

**HARBOUR STRUCTURES  
304, 305 & 306  
RECONSTRUCTION  
GRAHAMS POND HARBOUR, KINGS CO., PEI**

**PROJECT NO.: R.094628.001**

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## PART 1 General

1.1 LIST OF DRAWINGS

- .1 M00: Cover Sheet
- .2 M1: Location of Work and Existing Site Plan
- .3 M1a: Demolition Site Plan
- .4 M2: Existing Breakwaters & Wharf Sections
- .5 M3: New Site Plan and Rubble Mound Breakwaters 305 & 306
- .6 M4: New Site Plan and SSP Bulkheads 304 & 412
- .7 M5: This Sheet is Intentionally Blank
- .8 M6: New Plan and Elevation SSP Bulkhead 304
- .9 M7: New Plan and Elevation Dredge Platform
- .10 M8: New Breakwaters Sections - 305 & 306
- .11 M9: New Breakwaters Sections - 305 & 306
- .12 M10: Dredge Platform & SSP Bulkhead Sections & Details
- .13 M11: Ladder, Curb & Bracing Details
- .14 M12: Concrete Details
- .15 M13: SSP Bulkhead Details
- .16 M14: Steel Curb Details
- .17 M15: Borehole Data & Notes

END OF SECTION

PART 1 General

1.1 APPENDICES

.1 APPENDIX A:

- .1 Geotechnical Review, Proposed Breakwater Reconstruction (Structure 305) Graham's Pond Small Craft Harbour, Kings County, PEI, prepared by Joose Environmental, Project No. JE0160-A, dated March 29, 2016.
- .2 Geotechnical Investigation, Graham's Pond Breakwater, (Structure 306) Graham's Pond Harbour, Gaspereaux, PE, prepared by Stantec Consulting Ltd., Project No. 121621050, dated June 25, 2018.

.2 APPENDIX B:

- .1 Underwater Inspection Report, Graham's Pond (Structure 305), prepared by Diversified Divers Inc., dated September 8, 2016.
- .2 Underwater Inspection Report, Graham's Pond (Section 412/306), prepared by Diversified Divers Inc., dated June 21, 2018.

END OF SECTION

PART 1 General

1.1 SCOPE OF WORK

- .1 The work of this project involves reconstruction to the existing breakwaters 304, 305 & 306 located at Graham's Pond, Kings County, Prince Edward Island which includes but is not limited to:
  - .1 Removal of top sections of existing SSP bulkheads, concrete decks, fill, tie rods and other items as indicated at the new riprap breakwaters;
  - .2 Total removal of existing SSP bulkheads, concrete decks, fill, tie rods, and other items where indicated to be replaced with new SSP bulkheads;
  - .3 Excavation and removal of concrete foundations to allow construction of new wharfs;
  - .4 Construction of rubble mound, imported riprap, breakwaters;
  - .5 Provision for the construction of a dredging platform including Steel H Piles, bracing, concrete deck and wheel guards as indicated;
  - .6 Provision for cast-in-place concrete decks, steel, sheet piles bulkheads, wales, ladders, wheel guards, tie rods and concrete wall, welding, underwater work, and miscellaneous work related to the construction;
  - .7 Connection to existing wharfs;
  - .8 Concrete bases for navigation lights;
  - .9 All related site work including asphalt paving, select borrow sandstone fill, imported gravel, riprap, filter fabric and environmental protection;
  - .10 Traffic control and traffic management during construction;
  - .11 Provision for relocation or disconnection of older service and installation of new services where indicated;
- .2 All in accordance with the requirements of these specifications and drawings listed on the Index to Specifications and Drawings, construction schedule and Time and Order of Completion.

1.2 CODES AND STANDARDS

- .1 All work to be performed in conformity with applicable codes and standards.
- .2 Perform work in accordance with the latest editions of applicable codes, Canadian Standards Association (CSA), P.E.I. Occupational Health and Safety Act, Canada Labour Code Part II, and any other code of provincial or local

application provided that in any case of conflict or discrepancy, the more stringent requirements will apply.

- .3 Meet or exceed the requirement of specified Standards, Codes, and referenced documents.
- .4 Unless otherwise indicated, the latest editions of referenced Standards, Codes, and Documents will apply.

### 1.3 DOCUMENTS REQUIRED

- .1 Maintain one copy of each of the following at the job site:
  - .1 Contract drawings;
  - .2 Project manual;
  - .3 Addenda;
  - .4 Reviewed shop drawings;
  - .5 Change orders;
  - .6 Test reports;
  - .7 Copy of updated approved work schedule;
  - .8 Manufacturers' installation and application instructions;
  - .9 Health and Safety Plan and related documents;
  - .10 Permits, Codes and Acts;
  - .11 Specifications;
  - .12 Waste Management Plan;
  - .13 Fire Safety;
  - .14 Other requested documents.

### 1.4 SITE EXAMINATION

- .1 All bidders submitting tenders for this Work should first examine the site of the Work in its entirety prior to submission of tenders and make themselves acquainted with site conditions, tides and all information necessary for the proper execution of the Work covered by the tender documents. All tenders shall take into consideration all such conditions as may affect the Work under this Contract.
- .2 Must review Section 01 35 29 for potential hazards, wearing safety gear at site, and taking precautionary measures.
- .3 No extra payment will be made to the Contractor, above the Contract Price, for costs resultant from failure to determine the conditions that affect the work.

### 1.5 SITE CONDITIONS

- .1 Geotechnical Investigation: Refer to Appendix 'A':
  - .1 Geotechnical Review, Proposed Breakwater Reconstruction (Structure 305) Graham's Pond Small Craft Harbour, Kings County, PEI, prepared by Joose

Environmental, Project No. JE0160-A, dated March 29, 2016.

