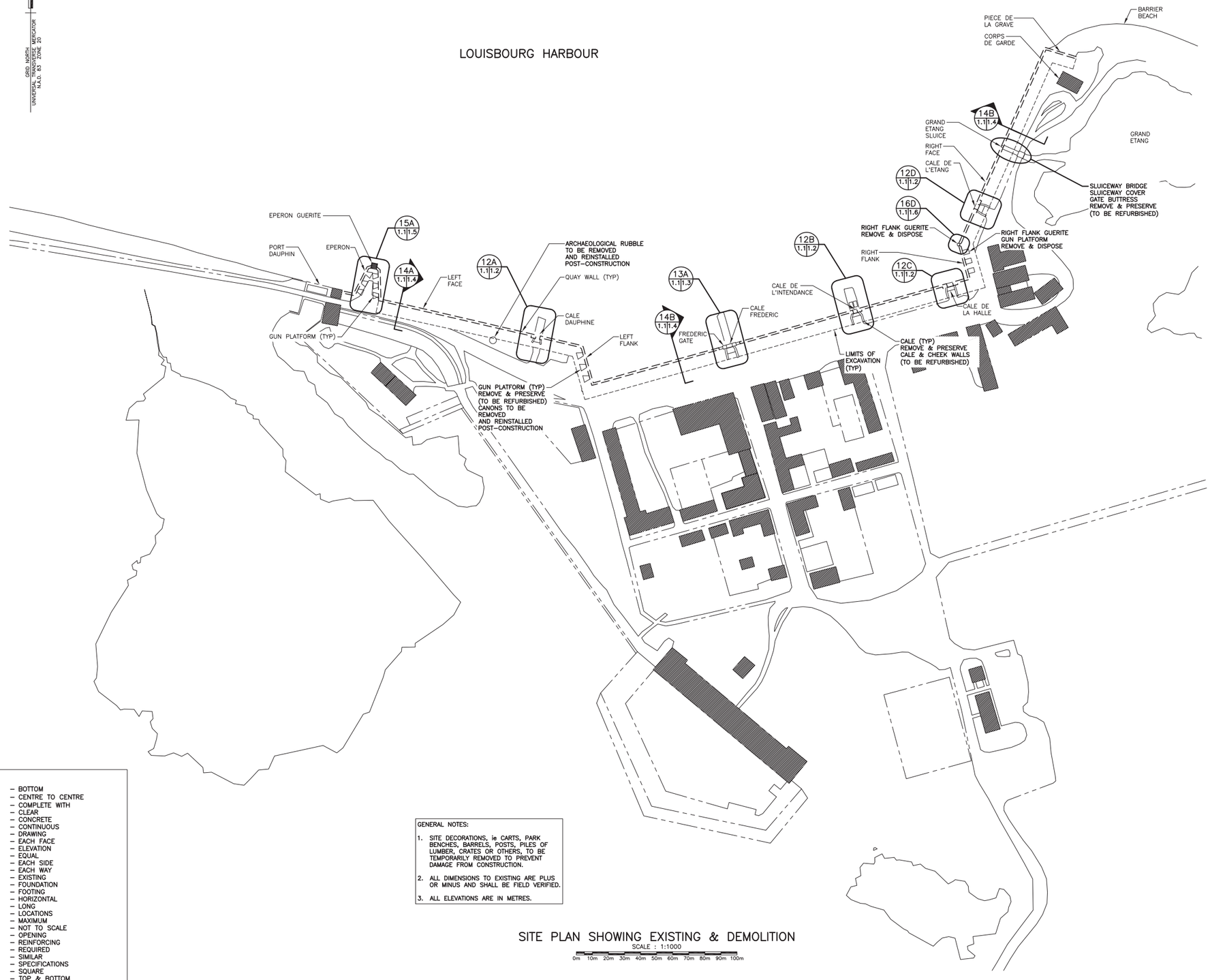
## DRAWING LIST



Canada

ISSUED FOR INFORMATION
JUNE 7, 2017

17/06/07 (15:30) 1545-00_B.dwg




LEGEND

| | |
|---|---|
| B | – BOTTOM |
| c/c | – CENTRE TO CENTRE |
| c/w | – COMPLETE WITH |
| CL | – CLEAR |
| CONC | – CONCRETE |
| CONT | – CONTINUOUS |
| DWG | – DRAWING |
| EF | – EACH FACE |
| EL | – ELEVATION |
| EQ | – EQUAL |
| ES | – EACH SIDE |
| EW | – EACH WAY |
| EXIST | – EXISTING |
| FDN | – FOUNDATION |
| FTG | – FOOTING |
| HORIZ | – HORIZONTAL |
| Lg | – LONG |
| LOCS | – LOCATIONS |
| MAX | – MAXIMUM |
| NTS | – NOT TO SCALE |
| OPG | – OPENING |
| REINF | – REINFORCING |
| REQ'D | – REQUIRED |
| SIM | – SIMILAR |
| SPECS | – SPECIFICATIONS |
| SQ | – SQUARE |
| T&B | – TOP & BOTTOM |
| UNO | – UNLESS NOTED OTHERWISE ON STRUCTURAL DRAWINGS |
| u/s | – UNDERSIDE |
| VERT | – VERTICAL |

GENERAL NOTES:

1. SITE DECORATIONS, ie CARTS, PARK BENCHES, BARRELS, POSTS, PILES OF LUMBER, CRATES OR OTHERS, TO BE TEMPORARILY REMOVED TO PREVENT DAMAGE FROM CONSTRUCTION.
2. ALL DIMENSIONS TO EXISTING ARE PLUS OR MINUS AND SHALL BE FIELD VERIFIED.
3. ALL ELEVATIONS ARE IN METRES.

## SITE PLAN SHOWING EXISTING & DEMOLITION

SCALE : 1:1000

0m 10m 20m 30m 40m 50m 60m 70m 80m 90m 100m

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

PRELIMINARY FOR INFORMATION ONLY

| revisions | | date |
|---|---|---|
| B | ISSUED FOR INFORMATION | June 7 2017 |
| A | ISSUED FOR 33% SUBMISSION | Mar 10 2017 |

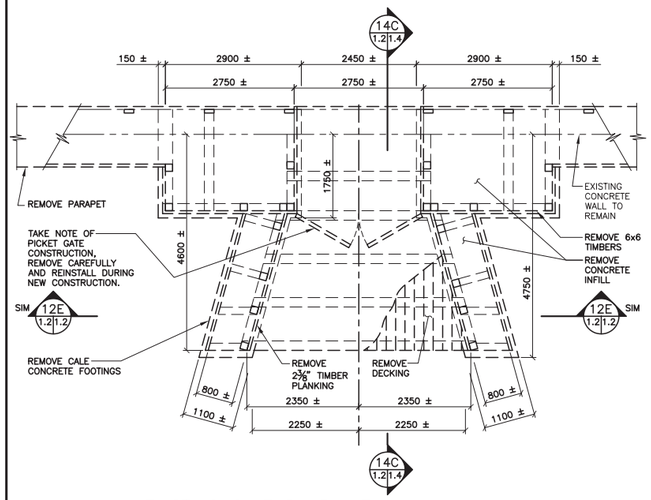
project / projet

QUAY WALL IMPROVEMENTS
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin

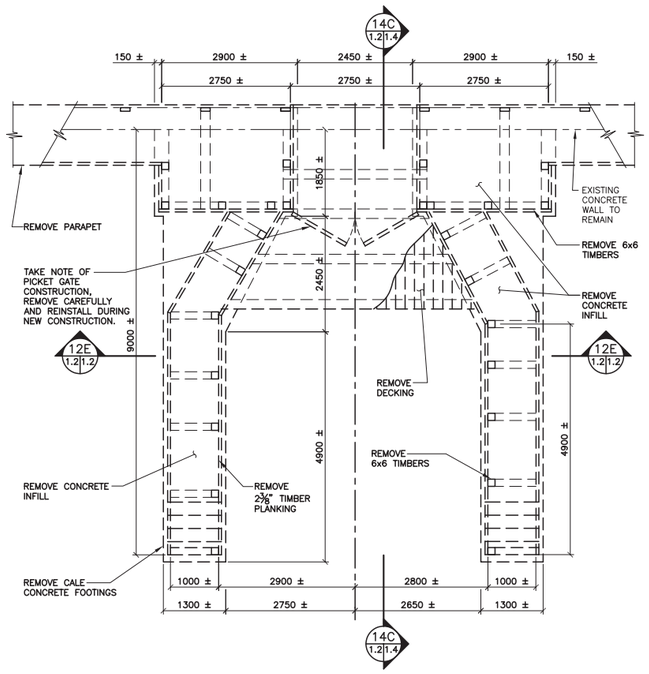
SITE PLAN SHOWING
EXISTING & DEMOLITION

| | | |
|---|---|---|
| designed | RSD | conçu |
| date | MARCH 10, 2017 | |
| drawn | JKL, PJN | dessiné |
| date | MARCH 10, 2017 | |
| approved | RSD | approuvé |
| date | MARCH 10, 2017 | |
| Tender | | Soumission |
| PWGSC Project Manager | | Administrateur de projets TPSGC |
| project number | | no. du projet |
| | _____ | |
| drawing no. | | no. du dessin |
| | 1.1 | |



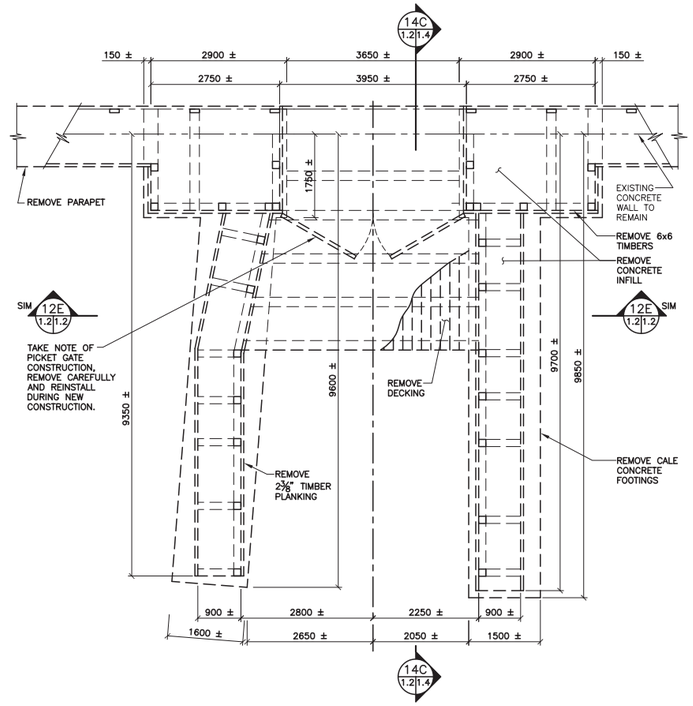

EXISTING CALE DAUPHINE
PLAN DETAIL 12A 1.1|1.2

SCALE: 1:50



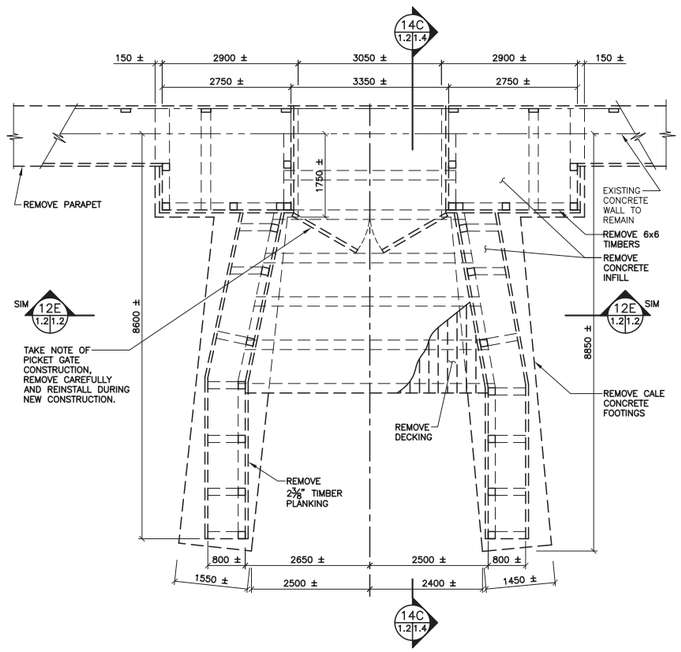

EXISTING CALE DE L'INTENDANCE
PLAN DETAIL 12B 1.1|1.2

SCALE: 1:50



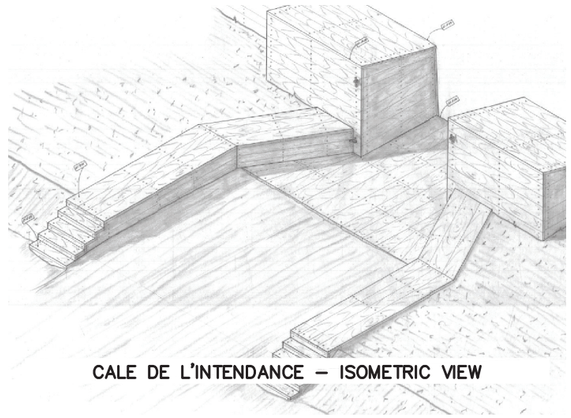

EXISTING CALE DE LA HALLE
PLAN DETAIL 12C 1.1|1.2

SCALE: 1:50

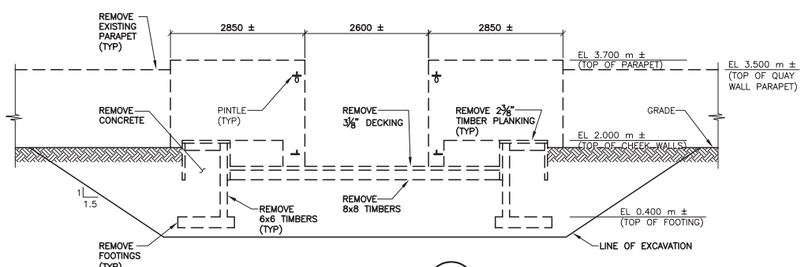



EXISTING CALE DE L'ETANG
PLAN DETAIL 12D 1.1|1.2

SCALE: 1:50



CALE DE L'INTENDANCE – ISOMETRIC VIEW




SECTION 12E 1.2|1.2

SCALE: 1:50

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

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project / projet

QUAY WALL IMPROVEMENTS
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin

EXISTING TYPICAL CALE DEMOLITION PLAN DETAIL & SECTIONS

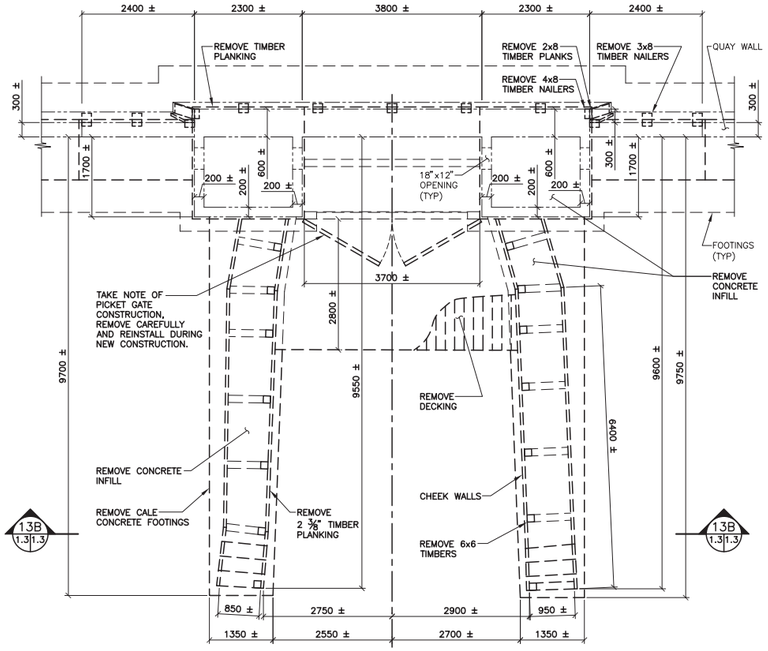
| | | |
|---|---|---|
| designed | RSD | conçu |
| date | MARCH 10, 2017 | |
| drawn | PM, PJN | dessiné |
| date | MARCH 10, 2017 | |
| approved | RSD | approuvé |
| date | MARCH 10, 2017 | |
| Tender | | Soumission |
| PWGSC Project Manager | | Administrateur de projets TPSGC |
| project number | | no. du projet |
| drawing no. | | no. du dessin |

1.2

17/06/07 (15:54) 1545-1.2_B.dwg

PWGSC B1 (2004)

E-DRM/GDD-E:



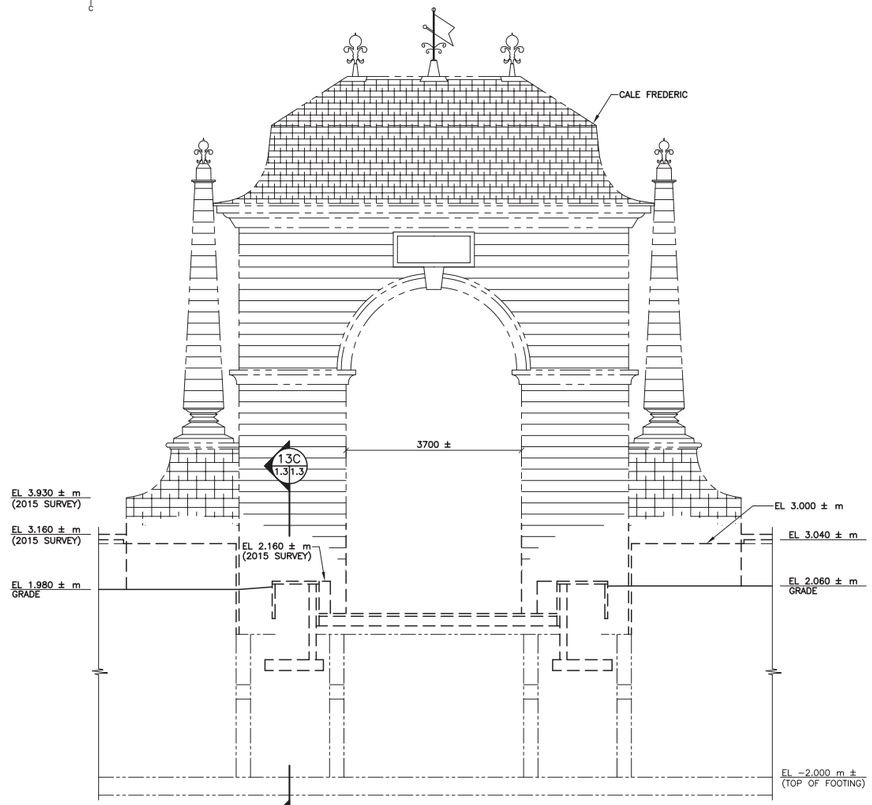

EXISTING CALE FREDERIC PLAN DETAIL 13A 1.1 1.3

SCALE: 1:50

0m 1m 2m 3m 4m 5m

**NOTE:**

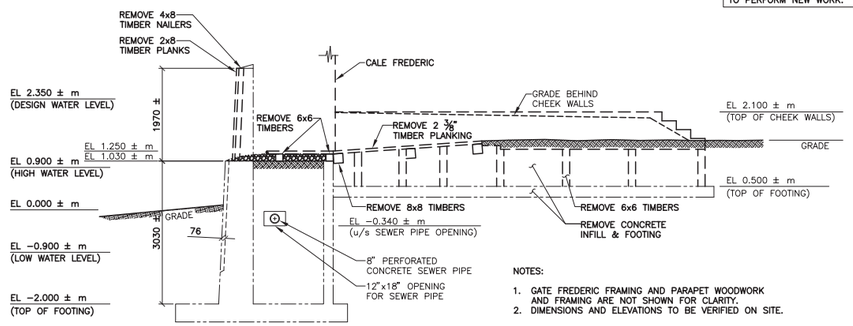
REMOVE TIMBER PLANKING & FRAMING AS REQ'D TO CONSTRUCT NEW QUAY WALL CONCRETE INFILL, EXTENSION & CHEEK WALLS. TEMPORARILY SUPPORT REMAINDER OF STRUCTURE AS REQUIRED TO PERFORM NEW WORK.




SECTION 13B 1.3 1.3

SCALE: 1:50

0m 1m 2m 3m 4m 5m




**NOTES:**

1. GATE FREDERIC FRAMING AND PARAPET WOODWORK AND FRAMING ARE NOT SHOWN FOR CLARITY.
2. DIMENSIONS AND ELEVATIONS TO BE VERIFIED ON SITE.

SECTION 13C 1.3 1.3

SCALE: 1:50

0m 1m 2m 3m 4m 5m

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

PRELIMINARY FOR INFORMATION ONLY

| revisions | | date |
|---|---|---|
| B | ISSUED FOR INFORMATION | June 7 2017 |
| A | ISSUED FOR 33% SUBMISSION | Mar 10 2017 |

project / projet

QUAY WALL IMPROVEMENTS
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin

EXISTING CALE FREDERIC DEMOLITION PLAN DETAIL & SECTIONS

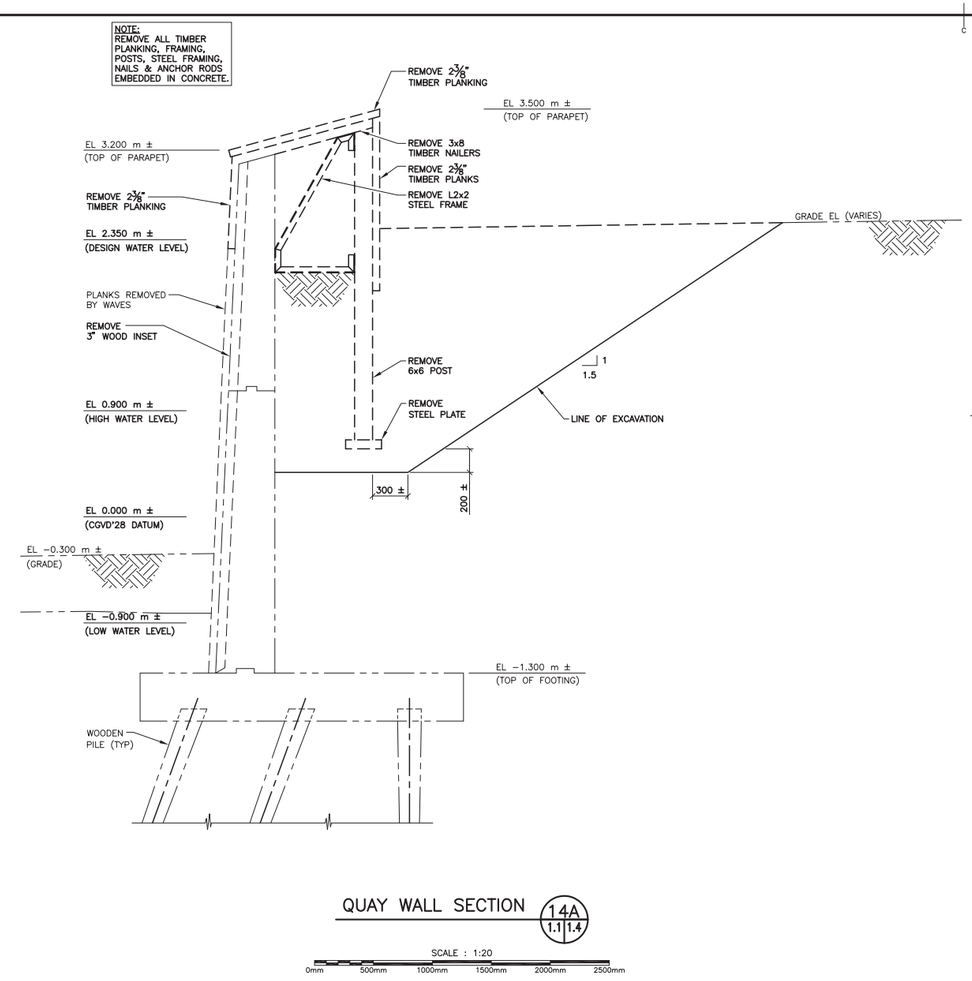
| | |
|---|---|
| designed / conçu | RSD |
| date | MARCH 10, 2017 |
| drawn / dessiné | PM, PJN |
| date | MARCH 10, 2017 |
| approved / approuvé | RSD |
| date | MARCH 10, 2017 |
| Tender / Soumission | |
| PWGSC Project Manager / Administrateur de projets TPSGC | |
| project number / no. du projet | |

drawing no. / no. du dessin: 1.3

17/06/07 (15:50) 1545-1.3_B.dwg

PWGSC B1 (2004)

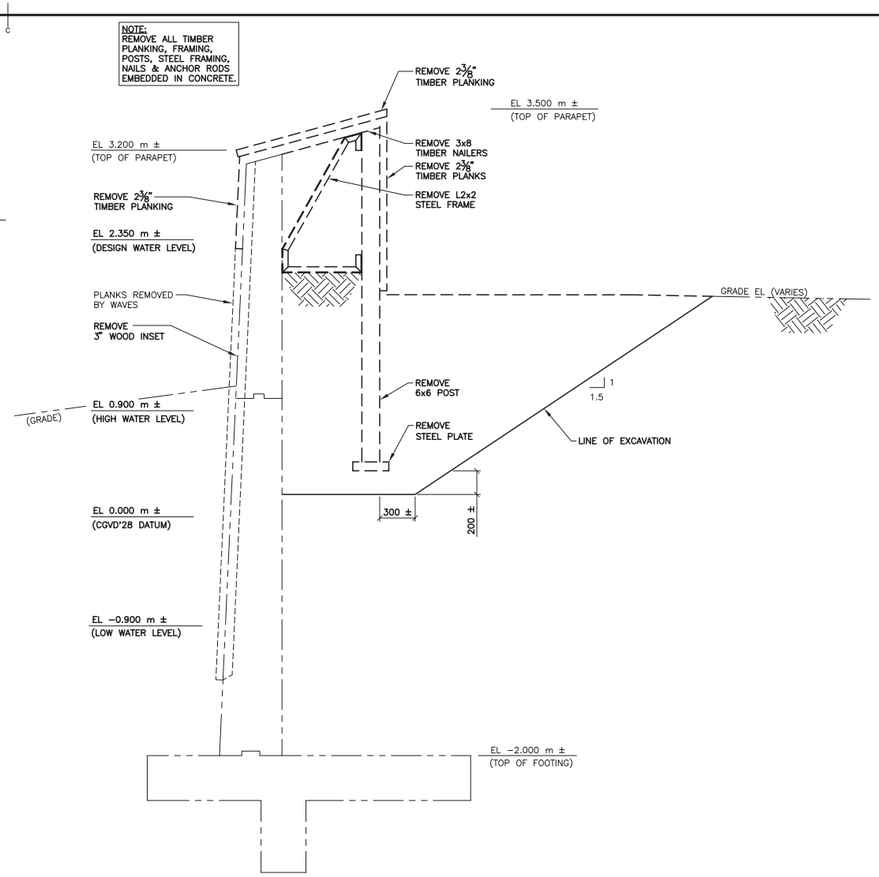
E-DRM/GDD-E:




QUAY WALL SECTION 14A 1.1 1.4

SCALE : 1:20

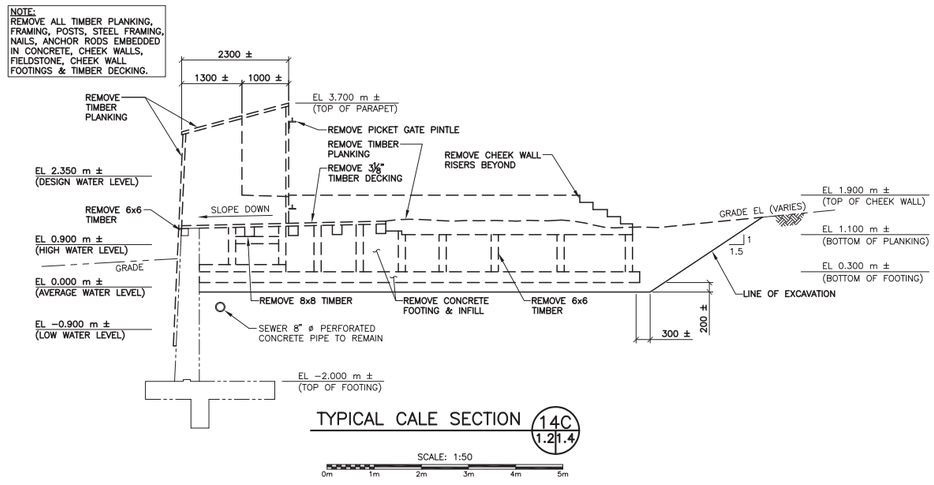
0mm 500mm 1000mm 1500mm 2000mm 2500mm




QUAY WALL SECTION 14B 1.1 1.4

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm




TYPICAL CALE SECTION 14C 1.2 1.4

SCALE: 1:50

0m 1m 2m 3m 4m 5m

Parks Canada / Parcs Canada

GEMTEC EASTERN JV

PRELIMINARY FOR INFORMATION ONLY

| revisions | | date |
|---|---|---|
| B | ISSUED FOR INFORMATION | June 7 2017 |
| A | ISSUED FOR 33% SUBMISSION | Mar 10 2017 |

project / projet

QUAY WALL IMPROVEMENTS
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin

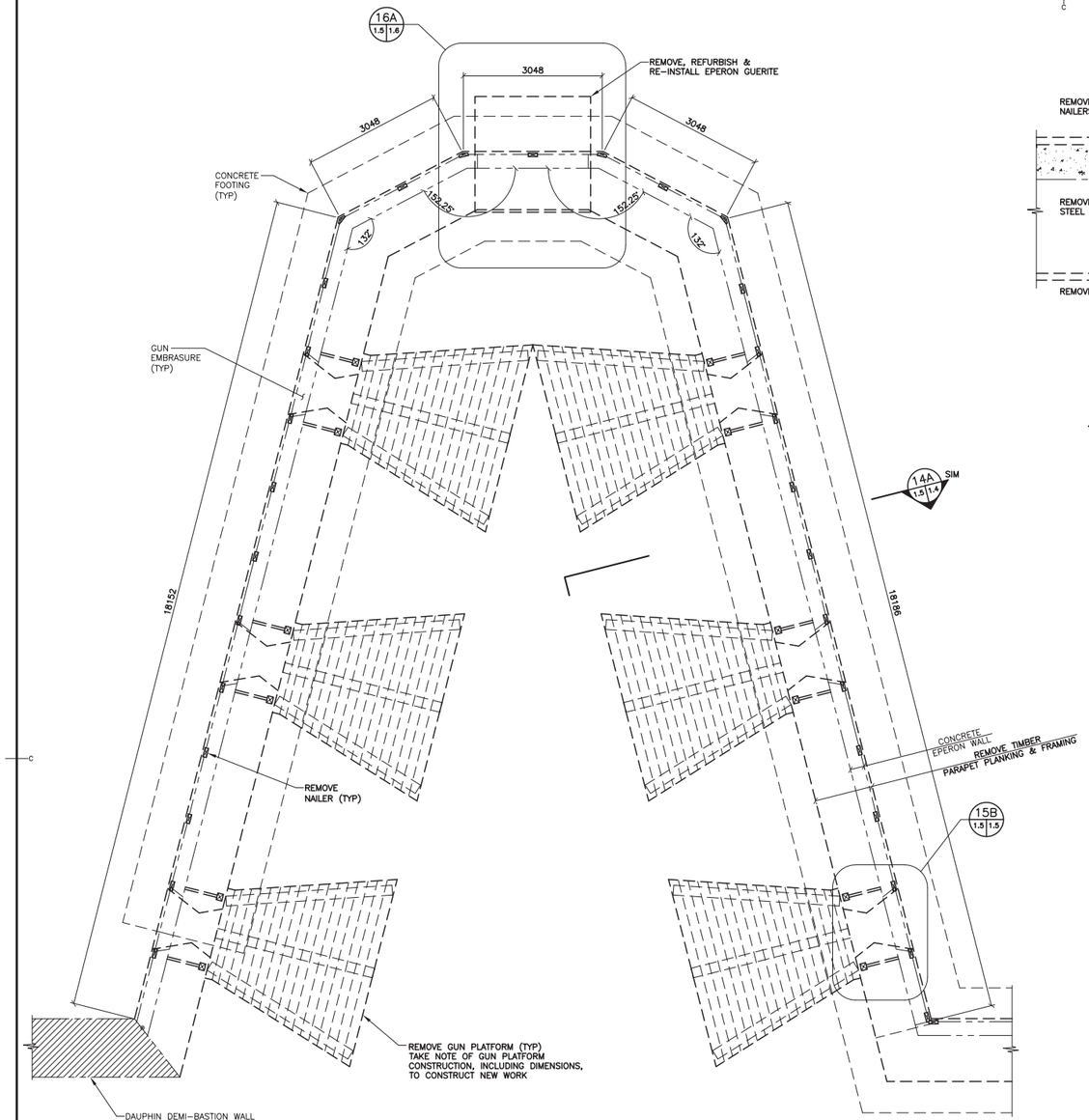
EXISTING QUAY WALL AND TYPICAL CALE DEMOLITION SECTIONS

| | | |
|---|---|---|
| designed / conçu | RSD | |
| date | MAR 10, 2017 | |
| drawn / dessiné | JKL, PJN | |
| date | MARCH 10, 2017 | |
| approved / approuvé | RSD | |
| date | MARCH 10, 2017 | |
| Tender / Soumission | | |
| PWGSC Project Manager / Administrateur de projets TPSGC | | |
| project number / no. du projet | ——— | |
| drawing no. / no. du dessin | 1.4 | |