- .2 Geotechnical Investigation, Graham's Pond Breakwater, (Structure 306) Graham's Pond Harbour, Gaspereaux, PE, prepared by Stantec Consulting Ltd., Project No. 121621050, dated June 25, 2018.
- .2 Underwater Inspection Report: Refer to Appendix 'B':
  - .1 Underwater Inspection Report, Graham's Pond (Structure 305), prepared by Diversified Divers Inc., dated September 8, 2016.
  - .2 Underwater Inspection Report, Graham's Pond (Section 412/306), prepared by Diversified Divers Inc., dated June 21, 2018.

#### 1.6 CONSTRUCTION SCHEDULE AND PROGRESS REPORTS

- .1 Submit a consolidated schedule in weekly increments within ten (10) days of Contract award.
- .2 Discuss work proposed schedule with Departmental Representative to ensure incorporation of any specific scheduling requirements of Departmental Representative related to work being carried out simultaneously by Departmental Representative.
- .3 Make allowance in the construction schedule for the following specific activities:
  - .1 Deficiency review.
  - .2 Deficiency clean-up.
  - .3 Construction close-out.
  - .4 Substantial completion.
  - .5 Project Record Drawings (As-built) submission.
  - .6 Warranties submission.
- .4 Update and re-issue the work schedule as required to conform to monthly progress reviews.

#### 1.7 COST BREAKDOWN

- .1 N/A.

#### 1.8 PERMITS

- .1 Contractor will apply and pay for any necessary permits/certificates.
- .2 Provide notification to inspection authorities.
- .3 Compliance certificates.
- .4 Submit copies to Departmental Representative.

#### 1.9 CONTRACTOR'S USE OF SITE

- .1 Do not unreasonably encumber site with materials or equipment.
- .2 Move stored products or equipment, which interfere with



operations of Departmental Representative or other Contractors.

- .3 Obtain and pay for use of additional off-site storage or work areas needed for operations.
- .4 Maintain all roads, streets, lanes, walks, driveways free from mud and debris tracked from construction site, on a daily basis.
- .5 Blackouts:
  - .1 April 15th to July 15th (of any year).
  - .2 All structures at the harbour must be completely accessible. Any new section of structure must be substantially complete. The contractor must have all construction materials and/or equipment stored within the lay down area or offsite during this time period.
  - .3 Contractor to coordinate work schedule with Department Representative.

#### 1.10 SECURITY

- .1 Watch the site at all times including weekends and holidays. No compensation will be paid by the Departmental Representative for materials of work stolen, lost, damaged, or destroyed.

#### 1.11 PROJECT MEETINGS

- .1 Hold bi-weekly project meetings at the site and at a time approved by the Departmental Representative. In addition, hold any additional meetings as the need arises or as directed by the Departmental Representative.
- .2 Notify all parties concerned of such meetings.
- .3 Contractor will record minutes of such meetings and distribute to all parties within three (3) working days of the meetings.

#### 1.12 SETTING OUT THE WORK

- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Protect and maintain all survey/reference points.
- .3 Provide devices and qualified personnel as required to layout and construct work.
- .4 Supply all stakes and markers required for laying out work.

#### 1.13 FIELD DIMENSIONS

- .1 Take all field measurements required to supplement drawing dimensions. The Departmental Representative's review of shop drawings and erection diagrams does not

relieve the Contractor of this responsibility.

1.14 LOCATIONS OF EQUIPMENT AND FIXTURES

- .1 Unless dimensioned, locations of equipment and systems as indicated or specified are to be considered as approximate.
- .2 Inform Departmental Representative of impending installations and obtain Departmental Representative's approval of actual locations.
- .3 When required by the Departmental Representative, submit field drawings to indicate the relative positions of various services and equipment.

1.15 COORDINATION AND COOPERATION WITH OTHER CONTRACTS

- .1 The construction scheduling for the work of this project necessitates that the Contractor for the work of this Contract should anticipate the requirement to coordinate and cooperate with the Departmental Representative and also with other independent contractors, engaged directly by the Departmental Representative, working simultaneously on other related work as may be required.
- .2 Coordination and cooperation with other contractors under the control and direction of the Departmental Representative, and with independent contractors, electric/telephone utilities and cable companies, will include, but not be limited to:
  - .1 Sharing access to site and various areas of work within and adjacent to the construction site.
  - .2 Sharing storage of reasonable quantity of materials in areas as directed by the Departmental Representative.
  - .3 Incorporating flexibility into work schedule as would normally be required to integrate Work with work of other trades working under separate contracts.
  - .4 Attend coordination meetings called by the Departmental Representative and maintain on-going consultation with on-site superintendents or foremen of other separate contracts, primarily, but not necessarily limited to, activities required to coordinate installation of services or other components proposed or built in, with the work of this Contract.
  - .5 Directly arrange for work relating to the relocation of electric and/or telephone, and/or cable poles, and/or lines to be carried out by the utility companies to meet the Contractor's schedule.
- .3 Before starting the Work of this Contract, it is the

responsibility of this Contractor to confirm to the satisfaction of this Contractor, that the existing work of other contractors, whether fully completed, or being completed simultaneously with the Work of this Contract, upon which the Work of this Contract will be installed, attached to or abut against, or in any other way be affected by the condition of the existing work, is acceptable to this Contractor for the installation of the work of this Contract. If the existing work is deemed by this Contractor to be unacceptable for the installation of the Work of this Contract, this Contractor shall stop work and notify the Departmental Representative, in writing, stating clearly the conditions, which in the opinion of this Contractor are unacceptable. If written notification of unacceptable conditions has not been received by the Departmental Representative, the commencement or continuation of the Work of this Contract, insofar as it is affected by the work of other contractors shall be considered by the Departmental Representative as an acknowledgement by this Contractor that the existing work of the other contractors is acceptable.

- .4 If required, prepare co-ordination drawings of installation for the efficient use of available space, for proper sequence of installation and to resolve conflicts. Consult with, and obtain the Departmental Representative's approval.

#### 1.16 CUTTING, FITTING AND PATCHING

- .1 Do all cutting, fitting, boring, and patching as required to complete the work of this Contract.

#### 1.17 EXISTING SERVICES

- .1 Where work involves breaking into, re-routing or connecting to existing services, submit work schedule to Departmental Representative sufficiently in advance to allow Departmental Representative to provide Owner with minimum seven (7) days notice of interruption of any active service or facility. Confirm each interruption 24 hours immediately prior to scheduled date of implementation.
- .2 Obtain Departmental Representative and Departmental Representative's approval of schedule of interruptions before proceeding with work and where applicable, coordinate with Local Authority or Public Utility.
- .3 Make all required connections to existing services, carry out such operations at the times directed by governing authorities, and with minimum disturbance to facilities

and vehicular traffic.

- .4 Before starting the Work establish the locations and extents of service lines in the area of the Work. Notify Departmental Representative if findings in conflict with information or intent shown on drawings or in specifications.
- .5 Submit schedules to, and obtain approval from the Departmental Representative for any shut-down or closure of active services or facilities. Adhere to approved schedules and provide notice to affected parties.
- .6 Where unknown services are encountered, immediately advise the Departmental Representative and confirm such findings in writing.
- .7 Record the locations of maintained, re-routed, and abandoned service lines. Include on the record drawings all field measurements.

#### 1.18 ADDITIONAL DRAWINGS

- .1 The Departmental Representative may furnish additional drawings to assist the proper execution of work. These drawings will be issued for clarification only. Such drawings will have the same meaning and intent as if they were included with plans referred to in the contract documents.

#### 1.19 RELICS AND ANTIQUITIES

- .1 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found during the excavation work, shall remain property of the Government, except when excavation is on private property when items become the property of the property Owner. Protect such articles and request directives from Departmental Representative.
- .2 Give immediate notice to Departmental Representative if evidence of archaeological finds are encountered during construction, and await Departmental Representative's written instructions before proceeding with work in this area.

#### 1.20 TRAFFIC REQUIREMENTS

- .1 See Section 01 35 29 - Health and Safety Requirements.
- .2 See Section 01 35 14 - Special Procedures for Traffic Control.

END OF SECTION

## PART 1 General

1.1 DESCRIPTION OF WORK

- .1 The work covered by the Plans and Specifications involves the supply of all labour, materials and equipment required for demolition and removal of existing structures, and completion of new construction as specified in the scope of work and indicated on the drawings.

1.2 GENERAL

- .1 Unit and lump sum prices are full compensation for the work necessary to complete each item in the contract, in combination for all work necessary to complete the Work as a whole, and provided in accordance with the Construction Schedule and other plans indicated requiring submittal to and approval by the Departmental Representative.

1.3 MEASUREMENT FOR PAYMENT

- .1 Notify Departmental Representative sufficiently in advance of operations to permit required measurements for payment.
- .2 Items included under "Measurement for payment". All lump sum and all unit price items shall include all materials, labour, equipment and all other items necessary to complete the work.
  - .1 Mobilization and Demobilization:
    - .1 Mobilization and demobilization and all other contract requirements not specifically measured, will be paid as a Lump Sum item.
  - .2 Project Layout and General Requirements:
    - .1 Project layout, Survey Control, indicated on drawings including concrete decks, concrete foundation, excavation and disposal of unsuitable soil material, total removal of existing anchored-bulkhead steel sheet piling, partial removal of top section of anchored steel sheet pile jetties (at new breakwaters), tie rods, anchor blocks where interfere with new work, curbing, ladders, redundant utility poles and other site items as indicated. All costs associated with environmental protection devices. Final payment for this item will only be made when all work is complete and all materials, equipment and other facilities are removed, the site cleaned and left in a condition satisfactory to the Departmental

Representative. This item will be paid as a Lump Sum.

- .2 Provide the Departmental Representative with weigh tickets at time of delivery to site.
- .3 Construction, maintenance and removal of haul roads are to be considered incidental to this work.
- .3 Excavation/Dredging:
  - .1 Excavation / dredging and disposal of excavated material from the channel to the design depth as indicated on the drawings shall be placed on site in the designated Disposal Cell and shall be measured by cubic meter of material removed.
- .4 Excavation:
  - .1 Excavation and disposal of excavated material from site to the design depth as indicated on the drawings shall be measured by cubic meter of material removed.
- .5 Cast-in-Place Concrete:
  - .1 Cast in Place (CIP) Concrete for slab-on-grades shall include all cast in place concrete elements and shall constitute a price per cubic meter for measurement purposes, based on dimensions shown on the drawings. Item to include supply and installation of necessary formwork, steel reinforcing as detailed, excavation and backfilling.
  - .2 Cast in Place (CIP) Concrete for structural decks, pile caps, shall include all cast in place concrete elements and shall constitute a price per cubic meter for measurement purposes, based on dimensions shown on the drawings. Item to include supply and installation of necessary formwork and steel reinforcing as detailed.
  - .3 Cast in Place (CIP) Concrete for pile jackets shall constitute a price per cubic meter for measurement purposes, based on dimensions shown on the drawings.
  - .4 Cast in Place Concrete for retaining walls, anchor walls (deadman), and navigation light bases shall include all elements and shall constitute a price per cubic meter for measurement purposes, based on dimensions shown on drawings. Item to include supply and installation of necessary formwork, steel reinforcing, and excavation and backfilling as detailed and as required.