17/06/07 (15:50) 1545-1.4_B.dwg

PWGSC B1 (2004)

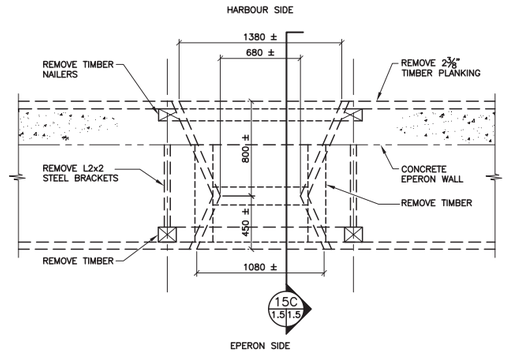
E-DRM/GDD-E:




## DEMOLITION PLAN OF EPERON DETAIL 15A 1.1 1.5

SCALE: 1:50

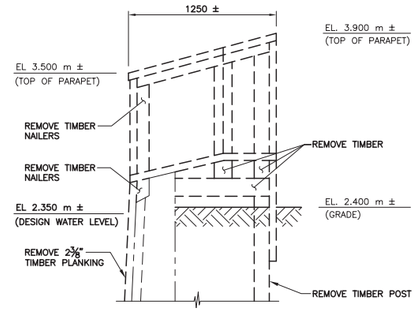
0m 1m 2m 3m 4m 5m




## TYPICAL GUN EMBRASURE LAYOUT PLAN DETAIL 15B 1.5 1.5

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm




## SECTION 15C 1.5 1.5

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm

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GEMTEC EASTERN JV

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QUAY WALL IMPROVEMENTS
FORTRESS OF LOUISBOURG
NATIONAL HISTORIC SITE
LOUISBOURG, NS

drawing / dessin

EXISTING EPERON DEMOLITION PLANS & SECTION

| | | |
|---|---|---|
| designed / conçu | RSD | |
| date | MARCH 10, 2017 | |
| drawn / dessiné | PM, PJN | |
| date | MARCH 10, 2017 | |
| approved / approuvé | RSD | |
| date | MARCH 10, 2017 | |

Tender / Soumission

PWGSC Project Manager / Administrateur de projets TPSGC

project number / no. du projet

drawing no. / no. du dessin

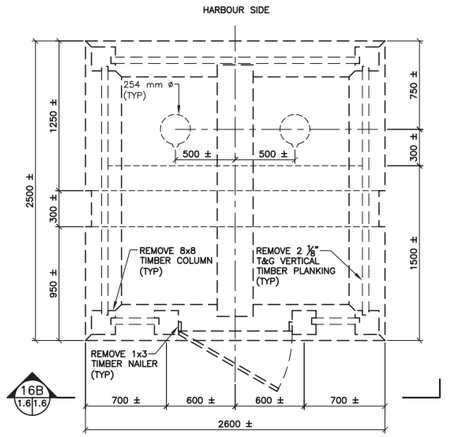
1.5

17/06/07 (15:50) 1545-1.5_B.dwg

PWGSC B1 (2004)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

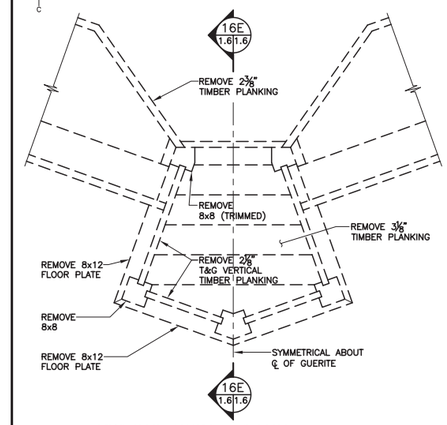
E-DRM/GDD-E:




## EXISTING GUERITE FLOOR FRAMING LAYOUT PLAN DETAIL 16A 1.5 1.6

SCALE : 1:20

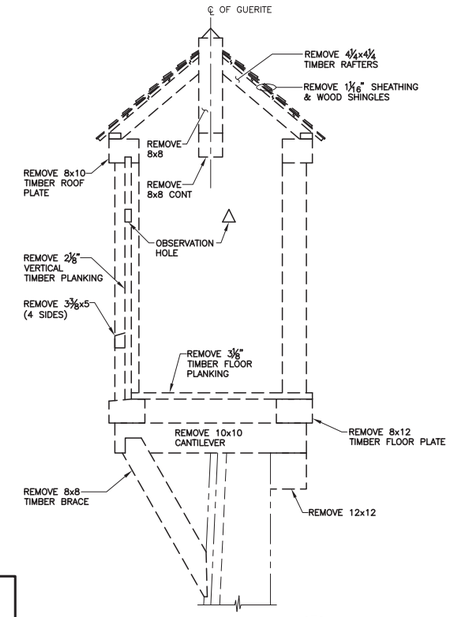
0mm 500mm 1000mm 1500mm 2000mm 2500mm




## EXISTING RIGHT FLANK GUERITE FLOOR FRAMING DEMOLITION PLAN DETAIL 16D 1.1 1.6

SCALE : 1:20

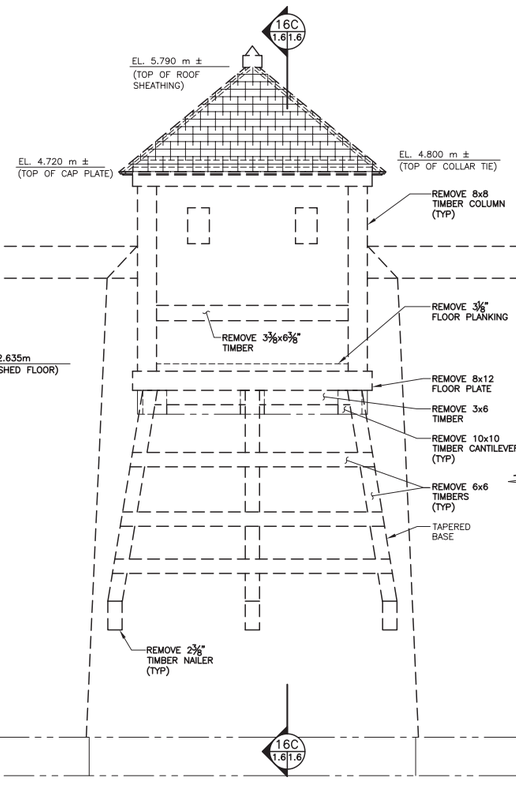
0mm 500mm 1000mm 1500mm 2000mm 2500mm




## SECTION 16E 1.6 1.6

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm



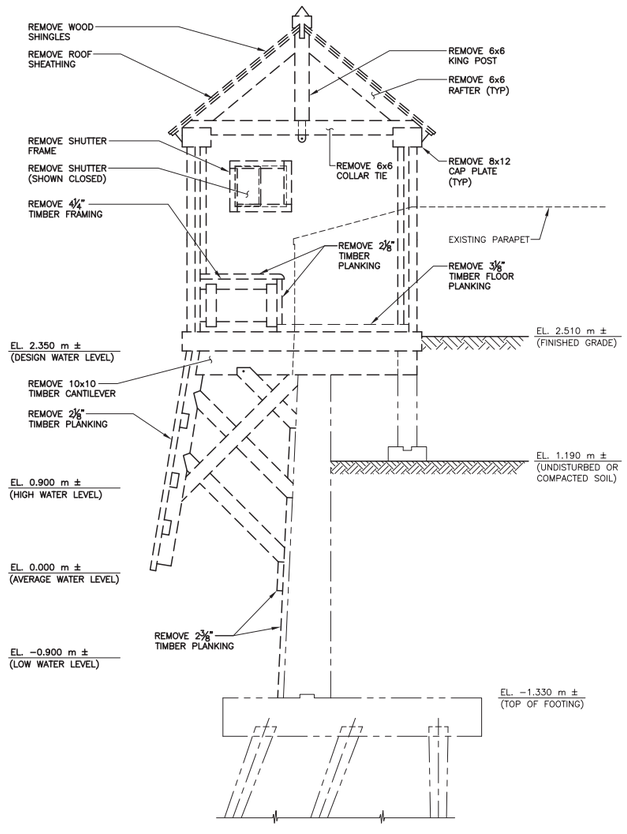

NOTE:

TAPERED BASE PLANKING NOT SHOWN FOR CLARITY.

## EXISTING EPERON GUERITE ELEVATION 16B 1.6 1.6

SCALE: 1:25

0mm 500mm 1000mm 1500mm 2000mm 2500mm




## EXISTING EPERON GUERITE SECTION 16C 1.6 1.6

SCALE: 1:25

0mm 500mm 1000mm 1500mm 2000mm 2500mm

NOTE:

1. CONFIRM EXISTING DIMENSIONS, FRAMING, ETC.
2. EPERON GUERITE TO BE REMOVED, REFURBISHED & REINSTALLED SIMILAR TO EXISTING.

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drawing / dessin

EXISTING EPERON GUERITES DEMOLITION PLANS, ELEVATION & SECTIONS

| | | |
|---|---|---|
| designed | RSD | conçu |
| date | MARCH 10, 2017 | |
| drawn | PM, PJN | dessiné |
| date | MARCH 10, 2017 | |
| approved | RSD | approuvé |
| date | MARCH 10, 2017 | |
| Tender | | Soumission |
| PWGSC Project Manager | | Administrateur de projets TPSGC |
| project number | | no. du projet |
| drawing no. | | no. du dessin |

1.6

17/06/07 (15:51) 1545-1.6_B.dwg

PWGSC B1 (2004)

E-DRM/GDD-E:

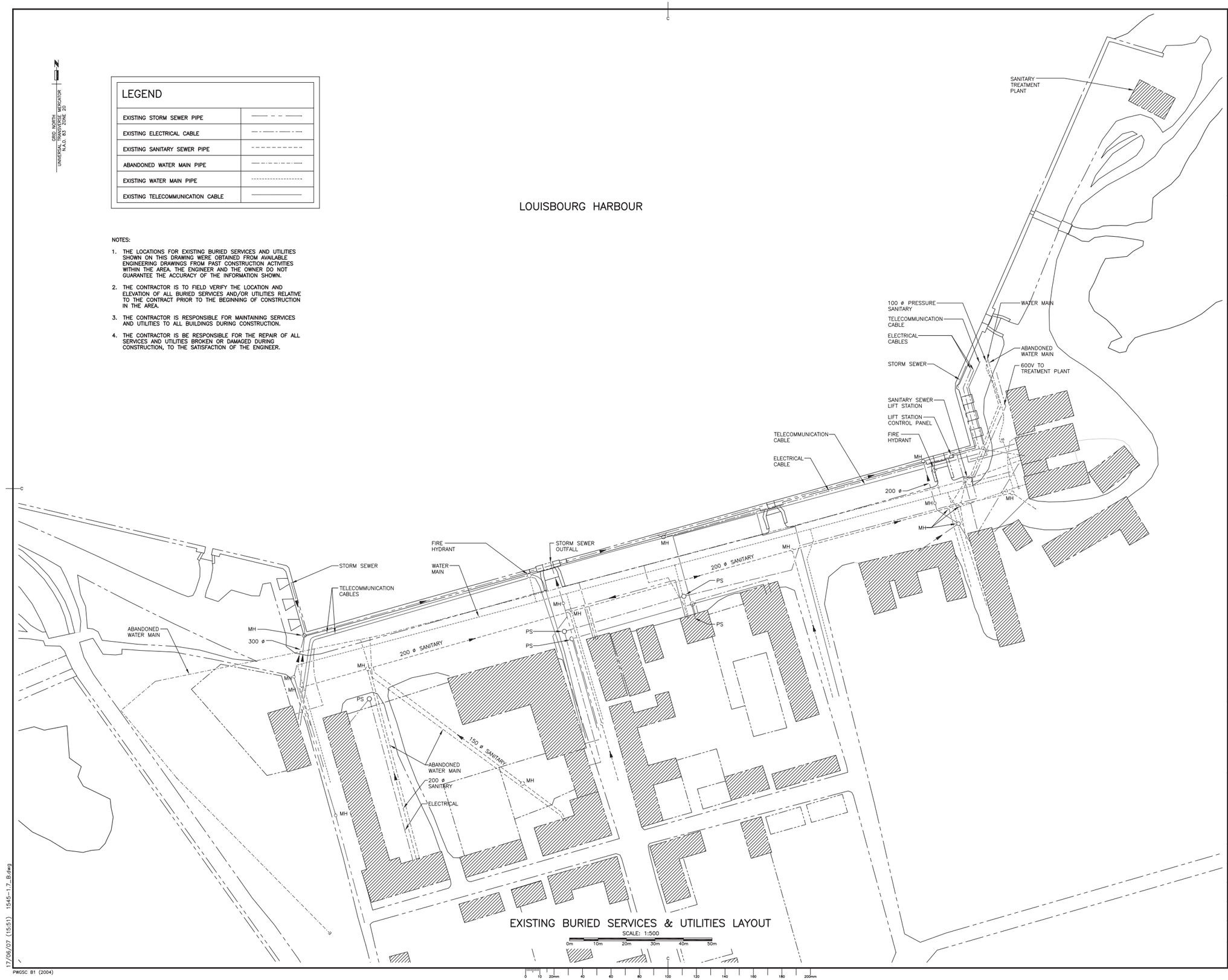
GRID NORTH
UNIVERSAL TRANSVERSE MERCATOR
N.A.D. 83 ZONE 20

| LEGEND | |
|---|---|
| EXISTING STORM SEWER PIPE | |
| EXISTING ELECTRICAL CABLE | |
| EXISTING SANITARY SEWER PIPE | |
| ABANDONED WATER MAIN PIPE | |
| EXISTING WATER MAIN PIPE | |
| EXISTING TELECOMMUNICATION CABLE | |

NOTES:

1. THE LOCATIONS FOR EXISTING BURIED SERVICES AND UTILITIES SHOWN ON THIS DRAWING WERE OBTAINED FROM AVAILABLE ENGINEERING DRAWINGS FROM PAST CONSTRUCTION ACTIVITIES WITHIN THE AREA. THE ENGINEER AND THE OWNER DO NOT GUARANTEE THE ACCURACY OF THE INFORMATION SHOWN.
2. THE CONTRACTOR IS TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL BURIED SERVICES AND/OR UTILITIES RELATIVE TO THE CONTRACT PRIOR TO THE BEGINNING OF CONSTRUCTION IN THE AREA.
3. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SERVICES AND UTILITIES TO ALL BUILDINGS DURING CONSTRUCTION.
4. THE CONTRACTOR IS BE RESPONSIBLE FOR THE REPAIR OF ALL SERVICES AND UTILITIES BROKEN OR DAMAGED DURING CONSTRUCTION, TO THE SATISFACTION OF THE ENGINEER.

LOUISBOURG HARBOUR




EXISTING BURIED SERVICES & UTILITIES LAYOUT

SCALE: 1:500

0m 10m 20m 30m 40m 50m

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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QUAY WALL IMPROVEMENTS
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EXISTING UNDERGROUND SERVICES AND UTILITIES

| | | |
|---|---|---|
| designed | RSD | conçu |
| date | MARCH 10, 2017 | |
| drawn | PM, PJN | dessiné |
| date | MARCH 10, 2017 | |
| approved | RSD | approuvé |
| date | MARCH 10, 2017 | |
| Tender | | Soumission |
| PWGSC Project Manager | | Administrateur de projets TPSGC |
| project number | | no. du projet |
| drawing no. | | no. du dessin |

1.7

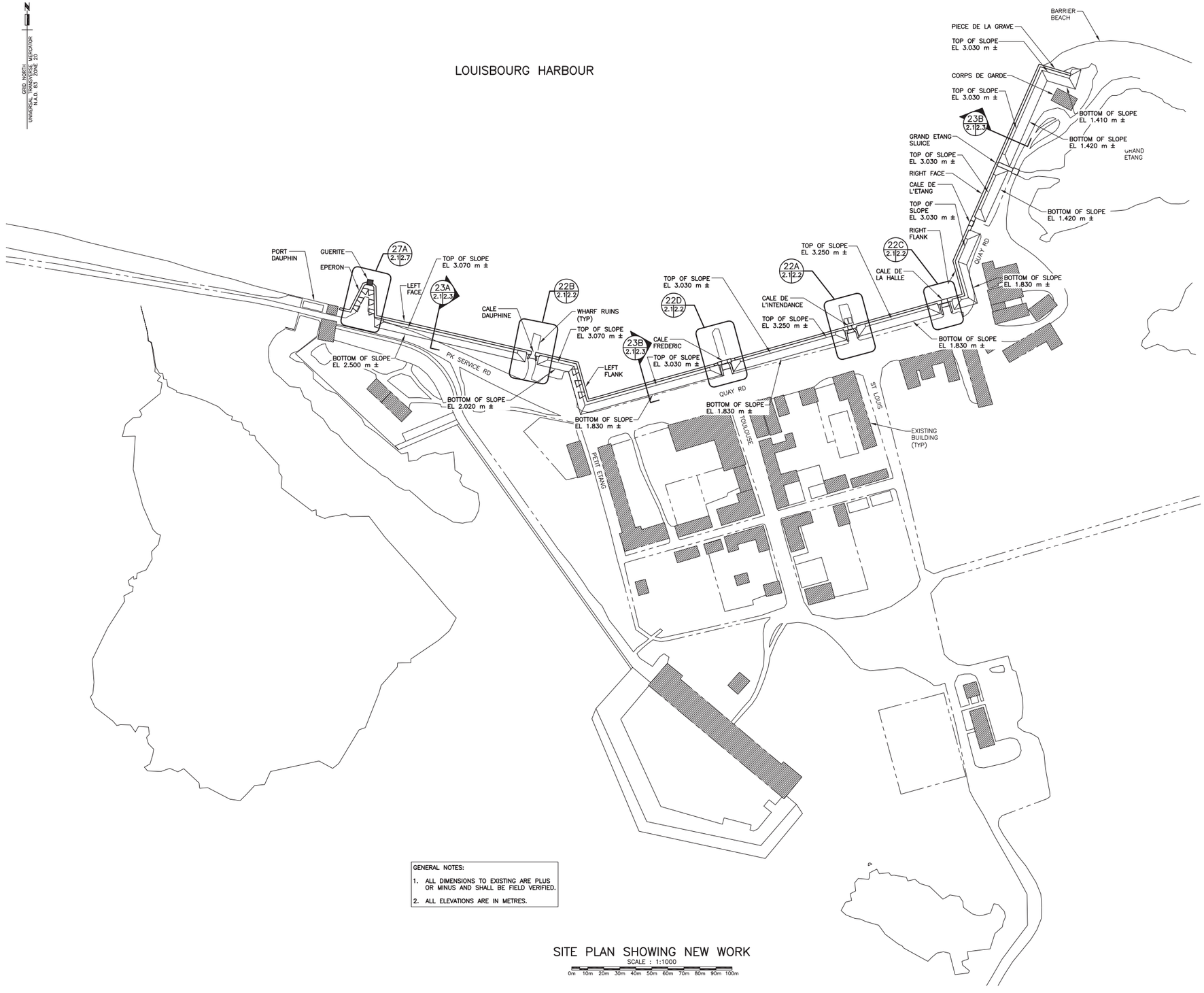
17/06/07 (15:51) 1545-1.7_B.dwg

PWGSC B1 (2004)

E-DRM/CDD-E:

GRID NORTH
UNIVERSAL TRANSVERSE MERCATOR
N.A.D. 83 ZONE 20

# LOUISBOURG HARBOUR




GENERAL NOTES:

1. ALL DIMENSIONS TO EXISTING ARE PLUS OR MINUS AND SHALL BE FIELD VERIFIED.
2. ALL ELEVATIONS ARE IN METRES.

## SITE PLAN SHOWING NEW WORK

SCALE : 1:1000

0m 10m 20m 30m 40m 50m 60m 70m 80m 90m 100m

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GEMTEC EASTERN JV

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QUAY WALL IMPROVEMENTS
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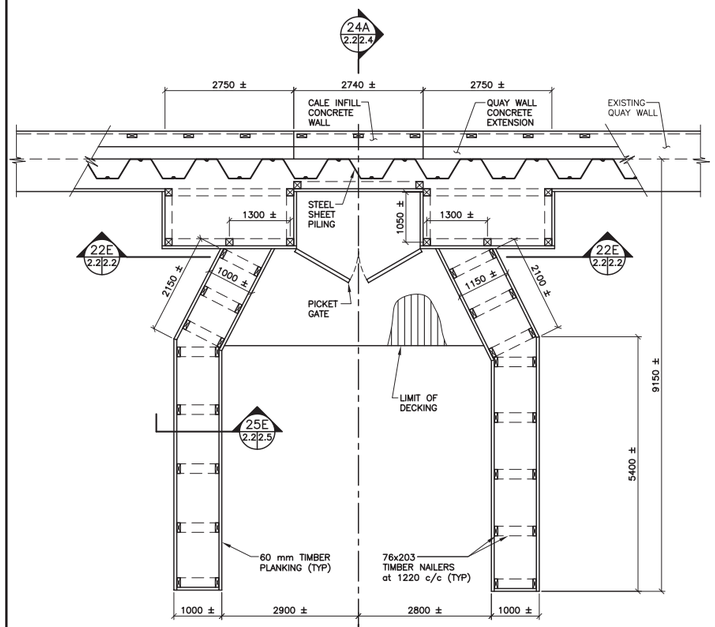
SITE PLAN SHOWING NEW WORK

| | | |
|---|---|---|
| designed | RSD | conçu |
| date | MARCH 10, 2017 | |
| drawn | JKL, PJN | dessiné |
| date | MARCH 10, 2017 | |
| approved | RSD | approuvé |
| date | MARCH 10, 2017 | |
| Tender | | Soumission |
| PWGSC Project Manager | | Administrateur de projets TPSGC |
| project number | | no. du projet |
| | ----- | |
| drawing no. | | no. du dessin |
| | 2.1 | |

17/06/07 (15:51) 1545-2.1_B.dwg

PWGSC B1 (2004)

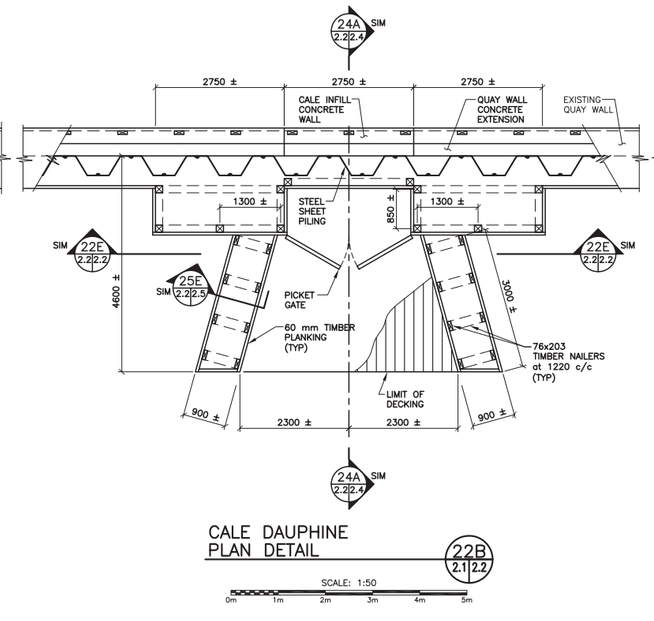
E-DRM/CDD-E:




CALE DE L'INTENDANCE
PLAN DETAIL — 22A 2.1|2.2

SCALE: 1:50

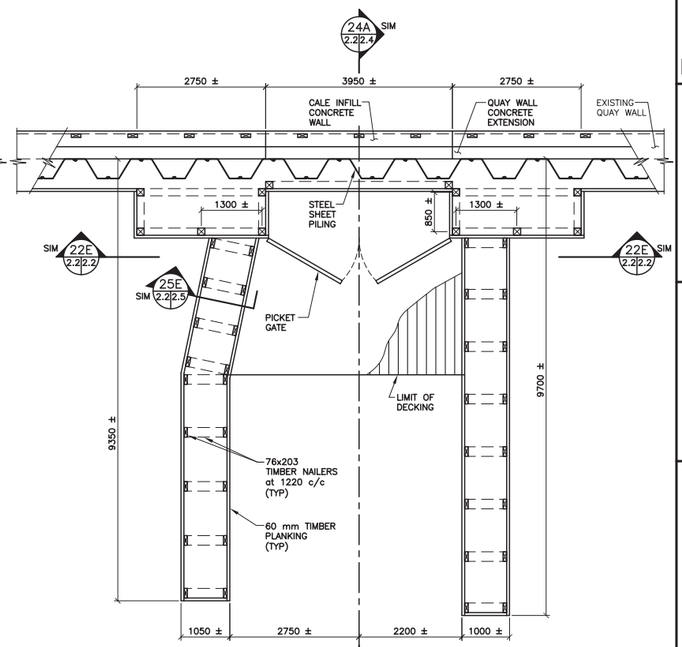
0m 1m 2m 3m 4m 5m




CALE DAUPHINE
PLAN DETAIL — 22B 2.1|2.2

SCALE: 1:50

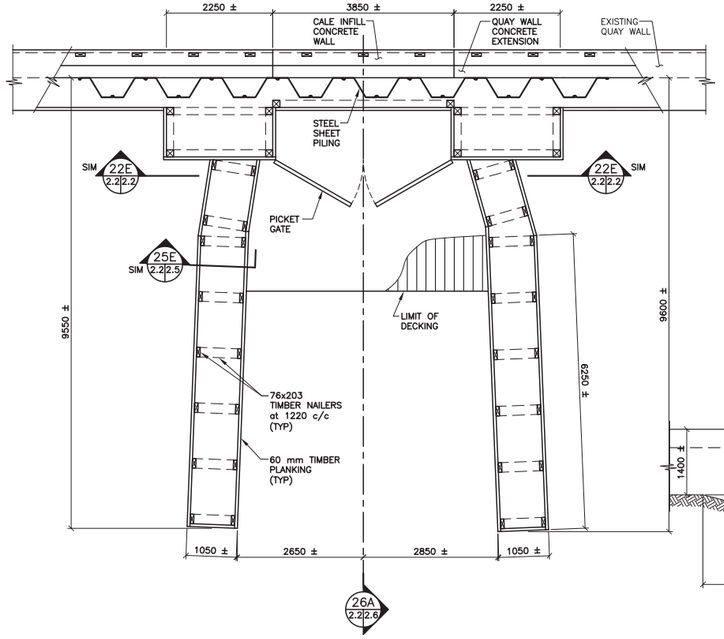
0m 1m 2m 3m 4m 5m




CALE DE LA HALLE
PLAN DETAIL — 22C 2.1|2.2

SCALE: 1:50

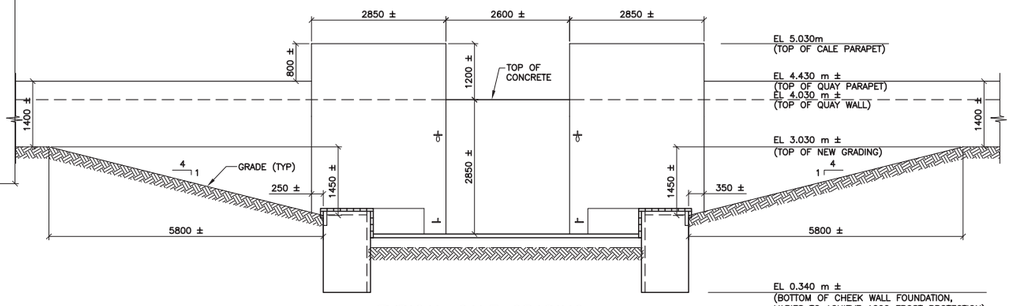
0m 1m 2m 3m 4m 5m




CALE FREDERIC
PLAN DETAIL — 22D 2.1|2.2

SCALE: 1:50

0m 1m 2m 3m 4m 5m




TYPICAL CALE GRADING
SECTION — 22E 2.2|2.2

SCALE: 1:50

0m 1m 2m 3m 4m 5m

**NOTE:**

ELEVATIONS VARY.
SEE PLAN ON DRAWING 2.1

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QUAY WALL IMPROVEMENTS
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NEW CALE
PLAN DETAILS

| | | |
|---|---|---|
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| date | MARCH 10, 2017 | |
| drawn | PM, PJN | dessiné |
| date | MARCH 10, 2017 | |
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| date | MARCH 10, 2017 | |
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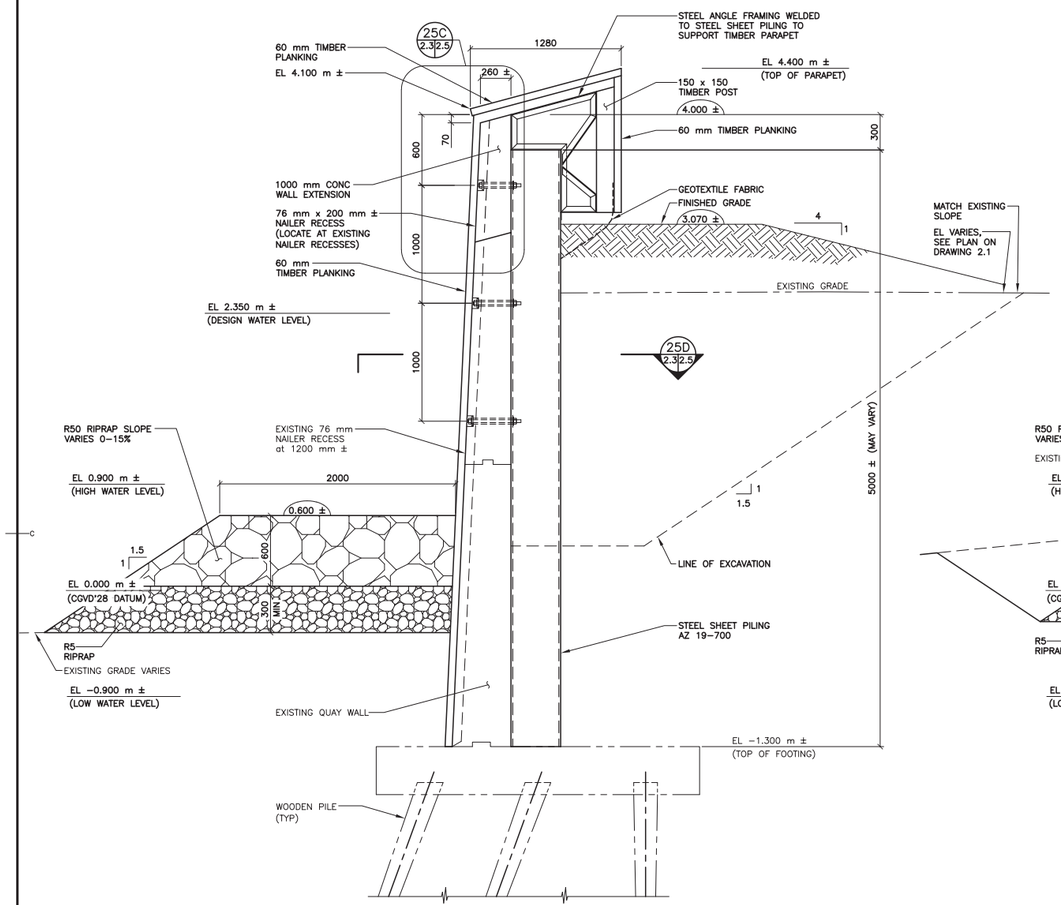
| project number | | no. du projet |
| drawing no. | | no. du dessin |

2.2

17/06/07 (15:52) 1545-2.2_B.dwg

PWGSC B1 (2004)