.6 Structural Steel:

- .1 Wheel Guards: All miscellaneous metals required to install Wheel Guards as detailed and shall be paid for per linear meter of installed wheel guards. Item shall include hot dipped galvanizing, integrated ladder holdfasts, legs, base plates and anchorage to concrete deck as detailed and shall be considered incidental to this work. Item shall include supply and installation.
- .2 Ladders and Holdfasts: All miscellaneous metals to install steel ladders and associated holdfasts (including vertical members, steel rungs, holdfasts and all associated connection devices) shall constitute a price per unit for measurement purposes. Item to include supply and installation for ladders at dredge platform and steel sheet pile bulkheads.
- .3 Cross Bracings: All miscellaneous metals required to install dredging platform cross bracings as detailed and shall be measured for payment per each cross bracing. Item shall include hot dipped galvanizing, welding, bolts, etc. as detailed integrated connections and anchorage to structures. Item shall include supply and installation.
- .4 Double Wales: All miscellaneous metals required to install double wales along back of steel sheet piling as detailed and shall be measured for payment per linear meter. Item shall include integrated connections, splicing, and anchorage to structures, welding, bolts, washers, concrete topping. etc. Item shall include supply and installation.
- .5 Miscellaneous Metal: Supply and install of steel angles and plates along top of steel sheet piling bulkheads as detailed. This item shall be measured for payment per linear meter. Item shall include connection to structure, welding, bolts, etc. as detailed.

.7 Tie-Rods:

- .1 Tie-Rods shall include the tie rod, standard or bevelled nuts and washers as detailed, the indicated embedded connection to the wharf rear, washer plates on the back of the deadmen, including all reinforcing steel and pipe sleeve assemblies and shall constitute a price per unit for measurement purposes. Item to include

supply and installation. Excavation for tie-rods shall be included under this item.

.8 Imported Riprap:

.1 Armour Stones (3-5 tonnes and 4-6 tonnes) shall each constitute a price per metric tonne for measurement purposes. Scale tickets shall be provided for each load entering the site. Items shall include supply and installation. Item includes quantities required to construct the new breakwaters and shore protection as applicable and as detailed.

.2 Filter Stones (200 kg to 900 kg) shall each constitute a price per metric tonne for measurement purposes. Scale tickets shall be provided for each load entering the site. Items shall include supply and installation. Item includes quantities required, under the new pile supported structures, quantities required to construct the access road and quantities required to construct the new breakwaters.

.3 Core Stones and R5 Riprap shall each constitute a price per metric tonne for measurement purposes. Scale tickets shall be provided for each load entering the site. Items shall include supply and installation. Item includes quantities required under the new pile supported structures and quantities required to construct the access road and containment area.

.4 Structural Fill:

.1 Structural fill (select sandstone) shall constitute a price per metric tonne for measurement purposes. Scale tickets shall be provided for each load entering the site. Item to include supply and installation.

.5 Rock Fill / Crushed Stone Base:

.1 Imported Rock fill shall constitute a price per metric tonne for measurement purposes. Scale tickets shall be provided for each load entering the site. Item to include supply and installation.

.6 Class "A" Gravel:

.1 Imported Class "A" Gravel shall constitute a price per metric tonne for measurement purposes. Scale tickets shall be provided for each load entering the site. Item to include supply and installation.



- .7 Asphalt Paving:
  - .1 Asphalt paving shall constitute a price per square meter installed and compacted as indicated on the drawings and specified. This item shall include all materials and equipment required to construct the specified asphalt structure including necessary prime coat, A-Base, and B-Seal layers.
- .8 Geotextile:
  - .1 Geotextiles shall constitute a price per square meter for measurement purposes. Measurement to be based on slope/surface coverage not usage (i.e. required overlaps are not measured for payment). Item to include supply and installation.
- .9 Steel H Bearing Piles:
  - .1 Steel H Bearing Piles (Supply) shall constitute a price per lineal meter for measurement purposes. This item includes all supply and onsite storage of all piles and any other associated products required in the work, including driving shoes/points as indicated. Price quoted in tender to account for any necessary variation in required supply length to provide full length piles (no splices) in finished work, with allowance for cut-off, trimming during installation or achievement of required driving resistance into sandstone bedrock or other foundation strata.
  - .2 Steel H Bearing Piles (Install) shall constitute a price per lineal meter for measurement purposes. Item includes installation of H piles to lines, grades, limits and resistance criteria as specified in the contract documents.
  - .3 Departmental Representative will establish actual number and lengths of piles installed from driving records.
  - .4 No payment will be made for rejected piles, including piles driven out of place, imperfect piles, or piles damaged in driving or handling.
- .10 Steel Sheet Piles:
  - .1 Steel Sheet Piles (Supply) shall

constitute a price per square meter for measurement purposes. This item includes all supply and onsite storage of all piles and any other associated products required in the work, including steel channel wales, steel angles, welding, and other miscellaneous steel associated with the installation and as indicated. Price quoted in tender to account for any necessary variation in required supply length to provide full length piles (no splices) in finished work, with allowance for cut-off, trimming during installation or achievement of required driving resistance into sandstone bedrock or other foundation strata.

- .2 Steel Sheet Piles (Install) shall constitute a price per square meter for measurement purposes. Item includes installation of steel sheet piles to lines, grades, limits and resistance criteria as specified in the contract documents.

.11 Pressure Treated Timber:

- .1 Pressure Treated Timber: Treated dimensional timber will be measured for payment by the cubic metre (m3). Calculations will be based on the timber dimensions indicated on the drawings. Installation of bolts, miscellaneous hardware and grouting will not be measured but considered incidental work.

PART 2 Products

2.1 NOT USED

- .1 Not used.

PART 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 General

1.1 GENERAL

- .1 This section specifies general requirements and procedures for contractor's submissions of shop drawings, product data, samples and mock-ups to Departmental Representative for review.
- .2 Do not proceed with work until relevant submissions are reviewed by Departmental Representative.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submissions.
- .5 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review of submission, unless Departmental Representative gives written acceptance of specific deviations.
- .7 Make any changes in submissions which Departmental Representative may require consistent with Contract Documents and resubmit as directed by Departmental Representative.
- .8 Notify Departmental Representative, in writing, when resubmitting, of any revisions other than those requested by 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 10 working days for Departmental Representatives review of each submission.
- .3 Accompany submissions with transmittal letter, 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.
- .4 Submissions shall 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 Contractors 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 Relationship to adjacent work.
- .5 After Departmental Representative's review, distribute copies.