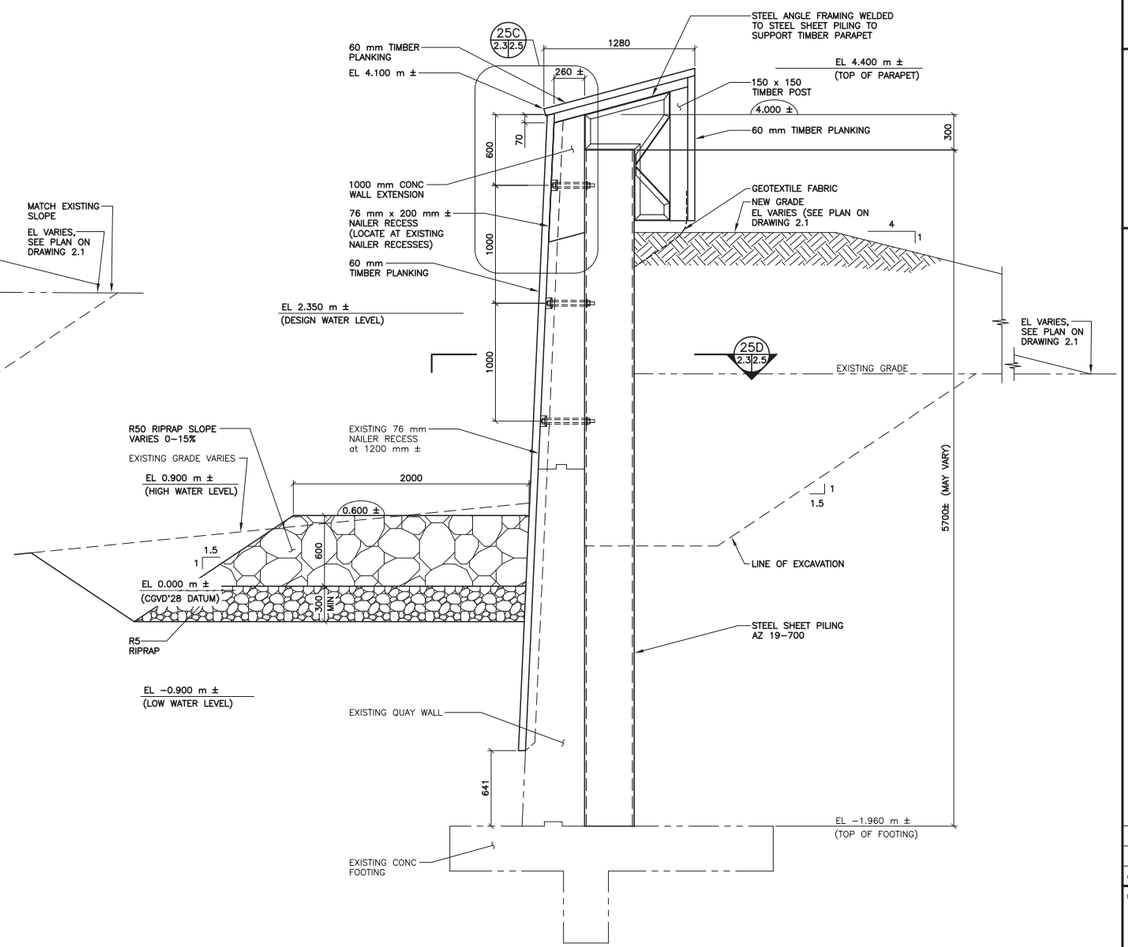
E-DRM/GDD-E:




SECTION 23A 2.1|2.3

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm




SECTION 23B 2.1|2.3

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm

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QUAY WALL IMPROVEMENTS
FORTRESS OF LOUISBOURG
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LOUISBOURG, NS

drawing / dessin

NEW QUAY WALL SECTIONS

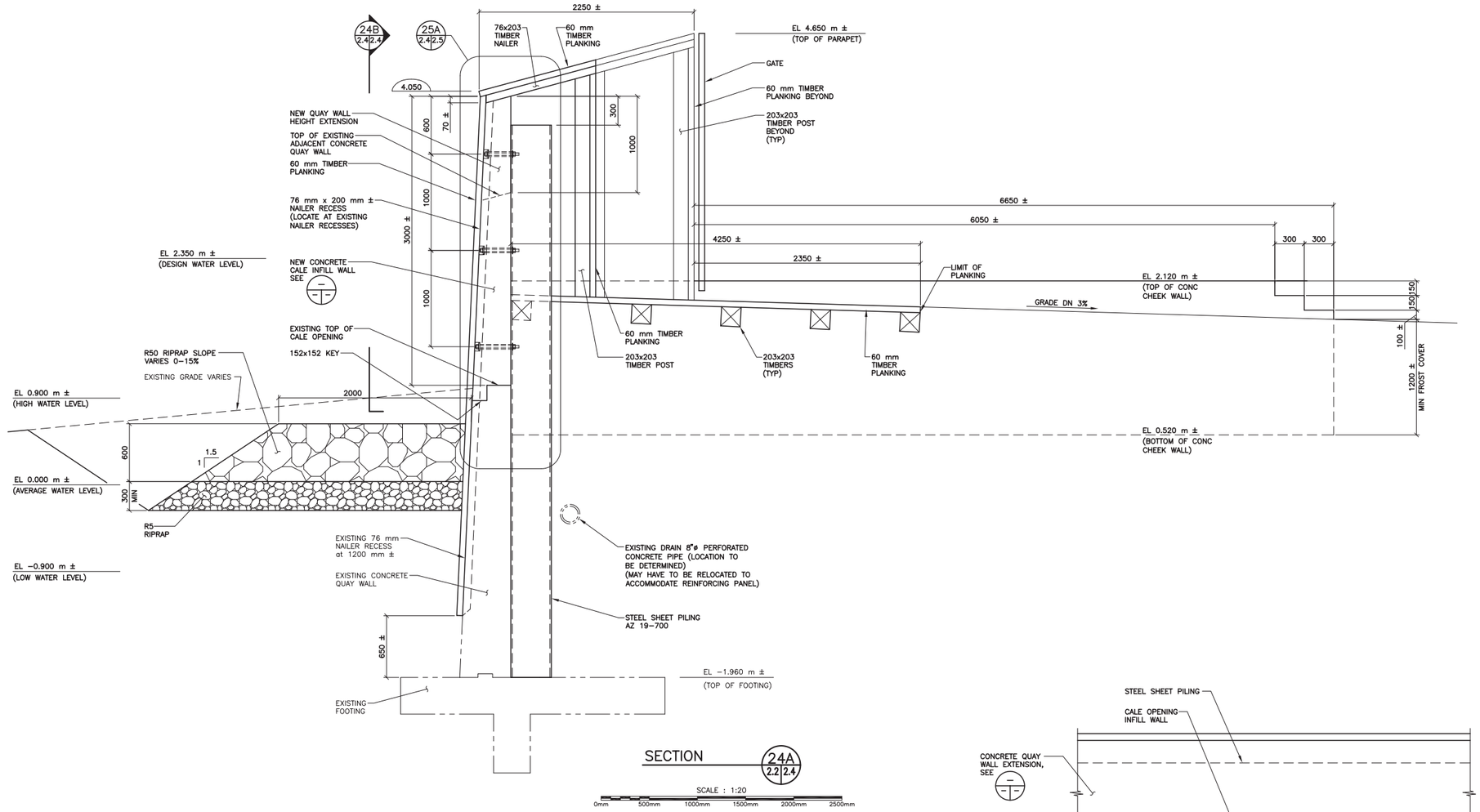
| | | |
|---|---|---|
| designed / conçu | RSD | |
| date | MARCH 10, 2017 | |
| drawn / dessiné | PM, PJN | |
| date | MARCH 10, 2017 | |
| approved / approuvé | RSD | |
| date | MARCH 10, 2017 | |
| Tender / Soumission | | |
| PWGSC Project Manager / Administrateur de projets TPSGC | | |
| project number / no. du projet | | |
| drawing no. / no. du dessin | 2.3 | |

17/06/07 (15:52) 1545-2.3_B.dwg

PWGSC B1 (2004)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

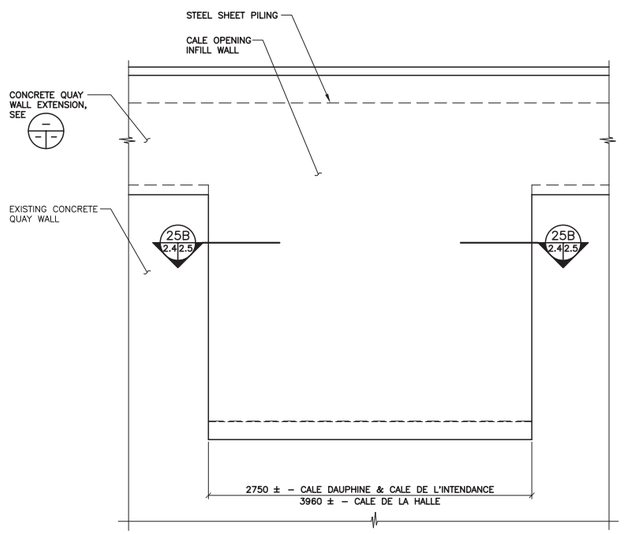
E-DRM/GDD-E:




SECTION 24A 2.2 2.4

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm




DETAIL 24B 2.4 2.4

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm

NOTE:
TIMBER FRAMING NOT SHOWN FOR CLARITY.

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QUAY WALL IMPROVEMENTS
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drawing / dessin

TYPICAL NEW CALE SECTION AND DETAIL

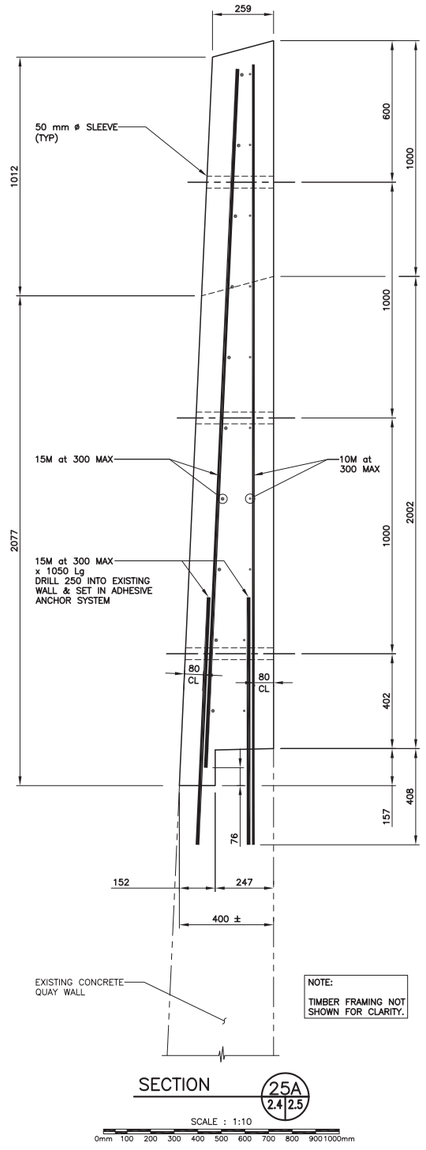
| | | |
|---|---|---|
| designed / conçu | RSD | |
| date | MARCH 10, 2017 | |
| drawn / dessiné | PM, PJN | |
| date | MARCH 10, 2017 | |
| approved / approuvé | RSD | |
| date | MARCH 10, 2017 | |
| Tender / Soumission | | |
| PWGSC Project Manager / Administrateur de projets TPSGC | | |
| project number / no. du projet | ——— | |
| drawing no. / no. du dessin | 2.4 | |

17/06/07 (15:52) 1545-2.4_B.dwg

PWGSC B1 (2004)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

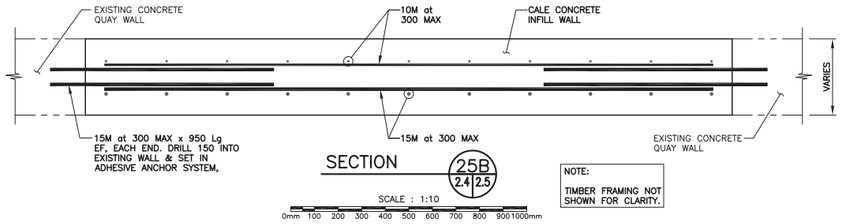
E-DRM/GDD-E:




SECTION 25A (2.4 | 2.5)

SCALE : 1:10

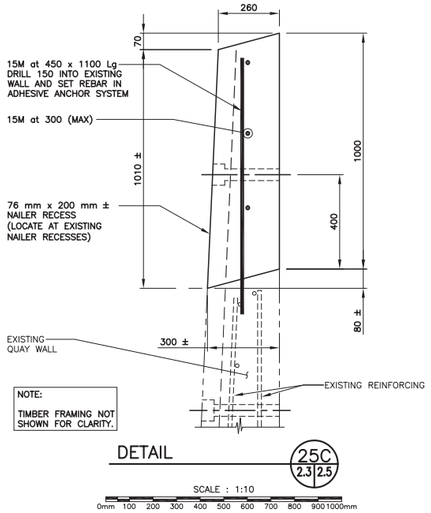
0mm 100 200 300 400 500 600 700 800 900 1000mm




SECTION 25B (2.4 | 2.5)

SCALE : 1:10

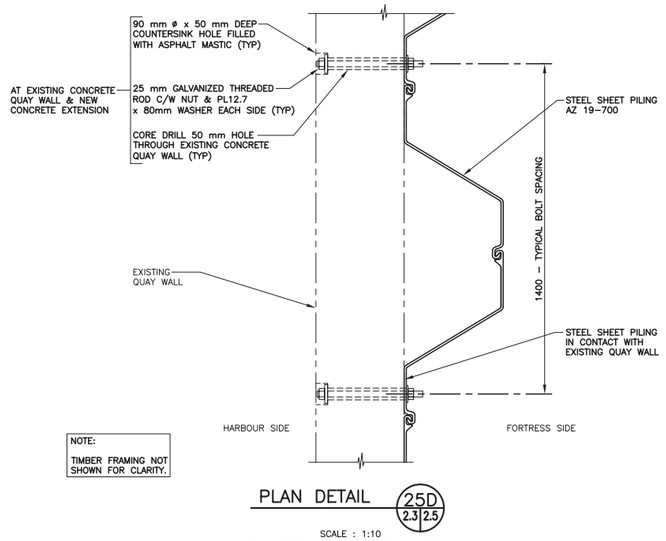
0mm 100 200 300 400 500 600 700 800 900 1000mm




DETAIL 25C (2.3 | 2.5)

SCALE : 1:10

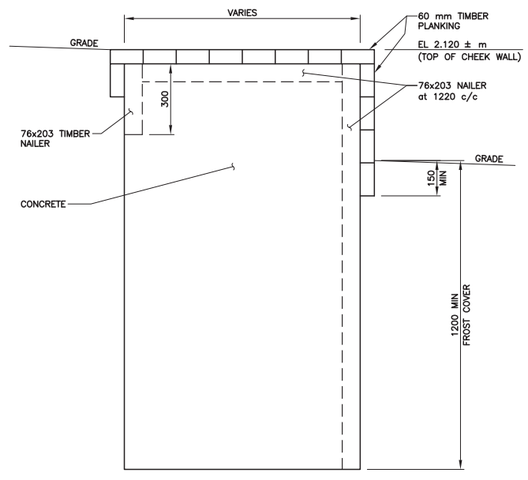
0mm 100 200 300 400 500 600 700 800 900 1000mm




PLAN DETAIL 25D (2.3 | 2.5)

SCALE : 1:10

0mm 100 200 300 400 500 600 700 800 900 1000mm




SECTION 25E (2.2 | 2.5)

SCALE : 1:10

0mm 100 200 300 400 500 600 700 800 900 1000mm

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TYPICAL NEW CALE AND CHEEK WALL PLAN DETAIL, SECTIONS & DETAILS

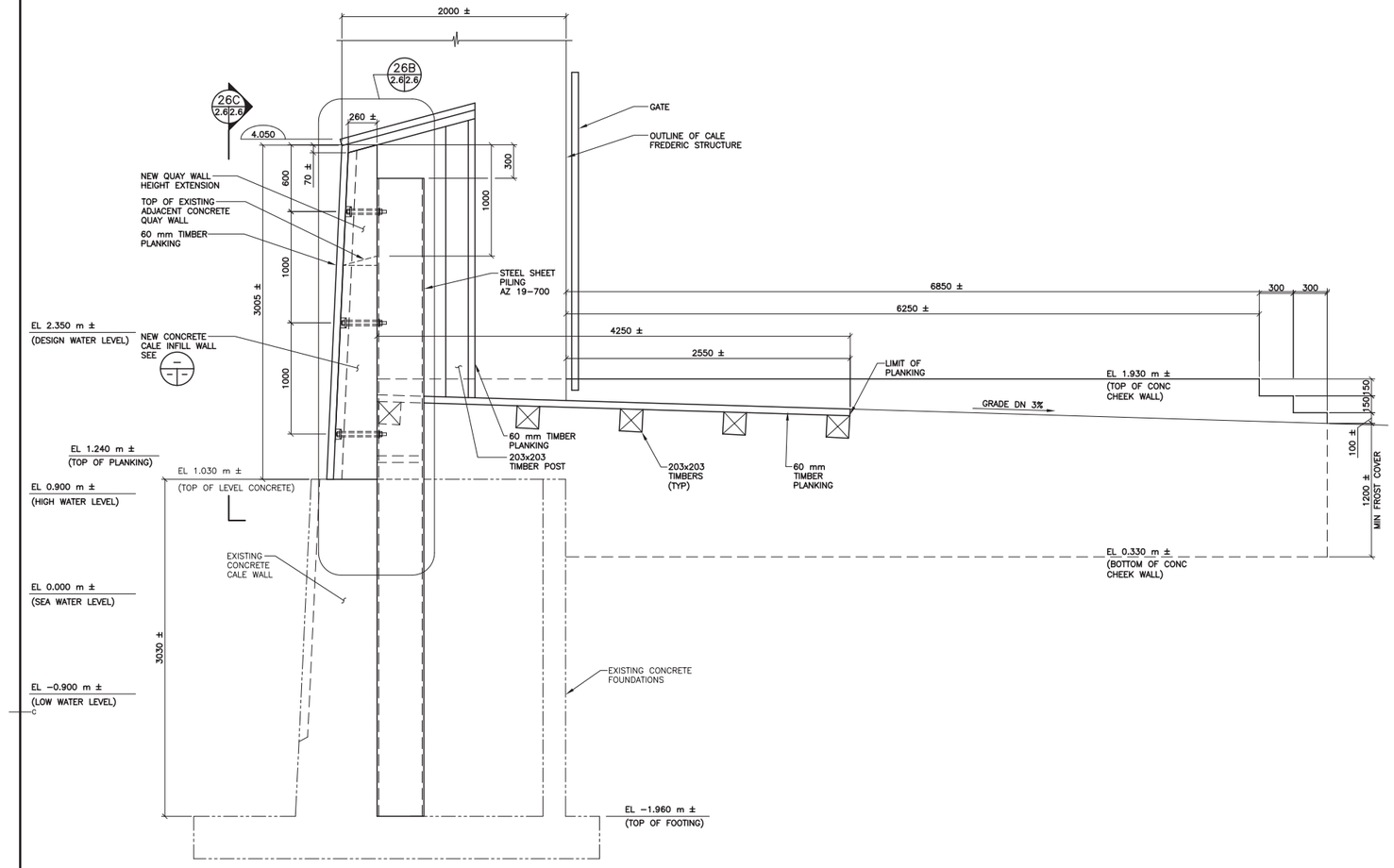
| | | |
|---|---|---|
| designed / conçu | RSD | |
| date | MARCH 10, 2017 | |
| drawn / dessiné | PM, PJN | |
| date | MARCH 10, 2017 | |
| approved / approuvé | RSD | |
| date | MARCH 10, 2017 | |
| Tender | | Soumission |
| PWGSC Project Manager | | Administrateur de projets TPSGC |
| project number | | no. du projet |
| drawing no. | | no. du dessin |

2.5

17/06/07 (15:53) 1545-2.5_B.dwg

PWGSC B1 (2004)

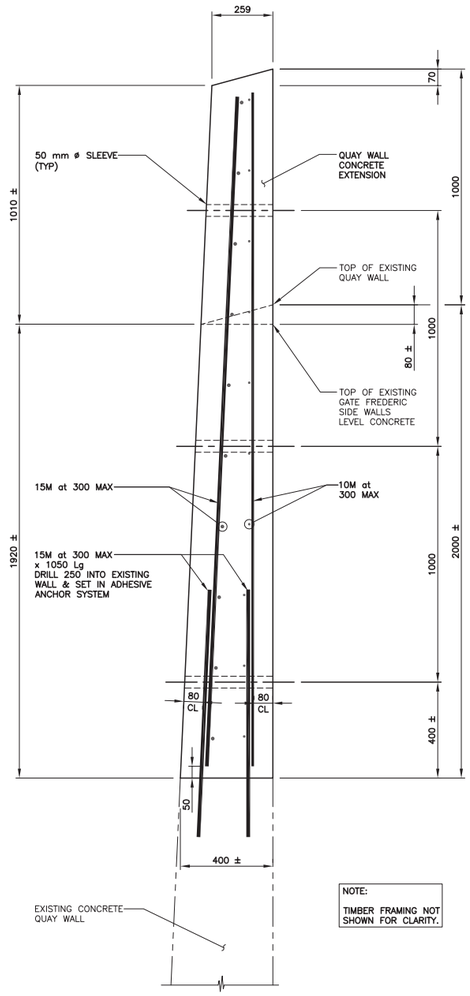
E-DRM/GDD-E:




SECTION 26A 2.2|2.6

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm



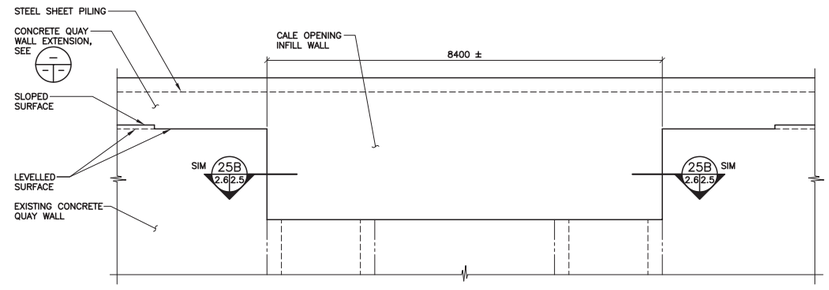

NOTE:

TIMBER FRAMING NOT SHOWN FOR CLARITY.

SECTION 26B 2.6|2.6

SCALE : 1:10

0mm 100 200 300 400 500 600 700 800 900 1000mm




NOTE:

TIMBER FRAMING NOT SHOWN FOR CLARITY.

DETAIL 26C 2.6|2.6

SCALE: 1:50

0m 1m 2m 3m 4m 5m

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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NEW CALE FREDERIC SECTIONS & DETAIL

| | | |
|---|---|---|
| designed / conçu | RSD | |
| date | MARCH 10, 2017 | |
| drawn / dessiné | PM, PJN | |
| date | MARCH 10, 2017 | |
| approved / approuvé | RSD | |
| date | MARCH 10, 2017 | |
| Tender / Soumission | | |
| PWGSC Project Manager / Administrateur de projets TPSGC | | |
| project number / no. du projet | | |
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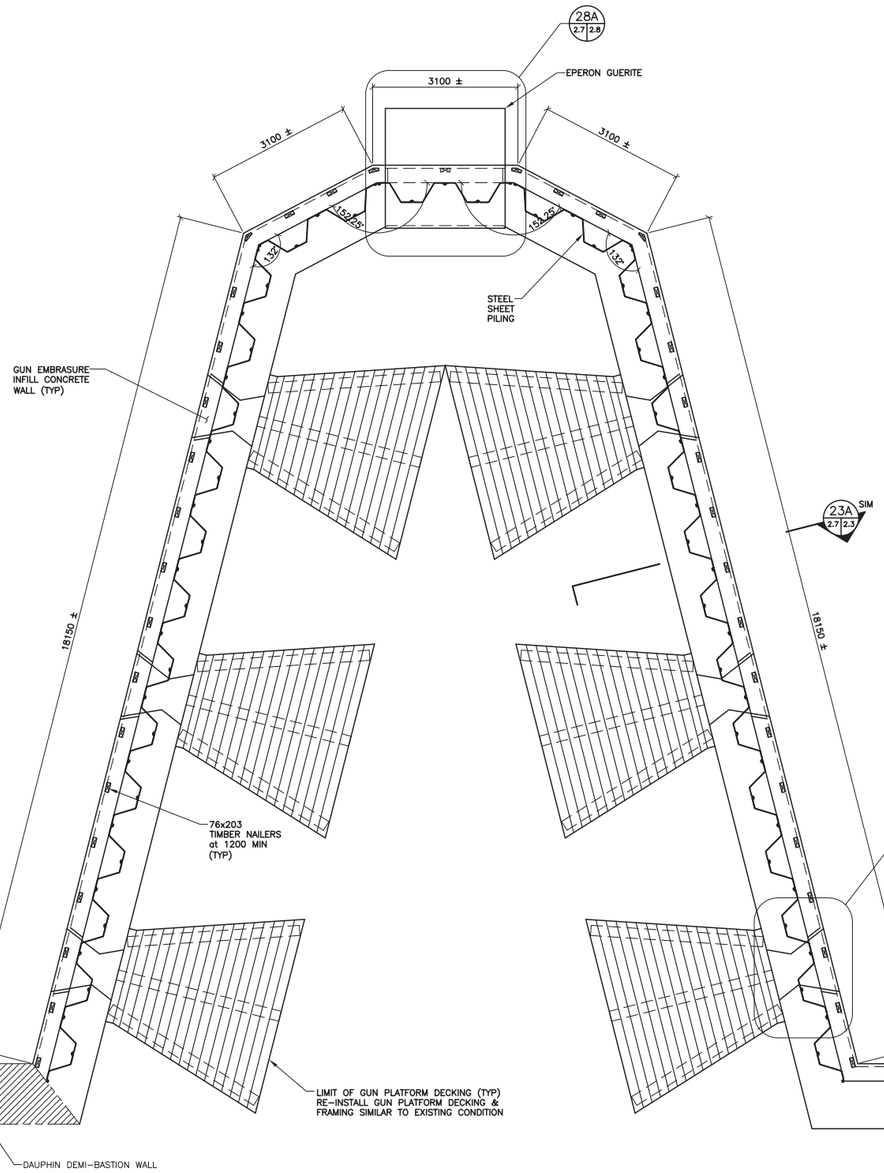
PWGSC B1 (2004)

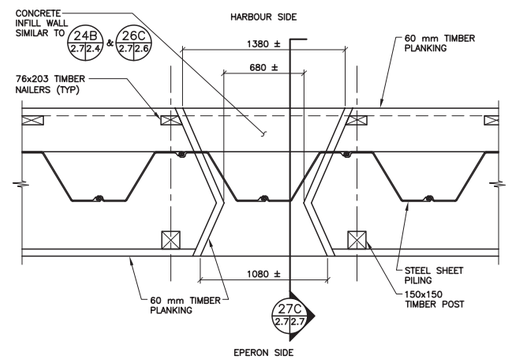
E-DRM/GDD-E:




## PLAN OF EPERON 27A 2.1 2.7

SCALE: 1:50

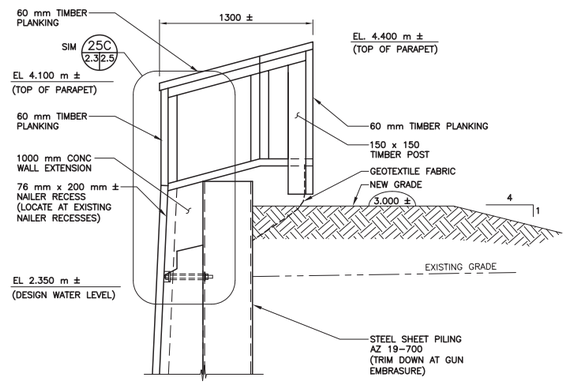
0m 1m 2m 3m 4m 5m




## TYPICAL GUN EMBRASURE LAYOUT PLAN DETAIL 27B 2.3 2.3

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm




## SECTION 27C 2.7 2.7

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm

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GEMTEC EASTERN JV

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NEW EPERON PLAN, SECTION AND DETAIL

| | | |
|---|---|---|
| designed | RSD | conçu |
| date | MARCH 10, 2017 | |
| drawn | PM, PJN | dessiné |
| date | MARCH 10, 2017 | |
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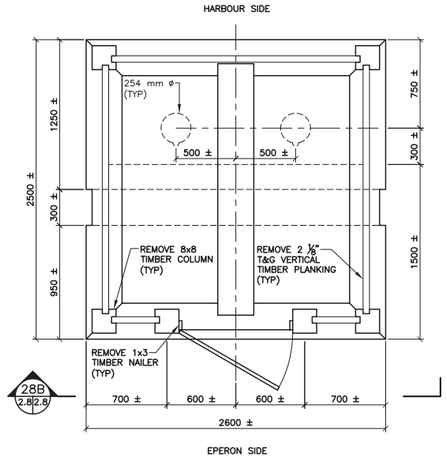
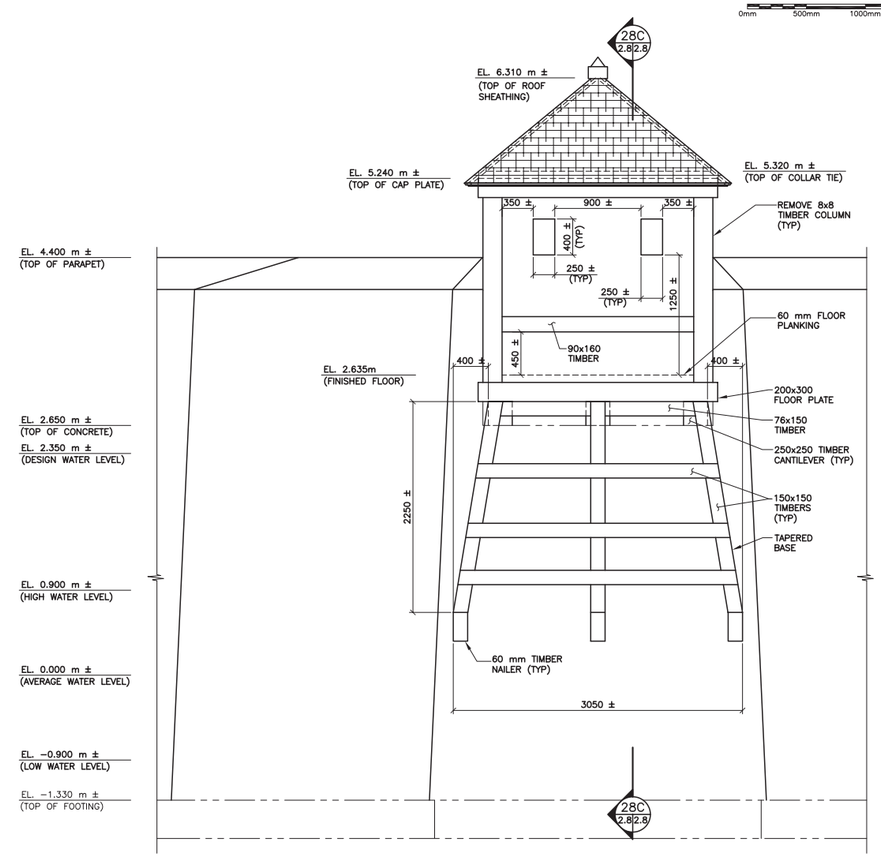



## GUERITE FLOOR FRAMING LAYOUT PLAN DETAIL

28A 2.7 2.8

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm




NOTE:

TAPERED BASE PLANKING NOT SHOWN FOR CLARITY.

## EPERON GUERITE ELEVATION

28B 2.8 2.8

SCALE: 1:25

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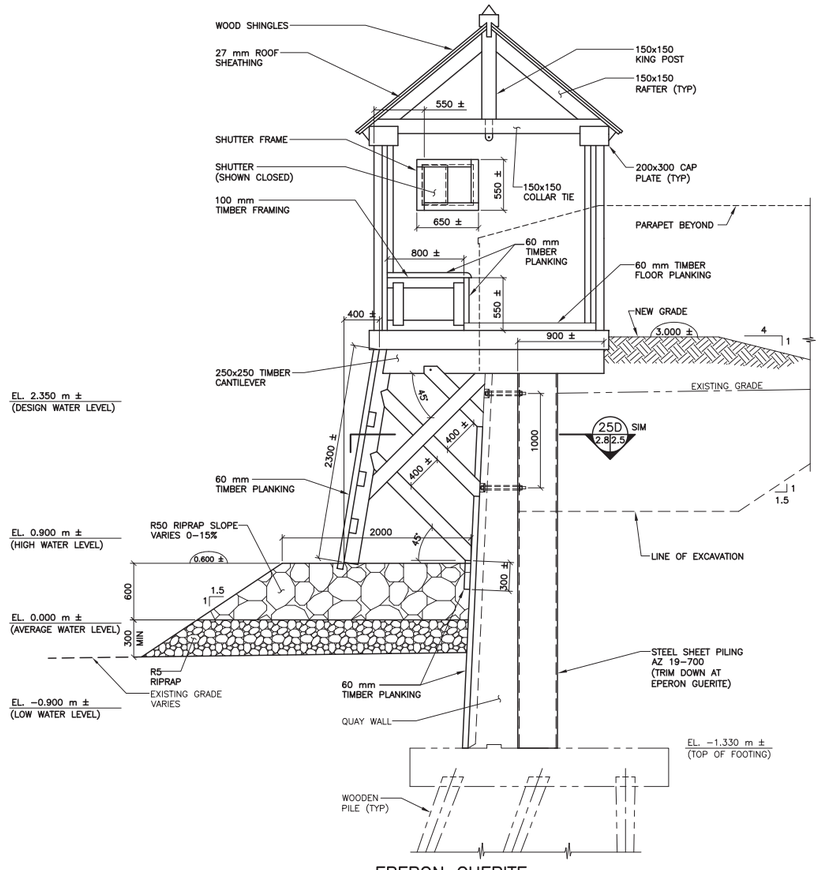


## EPERON GUERITE SECTION

28C 2.8 2.8

SCALE: 1:25

0mm 500mm 1000mm 1500mm 2000mm 2500mm

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NEW EPERON GUERITE PLAN DETAIL, ELEVATION & SECTION

| | | |
|---|---|---|
| designed / conçu | RSD | |
| date | MARCH 10, 2017 | |
| drawn / dessiné | PM, PJN | |
| date | MARCH 10, 2017 | |
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| date | MARCH 10, 2017 | |
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| drawing no. / no. du dessin | 2.8 | |

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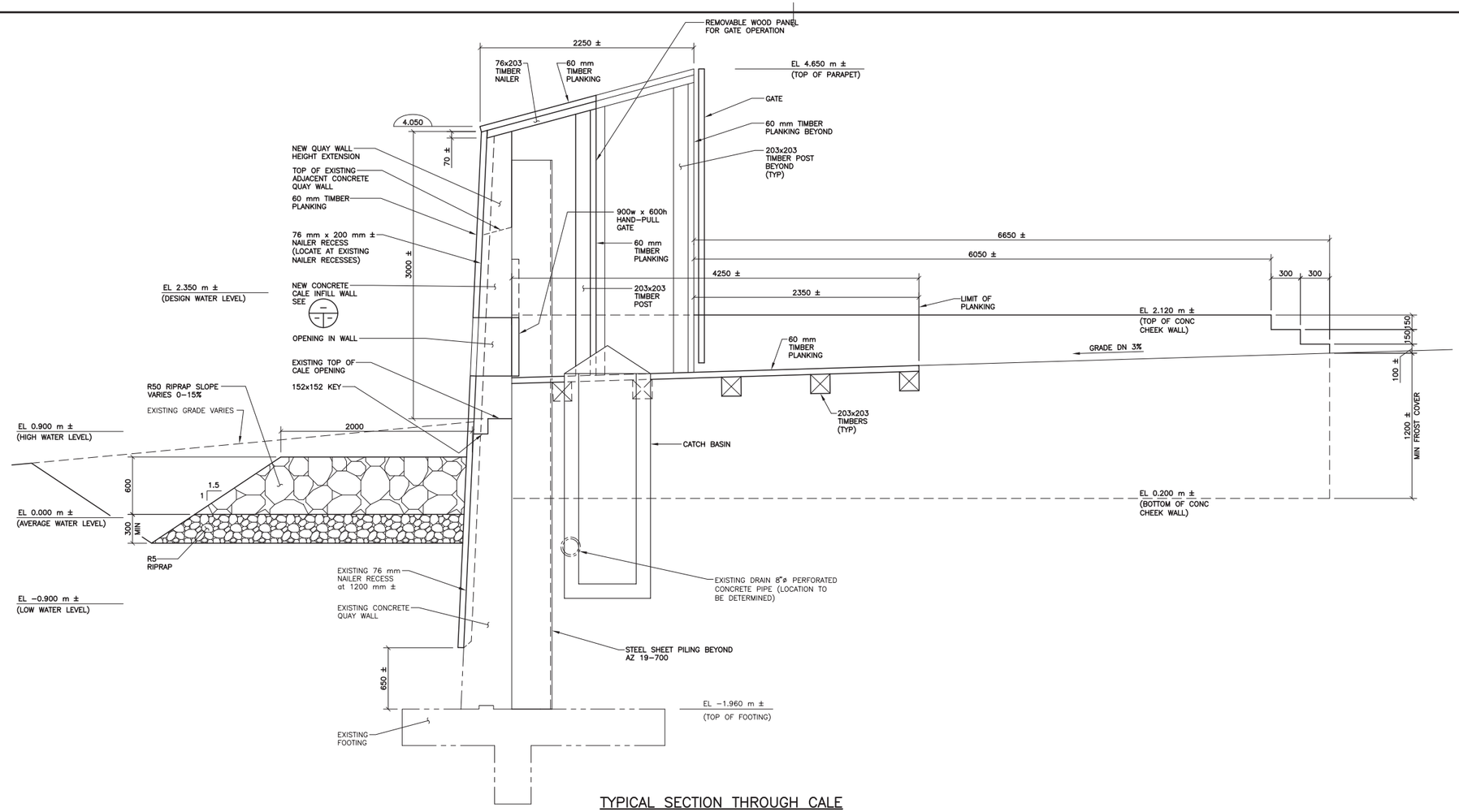
PWGSC B1 (2004)

E-DRM/GDD-E:




## TYPICAL SECTION THROUGH CALE

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm

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CALE SECTION OPTION

| | |
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| designed / conçu | RSD |
| date | MARCH 10, 2017 |
| drawn / dessiné | PM, PJN |
| date | MARCH 10, 2017 |
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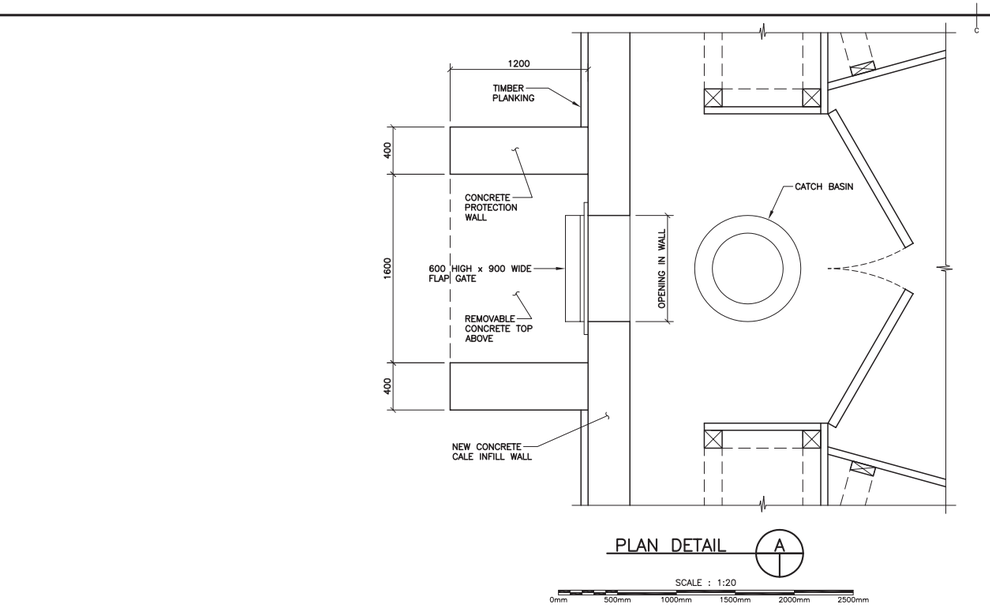
PWGSC B1 (2004)

E-DRM/GDD-E:




PLAN DETAIL A

SCALE : 1:20

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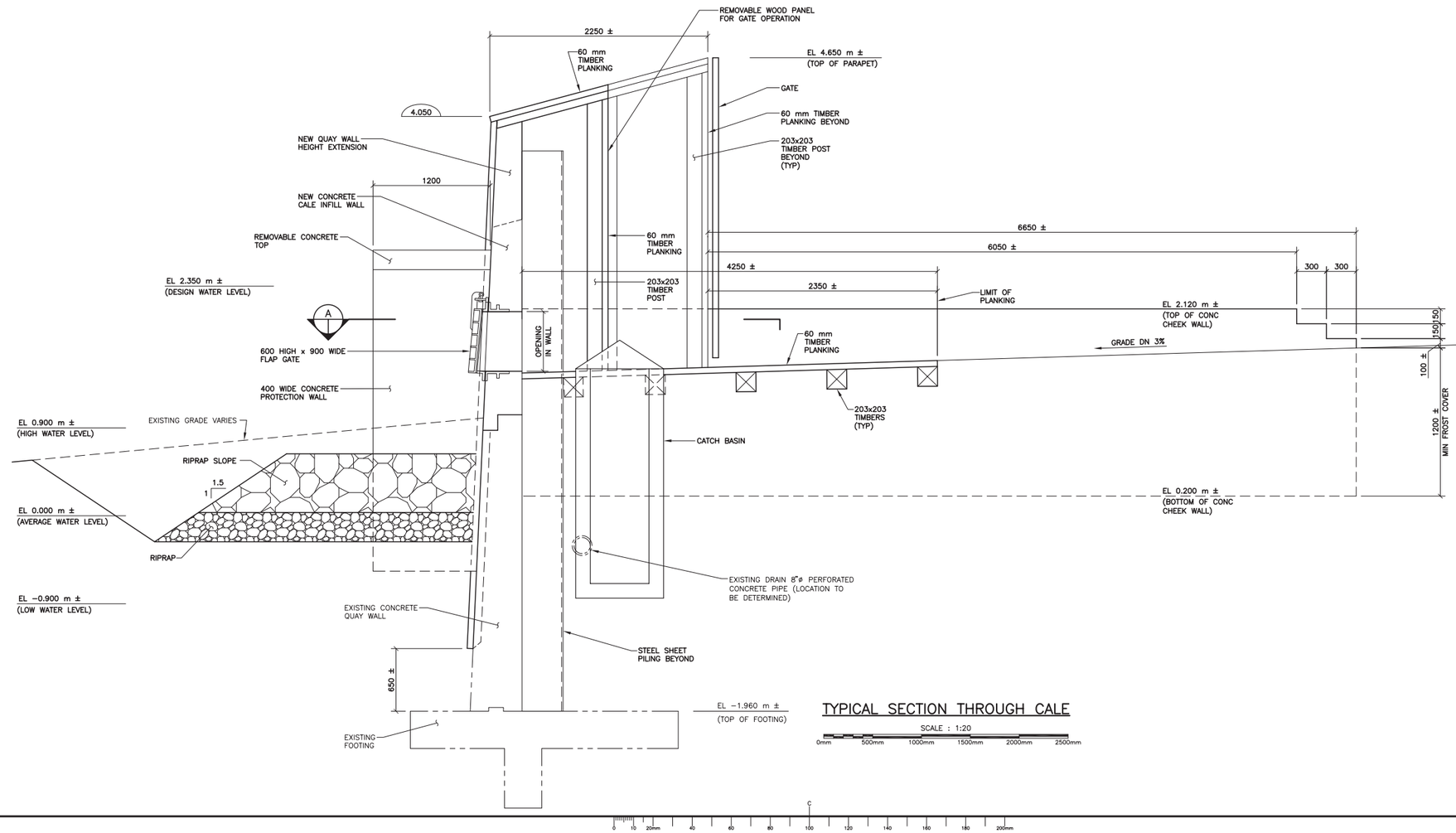


TYPICAL SECTION THROUGH CALE

SCALE : 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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PWGSC B1 (2004)

E-DRM/GDD-E:

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CALE SECTION OPTION
FLAP GATE

| | | |
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| designed | – | conçu |
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| drawn | KCRL | dessiné |
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| approved | RSD | approuvé |
| date | JULY 21, 2017 | |
| Tender | | Soumission |
| PWGSC Project Manager | | Administrateur de projets TPSGC |
| project number | | no. du projet |
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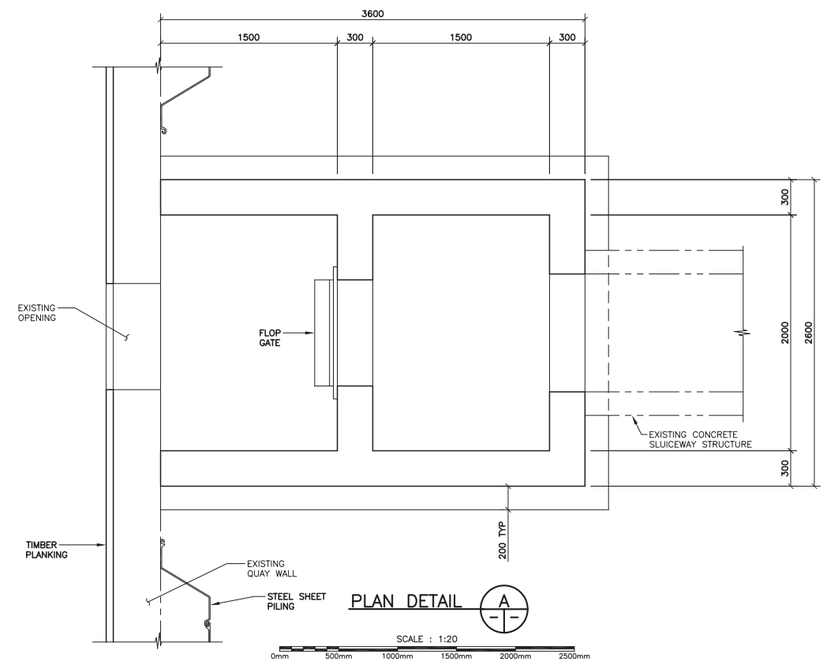
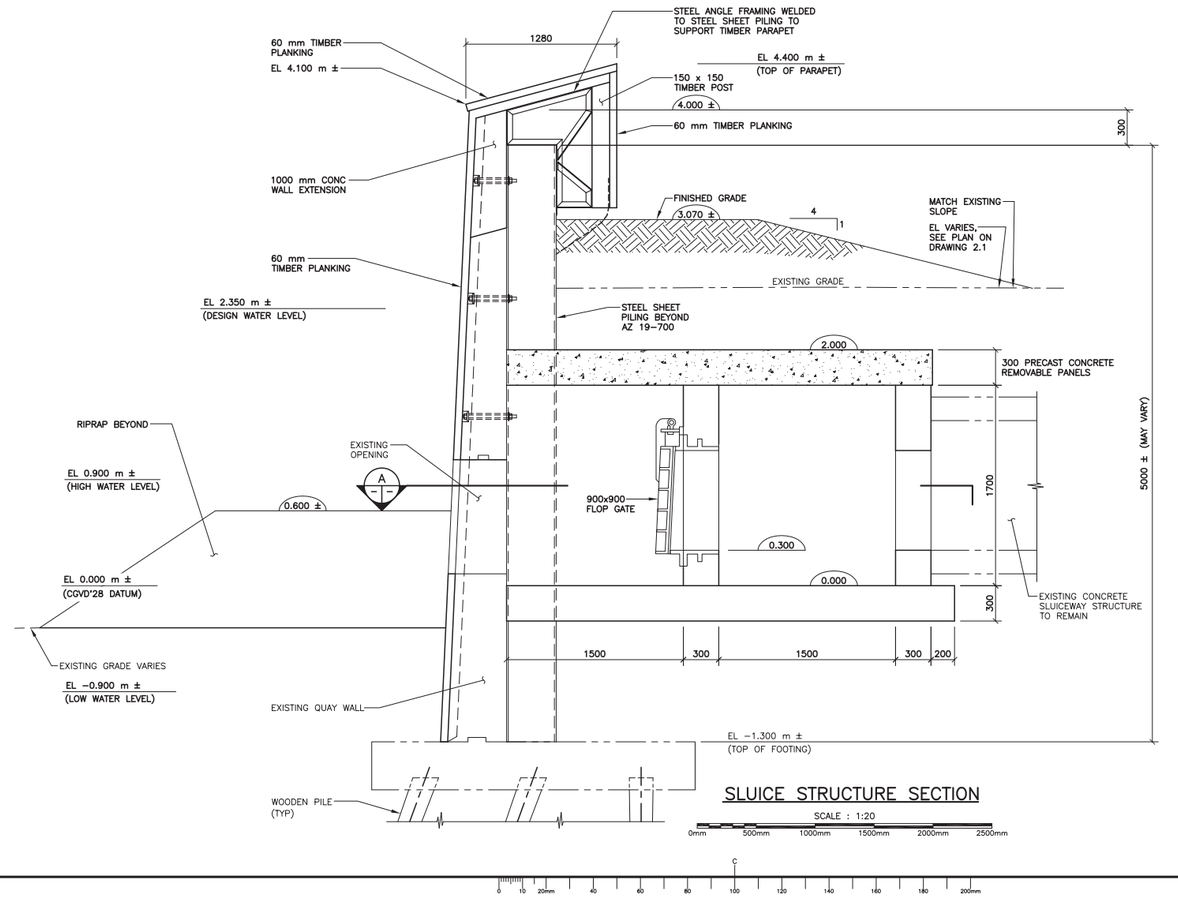
CALE SECTION OPTION

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SLUICE STRUCTURE
PLAN DETAIL
AND SECTION

| | | |
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| designed / conçu | RSD | |
| date | MARCH 10, 2017 | |
| drawn / dessiné | PM, PJN | |
| date | MARCH 10, 2017 | |
| approved / approuvé | RSD | |
| date | MARCH 10, 2017 | |
| Tender / Soumission | | |
| PWGSC Project Manager / Administrateur de projets TPSGC | | |
| project number / no. du projet | | |

drawing no. / no. du dessin

SLUICE STRUCTURE

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PWGSC B1 (2004)

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# Appendix C – ACCDC Report

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada atlantique

# DATA REPORT 5731: folnhs, NS

Prepared 10 January 2017
by J. Churchill, Data Manager

**CONTENTS OF REPORT**




**Map 1**. A 100 km buffer around the study area

## 1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The ACCDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the ACCDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees. URL: www.ACCDC.com.

Upon request and for a fee, the ACCDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the ACCDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

### 1.1 DATA LIST

Included datasets:

| Filename | Contents |
|---|---|
| FolnhsNS_5731ob.xls | All Rare and legally protected *Flora and Fauna* within 5 km of your study area |
| FolnhsNS_5731ob100km.xls | A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area |
| FolnhsNS_5731ma.xls | All *Managed Areas* in your study area |
| FolnhsNS_5731sa.xls | All *Significant Natural Areas* in your study area |
| FolnhsNS_5731bp.xls | Rare and common *Pelagic Birds* in your study area (CWS database) |
| FolnhsNS_5731sf.xls | Rare and common *Saltwater Fish* in your study area (DFO database) |
| FolnhsNS_5731bc.xls | Rare and common *Colonial Birds* in your study area |

### 1.2 RESTRICTIONS

The ACCDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting ACCDC data, recipients assent to the following limits of use:

a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
c) The ACCDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
d) ACCDC data responses are restricted to the data in our Data System at the time of the data request.
e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
f) ACCDC data responses are not to be construed as exhaustive inventories of taxa in an area.
g) The absence of a taxon cannot be inferred by its absence in an ACCDC data response.

### 1.3 ADDITIONAL INFORMATION

The attached file DataDictionary 2.1.pdf provides metadata for the data provided.

Please direct any additional questions about ACCDC data to the following individuals:

**Plants, Lichens, Ranking Methods, All other Inquiries**
Sean Blaney, Senior Scientist, Executive Director
Tel: (506) 364-2658
sblaney@mta.ca

**Animals (Fauna)**
John Klymko, Zoologist
Tel: (506) 364-2660
jklymko@mta.ca

**Plant Communities**
Sarah Robinson , Community Ecologist
Tel: (506) 364-2664
srobinson@mta.ca

**Data Management, GIS**
James Churchill, Data Manager
Tel: (902) 679-6146
jlchurchill@mta.ca

**Billing**
Jean Breau
Tel: (506) 364-2657
jrbreau@mta.ca

Questions on the biology of Federal Species at Risk can be directed to ACCDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Stewart Lusk, Natural Resources: (506) 453-7110.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Sherman Boates, NSDNR: (902) 679-6146. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NSDNR Regional Biologist:

**Western**: Duncan Bayne
(902) 648-3536
Duncan.Bayne@novascotia.ca

**Western**: Donald Sam
(902) 634-7525
Donald.Sam@novascotia.ca

**Central**: Shavonne Meyer
(902) 893-6353
Shavonne.Meyer@novascotia.ca

**Central**: Kimberly George
(902) 893-5630
Kimberly.George@novascotia.ca

**Eastern**: Mark Pulsifer
(902) 863-7523
Mark.Pulsifer@novascotia.ca

**Eastern**: Donald Anderson
(902) 295-3949
Donald.Anderson@novascotia.ca

**Eastern**: Terry Power
(902) 563-3370
Terrance.Power@novascotia.ca

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.

# 2.0 RARE AND ENDANGERED SPECIES

### 2.1 FLORA

A 5 km buffer around the study area contains 81 records of 18 vascular, 4 records of 2 nonvascular flora (Map 2 and attached: *ob.xls).

### 2.2 FAUNA

A 5 km buffer around the study area contains 274 records of 48 vertebrate, 5 records of 2 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Redacted per data use agreement

**Map 2**: Known observations of rare and/or protected flora and fauna within 5 km of the study area.

Redacted per data use agreement

**RESOLUTION**
- 4.7 within 50s of kilometers
- 4.0 within 10s of kilometers
- 3.7 within 5s of kilometers
- 3.0 within kilometers
- 2.7 within 500s of meters
- 2.0 within 100s of meters
- 1.7 within 10s of meters

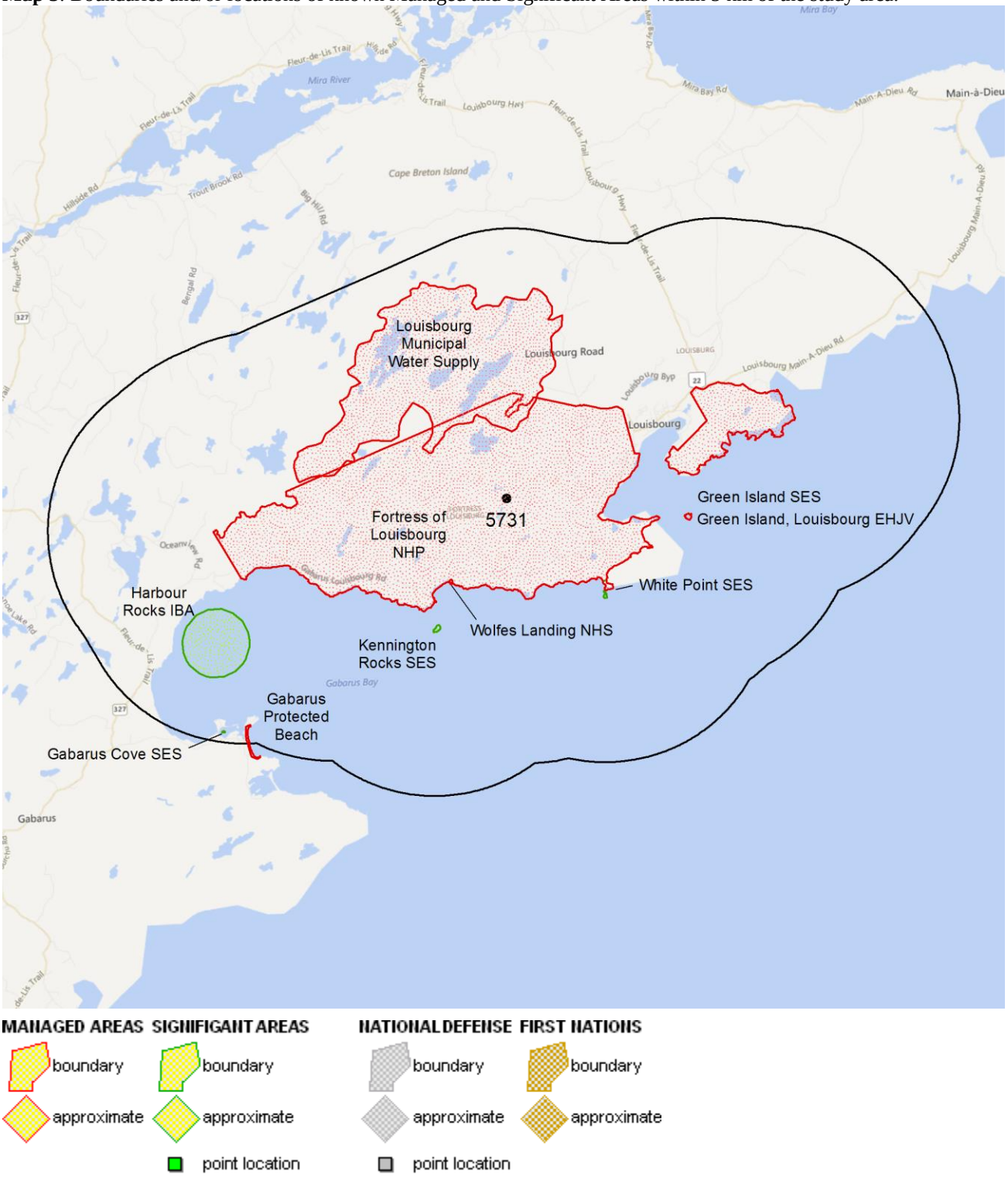
**HIGHER TAXON**
- vertebrate fauna
- invertebrate fauna
- vascular flora
- nonvascular flora

# 3.0 SPECIAL AREAS

### 3.1 MANAGED AREAS
The GIS scan identified 5 managed areas in the vicinity of the study area (Map 3 and attached file: *ma*.xls)

### 3.2 SIGNIFICANT AREAS
The GIS scan identified 6 biologically significant sites in the vicinity of the study area (Map 3 and attached file: *sa*.xls)

**Map 3**: Boundaries and/or locations of known Managed and Significant Areas within 5 km of the study area.



# 4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding "location-sensitive" species, section 4.3) within the 5 km-buffered area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files *ob.xls/*ob.shp only.

## 4.1 FLORA

| | Scientific *Name* | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) |
|---|---|---|---|---|---|---|---|---|---|
| N | *Racodium rupestre* | Rockhair Lichen | | | | S2S3 | 5 Undetermined | 2 | 12.4 ± 0.0 |
| N | *Platismatia norvegica* | Oldgrowth Rag Lichen | | | | S3 | 4 Secure | 2 | 12.0 ± 0.0 |
| P | *Carex rariflora* | Loose-flowered Alpine Sedge | | | | S1 | 2 May Be At Risk | 1 | 5.5 ± 5.0 |
| P | *Halenia deflexa ssp. brentoniana* | Spurred Gentian | | | | S1? | 5 Undetermined | 2 | 4.0 ± 0.0 |
| P | *Cornus suecica* | Swedish Bunchberry | | | | S1S2 | 3 Sensitive | 17 | 12.1 ± 0.0 |
| P | *Carex livida var. radicaulis* | Livid Sedge | | | | S1S2 | 2 May Be At Risk | 4 | 2.5 ± 0.0 |
| P | *Juncus bulbosus* | Bulbous Rush | | | | S1S2 | 5 Undetermined | 8 | 2.5 ± 0.0 |
| P | *Sparganium hyperboreum* | Northern Burreed | | | | S1S2 | 3 Sensitive | 5 | 2.5 ± 0.0 |
| P | *Stellaria humifusa* | Saltmarsh Starwort | | | | S2 | 3 Sensitive | 1 | 5.3 ± 0.0 |
| P | *Galium labradoricum* | Labrador Bedstraw | | | | S2 | 3 Sensitive | 8 | 10.0 ± 0.0 |
| P | *Juncus stygius ssp. americanus* | Moor Rush | | | | S2 | 3 Sensitive | 3 | 2.7 ± 0.0 |
| P | *Halenia deflexa* | Spurred Gentian | | | | S2S3 | 3 Sensitive | 8 | 2.5 ± 5.0 |
| P | *Vaccinium boreale* | Northern Blueberry | | | | S3 | 3 Sensitive | 10 | 2.4 ± 10.0 |
| P | *Vaccinium uliginosum* | Alpine Bilberry | | | | S3 | 3 Sensitive | 4 | 11.6 ± 0.0 |
| P | *Juncus subcaudatus var. planisepalus* | Woods-Rush | | | | S3 | 3 Sensitive | 1 | 3.0 ± 2.0 |
| P | *Sparganium natans* | Small Burreed | | | | S3 | 4 Secure | 1 | 4.0 ± 0.0 |
| P | *Isoetes acadiensis* | Acadian Quillwort | | | | S3 | 3 Sensitive | 3 | 1.9 ± 0.0 |
| P | *Lycopodium sitchense* | Sitka Clubmoss | | | | S3 | 4 Secure | 1 | 3.0 ± 1.0 |
| P | *Atriplex franktonii* | Frankton's Saltbush | | | | S3S4 | 4 Secure | 2 | 4.0 ± 0.0 |
| P | *Schizaea pusilla* | Little Curlygrass Fern | | | | S3S4 | 4 Secure | 2 | 2.7 ± 0.0 |

## 4.2 FAUNA

| | Scientific *Name* | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) |
|---|---|---|---|---|---|---|---|---|---|
| A | *Charadrius melodus melodus* | Piping Plover melodus ssp | Endangered | Endangered | Endangered | S1B | 1 At Risk | 2 | 3.0 ± 0.0 |
| A | *Chaetura pelagica* | Chimney Swift | Threatened | Threatened | Endangered | S2B,S1M | 1 At Risk | 1 | 10.5 ± 7.0 |
| A | *Chordeiles minor* | Common Nighthawk | Threatened | Threatened | Threatened | S2S3B | 1 At Risk | 1 | 10.5 ± 7.0 |
| A | *Hirundo rustica* | Barn Swallow | Threatened | | Endangered | S3B | 1 At Risk | 6 | 10.5 ± 0.0 |
| A | *Contopus cooperi* | Olive-sided Flycatcher | Threatened | Threatened | Threatened | S3B | 1 At Risk | 3 | 2.7 ± 5.0 |
| A | *Euphagus carolinus* | Rusty Blackbird | Special Concern | Special Concern | Endangered | S2B | 2 May Be At Risk | 1 | 10.5 ± 7.0 |
| A | *Sterna hirundo* | Common Tern | Not At Risk | | | S3B | 3 Sensitive | 7 | 10.5 ± 7.0 |
| A | *Accipiter gentilis* | Northern Goshawk | Not At Risk | | | S3S4 | 4 Secure | 2 | 2.7 ± 5.0 |
| A | *Circus cyaneus* | Northern Harrier | Not At Risk | | | S3S4B | 4 Secure | 4 | 2.7 ± 5.0 |
| A | *Salmo salar* | Atlantic Salmon | | | | S1 | 2 May Be At Risk | 2 | 3.1 ± 0.0 |
| A | *Mimus polyglottos* | Northern Mockingbird | | | | S1B | 4 Secure | 1 | 10.5 ± 7.0 |
| A | *Calidris minutilla* | Least Sandpiper | | | | S1B,S3M | 4 Secure | 2 | 3.4 ± 0.0 |
| A | *Charadrius semipalmatus* | Semipalmated Plover | | | | S1B,S3S4M | 4 Secure | 2 | 3.4 ± 0.0 |
| A | *Dendroica tigrina* | Cape May Warbler | | | | S2B | 3 Sensitive | 1 | 10.5 ± 7.0 |
| A | *Phalacrocorax carbo* | Great Cormorant | | | | S2S3 | 3 Sensitive | 28 | 10.5 ± 7.0 |
| A | *Carduelis pinus* | Pine Siskin | | | | S2S3 | 3 Sensitive | 5 | 10.5 ± 7.0 |
| A | *Tringa semipalmata* | Willet | | | | S2S3B | 2 May Be At Risk | 1 | 5.7 ± 7.0 |
| A | *Petrochelidon pyrrhonota* | Cliff Swallow | | | | S2S3B | 2 May Be At Risk | 6 | 10.5 ± 7.0 |
| A | *Pinicola enucleator* | Pine Grosbeak | | | | S2S3B,S5N | 2 May Be At Risk | 2 | 5.7 ± 7.0 |
| A | *Numenius phaeopus hudsonicus* | Hudsonian Whimbrel | | | | S2S3M | 3 Sensitive | 1 | 3.4 ± 0.0 |
| A | *Perisoreus canadensis* | Gray Jay | | | | S3 | 3 Sensitive | 6 | 10.5 ± 7.0 |

| | Scientific *Name* | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) |
|---|---|---|---|---|---|---|---|---|---|
| A | *Poecile hudsonica* | Boreal Chickadee | | | | S3 | 3 Sensitive | 14 | 10.0 ± 0.0 |
| A | *Sitta canadensis* | Red-breasted Nuthatch | | | | S3 | 4 Secure | 17 | 10.0 ± 0.0 |
| A | *Alosa pseudoharengus* | Alewife | | | | S3 | 3 Sensitive | 2 | 3.1 ± 0.0 |
| A | *Salvelinus fontinalis* | Brook Trout | | | | S3 | 3 Sensitive | 2 | 3.1 ± 0.0 |
| A | *Calidris maritima* | Purple Sandpiper | | | | S3?N | 3 Sensitive | 1 | 7.9 ± 10.0 |
| A | *Falco sparverius* | American Kestrel | | | | S3B | 4 Secure | 3 | 4.6 ± 5.0 |
| A | *Charadrius vociferus* | Killdeer | | | | S3B | 3 Sensitive | 1 | 10.5 ± 7.0 |
| A | *Gallinago delicata* | Wilson's Snipe | | | | S3B | 3 Sensitive | 3 | 2.7 ± 5.0 |
| A | *Sterna paradisaea* | Arctic Tern | | | | S3B | 2 May Be At Risk | 2 | 4.3 ± 0.0 |
| A | *Tringa melanoleuca* | Greater Yellowlegs | | | | S3B,S3S4M | 3 Sensitive | 5 | 2.9 ± 0.0 |
| A | *Rissa tridactyla* | Black-legged Kittiwake | | | | S3B,S5N | 3 Sensitive | 8 | 10.5 ± 7.0 |
| A | *Tringa flavipes* | Lesser Yellowlegs | | | | S3M | 4 Secure | 2 | 3.4 ± 0.0 |
| A | *Arenaria interpres* | Ruddy Turnstone | | | | S3M | 4 Secure | 1 | 3.4 ± 0.0 |
| A | *Calidris pusilla* | Semipalmated Sandpiper | | | | S3M | 3 Sensitive | 2 | 3.4 ± 0.0 |
| A | *Calidris fuscicollis* | White-rumped Sandpiper | | | | S3M | 4 Secure | 2 | 3.4 ± 0.0 |
| A | *Calidris alba* | Sanderling | | | | S3M,S2N | 4 Secure | 1 | 4.5 ± 0.0 |
| A | *Somateria mollissima* | Common Eider | | | | S3S4 | 4 Secure | 7 | 12.6 ± 0.0 |
| A | *Actitis macularius* | Spotted Sandpiper | | | | S3S4B | 3 Sensitive | 9 | 10.5 ± 0.0 |
| A | *Empidonax flaviventris* | Yellow-bellied Flycatcher | | | | S3S4B | 3 Sensitive | 19 | 11.0 ± 0.0 |
| A | *Regulus calendula* | Ruby-crowned Kinglet | | | | S3S4B | 3 Sensitive | 45 | 10.0 ± 0.0 |
| A | *Catharus ustulatus* | Swainson's Thrush | | | | S3S4B | 4 Secure | 22 | 10.0 ± 0.0 |
| A | *Vermivora peregrina* | Tennessee Warbler | | | | S3S4B | 3 Sensitive | 4 | 2.0 ± 0.0 |
| A | *Dendroica castanea* | Bay-breasted Warbler | | | | S3S4B | 3 Sensitive | 2 | 5.7 ± 7.0 |
| A | *Dendroica striata* | Blackpoll Warbler | | | | S3S4B | 3 Sensitive | 5 | 10.5 ± 7.0 |
| A | *Passerella iliaca* | Fox Sparrow | | | | S3S4B | 4 Secure | 8 | 2.7 ± 5.0 |
| A | *Mergus serrator* | Red-breasted Merganser | | | | S3S4B,S5N | 4 Secure | 2 | 4.6 ± 5.0 |
| A | *Morus bassanus* | Northern Gannet | | | | SHB,S5M | 4 Secure | 1 | 12.6 ± 0.0 |
| I | *Bombus terricola* | Yellow-banded Bumblebee | Special Concern | | | S3 | 3 Sensitive | 1 | 9.3 ± 0.0 |
| I | *Margaritifera margaritifera* | Eastern Pearlshell | | | | S2 | 3 Sensitive | 4 | 7.7 ± 0.0 |

## 4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species “location sensitive”. Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting a 5 km buffer of your study area are indicated below with “YES”.