#### 1.3 SHOW DRAWINGS

- .1 Shop drawings: original drawings, or modified standard drawings provided by Contractor, to illustrate details of portions of Work, which are specific to project requirements.
- .2 Maximum sheet size: 850 x 1050mm
- .3 Submit shop drawings as follows:
  - .1 Opaque diazo prints or photocopies of number Contractor requires for distribution plus 4 copies which will be retained by Departmental Representative.
  - .2 Indicate materials, methods of construction, connection details, etc.
- .4 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.
- .2 Submit 6 copies of product data.
- .3 Sheet size: 215x280mm, maximum of 3 modules.
- .4 Delete information not applicable to project.
- .5 Supplement standard information to provide details

applicable to project.

- .6 Cross-reference product data information to applicable portions of Contract Documents.

#### 1.5 SAMPLES

- .1 Samples: examples of materials, equipment, quality, finishes, workmanship.
- .2 Where colour, pattern or texture is criterion, submit full range of samples.
- .3 Reviewed and accepted samples will become standard of workmanship and material against which installed work will be verified.

#### 1.6 MOCK-UPS

- .1 Mock-ups: field-erected example of work complete with specified materials and workmanship.
- .2 Erect mock-ups at locations acceptable to Departmental Representative.
- .3 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be verified.

#### 1.7 SHOP DRAWINGS REVIEW

- .1 The review of shop drawings by Departmental Representative is for the sole purpose of ascertaining conformance with the general concept. This review shall not mean that Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and contract documents. Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all sub-trades.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 Manual of Uniform Traffic Control Devices for Streets and Highways - 2014.

1.2 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 Review with Departmental Representative all precautions to be taken and safety measures to be put in place and obtain acceptance before proceeding with work.
- .3 When working on traveled way:
  - .1 Place equipment in position to present minimum of interference and hazard to traveling public.
  - .2 Keep equipment units as close together when working conditions permit and preferably on same side of traveled way.
  - .3 Do not leave equipment on traveled way overnight.
- .4 Do not close any lanes of road without approval of Departmental Representative. Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in Part D of UTCD.
- .5 Keep traveled way graded, free of pot holes and of sufficient width for required number of lanes of traffic.
  - .1 Provide minimum 7m wide temporary roadway for traffic in two-way sections through Work and on detours.
  - .2 Provide minimum 5m wide temporary roadway for traffic in one-way sections through Work and on detours.
- .6 As indicated, provide graveled detours or temporary roads to facilitate passage of traffic around restricted construction area.
- .7 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, unless other means of road access exist that meet approval of Departmental Representative.

1.3 INFORMATION AND WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Work which requires road user response.
- .2 Supply and erect signs, delineators, barricades and

- miscellaneous warning devices as specified in Part D, Temporary Conditions Signs and Devices, of UTCD Manual.
- .3 Place signs and other devices in locations recommended in UTCD manual.
  - .4 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.
  - .5 Continually maintain traffic control devices in use by:
    - .1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
    - .2 Removing or covering signs which do not apply to conditions existing from day to day.

1.4 CONTROL OF PUBLIC TRAFFIC

- .1 Provide competent flag persons, trained in accordance with, and properly equipped as specified in, UTCD manual in following situations:
  - .1 When public traffic is required to pass working vehicles or equipment that block all or part of traveled roadway.
  - .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
  - .3 When workmen or equipment are employed on traveled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
  - .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
  - .5 For emergency protection when other traffic control devices are not readily available.
  - .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
  - .7 Delays to public traffic due to contractor's operators: maximum 10 minutes.
  - .8 Flag person to have two-way radio communications at all times.

END OF SECTION

PART 1 General

1.1 RELATED WORK

- .1 Section 01 35 29 - Health and Safety Requirements.

1.2 REFERENCES

- .1 National Fire Code 2015.
- .2 National Building Code 2015.

1.3 DEFINITIONS

- .1 Hot Work defined as:
  - .1 Welding work.
  - .2 Cutting of materials by use of torch or other open flame devices.
  - .3 Grinding with equipment which produces sparks.
  - .4 Use of open flame torches such as for roofing work.

1.4 SUBMITTALS

- .1 Submit copy of Hot Work Procedures and sample of Hot Work permit to Departmental Representative for review, within 14 calendar days of acceptance of bid.
- .2 Submit in accordance with Section 01 33 00 - Submittal Procedures.

1.5 FIRE SAFETY REQUIREMENTS

- .1 Implement and follow fire safety measures during Work. Comply with following:
  - .1 National Fire Code 2015.
  - .2 National Building Code 2015.
  - .3 Federal and Provincial Occupational Health and Safety Acts and Regulations.
- .2 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

1.6 HOT WORK AUTHORIZATION

- .1 Obtain Departmental Representative's written "Authorization to Proceed" before conducting any form of Hot Work on site.
- .2 To obtain authorization submit to Departmental Representative:
  - .1 Contractor's typewritten Hot Work Procedures to be followed on site as specified below.
  - .2 Description of the type and frequency of Hot Work required.



- .3 Sample Hot Work Permit to be used.
- .3 Upon review and confirmation that effective fire safety measures will be implemented and followed during performance of hot work, Departmental Representative will give authorization to proceed as follows:
  - .1 Issue one written "Authorization to Proceed" covering the entire project for duration of work or;
  - .2 Subdivide the work into pre-determined, individual activities, each activity requiring a separately written authorization to proceed.
- .4 Requirement for individual authorization will be based on:
  - .1 Nature or phasing of work;
  - .2 Risk to Facility operations;
  - .3 Quantity of various trades needing to perform hot work on project or;
  - .4 Other situation deemed necessary by Departmental Representative to ensure fire safety on premises.
- .5 Do not perform any Hot Work until receipt of Departmental Representative's written "Authorization to Proceed" for that portion of work.
- .6 In tenant occupied Facility, coordinate performance of Hot Work with Facility Manager through the Departmental Representative. When directed, perform Hot Work only during non-operative hours of the Facility. Follow Departmental Representative's directives in this regard.

#### 1.7 HOT WORK PROCEDURES

- .1 Develop and implement safety procedures and work practices to be followed during the performance of Hot Work.
- .2 Hot Work Procedures to include:
  - .1 Requirement to perform hazard assessment of site and immediate work area beforehand for each hot work event in accordance with Safety Plan specified in section 01 35 29.
  - .2 Use of a Hot Work Permit system with individually written permit issued by Contractor's Superintendent to specific worker or subcontractor granting permission to proceed with Hot Work.
  - .3 Permit required for each Hot Work event.
  - .4 Designation of a person on site as a Fire Safety Watcher responsible to conduct a fire safety watch for a minimum duration of 60 minutes immediately following the completion of the Hot Work.
  - .5 Compliance with fire safety codes, standards and occupational health and safety regulations

specified.

- .6 Site specific rules and procedures in force at the site as provided by the Facility Manager.
- .3 Generic procedures, if used, must be edited and supplemented with pertinent information tailored to reflect specific project conditions. Label document as being the Hot Work Procedures for this contract.
- .4 Procedures shall clearly establish responsibilities of:
  - .1 Worker performing hot work,
  - .2 Person issuing the Hot Work Permit,
  - .3 Fire Safety Watcher,
  - .4 Subcontractor(s) and Contractor.
- .5 Brief all workers and subcontractors on Hot Work Procedures and of Permit system. Stringently enforce compliance.
- .6 Failure to comply with fire safety procedures may result in the issue of a Non-Compliance notification as specified in Section 01 35 29 Health and Safety Requirements.

#### 1.8 HOT WORK PERMIT

- .1 Hot Work Permit to include the following:
  - .1 Project name and project number;
  - .2 Date of issue;
  - .3 Description of hot work type needed;
  - .4 Special precautions to be followed, including type of fire extinguisher needed;
  - .5 Name and signature of permit issuer.
  - .6 Name of worker to which the permit is issued.
  - .7 Permit validity period not to exceed 8 hours. Indicate start time/date and termination time/date.
  - .8 Worker's signature with time/date of hot work completion.
  - .9 Stipulated time period of safety watch.
  - .10 Fire Safety Watcher's signature with time/date.
- .2 Permit to be typewritten form. Industry Standard forms shall only be used if all data specified above is included on form.
- .3 Each Hot Work Permit to be completed in full, signed and returned to Contractor's Superintendent for safe keeping on site.

#### 1.9 FIRE PROTECTION AND ALARM SYSTEMS

- .1 Fire protection and alarm systems shall not be:
  - .1 Obstructed.
  - .2 Shut-off, unless approved by Departmental

Representative.

- .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than fire fighting.
- .3 Costs incurred, from the fire department, and Facility owner, resulting from negligently setting off false alarms will be charged to the Contractor in the form of financial progress payment reductions and holdback assessments against the Contract.

#### 1.10 DOCUMENTS ON SITE

- .1 Keep Hot Work Permits and Hazard assessment documentation on site for duration of Work.
- .2 Upon request, make available to Departmental Representative or to authorized safety Representative for inspection.

END OF SECTION

PART 1 General

1.1 RELATED WORK

- .1 Section 01 35 29 - Health and Safety Requirements.

1.2 REFERENCES

- .1 CSA C22.1-18 - Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 CAN/CSA C22.3 No.1-15 - Overhead Systems.
- .3 CSA C22.3 No.7-15 - Underground Systems.
- .4 COSH: Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code.
- .5 All standard mentioned above shall be of latest edition.

1.3 DEFINITIONS

- .1 Electrical Facility: means any system, equipment, device, apparatus, wiring, conductor, assembly or part thereof that is used for the generation, transformation, transmission, distribution, storage, control, measurement or utilization of electrical energy, and that has an amperage and voltage that is dangerous to persons.
- .2 Guarantee of Isolation: means a guarantee by a competent person in control or in charge that a particular facility or equipment has been isolated.
- .3 De-energize: in the electrical sense, that a piece of equipment is isolated and grounded, e.g. if the equipment is not grounded, it cannot be considered de-energized (DEAD).
- .4 Guarded: means that an equipment or facility is covered, shielded, fenced, enclosed, inaccessible by location, or otherwise protected in a manner that, to the extent that is reasonably practicable, will prevent or reduce danger to any person who might touch or go near such item.
- .5 Isolate: means that an electrical facility, mechanical equipment or machinery is separated or disconnected from every source of electrical, mechanical, hydraulic, pneumatic or other kind of energy that is capable of making it dangerous.
- .6 Live/alive: means that an electrical facility produces, contains, stores or is electrically connected to a source of alternating or direct current of an amperage and voltage that is dangerous or contains any hydraulic, pneumatic or other kind of energy that is capable of making the facility dangerous to persons.

1.4 COMPLIANCE REQUIREMENTS

- .1 Comply with the following in regards to isolation and

lockout of electrical facilities and equipment:

- .1 Canadian Electrical Code.
- .2 Federal and Provincial Occupational Health and Safety Acts and Regulations.
- .3 Regulations and code of practice as applicable to mechanical equipment or other machinery being de-energized.
- .4 Procedures specified herein.
- .2 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

#### 1.5 SUBMITTALS

- .1 Submit copy of proposed lockout procedures and sample of lockout permit or lockout tags to Departmental Representative for review, within 14 calendar days of acceptance of bid.
- .2 Submit in accordance with Section 01 33 00 - Submittal Procedures.

#### 1.6 ISOLATION OF EXISTING SERVICES

- .1 Obtain Departmental Representative's written authorization prior to working on existing live or active electrical facilities and equipment and before proceeding with isolation of such item.
- .2 To obtain authorization, submit to Departmental Representative the following documentation:
  - .1 Written request to isolate the particular service or facility and;
  - .2 Copy of Contractor's Lockout Procedures.
- .3 Make a Request for Isolation for each event, unless directed otherwise by Departmental Representative, as follows:
  - .1 Fill-out standard form in current use at the Facility as provided by Departmental Representative or;
  - .2 Where no form exists, make written request indicating:
    - .1 The equipment, system or service to be isolated and their location;
    - .2 Duration of isolation period (i.e.: start time & date and completion time & date).
    - .3 Voltage of service feed to system or equipment being isolated.
    - .4 Name of person making the request.