### Nova Scotia

| Scientific *Name* | Common Name | SARA | Prov Legal Prot | Known within 5 km of Study Site? |
|---|---|---|---|---|
| *Fraxinus nigra* | Black Ash | | Threatened | No |
| *Emydoidea blandingii* | *Blanding's Turtle - Nova Scotia pop.* | Endangered | Vulnerable | No |
| *Glyptemys insculpta* | Wood Turtle | Threatened | Threatened | No |
| *Falco peregrinus pop. 1* | Peregrine Falcon - anatum/tundrius pop. | Special Concern | Vulnerable | No |
| *Bat Hibernaculum* | | [Endangered][1] | [Endangered][1] | No |

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NS Endangered Species Act.

## 4.4 SOURCE BIBLIOGRAPHY

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# 5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 10389 records of 118 vertebrate and 320 records of 39 invertebrate fauna; 3636 records of 236 vascular, 533 records of 54 nonvascular flora (attached: *ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs. All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record).

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| A | *Myotis lucifugus* | Little Brown Myotis | Endangered | Endangered | Endangered | S1 | 1 At Risk | 28 | 30.6 ± 0.0 | NS |
| A | *Charadrius melodus melodus* | Piping Plover melodus ssp | Endangered | Endangered | Endangered | S1B | 1 At Risk | 91 | 3.0 ± 0.0 | NS |
| A | *Calidris canutus rufa* | Red Knot rufa ssp | Endangered | | Endangered | S2M | 1 At Risk | 131 | 26.1 ± 0.0 | NS |
| A | *Rangifer tarandus pop. 2* | Woodland Caribou (Atlantic-Gasp ├⌐sie pop.) | Endangered | Endangered | Extirpated | SX | 0.1 Extirpated | 1 | 88.1 ± 0.0 | NS |
| A | *Catharus bicknelli* | Bicknell's Thrush | Threatened | Special Concern | Endangered | S1S2B | 1 At Risk | 67 | 21.9 ± 0.0 | NS |
| A | *Glyptemys insculpta* | Wood Turtle | Threatened | Threatened | Threatened | S2 | 3 Sensitive | 37 | 27.1 ± 5.0 | NS |
| A | *Acipenser oxyrinchus* | Atlantic Sturgeon | Threatened | | | S2 | 2 May Be At Risk | 1 | 21.0 ± 0.0 | NS |
| A | *Anguilla rostrata* | American Eel | Threatened | | | S2 | 4 Secure | 2 | 35.1 ± 0.0 | NS |
| A | *Chaetura pelagica* | Chimney Swift | Threatened | Threatened | Endangered | S2B,S1M | 1 At Risk | 22 | 10.5 ± 7.0 | NS |
| A | *Chordeiles minor* | Common Nighthawk | Threatened | Threatened | Threatened | S2S3B | 1 At Risk | 33 | 10.5 ± 7.0 | NS |
| A | *Riparia riparia* | Bank Swallow | Threatened | | | S2S3B | 2 May Be At Risk | 110 | 15.4 ± 7.0 | NS |
| A | *Hirundo rustica* | Barn Swallow | Threatened | | Endangered | S3B | 1 At Risk | 209 | 2.7 ± 5.0 | NS |
| A | *Contopus cooperi* | Olive-sided Flycatcher | Threatened | Threatened | Threatened | S3B | 1 At Risk | 239 | 2.7 ± 5.0 | NS |
| A | *Wilsonia canadensis* | Canada Warbler | Threatened | Threatened | Endangered | S3S4B | 1 At Risk | 63 | 12.5 ± 0.0 | NS |
| A | *Dolichonyx oryzivorus* | Bobolink | Threatened | | Vulnerable | S3S4B | 3 Sensitive | 73 | 9.3 ± 7.0 | NS |
| A | *Falco peregrinus pop. 1* | Peregrine Falcon - anatum/tundrius | Special Concern | Special Concern | Vulnerable | S1B,SNAM | 3 Sensitive | 2 | 34.5 ± 0.0 | NS |
| A | *Bucephala islandica (Eastern pop.)* | Barrow's Goldeneye - Eastern pop. | Special Concern | Special Concern | | S1N | 1 At Risk | 1 | 41.4 ± 16.0 | NS |
| A | *Asio flammeus* | Short-eared Owl | Special Concern | Special Concern | | S1S2B | 2 May Be At Risk | 5 | 29.3 ± 7.0 | NS |
| A | *Euphagus carolinus* | Rusty Blackbird | Special Concern | Special Concern | Endangered | S2B | 2 May Be At Risk | 90 | 10.5 ± 7.0 | NS |
| A | *Histrionicus histrionicus pop. 1* | Harlequin Duck - Eastern pop. | Special Concern | Special Concern | Endangered | S2N | 1 At Risk | 5 | 34.7 ± 0.0 | NS |
| A | *Phalaropus lobatus* | Red-necked Phalarope | Special Concern | | | S2S3M | 3 Sensitive | 1 | 26.1 ± 0.0 | NS |
| A | *Chelydra serpentina* | Snapping Turtle | Special Concern | Special Concern | Vulnerable | S3 | 3 Sensitive | 2 | 21.2 ± 0.0 | NS |
| A | *Contopus virens* | Eastern Wood-Pewee | Special Concern | | Vulnerable | S3S4B | 3 Sensitive | 64 | 15.4 ± 7.0 | NS |
| A | *Tryngites subruficollis* | Buff-breasted Sandpiper | Special Concern | | | SNA | 8 Accidental | 23 | 26.1 ± 0.0 | NS |
| A | *Lynx canadensis* | Canadian Lynx | Not At Risk | | Endangered | S1 | 1 At Risk | 104 | 33.8 ± 1.0 | NS |
| A | *Accipiter cooperii* | Cooper's Hawk | Not At Risk | | | S1?B | 5 Undetermined | 1 | 23.3 ± 7.0 | NS |
| A | *Sorex dispar* | Long-tailed Shrew | Not At Risk | Special Concern | | S2 | 3 Sensitive | 12 | 52.6 ± 1.0 | NS |
| A | *Aegolius funereus* | Boreal Owl | Not At Risk | | | S2?B | 5 Undetermined | 7 | 29.3 ± 7.0 | NS |
| A | *Hemidactylium scutatum* | Four-toed Salamander | Not At Risk | | | S3 | 4 Secure | 6 | 54.6 ± 0.0 | NS |
| A | *Sterna hirundo* | Common Tern | Not At Risk | | | S3B | 3 Sensitive | 256 | 4.3 ± 0.0 | NS |
| A | *Sialia sialis* | Eastern Bluebird | Not At Risk | | | S3B | 3 Sensitive | 5 | 46.9 ± 7.0 | NS |
| A | *Accipiter gentilis* | Northern Goshawk | Not At Risk | | | S3S4 | 4 Secure | 49 | 2.7 ± 5.0 | NS |
| A | *Circus cyaneus* | Northern Harrier | Not At Risk | | | S3S4B | 4 Secure | 111 | 2.7 ± 5.0 | NS |
| A | *Ammodramus nelsoni* | Nelson's Sparrow | Not At Risk | | | S3S4B | 4 Secure | 26 | 12.6 ± 7.0 | NS |
| A | *Morone saxatilis* | Striped Bass | E,E,SC | | | S2S3 | 2 May Be At Risk | 4 | 21.0 ± 0.0 | NS |
| A | *Martes americana* | American Marten | | | Endangered | S1 | 1 At Risk | 19 | 56.3 ± 0.0 | NS |
| A | *Alces americanus* | Moose | | | Endangered | S1 | 1 At Risk | 1 | 98.1 ± 0.0 | NS |
| A | *Salmo salar* | Atlantic Salmon | | | | S1 | 2 May Be At Risk | 63 | 3.1 ± 0.0 | NS |
| A | *Picoides dorsalis* | American Three-toed Woodpecker | | | | S1? | 5 Undetermined | 3 | 77.3 ± 7.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| A | *Uria aalge* | Common Murre | | | | S1?B,S5N | 4 Secure | 3 | 59.8 ± 0.0 | NS |
| A | *Anas acuta* | Northern Pintail | | | | S1B | 2 May Be At Risk | 4 | 23.3 ± 0.0 | NS |
| A | *Haematopus palliatus* | American Oystercatcher | | | | S1B | 5 Undetermined | 7 | 96.7 ± 0.0 | NS |
| A | *Mimus polyglottos* | Northern Mockingbird | | | | S1B | 4 Secure | 9 | 10.5 ± 7.0 | NS |
| A | *Vireo gilvus* | Warbling Vireo | | | | S1B | 5 Undetermined | 3 | 72.8 ± 7.0 | NS |
| A | *Calidris minutilla* | Least Sandpiper | | | | S1B,S3M | 4 Secure | 208 | 3.4 ± 0.0 | NS |
| A | *Charadrius semipalmatus* | Semipalmated Plover | | | | S1B,S3S4M | 4 Secure | 271 | 3.4 ± 0.0 | NS |
| A | *Pluvialis dominica* | American Golden-Plover | | | | S1S2M | 3 Sensitive | 73 | 26.1 ± 0.0 | NS |
| A | *Limosa haemastica* | Hudsonian Godwit | | | | S1S2M | 3 Sensitive | 92 | 25.7 ± 1.0 | NS |
| A | *Microtus chrotorrhinus* | Rock Vole | | | | S2 | 4 Secure | 18 | 66.5 ± 0.0 | NS |
| A | *Vireo philadelphicus* | Philadelphia Vireo | | | | S2?B | 5 Undetermined | 3 | 39.4 ± 7.0 | NS |
| A | *Anas clypeata* | Northern Shoveler | | | | S2B | 2 May Be At Risk | 1 | 42.1 ± 0.0 | NS |
| A | *Anas strepera* | Gadwall | | | | S2B | 2 May Be At Risk | 1 | 42.4 ± 0.0 | NS |
| A | *Empidonax traillii* | Willow Flycatcher | | | | S2B | 3 Sensitive | 1 | 77.2 ± 0.0 | NS |
| A | *Dendroica tigrina* | Cape May Warbler | | | | S2B | 3 Sensitive | 30 | 9.3 ± 7.0 | NS |
| A | *Piranga olivacea* | Scarlet Tanager | | | | S2B | 5 Undetermined | 1 | 75.3 ± 7.0 | NS |
| A | *Pooecetes gramineus* | Vesper Sparrow | | | | S2B | 2 May Be At Risk | 5 | 64.1 ± 0.0 | NS |
| A | *Molothrus ater* | Brown-headed Cowbird | | | | S2B | 4 Secure | 11 | 20.2 ± 7.0 | NS |
| A | *Alca torda* | Razorbill | | | | S2B,S4N | 3 Sensitive | 42 | 31.1 ± 7.0 | NS |
| A | *Bucephala clangula* | Common Goldeneye | | | | S2B,S5N | 4 Secure | 40 | 31.3 ± 11.0 | NS |
| A | *Phalacrocorax carbo* | Great Cormorant | | | | S2S3 | 3 Sensitive | 206 | 4.3 ± 0.0 | NS |
| A | *Asio otus* | Long-eared Owl | | | | S2S3 | 2 May Be At Risk | 6 | 25.3 ± 7.0 | NS |
| A | *Carduelis pinus* | Pine Siskin | | | | S2S3 | 3 Sensitive | 136 | 3.4 ± 0.0 | NS |
| A | *Rallus limicola* | Virginia Rail | | | | S2S3B | 5 Undetermined | 1 | 97.7 ± 7.0 | NS |
| A | *Tringa semipalmata* | Willet | | | | S2S3B | 2 May Be At Risk | 294 | 5.7 ± 7.0 | NS |
| A | *Petrochelidon pyrrhonota* | Cliff Swallow | | | | S2S3B | 2 May Be At Risk | 87 | 2.7 ± 5.0 | NS |
| A | *Pheucticus ludovicianus* | Rose-breasted Grosbeak | | | | S2S3B | 3 Sensitive | 34 | 20.2 ± 7.0 | NS |
| A | *Pinicola enucleator* | Pine Grosbeak | | | | S2S3B,S5N | 2 May Be At Risk | 114 | 5.7 ± 7.0 | NS |
| A | *Numenius phaeopus hudsonicus* | Hudsonian Whimbrel | | | | S2S3M | 3 Sensitive | 151 | 3.4 ± 0.0 | NS |
| A | *Calidris melanotos* | Pectoral Sandpiper | | | | S2S3M | 4 Secure | 72 | 26.1 ± 0.0 | NS |
| A | *Phalaropus fulicarius* | Red Phalarope | | | | S2S3M | 3 Sensitive | 1 | 36.8 ± 0.0 | NS |
| A | *Perisoreus canadensis* | Gray Jay | | | | S3 | 3 Sensitive | 182 | 2.7 ± 5.0 | NS |
| A | *Poecile hudsonica* | Boreal Chickadee | | | | S3 | 3 Sensitive | 328 | 2.0 ± 0.0 | NS |
| A | *Sitta canadensis* | Red-breasted Nuthatch | | | | S3 | 4 Secure | 298 | 2.1 ± 0.0 | NS |
| A | *Alosa pseudoharengus* | Alewife | | | | S3 | 3 Sensitive | 43 | 3.1 ± 0.0 | NS |
| A | *Salvelinus fontinalis* | Brook Trout | | | | S3 | 3 Sensitive | 50 | 3.1 ± 0.0 | NS |
| A | *Synaptomys cooperi* | Southern Bog Lemming | | | | S3 | 4 Secure | 10 | 66.5 ± 0.0 | NS |
| A | *Pekania pennanti* | Fisher | | | | S3 | 3 Sensitive | 1 | 89.3 ± 0.0 | NS |
| A | *Calidris maritima* | Purple Sandpiper | | | | S3?N | 3 Sensitive | 16 | 7.9 ± 10.0 | NS |
| A | *Falco sparverius* | American Kestrel | | | | S3B | 4 Secure | 109 | 4.6 ± 5.0 | NS |
| A | *Charadrius vociferus* | Killdeer | | | | S3B | 3 Sensitive | 93 | 10.5 ± 7.0 | NS |
| A | *Gallinago delicata* | Wilson's Snipe | | | | S3B | 3 Sensitive | 228 | 2.7 ± 5.0 | NS |
| A | *Sterna paradisaea* | Arctic Tern | | | | S3B | 2 May Be At Risk | 70 | 4.3 ± 0.0 | NS |
| A | *Coccyzus erythropthalmus* | Black-billed Cuckoo | | | | S3B | 2 May Be At Risk | 5 | 23.3 ± 7.0 | NS |
| A | *Tyrannus tyrannus* | Eastern Kingbird | | | | S3B | 3 Sensitive | 34 | 13.4 ± 7.0 | NS |
| A | *Dumetella carolinensis* | Gray Catbird | | | | S3B | 2 May Be At Risk | 49 | 9.3 ± 7.0 | NS |
| A | *Wilsonia pusilla* | Wilson's Warbler | | | | S3B | 3 Sensitive | 52 | 12.6 ± 7.0 | NS |
| A | *Tringa melanoleuca* | Greater Yellowlegs | | | | S3B,S3S4M | 3 Sensitive | 396 | 2.9 ± 0.0 | NS |
| A | *Oceanodroma leucorhoa* | Leach's Storm-Petrel | | | | S3B,S5M | 4 Secure | 19 | 10.7 ± 0.0 | NS |
| A | *Rissa tridactyla* | Black-legged Kittiwake | | | | S3B,S5N | 3 Sensitive | 74 | 5.1 ± 0.0 | NS |
| A | *Fratercula arctica* | Atlantic Puffin | | | | S3B,S5N | 3 Sensitive | 34 | 53.9 ± 7.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| A | *Pluvialis squatarola* | Black-bellied Plover | | | | S3M | 4 Secure | 310 | 26.1 ± 0.0 | NS |
| A | *Tringa flavipes* | Lesser Yellowlegs | | | | S3M | 4 Secure | 169 | 3.4 ± 0.0 | NS |
| A | *Arenaria interpres* | Ruddy Turnstone | | | | S3M | 4 Secure | 139 | 3.4 ± 0.0 | NS |
| A | *Calidris pusilla* | Semipalmated Sandpiper | | | | S3M | 3 Sensitive | 237 | 3.4 ± 0.0 | NS |
| A | *Calidris fuscicollis* | White-rumped Sandpiper | | | | S3M | 4 Secure | 157 | 3.4 ± 0.0 | NS |
| A | *Limnodromus griseus* | Short-billed Dowitcher | | | | S3M | 4 Secure | 160 | 26.1 ± 0.0 | NS |
| A | *Calidris alba* | Sanderling | | | | S3M,S2N | 4 Secure | 159 | 4.5 ± 0.0 | NS |
| A | *Somateria mollissima* | Common Eider | | | | S3S4 | 4 Secure | 137 | 2.7 ± 5.0 | NS |
| A | *Picoides arcticus* | Black-backed Woodpecker | | | | S3S4 | 3 Sensitive | 33 | 12.6 ± 7.0 | NS |
| A | *Loxia curvirostra* | Red Crossbill | | | | S3S4 | 4 Secure | 20 | 13.4 ± 7.0 | NS |
| A | *Sorex palustris* | American Water Shrew | | | | S3S4 | 4 Secure | 1 | 99.7 ± 1.0 | NS |
| A | *Botaurus lentiginosus* | American Bittern | | | | S3S4B | 3 Sensitive | 33 | 9.3 ± 7.0 | NS |
| A | *Anas discors* | Blue-winged Teal | | | | S3S4B | 2 May Be At Risk | 48 | 9.3 ± 7.0 | NS |
| A | *Actitis macularius* | Spotted Sandpiper | | | | S3S4B | 3 Sensitive | 370 | 2.7 ± 5.0 | NS |
| A | *Empidonax flaviventris* | Yellow-bellied Flycatcher | | | | S3S4B | 3 Sensitive | 386 | 2.0 ± 0.0 | NS |
| A | *Regulus calendula* | Ruby-crowned Kinglet | | | | S3S4B | 3 Sensitive | 868 | 2.0 ± 0.0 | NS |
| A | *Catharus fuscescens* | Veery | | | | S3S4B | 4 Secure | 54 | 13.4 ± 7.0 | NS |
| A | *Catharus ustulatus* | Swainson's Thrush | | | | S3S4B | 4 Secure | 476 | 2.7 ± 5.0 | NS |
| A | *Vermivora peregrina* | Tennessee Warbler | | | | S3S4B | 3 Sensitive | 62 | 2.0 ± 0.0 | NS |
| A | *Dendroica castanea* | Bay-breasted Warbler | | | | S3S4B | 3 Sensitive | 74 | 5.7 ± 7.0 | NS |
| A | *Dendroica striata* | Blackpoll Warbler | | | | S3S4B | 3 Sensitive | 137 | 2.7 ± 5.0 | NS |
| A | *Passerella iliaca* | Fox Sparrow | | | | S3S4B | 4 Secure | 156 | 2.7 ± 5.0 | NS |
| A | *Coccothraustes vespertinus* | Evening Grosbeak | | | | S3S4B,S3N | 4 Secure | 101 | 12.6 ± 7.0 | NS |
| A | *Mergus serrator* | Red-breasted Merganser | | | | S3S4B,S5N | 4 Secure | 89 | 4.6 ± 5.0 | NS |
| A | *Bucephala albeola* | Bufflehead | | | | S3S4N | 4 Secure | 4 | 31.4 ± 1.0 | NS |
| A | *Eremophila alpestris* | Horned Lark | | | | SHB,S4S5N | 4 Secure | 2 | 28.1 ± 7.0 | NS |
| A | *Morus bassanus* | Northern Gannet | | | | SHB,S5M | 4 Secure | 22 | 10.3 ± 0.0 | NS |
| A | *Aythya americana* | Redhead | | | | SHB,SNAM | 4 Secure | 2 | 31.3 ± 11.0 | NS |
| I | *Lampsilis cariosa* | Yellow Lampmussel | Special Concern | Special Concern | Threatened | S1 | 1 At Risk | 37 | 20.5 ± 1.0 | NS |
| I | *Danaus plexippus* | Monarch | Special Concern | Special Concern | | S2B | 3 Sensitive | 11 | 37.8 ± 5.0 | NS |
| I | *Bombus terricola* | Yellow-banded Bumblebee | Special Concern | | | S3 | 3 Sensitive | 3 | 9.3 ± 0.0 | NS |
| I | *Quedius spelaeus* | Spelean Rove Beetle | | | | S1 | | 1 | 58.2 ± 1.0 | NS |
| I | *Papilio brevicauda* | Short-tailed Swallowtail | | | | S1 | 3 Sensitive | 5 | 57.9 ± 0.0 | NS |
| I | *Somatochlora albicincta* | Ringed Emerald | | | | S1 | 2 May Be At Risk | 7 | 86.0 ± 0.0 | NS |
| I | *Leucorrhinia patricia* | Canada Whiteface | | | | S1 | 2 May Be At Risk | 1 | 91.6 ± 0.0 | NS |
| I | *Coenagrion interrogatum* | Subarctic Bluet | | | | S1 | 2 May Be At Risk | 2 | 69.9 ± 0.0 | NS |
| I | *Leptodea ochracea* | Tidewater Mucket | | | | S1 | 3 Sensitive | 17 | 26.4 ± 1.0 | NS |
| I | *Lycaena dorcas* | Dorcas Copper | | | | S1? | 6 Not Assessed | 10 | 36.7 ± 0.0 | NS |
| I | *Polygonia satyrus* | Satyr Comma | | | | S1? | 3 Sensitive | 1 | 30.0 ± 1.0 | NS |
| I | *Strymon melinus* | Grey Hairstreak | | | | S1S2 | 4 Secure | 1 | 78.3 ± 0.0 | NS |
| I | *Nymphalis l-album* | Compton Tortoiseshell | | | | S1S2 | 4 Secure | 1 | 63.8 ± 1.0 | NS |
| I | *Haematopota rara* | Shy Cleg | | | | S1S3 | 5 Undetermined | 1 | 62.3 ± 0.0 | NS |
| I | *Boloria chariclea* | Arctic Fritillary | | | | S2 | 3 Sensitive | 6 | 40.1 ± 1.0 | NS |
| I | *Aglais milberti* | Milbert's Tortoiseshell | | | | S2 | 4 Secure | 1 | 59.9 ± 1.0 | NS |
| I | *Somatochlora septentrionalis* | Muskeg Emerald | | | | S2 | 3 Sensitive | 21 | 74.5 ± 1.0 | NS |
| I | *Somatochlora williamsoni* | Williamson's Emerald | | | | S2 | 2 May Be At Risk | 10 | 61.3 ± 0.0 | NS |
| I | *Margaritifera margaritifera* | Eastern Pearlshell | | | | S2 | 3 Sensitive | 64 | 7.7 ± 0.0 | NS |
| I | *Pantala hymenaea* | Spot-Winged Glider | | | | S2?B | 3 Sensitive | 2 | 66.8 ± 0.0 | NS |
| I | *Thorybes pylades* | Northern Cloudywing | | | | S2S3 | 3 Sensitive | 1 | 73.8 ± 0.0 | NS |
| I | *Euphydryas phaeton* | Baltimore Checkerspot | | | | S2S3 | 4 Secure | 7 | 56.7 ± 1.0 | NS |
| I | *Gomphus descriptus* | Harpoon Clubtail | | | | S2S3 | 3 Sensitive | 11 | 87.8 ± 0.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| I | *Ophiogomphus aspersus* | Brook Snaketail | | | | S2S3 | 2 May Be At Risk | 2 | 94.2 ± 0.0 | NS |
| I | *Somatochlora forcipata* | Forcipate Emerald | | | | S2S3 | 2 May Be At Risk | 7 | 24.6 ± 0.0 | NS |
| I | *Alasmidonta undulata* | Triangle Floater | | | | S2S3 | 4 Secure | 2 | 86.5 ± 0.0 | NS |
| I | *Speyeria aphrodite* | Aphrodite Fritillary | | | | S3 | 4 Secure | 2 | 98.7 ± 0.0 | NS |
| I | *Polygonia faunus* | Green Comma | | | | S3 | 4 Secure | 11 | 63.8 ± 1.0 | NS |
| I | *Oeneis jutta* | Jutta Arctic | | | | S3 | 2 May Be At Risk | 5 | 66.4 ± 0.0 | NS |
| I | *Boyeria grafiana* | Ocellated Darner | | | | S3 | 3 Sensitive | 1 | 13.4 ± 1.0 | NS |
| I | *Gomphaeschna furcillata* | Harlequin Darner | | | | S3 | 3 Sensitive | 1 | 87.8 ± 0.0 | NS |
| I | *Somatochlora tenebrosa* | Clamp-Tipped Emerald | | | | S3 | 4 Secure | 2 | 60.5 ± 0.0 | NS |
| I | *Sympetrum danae* | Black Meadowhawk | | | | S3 | 3 Sensitive | 9 | 15.6 ± 1.0 | NS |
| I | *Enallagma vernale* | Vernal Bluet | | | | S3 | 5 Undetermined | 6 | 65.6 ± 0.0 | NS |
| I | *Amphiagrion saucium* | Eastern Red Damsel | | | | S3 | 4 Secure | 14 | 27.6 ± 1.0 | NS |
| I | *Polygonia interrogationis* | Question Mark | | | | S3B | 4 Secure | 8 | 58.6 ± 0.0 | NS |
| I | *Polygonia progne* | Grey Comma | | | | S3S4 | 4 Secure | 10 | 54.7 ± 0.0 | NS |
| I | *Lanthus parvulus* | Northern Pygmy Clubtail | | | | S3S4 | 4 Secure | 14 | 43.3 ± 1.0 | NS |
| I | *Lampsilis radiata* | Eastern Lampmussel | | | | S3S4 | 3 Sensitive | 5 | 27.9 ± 0.0 | NS |
| N | *Erioderma pedicellatum (Atlantic pop.)* | Boreal Felt Lichen - Atlantic pop. | Endangered | Endangered | Endangered | S1 | 1 At Risk | 181 | 25.8 ± 0.0 | NS |
| N | *Sclerophora peronella (Nova Scotia pop.)* | Frosted Glass-whiskers Lichen - Nova Scotia pop. | Special Concern | Special Concern | | S1? | | 4 | 90.4 ± 1.0 | NS |
| N | *Degelia plumbea* | Blue Felt Lichen | Special Concern | Special Concern | Vulnerable | S3 | 4 Secure | 24 | 31.0 ± 0.0 | NS |
| N | *Gowardia nigricans* | Gray Witch's Beard Lichen | | | | S1 | 6 Not Assessed | 1 | 93.5 ± 1.0 | NS |
| N | *Cavernularia hultenii* | Powdered Honeycomb Lichen | | | | S1 | 2 May Be At Risk | 1 | 18.0 ± 1.0 | NS |
| N | *Metacalypogeia schusterana* | Schuster's Pouchwort | | | | S1? | 5 Undetermined | 1 | 54.8 ± 0.0 | NS |
| N | *Moerckia hibernica* | Irish Ruffwort | | | | S1? | | 1 | 54.8 ± 0.0 | NS |
| N | *Conardia compacta* | Coast Creeping Moss | | | | S1? | 3 Sensitive | 1 | 97.6 ± 5.0 | NS |
| N | *Paludella squarrosa* | Tufted Fen Moss | | | | S1? | 3 Sensitive | 1 | 65.2 ± 5.0 | NS |
| N | *Syntrichia ruralis* | a Moss | | | | S1? | 3 Sensitive | 1 | 65.9 ± 1.0 | NS |
| N | *Sanionia orthothecioides* | Coastal Hook Moss | | | | S1? | 5 Undetermined | 1 | 26.1 ± 0.0 | NS |
| N | *Flavocetraria nivalis* | Crinkled Snow Lichen | | | | S1? | 3 Sensitive | 1 | 97.8 ± 0.0 | NS |
| N | *Parmeliella parvula* | Poor-man's Shingles Lichen | | | | S1? | 2 May Be At Risk | 6 | 39.7 ± 0.0 | NS |
| N | *Buxbaumia minakatae* | Hump-Backed Elves | | | | S1S2 | 3 Sensitive | 2 | 62.9 ± 100.0 | NS |
| N | *Hygrohypnum montanum* | a Moss | | | | S1S2 | 3 Sensitive | 2 | 98.9 ± 0.0 | NS |
| N | *Platydictya confervoides* | a Moss | | | | S1S2 | 3 Sensitive | 1 | 40.9 ± 3.0 | NS |
| N | *Tetrodontium brownianum* | Little Georgia | | | | S1S2 | 3 Sensitive | 1 | 99.1 ± 0.0 | NS |
| N | *Anacamptodon splachnoides* | a Moss | | | | S2? | 3 Sensitive | 2 | 94.3 ± 1.0 | NS |
| N | *Atrichum angustatum* | Lesser Smoothcap Moss | | | | S2? | 3 Sensitive | 1 | 53.9 ± 30.0 | NS |
| N | *Bryum algovicum* | a Moss | | | | S2? | 3 Sensitive | 2 | 99.1 ± 0.0 | NS |
| N | *Fontinalis sullivantii* | a Moss | | | | S2? | 3 Sensitive | 1 | 62.9 ± 100.0 | NS |
| N | *Grimmia anomala* | Mountain Forest Grimmia | | | | S2? | 3 Sensitive | 1 | 91.8 ± 0.0 | NS |
| N | *Kiaeria blyttii* | Blytt's Fork Moss | | | | S2? | 3 Sensitive | 8 | 98.9 ± 0.0 | NS |
| N | *Kiaeria starkei* | Starke's Fork Moss | | | | S2? | 3 Sensitive | 2 | 98.9 ± 0.0 | NS |
| N | *Pseudoleskea patens* | Patent Leskea Moss | | | | S2? | 3 Sensitive | 1 | 89.4 ± 0.0 | NS |
| N | *Racomitrium affine* | a Moss | | | | S2? | 5 Undetermined | 2 | 99.1 ± 0.0 | NS |
| N | *Saelania glaucescens* | Blue Dew Moss | | | | S2? | 3 Sensitive | 1 | 100.0 ± 0.0 | NS |
| N | *Scorpidium scorpioides* | Hooked Scorpion Moss | | | | S2? | 3 Sensitive | 4 | 64.2 ± 0.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| N | *Sematophyllum marylandicum* | a Moss | | | | S2? | 3 Sensitive | 4 | 93.6 ± 1.0 | NS |
| N | *Tortella fragilis* | Fragile Twisted Moss | | | | S2? | 3 Sensitive | 3 | 54.7 ± 0.0 | NS |
| N | *Cyrtomnium hymenophylloides* | Short-pointed Lantern Moss | | | | S2? | 3 Sensitive | 1 | 68.1 ± 0.0 | NS |
| N | *Nephroma arcticum* | Arctic Kidney Lichen | | | | S2? | 2 May Be At Risk | 1 | 50.6 ± 0.0 | NS |
| N | *Peltigera collina* | Tree Pelt Lichen | | | | S2? | 3 Sensitive | 3 | 31.0 ± 0.0 | NS |
| N | *Platydictya subtilis* | Bark Willow Moss | | | | S2S3 | 3 Sensitive | 1 | 89.4 ± 0.0 | NS |
| N | *Cetraria muricata* | Spiny Heath Lichen | | | | S2S3 | 5 Undetermined | 3 | 89.8 ± 1.0 | NS |
| N | *Racodium rupestre* | Rockhair Lichen | | | | S2S3 | 5 Undetermined | 2 | 12.4 ± 0.0 | NS |
| N | *Usnea mutabilis* | Bloody Beard Lichen | | | | S2S3 | 3 Sensitive | 1 | 94.3 ± 0.0 | NS |
| N | *Sticta fuliginosa* | Peppered Moon Lichen | | | | S3 | 3 Sensitive | 2 | 42.3 ± 0.0 | NS |
| N | *Fuscopannaria ahlneri* | Corrugated Shingles Lichen | | | | S3 | 4 Secure | 23 | 30.5 ± 0.0 | NS |