- .4 Do not proceed with isolation until receipt of written notification from Departmental Representative granting the Isolation Request and authorizing to proceed with the work.
  - .1 Note that Departmental Representative may designate another person at the Facility being authorized to grant the Isolation Request.
- .5 Conduct safe, orderly shutdown of equipment or facility. De-energize, isolate and lockout power and other sources of energy feeding the equipment or facility.
- .6 Determine in advance, as much as possible, in cooperation with the Departmental Representative, the type and frequency of situations which will require isolation of existing services.
- .7 Plan and schedule shut down of existing services in consultation with the Departmental Representative and the Facility Manager. Minimize impact and downtime of Facility operations. Follow Departmental Representative's directives in this regard.
- .8 Conduct hazard assessment as part of the process in accordance with health and safety requirements specified Section 01 35 29 - Health and Safety Requirements.

#### 1.7 LOCKOUTS

- .1 De-energize, isolate and lockout electrical facility, mechanical equipment and machinery from all potential sources of energy prior to working on such items.
- .2 Develop and implement clear and specific lockout procedures to be followed as part of the Work.
- .3 Prepare typed written Lockout Procedures describing safe work practices, procedures, worker responsibilities and sequence of activities to be followed on site by workforce to safely isolate an active piece of equipment or electrical facility and effectively lockout and tagout it's sources of energy.
- .4 Include as part of the Lockout Procedures a system of lockout permits managed by Contractor's Superintendent or other qualified person designated by him/her as being "in-charge" at the site.
  - .1 A lockout permit shall be issued to specific worker providing a Guarantee of Isolation before each event when work must be performed on a live equipment or electrical facility.
  - .2 Duties of person managing the permit system to include:
    - .1 Issuance of permits and lockout tags to workers.

- .2 Determining permit duration.
- .3 Maintaining record of permits and tags issued.
- .4 Making a Request for Isolation to Departmental Representative when required as specified above.
- .5 Designating a Safety Watcher, when one is required based on type of work.
- .6 Ensuring equipment or facility has been properly isolated.
- .7 Collecting and safekeeping lockout tags returned by workers as a record of the event.
- .5 Clearly establish, describe and allocate responsibilities of:
  - .1 Workers.
  - .2 Person managing the lockout permit system.
  - .3 Safety Watcher.
  - .4 Subcontractor(s) and General Contractor.
- .6 Generic procedures, if used, must be edited and supplemented with pertinent information to reflect specific project requirements.
  - .1 Incorporate site specific rules and procedures in force at site as provided by Facility Manager through the Departmental Representative.
  - .2 Clearly label the document as being the Lockout procedures applicable to work of this contract.
- .7 Use energy isolation lockout devices specifically designed and appropriate for type of facility or equipment being locked out.
- .8 Use industry standard lockout tags.
- .9 Provide appropriate safety grounding and guards as required.

#### 1.8 CONFORMANCE

- .1 Brief all workers and subcontractors on requirements of this section. Stringently enforce use and compliance.
- .2 Failure to follow lockouts procedures specified herein may result in the issuance of a Non-Compliance notification as specified in Section 01 35 29 - Health and Safety Requirements.

#### 1.9 DOCUMENTS ON SITE

- .1 Post Lockout Procedures on site in common location for viewing by workers.
- .2 Keep copies of Request for Isolation forms and lockout permits and tags issued to workers on site for full duration of Work.
- .3 Upon request, make available to Departmental

Representative or to authorized safety Representative for  
inspection.

END OF SECTION



PART 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 25 - Special Procedures on Lockout Requirements.

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and copies of the following documents, including updates:
  - .1 Submit site-specific Health and Safety Plan;
  - .2 Submit site-specific Dive Plan;
  - .3 Building permit, compliance certificate and other permits required to complete the work.
- .2 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .4 Submit copies of incident and accident reports.
- .5 Submit WHMIS MSDS - Material Safety Data Sheets.
- .6 Name of contractor's representative designated to perform full time health and safety supervision on site.

1.3 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Act, for the Province of PEI, and the Occupational Health and Safety Act Regulations made pursuant to the Act.
- .2 Comply with Canada Labour Code - Part II Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.
- .3 Observe and enforce construction safety measures required by:
  - .1 National Building Code of Canada;
  - .2 Provincial Worker's Compensation Board;
  - .3 Municipal statutes and ordinances.
- .4 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
- .5 The Canada Labour Code can be viewed at: <http://laws-lois.justice.gc.ca/eng/>
- .6 Maintain Workers Compensation Coverage for duration of

Contract. Submit letter of good standing to Departmental Representative upon request.

#### 1.4 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to the site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

#### 1.5 SITE CONTROL AND ACCESS

- .1 Control work site and entry points to construction areas.
  - .1 Delineate and isolate construction areas from other areas of site by use of appropriate means.
  - .2 Post notices and signage at entry points and at other strategic locations identifying entrance onto site to be restricted to authorized persons only.
  - .3 Signage must be professionally made, bilingual in both official languages or display internationally understood graphic symbols.
- .2 Approve and grant access to site only to workers and authorized persons.
  - .1 Immediately stop non-authorized persons from circulating in construction areas and remove from site.
  - .2 Provide site safety orientation to all persons before granting access. Advise of site conditions, hazards and mandatory safety rules to be observed on site.
- .3 Secure site at night time to the extent required to protect against unauthorized entry. Provide security guard where protection cannot be achieved by other means.
- .4 Ensure persons granted access to site wear appropriate personal protective equipment (PPE) suitable to work and site conditions.
  - .1 Provide such PPE to authorized persons who require access to perform inspections or other approved purposes.
- .5 Ensure persons granted access are familiar with the Health and Safety Plan defined in sub-section 1.2

#### 1.6 PROTECTION

- .1 Carry out work placing emphasis on health and safety of the Public, Facility personnel, construction workers and

protection of the environment.