| N | *Heterodermia speciosa* | Powdered Fringe Lichen | | | | S3 | 4 Secure | 2 | 41.9 ± 0.0 | NS |
| N | *Nephroma bellum* | Naked Kidney Lichen | | | | S3 | 3 Sensitive | 1 | 50.6 ± 0.0 | NS |
| N | *Platismatia norvegica* | Oldgrowth Rag Lichen | | | | S3 | 4 Secure | 20 | 12.0 ± 0.0 | NS |
| N | *Moelleropsis nebulosa* | Blue-gray Moss Shingle Lichen | | | | S3 | 4 Secure | 11 | 40.5 ± 0.0 | NS |
| N | *Calliergon giganteum* | Giant Spear Moss | | | | S3? | 3 Sensitive | 1 | 70.9 ± 0.0 | NS |
| N | *Mnium stellare* | Star Leafy Moss | | | | S3? | 5 Undetermined | 1 | 56.0 ± 0.0 | NS |
| N | *Encalypta procera* | Slender Extinguisher Moss | | | | S3S4 | 4 Secure | 1 | 64.9 ± 0.0 | NS |
| N | *Sphagnum lindbergii* | Lindberg's Peat Moss | | | | S3S4 | 4 Secure | 1 | 13.9 ± 0.0 | NS |
| N | *Schistidium agassizii* | Elf Bloom Moss | | | | S3S4 | 4 Secure | 1 | 78.9 ± 2.0 | NS |
| N | *Hylocomiastrum pyrenaicum* | a Feather Moss | | | | S3S4 | 3 Sensitive | 1 | 92.0 ± 3.0 | NS |
| N | *Arctoparmelia incurva* | Finger Ring Lichen | | | | S3S4 | 4 Secure | 3 | 93.5 ± 1.0 | NS |
| N | *Cladonia floerkeana* | Gritty British Soldiers Lichen | | | | S3S4 | 5 Undetermined | 2 | 13.8 ± 0.0 | NS |
| N | *Leptogium saturninum* | Bearded Jellyskin Lichen | | | | S3S4 | 5 Undetermined | 1 | 33.3 ± 0.0 | NS |
| N | *Coccocarpia palmicola* | Salted Shell Lichen | | | | S3S4 | 4 Secure | 185 | 31.0 ± 0.0 | NS |
| N | *Heterodermia neglecta* | Fringe Lichen | | | | S3S4 | 4 Secure | 3 | 31.0 ± 0.0 | NS |
| P | *Juncus caesariensis* | New Jersey Rush | Special Concern | Special Concern | Vulnerable | S2 | 3 Sensitive | 239 | 16.6 ± 0.0 | NS |
| P | *Isoetes prototypus* | Prototype Quillwort | Special Concern | Special Concern | Vulnerable | S2 | 3 Sensitive | 13 | 37.2 ± 0.0 | NS |
| P | *Floerkea proserpinacoides* | False Mermaidweed | Not At Risk | | | S2 | 3 Sensitive | 9 | 88.1 ± 7.0 | NS |
| P | *Thuja occidentalis* | Eastern White Cedar | | | Vulnerable | S1 | 1 At Risk | 2 | 25.0 ± 0.0 | NS |
| P | *Acer saccharinum* | Silver Maple | | | | S1 | 5 Undetermined | 1 | 31.1 ± 0.0 | NS |
| P | *Sanicula odorata* | Clustered Sanicle | | | | S1 | 2 May Be At Risk | 4 | 64.6 ± 1.0 | NS |
| P | *Arnica lonchophylla* | Northern Arnica | | | | S1 | 2 May Be At Risk | 1 | 81.9 ± 7.0 | NS |
| P | *Bidens hyperborea* | Estuary Beggarticks | | | | S1 | 2 May Be At Risk | 2 | 97.7 ± 7.0 | NS |
| P | *Prenanthes racemosa* | Glaucous Rattlesnakeroot | | | | S1 | 2 May Be At Risk | 1 | 40.5 ± 3.0 | NS |
| P | *Betula glandulosa* | Glandular Birch | | | | S1 | 2 May Be At Risk | 5 | 89.9 ± 7.0 | NS |
| P | *Barbarea orthoceras* | American Yellow Rocket | | | | S1 | 2 May Be At Risk | 5 | 99.4 ± 0.0 | NS |
| P | *Cardamine pratensis var. angustifolia* | Cuckoo Flower | | | | S1 | 2 May Be At Risk | 4 | 86.9 ± 0.0 | NS |
| P | *Draba norvegica var. clivicola* | Norwegian Whitlow-Grass | | | | S1 | 2 May Be At Risk | 1 | 91.6 ± 2.0 | NS |
| P | *Stellaria crassifolia* | Fleshy Stitchwort | | | | S1 | 2 May Be At Risk | 1 | 82.7 ± 2.0 | NS |
| P | *Diapensia lapponica* | Diapensia | | | | S1 | 2 May Be At Risk | 1 | 98.5 ± 0.0 | NS |
| P | *Pinguicula vulgaris* | Common Butterwort | | | | S1 | 2 May Be At Risk | 1 | 98.5 ± 1.0 | NS |
| P | *Utricularia ochroleuca* | Yellowish-white Bladderwort | | | | S1 | 5 Undetermined | 1 | 79.6 ± 1.0 | NS |
| P | *Polygonum viviparum* | Alpine Bistort | | | | S1 | 2 May Be At Risk | 1 | 72.1 ± 1.0 | NS |
| P | *Pedicularis palustris* | Marsh Lousewort | | | | S1 | 2 May Be At Risk | 3 | 16.8 ± 0.0 | NS |
| P | *Scrophularia lanceolata* | Lance-leaved Figwort | | | | S1 | 5 Undetermined | 1 | 57.7 ± 1.0 | NS |
| P | *Carex granularis* | Limestone Meadow Sedge | | | | S1 | 2 May Be At Risk | 20 | 70.2 ± 0.0 | NS |
| P | *Carex gynocrates* | Northern Bog Sedge | | | | S1 | 2 May Be At Risk | 12 | 75.6 ± 0.0 | NS |
| P | *Carex haydenii* | Hayden's Sedge | | | | S1 | 2 May Be At Risk | 1 | 91.2 ± 0.0 | NS |
| P | *Carex rariflora* | Loose-flowered Alpine Sedge | | | | S1 | 2 May Be At Risk | 14 | 5.5 ± 5.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| P | *Carex saxatilis* | Russet Sedge | | | | S1 | 2 May Be At Risk | 7 | 93.6 ± 1.0 | NS |
| P | *Carex tenuiflora* | Sparse-Flowered Sedge | | | | S1 | 2 May Be At Risk | 2 | 64.2 ± 0.0 | NS |
| P | *Carex viridula var. elatior* | Greenish Sedge | | | | S1 | 2 May Be At Risk | 21 | 66.6 ± 0.0 | NS |
| P | *Eleocharis erythropoda* | Red-stemmed Spikerush | | | | S1 | 2 May Be At Risk | 6 | 57.4 ± 0.0 | NS |
| P | *Rhynchospora capillacea* | Slender Beakrush | | | | S1 | 2 May Be At Risk | 3 | 64.8 ± 1.0 | NS |
| P | *Iris prismatica* | Slender Blue Flag | | | | S1 | 2 May Be At Risk | 1 | 14.6 ± 0.0 | NS |
| P | *Bromus latiglumis* | Broad-Glumed Brome | | | | S1 | 2 May Be At Risk | 11 | 98.2 ± 0.0 | NS |
| P | *Elymus wiegandii* | Wiegand's Wild Rye | | | | S1 | 2 May Be At Risk | 7 | 30.3 ± 1.0 | NS |
| P | *Elymus hystrix var. bigeloviana* | Spreading Wild Rye | | | | S1 | 2 May Be At Risk | 1 | 22.9 ± 4.0 | NS |
| P | *Hordeum brachyantherum* | Meadow Barley | | | | S1 | 2 May Be At Risk | 1 | 92.6 ± 0.0 | NS |
| P | *Phleum alpinum* | Alpine Timothy | | | | S1 | 2 May Be At Risk | 3 | 91.9 ± 0.0 | NS |
| P | *Torreyochloa pallida var. pallida* | Pale False Manna Grass | | | | S1 | 0.1 Extirpated | 2 | 24.6 ± 1.0 | NS |
| P | *Trisetum melicoides* | Purple False Oats | | | | S1 | 2 May Be At Risk | 3 | 65.5 ± 4.0 | NS |
| P | *Botrychium lunaria* | Common Moonwort | | | | S1 | 2 May Be At Risk | 2 | 65.1 ± 1.0 | NS |
| P | *Halenia deflexa ssp. brentoniana* | Spurred Gentian | | | | S1? | 5 Undetermined | 2 | 4.0 ± 0.0 | NS |
| P | *Spiraea septentrionalis* | Northern Meadowsweet | | | | S1? | 2 May Be At Risk | 2 | 94.4 ± 0.0 | NS |
| P | *Schoenoplectus robustus* | Sturdy Bulrush | | | | S1? | 5 Undetermined | 2 | 59.8 ± 5.0 | NS |
| P | *Dichanthelium acuminatum var. lindheimeri* | Woolly Panic Grass | | | | S1? | 5 Undetermined | 1 | 98.1 ± 1.0 | NS |
| P | *Huperzia selago* | Northern Firmoss | | | | S1? | 2 May Be At Risk | 2 | 17.9 ± 2.0 | NS |
| P | *Fraxinus nigra* | Black Ash | | | Threatened | S1S2 | 1 At Risk | 55 | 28.0 ± 0.0 | NS |
| P | *Arabis hirsuta var. pycnocarpa* | Western Hairy Rockcress | | | | S1S2 | 2 May Be At Risk | 7 | 40.1 ± 0.0 | NS |
| P | *Cornus suecica* | Swedish Bunchberry | | | | S1S2 | 3 Sensitive | 30 | 3.5 ± 0.0 | NS |
| P | *Anemone virginiana var. alba* | Virginia Anemone | | | | S1S2 | 3 Sensitive | 5 | 65.5 ± 0.0 | NS |
| P | *Ranunculus sceleratus* | Cursed Buttercup | | | | S1S2 | 2 May Be At Risk | 6 | 16.9 ± 1.0 | NS |
| P | *Parnassia palustris var. parviflora* | Marsh Grass-of-Parnassus | | | | S1S2 | 2 May Be At Risk | 7 | 51.6 ± 7.0 | NS |
| P | *Carex livida var. radicaulis* | Livid Sedge | | | | S1S2 | 2 May Be At Risk | 27 | 2.5 ± 0.0 | NS |
| P | *Juncus alpinoarticulatus ssp. nodulosus* | Richardson's Rush | | | | S1S2 | 2 May Be At Risk | 4 | 61.6 ± 0.0 | NS |
| P | *Juncus bulbosus* | Bulbous Rush | | | | S1S2 | 5 Undetermined | 12 | 2.5 ± 0.0 | NS |
| P | *Platanthera huronensis* | Fragrant Green Orchid | | | | S1S2 | 5 Undetermined | 3 | 24.3 ± 100.0 | NS |
| P | *Calamagrostis stricta ssp. stricta* | Slim-stemmed Reed Grass | | | | S1S2 | 3 Sensitive | 1 | 64.8 ± 1.0 | NS |
| P | *Cinna arundinacea* | Sweet Wood Reed Grass | | | | S1S2 | 2 May Be At Risk | 24 | 97.2 ± 0.0 | NS |
| P | *Sparganium hyperboreum* | Northern Burreed | | | | S1S2 | 3 Sensitive | 9 | 2.5 ± 0.0 | NS |
| P | *Cryptogramma stelleri* | Steller's Rockbrake | | | | S1S2 | 2 May Be At Risk | 10 | 85.9 ± 0.0 | NS |
| P | *Woodsia alpina* | Alpine Cliff Fern | | | | S1S2 | 2 May Be At Risk | 4 | 67.1 ± 2.0 | NS |
| P | *Selaginella selaginoides* | Low Spikemoss | | | | S1S2 | 2 May Be At Risk | 2 | 64.2 ± 0.0 | NS |
| P | *Osmorhiza longistylis* | Smooth Sweet Cicely | | | | S2 | 2 May Be At Risk | 14 | 85.4 ± 10.0 | NS |
| P | *Erigeron philadelphicus* | Philadelphia Fleabane | | | | S2 | 3 Sensitive | 5 | 43.7 ± 1.0 | NS |
| P | *Solidago multiradiata* | Multi-rayed Goldenrod | | | | S2 | 2 May Be At Risk | 2 | 16.8 ± 0.0 | NS |
| P | *Symphyotrichum* | Fringed Blue Aster | | | | S2 | 3 Sensitive | 1 | 94.8 ± 7.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| | *ciliolatum* | | | | | | | | | |
| P | *Impatiens pallida* | Pale Jewelweed | | | | S2 | 3 Sensitive | 6 | 58.0 ± 7.0 | NS |
| P | *Caulophyllum thalictroides* | Blue Cohosh | | | | S2 | 2 May Be At Risk | 10 | 89.6 ± 0.0 | NS |
| P | *Betula borealis* | Northern Birch | | | | S2 | 3 Sensitive | 4 | 67.0 ± 0.0 | NS |
| P | *Arabis drummondii* | Drummond's Rockcress | | | | S2 | 3 Sensitive | 4 | 42.6 ± 1.0 | NS |
| P | *Cardamine parviflora var. arenicola* | Small-flowered Bittercress | | | | S2 | 3 Sensitive | 10 | 30.2 ± 0.0 | NS |
| P | *Draba arabisans* | Rock Whitlow-Grass | | | | S2 | 3 Sensitive | 11 | 65.5 ± 4.0 | NS |
| P | *Lobelia kalmii* | Brook Lobelia | | | | S2 | 2 May Be At Risk | 46 | 25.3 ± 7.0 | NS |
| P | *Stellaria humifusa* | Saltmarsh Starwort | | | | S2 | 3 Sensitive | 5 | 5.3 ± 0.0 | NS |
| P | *Stellaria longifolia* | Long-leaved Starwort | | | | S2 | 3 Sensitive | 1 | 99.6 ± 0.0 | NS |
| P | *Chenopodium rubrum* | Red Pigweed | | | | S2 | 2 May Be At Risk | 3 | 31.3 ± 7.0 | NS |
| P | *Hypericum majus* | Large St John's-wort | | | | S2 | 3 Sensitive | 2 | 64.7 ± 1.0 | NS |
| P | *Crassula aquatica* | Water Pygmyweed | | | | S2 | 3 Sensitive | 8 | 10.1 ± 0.0 | NS |
| P | *Myriophyllum verticillatum* | Whorled Water Milfoil | | | | S2 | 3 Sensitive | 5 | 67.3 ± 0.0 | NS |
| P | *Utricularia resupinata* | Inverted Bladderwort | | | | S2 | 3 Sensitive | 1 | 48.5 ± 0.0 | NS |
| P | *Oenothera fruticosa ssp. glauca* | Narrow-leaved Evening Primrose | | | | S2 | 5 Undetermined | 1 | 92.7 ± 1.0 | NS |
| P | *Rumex salicifolius var. mexicanus* | Triangular-valve Dock | | | | S2 | 3 Sensitive | 13 | 26.3 ± 5.0 | NS |
| P | *Primula mistassinica* | Mistassini Primrose | | | | S2 | 3 Sensitive | 1 | 97.2 ± 1.0 | NS |
| P | *Anemone quinquefolia* | Wood Anemone | | | | S2 | 3 Sensitive | 4 | 76.6 ± 1.0 | NS |
| P | *Caltha palustris* | Yellow Marsh Marigold | | | | S2 | 3 Sensitive | 13 | 57.7 ± 2.0 | NS |
| P | *Galium labradoricum* | Labrador Bedstraw | | | | S2 | 3 Sensitive | 47 | 5.3 ± 10.0 | NS |
| P | *Salix pedicellaris* | Bog Willow | | | | S2 | 3 Sensitive | 6 | 91.6 ± 0.0 | NS |
| P | *Comandra umbellata* | Bastard's Toadflax | | | | S2 | 2 May Be At Risk | 6 | 40.5 ± 3.0 | NS |
| P | *Saxifraga paniculata ssp. neogaea* | White Mountain Saxifrage | | | | S2 | 3 Sensitive | 7 | 65.5 ± 4.0 | NS |
| P | *Viola nephrophylla* | Northern Bog Violet | | | | S2 | 3 Sensitive | 7 | 78.0 ± 0.0 | NS |
| P | *Carex atratiformis* | Scabrous Black Sedge | | | | S2 | 3 Sensitive | 6 | 65.5 ± 1.0 | NS |
| P | *Carex bebbii* | Bebb's Sedge | | | | S2 | 3 Sensitive | 18 | 41.1 ± 0.0 | NS |
| P | *Carex castanea* | Chestnut Sedge | | | | S2 | 2 May Be At Risk | 22 | 65.7 ± 7.0 | NS |
| P | *Carex hystericina* | Porcupine Sedge | | | | S2 | 2 May Be At Risk | 9 | 41.0 ± 0.0 | NS |
| P | *Carex scirpoidea* | Scirpuslike Sedge | | | | S2 | 3 Sensitive | 5 | 33.5 ± 10.0 | NS |
| P | *Carex tenera* | Tender Sedge | | | | S2 | 3 Sensitive | 1 | 98.6 ± 3.0 | NS |
| P | *Carex tuckermanii* | Tuckerman's Sedge | | | | S2 | 3 Sensitive | 2 | 65.6 ± 0.0 | NS |
| P | *Eleocharis quinqueflora* | Few-flowered Spikerush | | | | S2 | 3 Sensitive | 14 | 23.7 ± 1.0 | NS |
| P | *Vallisneria americana* | Wild Celery | | | | S2 | 2 May Be At Risk | 1 | 27.9 ± 10.0 | NS |
| P | *Juncus stygius ssp. americanus* | Moor Rush | | | | S2 | 3 Sensitive | 33 | 2.7 ± 0.0 | NS |
| P | *Allium schoenoprasum* | Wild Chives | | | | S2 | 2 May Be At Risk | 1 | 30.8 ± 0.0 | NS |
| P | *Allium schoenoprasum var. sibiricum* | Wild Chives | | | | S2 | 2 May Be At Risk | 5 | 14.6 ± 1.0 | NS |
| P | *Lilium canadense* | Canada Lily | | | | S2 | 2 May Be At Risk | 13 | 59.6 ± 7.0 | NS |
| P | *Cypripedium parviflorum var. pubescens* | Yellow Lady's-slipper | | | | S2 | 3 Sensitive | 3 | 56.0 ± 0.0 | NS |
| P | *Cypripedium parviflorum var. makasin* | Small Yellow Lady's-Slipper | | | | S2 | 3 Sensitive | 16 | 45.4 ± 7.0 | NS |
| P | *Cypripedium reginae* | Showy Lady's-Slipper | | | | S2 | 2 May Be At Risk | 249 | 35.6 ± 1.0 | NS |
| P | *Spiranthes lucida* | Shining Ladies'-Tresses | | | | S2 | 2 May Be At Risk | 1 | 46.0 ± 5.0 | NS |
| P | *Piptatherum canadense* | Canada Rice Grass | | | | S2 | 3 Sensitive | 1 | 91.0 ± 0.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| P | *Piptatherum pungens* | Slender Rice Grass | | | | S2 | 3 Sensitive | 1 | 14.5 ± 10.0 | NS |
| P | *Potamogeton friesii* | Fries' Pondweed | | | | S2 | 2 May Be At Risk | 3 | 99.1 ± 0.0 | NS |
| P | *Potamogeton richardsonii* | Richardson's Pondweed | | | | S2 | 2 May Be At Risk | 8 | 30.8 ± 7.0 | NS |
| P | *Cystopteris laurentiana* | Laurentian Bladder Fern | | | | S2 | 2 May Be At Risk | 7 | 68.0 ± 0.0 | NS |
| P | *Dryopteris fragrans var. remotiuscula* | Fragrant Wood Fern | | | | S2 | 3 Sensitive | 9 | 66.4 ± 1.0 | NS |
| P | *Polystichum lonchitis* | Northern Holly Fern | | | | S2 | 3 Sensitive | 11 | 65.3 ± 7.0 | NS |
| P | *Woodsia glabella* | Smooth Cliff Fern | | | | S2 | 3 Sensitive | 12 | 58.0 ± 7.0 | NS |
| P | *Symphyotrichum boreale* | Boreal Aster | | | | S2? | 3 Sensitive | 40 | 21.0 ± 1.0 | NS |
| P | *Rumex maritimus var. persicarioides* | Peach-leaved Dock | | | | S2? | 2 May Be At Risk | 1 | 67.5 ± 0.0 | NS |
| P | *Eleocharis ovata* | Ovate Spikerush | | | | S2? | 3 Sensitive | 1 | 34.2 ± 0.0 | NS |
| P | *Scirpus pedicellatus* | Stalked Bulrush | | | | S2? | 3 Sensitive | 3 | 98.3 ± 0.0 | NS |
| P | *Hieracium robinsonii* | Robinson's Hawkweed | | | | S2S3 | 3 Sensitive | 10 | 67.1 ± 1.0 | NS |
| P | *Iva frutescens ssp. oraria* | Big-leaved Marsh-elder | | | | S2S3 | 3 Sensitive | 1 | 33.6 ± 4.0 | NS |
| P | *Senecio pseudoarnica* | Seabeach Ragwort | | | | S2S3 | 3 Sensitive | 10 | 18.3 ± 7.0 | NS |
| P | *Betula michauxii* | Michaux's Dwarf Birch | | | | S2S3 | 3 Sensitive | 8 | 16.6 ± 7.0 | NS |
| P | *Sagina nodosa* | Knotted Pearlwort | | | | S2S3 | 4 Secure | 1 | 98.2 ± 5.0 | NS |
| P | *Hypericum dissimulatum* | Disguised St John's-wort | | | | S2S3 | 3 Sensitive | 1 | 35.4 ± 2.0 | NS |
| P | *Triosteum aurantiacum* | Orange-fruited Tinker's Weed | | | | S2S3 | 3 Sensitive | 32 | 74.6 ± 0.0 | NS |
| P | *Shepherdia canadensis* | Soapberry | | | | S2S3 | 3 Sensitive | 98 | 47.0 ± 1.0 | NS |
| P | *Empetrum eamesii ssp. atropurpureum* | Pink Crowberry | | | | S2S3 | 3 Sensitive | 2 | 90.8 ± 7.0 | NS |
| P | *Empetrum eamesii ssp. eamesii* | Pink Crowberry | | | | S2S3 | 3 Sensitive | 4 | 90.8 ± 7.0 | NS |
| P | *Chamaesyce polygonifolia* | Seaside Spurge | | | | S2S3 | 3 Sensitive | 3 | 17.7 ± 0.0 | NS |
| P | *Halenia deflexa* | Spurred Gentian | | | | S2S3 | 3 Sensitive | 23 | 2.5 ± 5.0 | NS |
| P | *Hedeoma pulegioides* | American False Pennyroyal | | | | S2S3 | 3 Sensitive | 1 | 29.8 ± 1.0 | NS |
| P | *Polygonum raii* | Sharp-fruited Knotweed | | | | S2S3 | 5 Undetermined | 8 | 18.0 ± 5.0 | NS |
| P | *Amelanchier fernaldii* | Fernald's Serviceberry | | | | S2S3 | 5 Undetermined | 4 | 8.9 ± 0.0 | NS |
| P | *Potentilla canadensis* | Canada Cinquefoil | | | | S2S3 | 3 Sensitive | 2 | 30.8 ± 0.0 | NS |
| P | *Salix pellita* | Satiny Willow | | | | S2S3 | 3 Sensitive | 4 | 37.5 ± 7.0 | NS |
| P | *Veronica serpyllifolia ssp. humifusa* | Thyme-Leaved Speedwell | | | | S2S3 | 3 Sensitive | 6 | 31.1 ± 0.0 | NS |
| P | *Carex adusta* | Lesser Brown Sedge | | | | S2S3 | 3 Sensitive | 4 | 94.2 ± 5.0 | NS |
| P | *Carex hirtifolia* | Pubescent Sedge | | | | S2S3 | 3 Sensitive | 4 | 73.2 ± 0.0 | NS |
| P | *Eriophorum gracile* | Slender Cottongrass | | | | S2S3 | 3 Sensitive | 7 | 92.1 ± 0.0 | NS |
| P | *Juncus trifidus* | Highland Rush | | | | S2S3 | 3 Sensitive | 7 | 70.1 ± 0.0 | NS |
| P | *Cypripedium parviflorum* | Yellow Lady's-slipper | | | | S2S3 | 3 Sensitive | 59 | 36.7 ± 1.0 | NS |
| P | *Poa glauca* | Glaucous Blue Grass | | | | S2S3 | 3 Sensitive | 14 | 58.7 ± 1.0 | NS |
| P | *Stuckenia filiformis* | Thread-leaved Pondweed | | | | S2S3 | 3 Sensitive | 3 | 63.9 ± 0.0 | NS |
| P | *Stuckenia filiformis ssp. alpina* | Thread-leaved Pondweed | | | | S2S3 | 3 Sensitive | 28 | 53.0 ± 7.0 | NS |
| P | *Botrychium lanceolatum var. angustisegmentum* | Lance-Leaf Grape-Fern | | | | S2S3 | 3 Sensitive | 5 | 43.8 ± 1.0 | NS |
| P | *Botrychium simplex* | Least Moonwort | | | | S2S3 | 3 Sensitive | 4 | 70.5 ± 1.0 | NS |
| P | *Ophioglossum pusillum* | Northern Adder's-tongue | | | | S2S3 | 3 Sensitive | 1 | 43.1 ± 5.0 | NS |
| P | *Angelica atropurpurea* | Purple-stemmed Angelica | | | | S3 | 4 Secure | 13 | 29.5 ± 0.0 | NS |
| P | *Erigeron hyssopifolius* | Hyssop-leaved Fleabane | | | | S3 | 3 Sensitive | 61 | 52.3 ± 0.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| P | *Erigeron hyssopifolius var. hyssopifolius* | Daisy Fleabane | | | | S3 | 3 Sensitive | 1 | 52.6 ± 0.0 | NS |
| P | *Megalodonta beckii* | Water Beggarticks | | | | S3 | 4 Secure | 5 | 28.2 ± 1.0 | NS |
| P | *Packera paupercula* | Balsam Groundsel | | | | S3 | 4 Secure | 82 | 52.2 ± 0.0 | NS |
| P | *Betula pumila* | Bog Birch | | | | S3 | 3 Sensitive | 5 | 79.6 ± 2.0 | NS |
| P | *Betula pumila var. pumila* | Bog Birch | | | | S3 | 3 Sensitive | 1 | 97.2 ± 1.0 | NS |
| P | *Campanula aparinoides* | Marsh Bellflower | | | | S3 | 3 Sensitive | 1 | 84.9 ± 5.0 | NS |
| P | *Viburnum edule* | Squashberry | | | | S3 | 3 Sensitive | 3 | 91.9 ± 0.0 | NS |
| P | *Empetrum eamesii* | Pink Crowberry | | | | S3 | 3 Sensitive | 9 | 87.6 ± 0.0 | NS |
| P | *Vaccinium boreale* | Northern Blueberry | | | | S3 | 3 Sensitive | 29 | 2.4 ± 10.0 | NS |
| P | *Vaccinium caespitosum* | Dwarf Bilberry | | | | S3 | 4 Secure | 11 | 33.7 ± 7.0 | NS |
| P | *Vaccinium uliginosum* | Alpine Bilberry | | | | S3 | 3 Sensitive | 24 | 11.6 ± 0.0 | NS |
| P | *Bartonia virginica* | Yellow Bartonia | | | | S3 | 4 Secure | 1 | 70.8 ± 0.0 | NS |
| P | *Proserpinaca palustris* | Marsh Mermaidweed | | | | S3 | 4 Secure | 24 | 27.3 ± 0.0 | NS |
| P | *Proserpinaca palustris var. crebra* | Marsh Mermaidweed | | | | S3 | 4 Secure | 23 | 66.5 ± 0.0 | NS |
| P | *Teucrium canadense* | Canada Germander | | | | S3 | 3 Sensitive | 33 | 55.1 ± 0.0 | NS |
| P | *Decodon verticillatus* | Swamp Loosestrife | | | | S3 | 4 Secure | 4 | 80.2 ± 7.0 | NS |
| P | *Epilobium hornemannii* | Hornemann's Willowherb | | | | S3 | 4 Secure | 13 | 77.1 ± 6.0 | NS |
| P | *Epilobium strictum* | Downy Willowherb | | | | S3 | 3 Sensitive | 7 | 28.0 ± 1.0 | NS |
| P | *Polygala sanguinea* | Blood Milkwort | | | | S3 | 3 Sensitive | 1 | 73.3 ± 7.0 | NS |
| P | *Polygonum pensylvanicum* | Pennsylvania Smartweed | | | | S3 | 4 Secure | 7 | 85.4 ± 3.0 | NS |
| P | *Polygonum scandens* | Climbing False Buckwheat | | | | S3 | 3 Sensitive | 7 | 98.2 ± 0.0 | NS |
| P | *Primula laurentiana* | Laurentian Primrose | | | | S3 | 4 Secure | 1 | 80.8 ± 7.0 | NS |
| P | *Samolus valerandi ssp. parviflorus* | Seaside Brookweed | | | | S3 | 3 Sensitive | 6 | 50.7 ± 0.0 | NS |
| P | *Pyrola asarifolia* | Pink Pyrola | | | | S3 | 4 Secure | 4 | 55.4 ± 0.0 | NS |
| P | *Pyrola minor* | Lesser Pyrola | | | | S3 | 3 Sensitive | 11 | 17.4 ± 1.0 | NS |
| P | *Ranunculus gmelinii* | Gmelin's Water Buttercup | | | | S3 | 4 Secure | 62 | 38.7 ± 0.0 | NS |
| P | *Rhamnus alnifolia* | Alder-leaved Buckthorn | | | | S3 | 4 Secure | 278 | 19.3 ± 0.0 | NS |
| P | *Agrimonia gryposepala* | Hooked Agrimony | | | | S3 | 4 Secure | 99 | 35.1 ± 0.0 | NS |
| P | *Amelanchier stolonifera* | Running Serviceberry | | | | S3 | 4 Secure | 4 | 18.0 ± 2.0 | NS |
| P | *Galium kamtschaticum* | Northern Wild Licorice | | | | S3 | 4 Secure | 4 | 67.9 ± 5.0 | NS |
| P | *Geocaulon lividum* | Northern Comandra | | | | S3 | 4 Secure | 9 | 25.9 ± 0.0 | NS |
| P | *Limosella australis* | Southern Mudwort | | | | S3 | 4 Secure | 7 | 12.7 ± 1.0 | NS |
| P | *Lindernia dubia* | Yellow-seeded False Pimperel | | | | S3 | 4 Secure | 2 | 99.5 ± 0.0 | NS |
| P | *Laportea canadensis* | Canada Wood Nettle | | | | S3 | 3 Sensitive | 11 | 91.0 ± 0.0 | NS |
| P | *Verbena hastata* | Blue Vervain | | | | S3 | 4 Secure | 1 | 85.4 ± 0.0 | NS |
| P | *Carex cryptolepis* | Hidden-scaled Sedge | | | | S3 | 4 Secure | 12 | 35.2 ± 0.0 | NS |
| P | *Carex eburnea* | Bristle-leaved Sedge | | | | S3 | 3 Sensitive | 129 | 52.2 ± 0.0 | NS |
| P | *Carex rosea* | Rosy Sedge | | | | S3 | 4 Secure | 2 | 68.5 ± 5.0 | NS |
| P | *Carex tribuloides* | Blunt Broom Sedge | | | | S3 | 4 Secure | 4 | 29.8 ± 0.0 | NS |
| P | *Carex wiegandii* | Wiegand's Sedge | | | | S3 | 3 Sensitive | 11 | 29.4 ± 0.0 | NS |
| P | *Carex foenea* | Fernald's Hay Sedge | | | | S3 | 4 Secure | 3 | 30.4 ± 0.0 | NS |
| P | *Eleocharis nitida* | Quill Spikerush | | | | S3 | 4 Secure | 2 | 24.9 ± 0.0 | NS |
| P | *Elodea canadensis* | Canada Waterweed | | | | S3 | 4 Secure | 8 | 92.6 ± 0.0 | NS |
| P | *Juncus subcaudatus var. planisepalus* | Woods-Rush | | | | S3 | 3 Sensitive | 6 | 3.0 ± 2.0 | NS |
| P | *Juncus dudleyi* | Dudley's Rush | | | | S3 | 4 Secure | 9 | 61.3 ± 0.0 | NS |
| P | *Goodyera oblongifolia* | Menzies' Rattlesnake-plantain | | | | S3 | 3 Sensitive | 13 | 61.2 ± 0.0 | NS |
| P | *Goodyera repens* | Lesser Rattlesnake-plantain | | | | S3 | 3 Sensitive | 19 | 26.3 ± 0.0 | NS |
| P | *Listera australis* | Southern Twayblade | | | | S3 | 4 Secure | 17 | 30.5 ± 0.0 | NS |

| Taxonomic Group | Scientific Name | Common Name | COSEWIC | SARA | Prov Legal Prot | Prov Rarity Rank | Prov GS Rank | # recs | Distance (km) | Prov |
|---|---|---|---|---|---|---|---|---|---|---|
| P | *Platanthera grandiflora* | Large Purple Fringed Orchid | | | | S3 | 4 Secure | 13 | 9.9 ± 1.0 | NS |
| P | *Platanthera hookeri* | Hooker's Orchid | | | | S3 | 4 Secure | 1 | 77.7 ± 0.0 | NS |
| P | *Platanthera orbiculata* | Small Round-leaved Orchid | | | | S3 | 4 Secure | 9 | 30.9 ± 0.0 | NS |
| P | *Spiranthes ochroleuca* | Yellow Ladies'-tresses | | | | S3 | 4 Secure | 1 | 10.5 ± 0.0 | NS |
| P | *Alopecurus aequalis* | Short-awned Foxtail | | | | S3 | 4 Secure | 13 | 56.3 ± 0.0 | NS |
| P | *Potamogeton obtusifolius* | Blunt-leaved Pondweed | | | | S3 | 4 Secure | 5 | 89.6 ± 7.0 | NS |
| P | *Potamogeton praelongus* | White-stemmed Pondweed | | | | S3 | 3 Sensitive | 10 | 15.6 ± 1.0 | NS |
| P | *Potamogeton zosteriformis* | Flat-stemmed Pondweed | | | | S3 | 3 Sensitive | 10 | 55.5 ± 0.0 | NS |
| P | *Sparganium natans* | Small Burreed | | | | S3 | 4 Secure | 10 | 4.0 ± 0.0 | NS |
| P | *Asplenium trichomanes* | Maidenhair Spleenwort | | | | S3 | 4 Secure | 16 | 42.6 ± 2.0 | NS |
| P | *Asplenium trichomanes-ramosum* | Green Spleenwort | | | | S3 | 3 Sensitive | 27 | 40.8 ± 0.0 | NS |
| P | *Equisetum pratense* | Meadow Horsetail | | | | S3 | 3 Sensitive | 15 | 72.5 ± 0.0 | NS |
| P | *Equisetum variegatum* | Variegated Horsetail | | | | S3 | 4 Secure | 6 | 30.5 ± 0.0 | NS |
| P | *Isoetes acadiensis* | Acadian Quillwort | | | | S3 | 3 Sensitive | 9 | 1.9 ± 0.0 | NS |
| P | *Lycopodium sitchense* | Sitka Clubmoss | | | | S3 | 4 Secure | 9 | 3.0 ± 1.0 | NS |
| P | *Huperzia appalachiana* | Appalachian Fir-Clubmoss | | | | S3 | 3 Sensitive | 6 | 65.1 ± 4.0 | NS |
| P | *Botrychium dissectum* | Cut-leaved Moonwort | | | | S3 | 4 Secure | 1 | 43.1 ± 5.0 | NS |
| P | *Polypodium appalachianum* | Appalachian Polypody | | | | S3 | 5 Undetermined | 3 | 61.9 ± 0.0 | NS |
| P | *Asclepias incarnata ssp. pulchra* | Swamp Milkweed | | | | S3? | 5 Undetermined | 42 | 55.5 ± 0.0 | NS |
| P | *Lycopodium sabinifolium* | Ground-Fir | | | | S3? | 4 Secure | 6 | 74.0 ± 5.0 | NS |
| P | *Atriplex franktonii* | Frankton's Saltbush | | | | S3S4 | 4 Secure | 8 | 4.0 ± 0.0 | NS |
| P | *Suaeda calceoliformis* | Horned Sea-blite | | | | S3S4 | 4 Secure | 5 | 17.8 ± 0.0 | NS |
| P | *Myriophyllum sibiricum* | Siberian Water Milfoil | | | | S3S4 | 4 Secure | 10 | 55.5 ± 0.0 | NS |
| P | *Sanguinaria canadensis* | Bloodroot | | | | S3S4 | 4 Secure | 84 | 30.6 ± 0.0 | NS |
| P | *Fragaria vesca ssp. americana* | Woodland Strawberry | | | | S3S4 | 4 Secure | 57 | 40.7 ± 0.0 | NS |
| P | *Salix petiolaris* | Meadow Willow | | | | S3S4 | 4 Secure | 8 | 29.6 ± 0.0 | NS |
| P | *Carex argyrantha* | Silvery-flowered Sedge | | | | S3S4 | 4 Secure | 3 | 29.6 ± 0.0 | NS |
| P | *Eriophorum russeolum* | Russet Cottongrass | | | | S3S4 | 4 Secure | 2 | 80.5 ± 0.0 | NS |
| P | *Triglochin gaspensis* | Gasp ├─ Arrowgrass | | | | S3S4 | 5 Undetermined | 6 | 64.5 ± 0.0 | NS |
| P | *Juncus acuminatus* | Sharp-Fruit Rush | | | | S3S4 | 4 Secure | 3 | 74.4 ± 4.0 | NS |
| P | *Luzula parviflora* | Small-flowered Woodrush | | | | S3S4 | 4 Secure | 12 | 33.8 ± 0.0 | NS |
| P | *Liparis loeselii* | Loesel's Twayblade | | | | S3S4 | 4 Secure | 11 | 34.5 ± 2.0 | NS |
| P | *Panicum tuckermanii* | Tuckerman's Panic Grass | | | | S3S4 | 4 Secure | 1 | 84.6 ± 0.0 | NS |
| P | *Trisetum spicatum* | Narrow False Oats | | | | S3S4 | 4 Secure | 8 | 62.5 ± 5.0 | NS |
| P | *Cystopteris bulbifera* | Bulblet Bladder Fern | | | | S3S4 | 4 Secure | 313 | 40.0 ± 1.0 | NS |
| P | *Equisetum hyemale var. affine* | Common Scouring-rush | | | | S3S4 | 4 Secure | 9 | 28.2 ± 2.0 | NS |
| P | *Equisetum scirpoides* | Dwarf Scouring-Rush | | | | S3S4 | 4 Secure | 45 | 40.8 ± 0.0 | NS |
| P | *Lycopodium complanatum* | Northern Clubmoss | | | | S3S4 | 4 Secure | 5 | 22.1 ± 2.0 | NS |
| P | *Schizaea pusilla* | Little Curlygrass Fern | | | | S3S4 | 4 Secure | 11 | 2.7 ± 1.0 | NS |
| P | *Poa alpina* | Alpine Blue Grass | | | | SH | 0.1 Extirpated | 2 | 59.7 ± 0.0 | NS |
| P | *Botrychium minganense* | Mingan Moonwort | | | | SH | 0.1 Extirpated | 1 | 55.1 ± 1.0 | NS |

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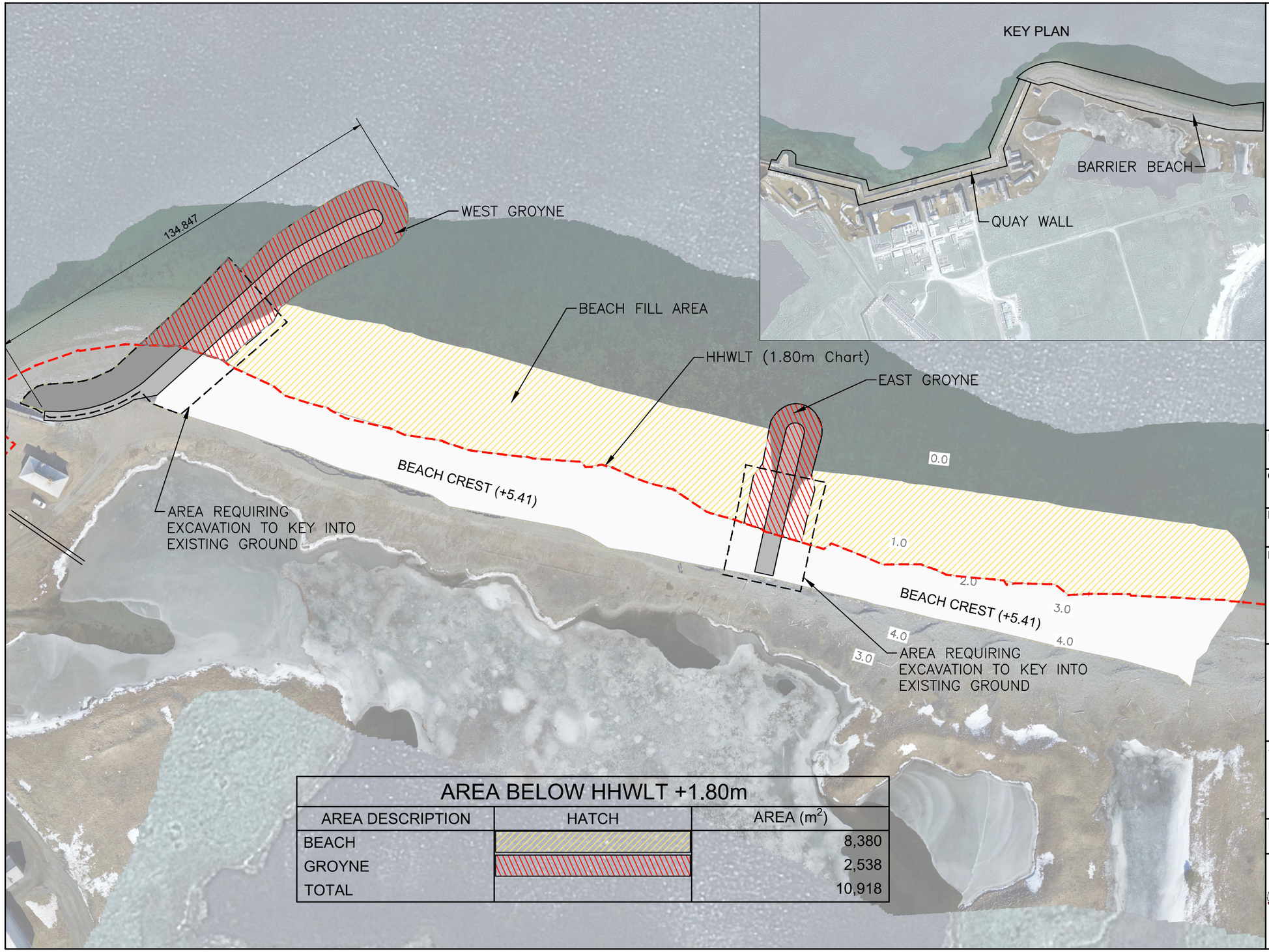
# Appendix D – Project Footprints Below OHWM




ALL ELEVATIONS AND COORDINATES ARE IN METRES REFERENCED TO CHART DATUM FOR LOUISBOUR, NOVA SCOTIA

AREA BELOW HHWLT +1.80m

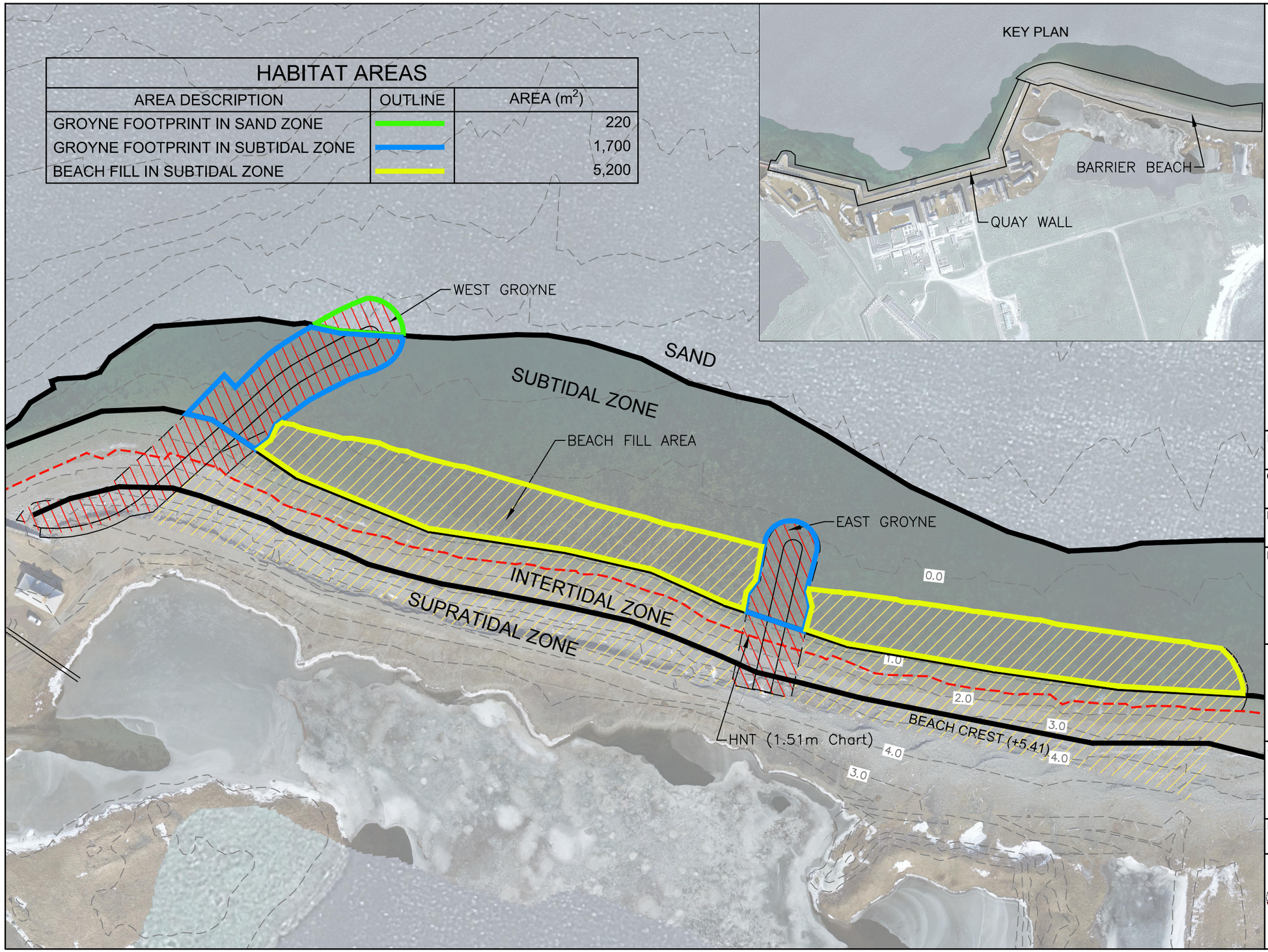
| AREA DESCRIPTION | HATCH | AREA ($m^2$) |
|---|---|---|
| BEACH | | 8,380 |
| GROYNE | | 2,538 |
| TOTAL | | 10,918 |

| | |
|---|---|
| Drawn By: MN | Checked By: DP |
| Calculations By: MN | Checked By: DP |
| Date: AUGUST, 2017 | |
| Project: DESIGN FOR PERIOD SITE EROSION PROTECTION, FORTRESS OF LOUISBOURG BARRIER BEACH | |
| Drawing: BARRIER BEACH NOURISHMENT AND GROYNES PROJECT COMPONENT | |
| Scale: 1:1250 (0, 25, 50, 75m) | |
| File No.: 408827 | Drawing: FIGURE 1 / Revision No.: 2 |

GEMTEC EASTERN JV

## HABITAT AREAS

| AREA DESCRIPTION | OUTLINE | AREA ($m^2$) |
|---|---|---|
| GROYNE FOOTPRINT IN SAND ZONE | | 220 |
| GROYNE FOOTPRINT IN SUBTIDAL ZONE | | 1,700 |
| BEACH FILL IN SUBTIDAL ZONE | | 5,200 |







ALL ELEVATIONS AND COORDINATES ARE IN METRES REFERENCED TO CHART DATUM FOR LOUISBOUR, NOVA SCOTIA

GROYNE AREA

BEACH FILL AREA

HIGH NORMAL TIDE (HNT)

ZONE LIMITS

| | |
|---|---|
| Drawn By: MN | Checked By: JH |
| Calculations By: MN | Checked By: JH |

Date: JULY, 2017

Project: DESIGN FOR PERIOD SITE EROSION PROTECTION, FORTRESS OF LOUISBOURG BARRIER BEACH

Drawing: APPROXIMATE SPATIAL EXTEND OF MARINE HABITAT TYPES WITHIN PROJECT FOOTPRINT

Scale: 1:1250

0 25 50 75m

| File No. | Drawing | Revision No. |
|---|---|---|
| 408827 | FIGURE 2 | 2 |

GEMTEC EASTERN JV

| AREA BELOW HHWLT +1.80m | | |
|---|---|---|
| AREA DESCRIPTION | HATCH | AREA ($m^2$) |
| BELOW HHWLT 1.80m | | 3,554 |


ALL ELEVATIONS AND COORDINATES ARE IN METRES REFERENCED TO CHART DATUM FOR LOUISBOUR, NOVA SCOTIA

| Drawn By | Checked By |
|---|---|
| MN | DP |
| **Calculations By** | **Checked By** |
| MN | DP |

Date
AUGUST, 2017

Project
DESIGN FOR PERIOD SITE EROSION PROTECTION, FORTRESS OF LOUISBOURG QUAY WALL

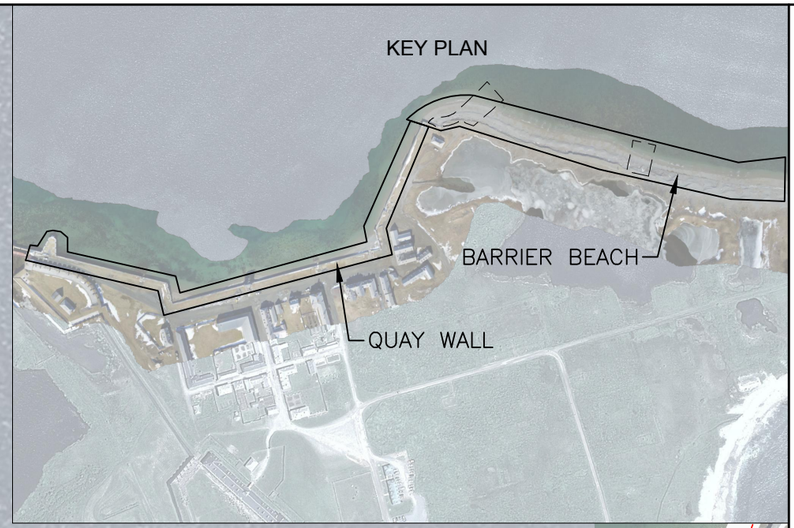
Drawing
QUAY WALL PROJECT COMPONENT

Scale
1:1500
0 20 40 60m

| File No. | Drawing | Revision No. |
|---|---|---|
| 408827 | FIGURE 3 | 3 |

GEMTEC EASTERN JV

| AREA BELOW HHWLT +1.80m | | |
|---|---|---|
| AREA DESCRIPTION | HATCH | AREA ($m^2$) |
| BELOW HHWLT 1.80m | | 1,023 |





ALL ELEVATIONS AND COORDINATES ARE IN METRES REFERENCED TO CHART DATUM FOR LOUISBOUR, NOVA SCOTIA

| Drawn By | Checked By |
|---|---|
| MN | DP |
| **Calculations By** | **Checked By** |
| MN | DP |

Date
AUGUST, 2017

Project
DESIGN FOR PERIOD SITE EROSION PROTECTION, FORTRESS OF LOUISBOURG BARRIER BEACH

Drawing
QUAY WALL INITIAL DREDGE AREA

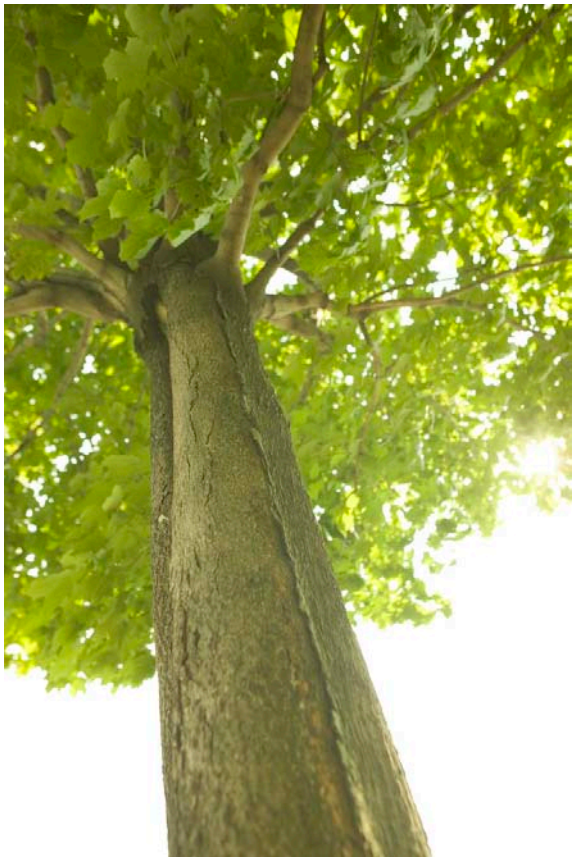
Scale
1:1250
0 25 50 75m

| File No. | Drawing | Revision No. |
|---|---|---|
| 408827 | FIGURE 4 | 2 |

GEMTEC EASTERN JV

# Appendix E – Guidelines for the Use, Handling and Disposal of Treated Wood (March 2009)

# Guidelines for the Use, Handling and Disposal of Treated Wood



**Parks Canada Agency**
**March 2009**

# Table of Content

# List of Acronyms

| | |
|---|---|
| ACA | Ammoniacal copper arsenate |
| ACQ | Ammoniacal copper quaternary |
| ACZA | Ammoniacal copper zinc arsenate |
| CA | Copper azole |
| CCA | Chromated copper arsenate |
| CuN | Copper naphthenate |
| DOT | Disodium octaborate tetrahydrate |
| HDPE | High density polyethylene |
| IC&I | Industrial, commercial and institutional |
| LDPE | Low density polyethylene |
| PAH | Polycyclic aromatic hydrocarbon |
| PCF | Pounds per cubic foot |
| PCP | Pentachlorophenol |
| PE | Polyethylene |
| PTW | Pressure treated wood |
| ZnN | Zinc naphthenate |

# 1. Guideline Objectives

The main objective of these guidelines is to provide Parks Canada management and staff with the necessary information and tools to reduce environmental impacts and health risks to employees, as well as visitors when using treated wood in various construction structures.

These guidelines also establish the best practices regarding the use, handling and disposal of treated wood within Parks Canada's field units. These guidelines focus on various types of preservatives used to treat wood that may be used to extend the service life of wood.

## 2. Introduction

Across Canada, wood has been the material of choice for many applications such as building construction, decking, retaining walls, outdoor furniture, playground equipment, bulkheads, piers, pilings, utility poles, and many other uses. Wood has many advantages such as strength, appearance, ease of fabrication, availability, renewability, and cost, but when it is used in certain situations, particularly outdoors, wood is subject to attack by fungi, insects, and marine organisms (Dickey, 2003).

A wide range of wood preservative treatments has since been developed to protect wood and prolong its useful life. Wood preservatives have been used around the world for many years and across Canada for more than 100 years. During which time, wood preservatives have proven to be an effective treatment against natural degradation agents (CITW, 2004).

Treated wood was most commonly produced with chromated copper arsenate (CCA). Chromium (a bactericide), copper (a fungicide) and arsenic (an insecticide) were combined to prevent decay and insect infestation. Other arsenic containing preservatives include ammoniacal copper arsenate (ACA) and ammoniacal copper zinc arsenate (ACZA). Despite being aware of possible risks from CCA treated wood since the late 1970's, it was still widely used in Canada and the United States up to December 2003.

In February 2002, the U.S. Environmental Protection Agency (EPA) announced that the treated wood industry would voluntarily phase out use of CCA wood preservatives for residential applications (MTURI, date NA). Canadian wood preservation companies announced a similar phase-out as Health Canada's Pest Management Regulatory Agency (PMRA) followed in the footsteps of its American counterpart. Other countries also have restrictions or proposed restrictions. They include Japan, Denmark, Sweden, Germany, Australia and New Zealand.

Wood produced prior to the voluntary phase out is expected to remain in-service for many years. Moreover, this voluntary phase-out still allows the use of CCA treated wood outside residential settings.

# 3. Best Practices

## 3.1 Existing Treated Wood Structures and Facilities

Many structures and facilities built with treated wood can be found in sites managed by Parks Canada. These structures and facilities should be handled as follows:

***1.*** If they are in good condition, existing structures and facilities built with any type of treated wood should not be replaced, unless they are in direct contact with drinking water.

***2.*** The surfaces of all structures and facilities that have been treated with a CCA wood preservative and that may be touched regularly by visitors must be completely covered with a penetrating, oil-based finish, such as a stain or water-resistant sealer. It is preferable to use a durable, high-quality product. In addition to waterproofing the wood, the application of such sealers reduces the release of chemicals contained in CCA-treated wood by 80% to 95%. Another coat of penetrating oil-based sealer should be applied when the current finish begins to show signs of deterioration. Particular attention should be paid to structures that are regularly touched by visitors (e.g. handrails, picnic tables, etc.). (Stilwell and Musante, 2003).

***3.*** The use of non-penetrating finishes, such as paint or urethane, is not recommended because peeling and flaking can have an impact on the wood's durability and on exposure to preservatives contained in the wood.

***4.*** It may not be justifiable to add a coat of preservative to a structure made from old treated wood. This practice would not extend the structure's durability. Instead, the replacement of the existing structure should be considered if it has reached the end of its useful life.

***5.*** Old structures made with CCA-treated wood should be monitored carefully and replaced before the end of their useful lives, i.e. before the wood begins to break down or decompose, in order to avoid the release of highly toxic arsenic.

***6.*** Treated wood should not be used where it may come into direct or indirect contact with drinking water, except for uses involving incidental contact such as docks, signage posts and bridges.

## 3.2 New Treated Wood Structures and Facilities

***1.*** The use of CCA-treated wood in proposed construction and development projects should be limited as much as possible. The use of alternative products should be promoted. CCA-treated wood should only be used when such protection is important, as in areas where the wood is subject to decay or insect attack, or is in contact with damp soil or water and that no alternate measure is available.

***2.*** CCA-treated wood must not be used in the construction of play structures, and landscaping timbers. Other types of treated wood products should be promoted for patios, walkways/sidewalks or footbridges.

***3.*** No treated wood should be used in the construction of items that may come in direct contact with food or that may introduce chemicals into the food chain: feeders, picnic tables, silos, feed storage structures, hives, drinking troughs, compost bins and wood chip mulch.

***4.*** Creosote-treated wood should not be used inside dwellings or areas where it may come into frequent contact with human hands, such as handrails.

***5.*** Pentachlorophenol-treated wood should not be used inside dwellings and is generally not recommended for areas where it may come into frequent contact with human hands, such as handrails.

## 3.3 Appropriateness and Justification of the Use of Treated Wood

***1.*** Project proponents should be able to determine the most appropriate products and should be able to justify their use.

***2.*** Treated wood should only be used when it is important that the wood be protected (risk of decay, attack by insects or contact with water or damp soil). Wood treatment should not be a substitute for good construction design.

***3.*** Use treated wood that has undergone a fixation or stabilization process.

## 3.4 Usage of Treated Wood in Aquatic Environments

Particular attention should be given to the environmental risks associated with all structures placed in aquatic environments. Since the long-term impacts of treated wood on aquatic environments are relatively unknown and may vary depending on many factors, a preventive approach is essential.

***1.*** Treated wood should not be used under water or where it has contact with a body of water.

***2.*** Proponents must conduct a thorough evaluation of the receiving environment before choosing the most appropriate construction material.

***3.*** If appropriate, after having demonstrated the need to use treated wood in an aquatic environment, proponents must identify the most suitable type of wood treatment given the characteristics of the receiving environment.

***4.*** The use of treated wood should always be managed so that the resulting water and sediment concentrations of preservative active ingredients (including background concentrations) remain below water quality criteria and sediment benchmarks or quality criteria, where they exist.

***5.*** Restrictions may be placed on the period when work can be carried out in order to protect sensitive aquatic species and reduce the risk of exposure to toxic elements during particularly sensitive life stages.

***6.*** Polyethylene (PE) wear strips should be used to prevent abrasion of treated wood structures in aquatic environments.

## 3.5 Safe Handling of Treated Wood

***1.*** Project managers should ensure that the treated wood to be used has been certified according to the standards of the treated wood industry.

***2.*** Treated wood must be visually inspected before use to ensure that it appears clean and its surface is free of preservative residues. Otherwise, the lumber should not be used and should be disposed of in accordance with the manufacturer's guidelines and with local and provincial regulations.

***3.*** Anyone who handles treated wood should wear gloves and a long-sleeve shirt. When sawing, sanding and shaping treated wood, workers should also wear dust masks and goggles to avoid touching or inhaling sawdust.

***4.*** Workers must always cut and work with treated wood outdoors or in an adequately ventilated area.

***5.*** Anyone who works with treated wood should wash their hands immediately after finishing their work, and especially before eating, drinking or smoking.

***6.*** During and after construction, all remaining scraps, cuttings, wood chips and sawdust must be collected efficiently and in a timely manner. All wood waste must be disposed of in accordance with the manufacturer's guidelines and with local and provincial regulations.

## 3.6 Installation and Maintenance of Treated Wood

***1.*** If exposed, cut ends should be protected with a preservative applied in accordance with the manufacturer's instructions, preferably in a protected cutting area and before installation.

***2.*** If the chemical solution is accidentally spilled while ends are being treated, the spill should be cleaned up immediately with a disposable absorbent substance (soil, sawdust, forest litter or rags). Dispose of the contaminated absorbent material safely, in accordance with local and provincial regulations.

***3.*** Corrosion-resistant fastenings should be used to minimize moisture damage.

***4.*** The use of cleaning and bleaching products containing sodium hypochlorite, sodium hydroxide, sodium percarbonate or citric or oxalic acid on treated wood should be avoided because these products can cause the wood to release toxic chemicals.

## 3.7 Disposal of Treated Wood

***1.*** Never dispose of treated wood by burning.

***2.*** Do not compost scraps, wood chips or sawdust from treated wood.

***3.*** Contact the local or provincial government for information on how to dispose of this material in the community.

***4.*** Re-use treated wood to the extent possible.

## 3.8 Recommended Hardware for Treated Wood

### *3.8.1 Connectors*

***1.*** Connectors used for ACQ- or CA-treated wood should be manufactured from steel and be either galvanized in accordance with ASTM A653, G185 designation, or be galvanized after manufacture in accordance with ASTM A123. Stainless steel connectors (type 304 or 316) are recommended for maximum service life or severe applications.

***2.*** For borate-treated wood used inside buildings, the same connectors can be used as for untreated wood.

### *3.8.2 Fasteners*

***1.*** Fasteners for ACQ- or CA-treated wood should be galvanized in accordance with ASTM A153. Stainless steel may be used for maximum service life or severe applications. Where appropriate, copper fasteners may also be used.

***2.*** Fasteners used in combination with metal connectors must be the same type of metal to avoid galvanic corrosion caused by dissimilar metals.

***3.*** For borate-treated wood used inside buildings, the same fasteners can be used as for untreated wood.

### *3.8.3 Flashing*

***1.*** Flashing used in contact with treated wood must be compatible with the treated wood.

***2.*** Copper and stainless steel are the most durable metals for flashing. Galvanized steel, in accordance with ASTM A653, G185 designation, is also suitable for use as flashing. Fasteners should be compatible to avoid galvanic corrosion.

### *3.8.4 Other Hardware*

***1.*** There may be additional products such as polymer or ceramic coatings, or vinyl or plastic flashings that are suitable for use with treated wood products. Consult the individual fastener, connector or flashing manufacturer for recommendations for use of their products with treated wood.

# 4. Various Types of Wood Preservatives

Wood preservatives have been used around the world for many years and across Canada for more than a hundred years. During that time, wood preservatives have proven to be an effective treatment against natural wood degradation agents such as fungi and insects. Wood used in outdoor applications, with the exception of naturally rot-resistant species such as cedar and redwood, should be treated with preservatives if it is expected to last more than a few years.

In the past few years, several new wood preservatives have been developed. Some confusion has come about with this broadened range of wood preservatives. Hence, it has become necessary to clarify which substances are contained in treated wood and what types of treated wood can be used in the various environments.

Identification of wood preservatives can be simplified by classifying them as either waterborne or oilborne, depending on the chemical composition of the preservative and the carrier solvent used during the treating process. The following section describes the most common types of wood preservatives.

Table 4.1 Wood Preservatives and Carriers (Arnold Lumber, date NA).

| **Wood Preservatives and Carriers** | | | | |
|---|---|---|---|---|
| **Carrier** | Creosote (Tar Oil) | Heavy Petroleum Oil | Water | Water & Ammonia |
| **Preservative** | Creosote | Pentachloro-phenol (PCP) | Chromated Copper Arsenate (CCA), Borates | ACQ, AZCA, CA |

## 4.1 Waterborne Wood Preservatives

Chromated copper arsenate (CCA), alkaline copper quaternary compounds (ACQ), copper azole (CA), and ammoniacal copper zinc arsenate (ACZA) are waterborne preservatives that react with or precipitate in the wood substrate and become “fixed” to prevent leaching. Waterborne preservatives have a dry paintable surface, which is the main reason behind their common use in residential applications. These preservatives are primarily used to treat softwood species and are very effective for this application. However, because their cellular structure is different, hardwoods treated with waterborne preservatives may not be adequately protected in some types of exposures or environments (Lebow and Tippie, 2001). Waterborne wood preservatives may increase corrosion of unprotected metal, and so all metal fasteners used with treated wood should be hot-dipped galvanized or stainless steel. Although, not all stainless steel fasteners are acceptable for use with treated wood (Simpson, 2005). Borates are another type of waterborne preservative, but borate-based preservatives have the disadvantage of not being fixed in the wood and thus are readily leached if exposed to rainfall or standing water (Lebow and Tippie, 2001).

Figure 4.1 Wood treated with waterborne preservatives is often used for decking, such as in this wetland boardwalk (Lebow and Tippie, 2001).

### 4.1.1 Chromated Copper Arsenate (CCA)

Chromated copper arsenate (CCA) is a waterborne preservative containing arsenic, chromium and copper. This type of preservative is used for the long-term protection of wood against attack by fungi, insects and marine borers. CCA-treated wood typically has a light green color but it may also be factory stained or dyed to various shades of brown. A water-repellent treatment may also be applied to help prevent checking and splitting when the wood is used on a flat surface, such as decking. CCA-treated wood has little or no odour associate to it (Lebow and Tippie, 2001).

Until January 2004, CCA was the most widely used wood preservative in North America (Health Canada, 2005). For over seventy years, CCA was the preservative of choice for the pressure-treatment of wood. (Harrison, 2003). Wood preservation companies in the U.S. and Canada did pledge to phase out the use of the arsenic-based preservative CCA in treated wood because of consumer pressure. Prior to the voluntary phase-out of CCA usage by the Wood Treatment industry, CCA-treated wood was commonly used in residential construction such as playground structures, fences, gazebos and decks. Although, it may still be used for industrial uses such as utility and construction poles, marine timbers and pilings (Health Canada, 2005).

### 4.1.2 Alkaline Copper Quaternary (ACQ)

Alkaline copper quaternary (ACQ) is one of several wood preservatives that have been developed in recent years because of environmental or safety concerns with CCA. This preservative contains copper and a quaternary ammonium compound. Multiple variations of ACQ have already been standardized but some are still in the process of standardization (USDA Forest Service, date NA). ACQ-B is formulated using ammoniacal copper, and like ACZA, ACQ-B is able to penetrate Douglas fir and other difficult-to-treat wood species. This preservative is marketed primarily on the West Coast. ACQ-B treated wood has a dark greenish brown color and may have an ammonia odour until the wood dries. ACQ-D is formulated using amine copper, which gives the

wood a light brown color and little noticeable odour. It does not penetrate difficult-to-treat wood as well as ACQ-B and is most commonly used for treatment of thick sapwood pine species (Lebow and Tippie, 2001).

The multiple formulations of ACQ allow some flexibility in achieving compatibility with a specific wood species and application. When ammonia is used as the carrier solvent, ACQ has an improved ability to penetrate difficult-to-treat wood species. However, if the wood species is readily treated, such as southern pine, an amine carrier may be used to provide a more uniform surface appearance. All the ACQ treatments accelerate corrosion of metal fasteners relative to untreated wood, and hot-dipped galvanized or stainless steel fasteners are recommended (USDA Forest Service, date NA).

### 4.1.3 Copper Azole (CA)

Copper azole (CA) is another recently developed wood preservative that contains copper, boric acid, and tebuconazole. These three active ingredients work together to protect against decay fungi and insects. CA has not been standardized for use in seawater. Because CA was developed very recently, it is not yet widely used and may not be available in some areas. CA is able to provide good treatment for southern pine and hemlock/fir species groups (Lebow and Tippie, 2001). Douglas fir may adequately be treated when ammonia is included in the CA formulations. However, including ammonia is likely to have slight affects on the surface appearance and initial odour of the treated wood. The CA treatments do increase the rate of corrosion of metal fasteners relative to untreated wood, and hot-dipped galvanized or stainless steel fasteners are recommended (USDA Forest Service, date NA). CA-treated wood has a uniform greenish brown color and little or no odour. It can also be painted or stained (Lebow and Tippie, 2001).

### 4.1.4 Ammoniacal Copper Zinc Arsenate (ACZA)

Ammoniacal copper zinc arsenate (ACZA) contains copper, zinc, and arsenic. ACZA is a refinement on the original formulation, ACA. ACZA protects against attack by decay fungi, insects, and most types of marine borers. Its uses are very similar to those of CCA-C and include treatment of poles, piling, and timbers. Because of its ability to penetrate Douglas fir and other difficult-to-treat wood species, it is most widely used on the West Coast. The color of the treated wood is dark brown to bluish green. The wood initially has a slight ammonia odour, but soon dissipates after treatment as the wood dries (Lebow and Tippie, 2001).

### 4.1.5 Borate-Based Preservatives

Borate preservatives are salts such as sodium octaborate (disodium octaborate tetrahydrate – DOT), sodium tetraborate, and sodium pentaborate that are dissolved in water. They are also referred as “oxides of boron” (SBX) Borates are effective preservatives against decay fungi, wood-boring insects and subterranean termites (PTW-SafetyInfo, date NA). Borate preservatives are diffusible, and with appropriate treating practices, they can achieve excellent penetration in species that are difficult-to-treat with other preservatives. However, the borate in the wood remains water-soluble and readily leaches out in soil or rainwater (Lebow and Tippie, 2001). Borate-treated wood is not considered suitable for unprotected outdoor use, such as for fence posts or poles, but is suitable for most building construction purposes (Gegner, 2002) and for

applications where the wood is kept free from rainwater, out of standing water, and away from ground contact. An example of such a use is in the construction of wooden buildings in areas of high termite hazard. Borate-treated wood is odourless and colorless and may be painted or stained (Lebow and Tippie, 2001).

## 4.2 Oilborne Wood Preservatives

The most common oilborne preservatives are creosote, pentachlorophenol (PCP), and copper naphthenate (CuN). These types of preservatives are commonly used for applications such as utility poles, bridge timbers, railroad ties, pilings, and laminated beams. They are less frequently used for applications that involve frequent human skin contact or for inside dwellings because they may be oily and/or have a strong odour. These preservatives also act as water repellants because of their oily nature, and can help to prevent the checking and splitting of wood (Lebow and Tippie, 2001).

Figure 4.2 Oilborne preservatives are often used for treatment of glulam beams, such as in this bridge (Lebow and Tippie, 2001).

### 4.2.1 Creosote

Creosote is a distillate of coal tar, which is a byproduct of the carbonization of coal during coke production. Unlike the other oilborne preservatives, creosote is not typically dissolved in oil, but it does maintain properties that make it look and feel oily. Creosote contains a chemically complex mixture of organic molecules, up to 80% of which are polycyclic aromatic hydrocarbons (PAHs). Creosote is effective in preventing attack by decay fungi, insects, and is most particularly effective in repelling marine borers. Creosote is widely used in railroad ties, utility poles, bridge timbers, and piling. It has a dark brown-black color with a noticeably oily surface and strong odour. It is very difficult to paint, stain, or seal a piece of wood or structure treated with creosote (Lebow and Tippie, 2001).

### 4.2.2 Pentachlorophenol (PCP)

Pentachlorophenol (PCP) is a crystalline solid that can be dissolved in various types of oils. Petroleum oils are generally used as carriers of PCP (NEIA, 1993). This type of

preservative is very effective against fungi and insects but does not protect well against ocean marine borers. It is widely used to treat utility poles, bridge timbers, laminated beams, and fresh water and foundation piling. The appearance of PCP-treated wood depends greatly on the type of oil that it is used as a carrier solvent: a very light brown color and dry surface if a light oil is used or a dark brown color and somewhat oily surface if a heavy oil is used (Lebow and Tippie, 2001). The oil used as a carrier for PCP also provides extra protection against moisture-content changes, providing more stability and resistance to splitting (NEIA, 1993). PCP-treated wood is generally more durable if heavy oil is used as a carrier. Hence, light oil is most often used to treat wood for above ground constructions or in covered structures. PCP itself is odourless, but the carrier solvent may have a distinct odour that can be noticed when approaching this type of treated wood. Wood that is pressure treated using PCP in light oil as the carrier solvent is easier to paint or stain which, otherwise, may be difficult to do (Lebow and Tippie, 2001).

### 4.2.3 Copper Naphtenate (CuN)

Copper naphthenate (CuN) is the reaction product of naphthenic acids and copper salts dissolved in oil. This type of preservative is effective against decay fungi and insects but is not recommended for use in marine applications. CuN is not as widely used as creosote or PCP, but it is used for the treatment of utility poles, highway construction (Lebow and Tippie, 2001) bridges and is commonly available in retail lumberyards for use in fencing and decking (Hutton and Samis, 2000). Like PCP, the properties of CuN are dependent on the type of oil used as the carrier. The oils that are most commonly used as carrier solvents are fuel oil and mineral spirits. The color of the CuN-treated wood varies from light brown to dark green, depending on the type of carrier solvent and the applied treating process. The carrier solvents for CuN-treated wood give it a distinct odour. Wood that is treated using CuN in light oil is easier to paint or stain than wood treated with CuN in dark oil. CuN is widely applied for hand dressing on end cuts or holes bored into treated wood during construction (Lebow and Tippie, 2001).

## 5. Definitions

The following definitions have been added to help the reader grasp the various technical terms included in this document and to better comprehend the complexity of this matter.

| | |
|---|---|
| **Alkaline Copper Quaternary (ACQ)** | Wood preservative containing copper oxide and dimethyl (octadecyl) ammonium chloride. |
| **Borate** | Natural mineral, harmless to humans and animals, effective in protecting wood against rot and insects. Borates are water-soluble. |
| **Cambium** | The cambium is a thin layer of generative tissue lying between the bark and the wood of a stem, which is most active in woody plants. The cambium produces new layers of phloem on the outside and of xylem (wood) on the inside, thus increasing the diameter of the stem. |
| **Chromated Copper Arsenate (CCA)** | Waterborne wood preservative containing arsenic, chromium and copper. |
| **Copper Azole (CA)** | Wood preservative containing copper, boric acid and tebuconazole. |
| **Disposal** | Consists of the final disposal of the material (e.g., landfill), or treatment (e.g., stabilization) prior to final disposal. |
| **Fasteners** | The hardware (e.g. nails, screws, bolts, joist hangers) used to secure treated wood. Since treated lumber is used for durability, fasteners should be hot-dipped galvanized or stainless steel, especially with water borne preservatives, which contain corrosive salt. |
| **Fixation** | The chemical process in which the preservative metals in waterborne solution reacts with and bond to wood fiber molecules. |
| **Fungi** | Organisms (plant-like) that lack chlorophyll and must obtain their food by microscopic, root-like filaments that penetrate wood tissue and absorb its energy rich chemicals. |

| | |
|---|---|
| **Hardwood** | The term hardwood designates wood from deciduous trees. Hardwood contrasts with softwood, which generally comes from coniferous trees. They are in typically of higher density and hardness, but there is considerable variation in actual wood hardness in both groups, with a large amount of overlap. |
| **Heat-Treated Wood** | Wood that is heat-treated in oxygen-free kilns at temperatures of between 180 C and 280 C. This process makes wood harder, darker and more resistant to decay and compression. However, it loses its elasticity and deals less well with bending, shear force and impact. |
| **Heartwood** | This inert or dead portion is called heartwood. Its name derives solely from its position and not from any vital importance to the tree. |
| **Lignin** | The stiffening material inside cell walls. Allows trees to grow tall and out-compete other plants for sunlight. Accounts for about 30% of the dry weight of wood. |
| **Marine Borers** | Xylophagous bivalve molluscs of the *Teredinidae* family. Their reduced shell is striated with toothed rings used as drills to bore tunnels in submerged wood. |
| **Moisture Content** | The weight of water in wood, expressed as a percent of the oven-dried weight of the wood. |
| **On-Site Release** | An "on-site release" is an on-site discharge of a pollutant to the environment. This includes emissions to air, discharges to surface waters, on-site releases to land and deep-well underground injection, within the boundaries of the facility. |
| **Pesticide** | Chemical substance or product capable of destroying or limiting the growth of living organisms (micro-organisms, animals or plants) that are considered harmful. |
| **Phloem** | In vascular plants, phloem is the living tissue that carries organic nutrients, particularly sucrose to all parts of the plant where needed. In trees, the phloem is part of the bark. |

| | |
|---|---|
| **Pressure-Treated Wood** | Wood preservation process consisting in the pressure injection of a fungicidal, insecticidal preservative into the wood. |
| **Sapwood** | Sapwood is comparatively new wood, comprising living cells in the growing tree. All wood in a tree is first formed as sapwood. Its principal functions are to conduct water from the roots to the leaves and to store up and give back according to the season the food prepared in the leaves. |
| **Sealant** | A water repellent, which may be forced into the wood along with the chemical preservative in a closed cylinder under pressure. However, treated wood should be cleaned and resealed yearly to maintain optimum appearance. |
| **Severe Damage** | Damage, which prevents use of equipment or installations permanently. |
| **Softwood** | Wood from conifers are generally referred to as softwood; the term is also used as an adjective for the trees that produce softwood. |
| **Treated Wood** | Wood saturated with pesticides to ensure durable resistance to wood-destroying organisms. |
| **Xylem** | In vascular plants, the xylem is the tissue that carries water up the root and stem. Wood is composed almost entirely of xylem tissue. |

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# Appendices

# Appendix 1 – Understanding the Structure of Wood

First, a tree has all the characteristics of green plants. Beyond that, a tree is a tall plant with woody tissue. It has the capability to "push" its crown (the primary location for photosynthesis) above other vegetation competing for light. A tree has a distinct light-gathering advantage of having its leaves high above other plants. Although, getting the water and soil nutrients to the upper tissues may be problematic. At the opposite end of the tree, the roots system is dependent upon materials produced way up in the crown. The structure of the tree trunk allows for this problem to be solved, which is the most distinctive feature of trees (Fung et al., 2004).

A tree trunk is primarily composed of dead tissue and serves only to support the weight of the crown. The very outside layers of the tree are the only living portions of a tree trunk. This layer transports materials from the crown to the roots and is called the phloem. The cambium, which produces new wood and new bark tissue, is found on the outside of the phloem. A band of sapwood, called xylem, is found inside the phloem. It transports water to the crown, but is not necessarily a living tissue. The heartwood can be found inside the xylem (Fung et al., 2004).

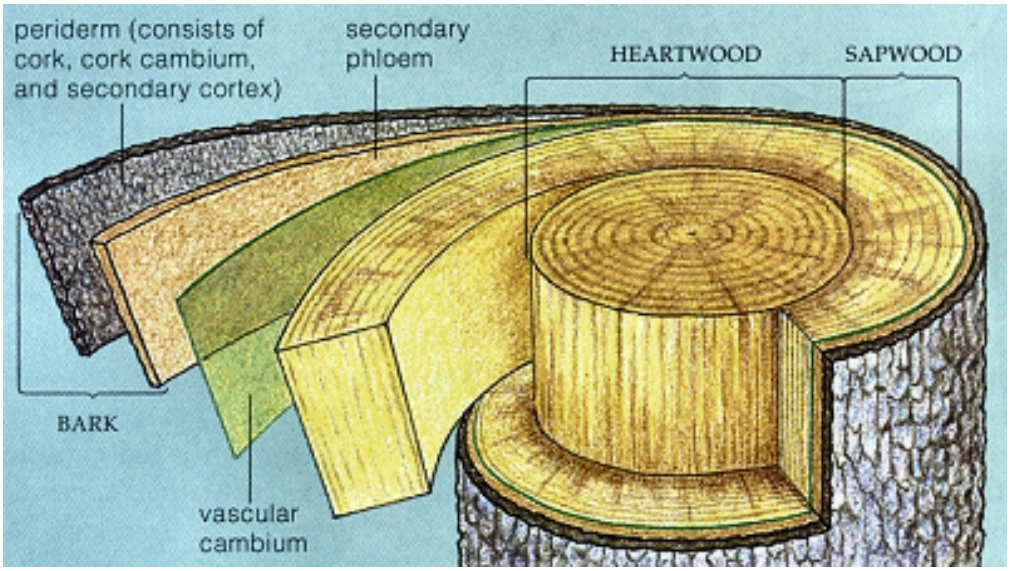


Figure A1.1 Structure of a stem with extensive secondary growth (Fung et al., 2004).

The wood in a tree consists of two general regions: the heartwood and the sapwood. Typically, the heartwood – or center part of the tree – may be quite dense and less porous than the sapwood, and is also generally darker in color (see figure A1.1). This difference is primarily due to the presence of substances called extractives, which are deposited as a result of the tree's growth processes (Hoffman et al., 1995), but also makes it less accepting of preservative (AWP, Inc. 2005). Since sapwood does not contain extractives, it is non-durable even in species with heartwood of high durability. Table Aa.1 lists the heartwood durability of various woods commonly available and their estimated ranges of service life.

Table A1.1 Life expectancy of various species of untreated heartwood in ground contact (Hoffman et al., 1995).

| Durability | Species | Life Expectancy of Untreated Heartwood (years) |
|---|---|---|
| Very Durable | Eastern Red Cedar | 30+ |
| | Redwood | 10-30* |
| | Western Red Cedar | 10-25 |
| Durable | White and Burr Oak | 10-15 |
| | Northern White Cedar | 5-15 |
| Moderately Durable | Tamarack | 8-10 |
| | Red Oak | 6-8 |
| | Douglas Fir | 4-6 |
| Non-Durable | Red and Jack Pine | 2-6 |
| | Aspen (poplar) and Cottonwood | 3-4 |
| | Ponderosa Pine | 3-4 |
| | White Birch | 3-4 |
| | Spruce and Balsam Fir | 3-4 |
| | Basswood | <5 |
| | Maple | 2-4 |
| | Ash | <5 |
| | Willow | <5 |

**Although tests at the Forest Products Laboratory in Madison, Wisconsin show that redwood durability can be good, it is at best quite variable. Their recommendation is treatment of redwood whenever it is used in ground contact* (Hoffman et al., 1995).

It should be noted that the durability of heartwood varies not only between species but also between trees of the same species, and within the tree itself. As a result, wide ranges of service life in the lumber of even a highly durable wood may be experienced and rapid decay may be occasionally reported (Hoffman et al., 1995).

Hardwood and softwood are the two main categories of tree anatomy. Softwoods are classified as the conifers, or the trees that bear seeds without a seedpod. Hardwoods, or

deciduous trees, have seeds encased in pods, which are found in the tree's flowers and fruits. The terms "hardwood" and "softwood" do not indicate the strength of the wood, but rather specify the type of water conducting cells in the living tree. In accordance with it's original source, wood will vary in texture, strength, and color. Some softwood, like pine, is considered very sturdy, while some hardwoods, like balsa wood, are very flimsy and weak (The Mint Museums, date NA). The following table shows the levels of durability generally associated with common North American softwood species

Table A1.2 Natural Durability of North American Softwoods (FCC and CWC, 2005b).

| Species | Predominant In the Tree | Heartwood Durability |
|---|---|---|
| Western Red Cedar (Thuja plicata) | Heartwood | Durable |
| Eastern White Cedar (Thuja occidentalis) | Heartwood | Durable |
| Yellow Cedar (Chamaecyparis nootkatensis) | Heartwood | Durable |
| Redwood | Heartwood | Durable |
| Douglas Fir (Pseudotsuga menziesii) | Heartwood | Moderately Durable |
| Southern Pine | Sapwood | Moderately Durable |
| Western Larch (Larix occidentalis) | Heartwood | Moderately Durable |
| Tamarack (E. Larch) (Larix laricina) | Heartwood | Moderately Durable |
| Western Hemlock (Tsuga heterophylla) | Heartwood | Slightly Durable |
| Eastern Hemlock (Tsuga canadensis) | Heartwood | Slightly Durable |
| White Spruce (Picea glauca) | Heartwood | Slightly Durable |
| Engelmann Spruce (Picea engelmannii) | Heartwood | Slightly Durable |
| Black Spruce (Picea mariana) | Heartwood | Slightly Durable |
| Red Spruce (Picea rubens) | Heartwood | Slightly Durable |
| Sitka Spruce (Picea sitchensis) | Heartwood | Slightly Durable |
| Lodgepole Pine (Pinus contorta) | Heartwood | Slightly Durable |
| Jack Pine (Pinus banksiana) | Heartwood | Slightly Durable |
| Red Pine (Pinus resinosa) | Sapwood | Slightly Durable |
| Ponderosa Pine (Pinus ponderosa) | Sapwood | Slightly Durable |
| Western White Pine (Pinus Monticola pinaceae) | Heartwood | Slightly Durable |
| Eastern White Pine (Pinus strobus) | Heartwood | Slightly Durable |
| Amabilis Fir (Abies amabilis) | Heartwood | Slightly Durable |
| Alpine Fir (Abies lasiocarpa) | Heartwood | Slightly Durable |
| Balsam Fir (Abies balsamea) | Heartwood | Slightly Durable |
| Western Spruce/Pine/Fir | Heartwood | Slightly Durable |
| Eastern Spruce/Pine/Fir | Heartwood | Slightly Durable |
| Hem Fir | Heartwood | Slightly Durable |

# Appendix 2 – Treatment Method for Pressure Treated Wood

When wood that is not naturally decay resistant is used in an outdoors or wet application, it may be at risk for fungi decay or insect attack. In such cases, preservative-treated wood may be specified. This is lumber that has been chemically treated to make it unattractive to fungi and other pests. Chemical wood preservatives are commonly used to enhance wood durability, and if effectively applied, they can increase the life expectancy of wood by a factor of five to ten times. Not only does treating wood with the appropriate preservative increases its service life but it also helps to conserve our nation's timber resources (EC, 2002).

In Canada, use of treated wood is guided by industry standards and by building codes. The Canadian Standards Association (CSA) has produced the O80 series of standards for treated wood. The National Building Code of Canada (NBCC) is our model building code, adopted and/or modified according to the wishes of various jurisdictions across the country. It contains requirements regarding the use of treated wood in buildings (FCC and CWC, 2005b).

There are two basic methods of treating wood: with and without pressure. For the purposes of this document and because the most commonly used type of preservative-treated wood is pressure-treated, the emphasis will be put on this treatment method.

## Process

The pressure treatment of wood involves a series of pressure and vacuum cycles that force the waterborne preservative deep into the wood cell structure. The treatment process is carefully monitored and controlled within an enclosed cylinder. An initial vacuum removes air from the cylinder and wood. The preservative is then introduced into the cylinder without breaking the vacuum. The following step involves the application of pressure until the specified preservative retention is obtained. A final vacuum is pulled to remove excess preservative (Arnold Lumber, date NA).

Although deeper penetration is highly desirable, the impermeable nature of dead wood cells makes it extremely difficult to achieve anything more than a thin shell of treated wood. Key results of the pressure-treating process are the amount of preservative impregnated into the wood (called retention), and the depth of penetration. These characteristics of treatment are specified in results-based standards (FCC and CWC, 2005b).

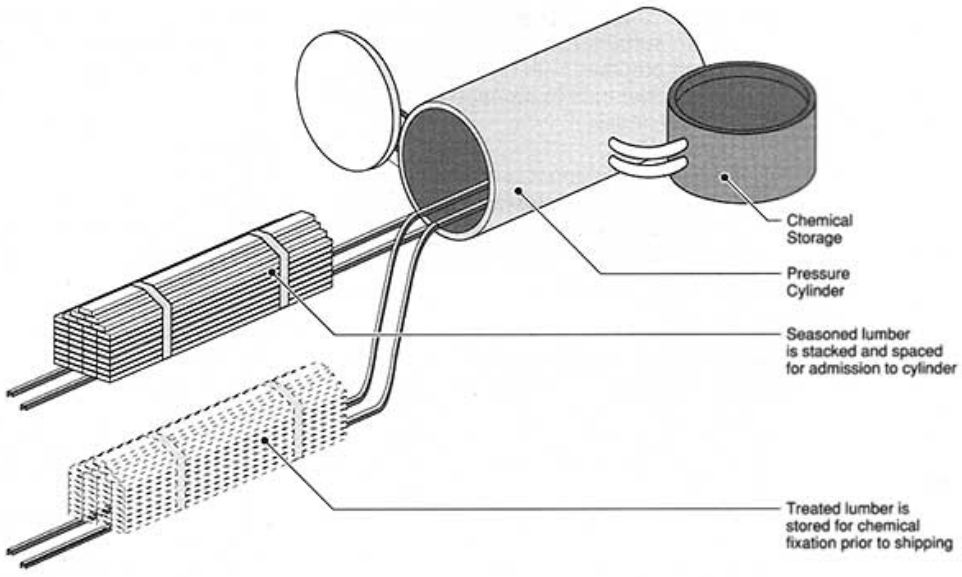


Figure A2.1 Manufacture of pressure-treated wood (CWC, 1995).

## Retention of Preservative

Retention of preservatives in wood is typically expressed as kilograms of preservatives per cubic metre (kcm) of wood or pounds per cubic foot (pcf). This relates to the amount of preservatives retained in the wood after completing its treatment cycle and is also considered as a measure of the degree of protection provided (CWC, 1995). The higher the number, the harsher the conditions to which the wood may be exposed (SPC, 2005).

For example, wood preservatives penetrate more readily in plywood than in solid wood of the same species because the veneer cutting process opens the wood grain. The infinitely small fissures created by this process are difficult to detect with the naked eye but greatly enhance the penetration of preservatives under pressure (CWC, 1995).

Canadian standards for wood preservation are based on the American Wood Preservers' Association (AWPA) standards, modified for Canadian conditions. Only preservatives registered by the Canadian Pest Management Regulatory Agency (PMRA) are listed. The typical requirements for treated lumber are that 80% of samples must be penetrated to 10mm or more and the retention must be minimum of 4.0 kg/$m^3$ CCA (as oxides) for above ground and 6.4 kg/$m^3$ for ground contact in a 16mm assay zone. Utility poles require a retention of 9.6 kg/$m^3$ CCA and a penetration of 85% - 100% sapwood. The required penetration and the assay zone for poles vary according to the wood species (FCC and CWC, 2005a).

The CSA O80 series-97 (the current version) contains two new standards: O80.32 for residential decking with a 5mm, rather than 10mm penetration requirement, and O80.34 for borate treatment of lumber for protected applications. The 1997 standard introduced a large number of major revisions including the removal of obsolete waterborne preservatives, the addition of ammoniacal copper quat type B (ACQ-B), the addition of western spruces to the lumber standard, and a reduction of preservative retentions and cleaner processes for wood in marine applications. The current standard also requires

testing of all wood products treated to CSA standards to ensure fixation before they leave the treating plant (FCC and CWC, 2005a).

## Penetration of Preservative

A deeper and more thorough penetration can be achieved by driving the preservative into the wood cells with pressure. Combinations of pressure and vacuum are used to force adequate levels of chemical into the wood. Pressure-treating preservatives consist of chemicals carried in a solvent that is typically water or oil. Waterborne preservatives have become increasingly popular over the last 20 years, due to the absence of odour, the cleaner wood surface and the ability to paint or stain the wood product (FCC and CWC, 2005b).

Penetration is the depth to which a preservative is forced into the wood. It is an indication of the amount of protection provided. The amount of penetration is determined by the qualities of the wood species used and the treating process. The greater the depth of penetration, the less likely it is that the protected boundary of pressure-treated wood will be breached (CWC, 1995).

In some case, the penetration of the preservative can be improved by incising the surfaces of lumber with knives to create artificial openings through which the preservative can enter the wood (CWC, 1995).

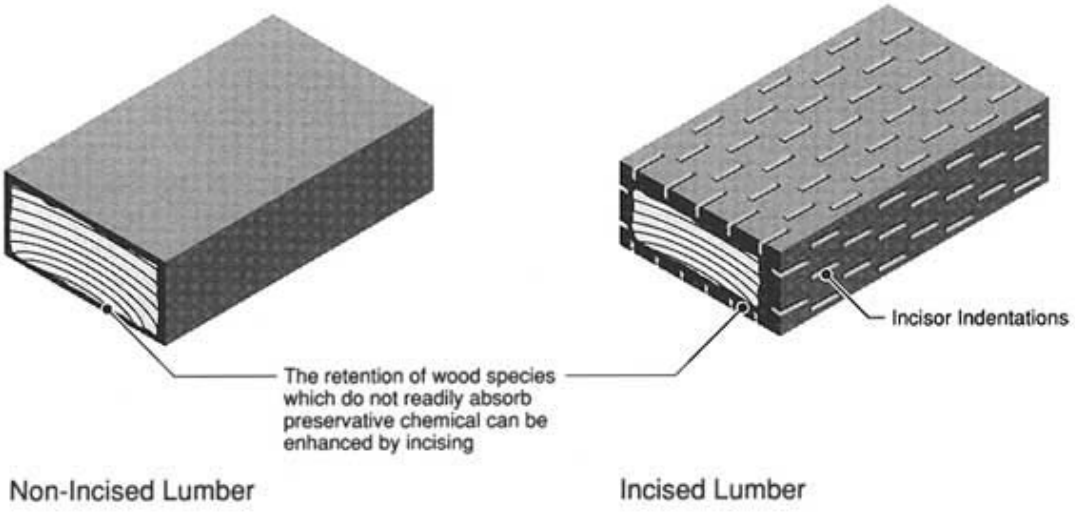


Figure A2.2 Cross section of preservative-treated lumber (CWC, 1995).

## Usage of Sealant

If consumers have concerns about existing treated wood structures (e.g., decks or fences), they may consider applying a coating to the wood. Sealing involves treating the wood by applying a layer of paint or stain. Preliminary results from studies conducted by the U.S. EPA and the U.S. Consumer Product Safety Commission (USCPSC) on the effectiveness of commercially available sealants in reducing or eliminating the potential

of arsenic exposure from contact with the surfaces of CCA-treated wood, indicate that application of penetrating coatings to CCA-treated structures at least once a year can reduce exposure to arsenic (Health Canada, 2005).

Wood treated with waterborne preservatives may be treated with stains to enhance its appearance or with water repellants to improve its dimensional stability. Water repellants help to prevent the splitting, warping, and twisting of treated wood, especially of horizontal structures, such as decking. Water repellants and stains are sometimes incorporated into the treatment process or may be hand-applied at the construction site. These secondary treatments appear to be beneficial for both increasing longevity and reducing leaching from the treated wood. Field application of finishes must be done with great care in sensitive environments (Hutton and Samis, 2000).

The data show that oil- or water-based sealants or stains that can readily penetrate wood surfaces are preferable to products such as paint, because paints and other film-formers can chip or flake, requiring scraping or sanding for removal, which can increase exposure to arsenic and other toxic chemicals (U.S. EPA, 2005c).