- .2 Erect safety barricades, lights and signage on site to effectively delineate work areas, protect pedestrian and vehicular traffic around and adjacent to work and to create a safe working environment.
  - .1 Erect fences, hoarding, protective barriers and temporary lighting as required. See Section 01 56 00 - Temporary Barriers and Enclosures for minimum acceptable barricades.
- .3 Should unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

#### 1.7 FILING OF NOTICE

- .1 File Notice of Project and other Notices with Provincial authorities prior to commencement of Work.
  - .1 Departmental Representative will assist in locating address for Filing Notice of Project if needed.

#### 1.8 PERMITS

- .1 Post on site permits, licenses, compliance certificates specified in Section 01 10 10 - Instructions to Bidders.
- .2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Departmental Representative in writing and obtain his/her approval to proceed before carrying out that portion of work.

#### 1.9 HAZARD ASSESSMENTS

- .1 Conduct site specific health and safety hazard assessment before commencing project and during course of work identifying risks and hazards resulting from site conditions, weather conditions and work operations.
  - .1 Perform on-going assessments addressing new risks and hazards as work progresses including when new sub-trade or sub-contractor arrives on site.
  - .2 Also, conduct assessment when the scope of work has been changed by Change Order and when potential hazard or weakness in current health and safety practices are identified by Departmental Representative or by an authorized safety Representative.
- .2 Record results in writing and address in Health and Safety Plan.
- .3 Keep copy of all assessments on site.

#### 1.10 PROJECT/SITE CONDITIONS

- .1 The following are known or potential project related health, environmental and safety hazards at the site which must be properly managed if encountered during course of work:
  - .1 There are no known existing hazardous or contaminated building materials on site.
  - .2 Safety hazards due to existing site conditions and conduct of work are:
    - .1 overhead electrical wires
    - .2 tidal waters
    - .3 winter work, freezing conditions (ice, wind and water)
    - .4 unpredictable marine weather and wave conditions
    - .5 sharp or protruding objects
    - .6 heavy vehicle movement
    - .7 loading and unloading materials
    - .8 moving and working with large and heavy materials
    - .9 creosote timber and jagged wharf materials
    - .10 working over, near or on the water
    - .11 falling in the water
    - .12 uneven and jagged travelling and working surfaces
    - .13 slippery surface conditions
    - .14 slipping and falling
    - .15 falling materials
    - .16 unknown load carrying ability of structure and access to site
    - .17 Harbour users, activities and traffic
    - .18 pedestrians, vehicles and Harbour operation traffic
- .2 Above list shall not be construed as being complete and inclusive of potential health, and safety hazards encountered during work. Include above items into hazard assessment process.

#### 1.11 HEALTH AND SAFETY MEETINGS

- .1 Attend pre-construction health and safety meeting, conducted by Departmental Representative. Have following persons in attendance:
  - .1 Site Superintendent.
  - .2 Contractor's designated Health and Safety Site Supervisor.
  - .3 Departmental Representative will advise of date,

time and location.

- .2 Conduct health and safety meetings and tool box briefings on site. Hold on a regular and pre-scheduled basis during entire work in accordance with requirements and frequency as stipulated in provincial occupational health and safety regulations.
  - .1 Keep workers informed of potential hazards and provide safe work practices and procedures to be followed.
  - .2 Take written minutes and post on site.
  - .3 Conduct formal meetings on a bi-weekly basis.

#### 1.12 HEALTH AND SAFETY PLAN

- .1 Develop written site-specific Project Health and Safety Plan, based on hazard assessments, prior to commencement of work.
  - .1 Submit copy to Departmental Representative within 7 calendar days of contract award.
  - .2 Submit updates as work progresses.
- .2 Health and Safety Plan shall contain three (3) parts with following information:
  - .1 Part 1 - Hazards: List of individual health risks and safety hazards identified by hazard assessment process.
  - .2 Part 2 - Safety Measures: engineering controls, personal protective equipment and safe work practices used to mitigate hazards and risks listed in Part 1 of Plan.
  - .3 Part 3a: Emergency Response: standard operating procedures, evacuation measures and emergency response in the occurrence of an accident, incident or emergency.
    - .1 Include response to all hazards listed in Part 1 of Plan.
    - .2 Evacuation measures.
    - .3 List names and telephone numbers of officials to contact including:
      - .1 General Contractor and all Subcontractors.
      - .2 Departmental Representatives and site facility management. Departmental Representative will provide list.
  - .4 Part 3b: Site Communications:
    - .1 Procedures used on site to share work related safety issues between workers, subcontractors, and General Contractor.
    - .2 List of critical tasks and work activities, to be communicated with the Facility Manager,

which has risk of affecting tenant operations, or endangering health and safety of Facility personnel and the general public. Develop list in consultation with the Departmental Representative.

- .3 Prepare Health and Safety Plan in a three column format, addressing the three parts specified above, as follows:
- | Column 1           | Column 2        | Column 3                               |
|--------------------|-----------------|--|
| Part 1             | Part 2          | Part 3a/3b                             |
| Identified Hazards | Safety Measures | Emergency Response Site Communications |
- .4 Develop Plan in collaboration with subcontractors. Address work activities of all trades. Revise and update Plan as Sub-Contractors arrive on site.
- .5 Implement and enforce compliance with requirements of Plan for full duration of work to final completion and demobilization from site.
- .6 As work progresses, review and update Plan. Address additional health risks and safety hazards identified by on-going hazard assessments.
- .7 Post copy of Plan, and updates, on site.
- .8 Submission of the Health and Safety Plan, and updates, to the Departmental Representative is for review and information purposes only. Departmental Representative's receipt review and any comments made of the Plan shall not be construed to imply approval in part or in whole of such Plan by Departmental Representative and shall not be interpreted as a warranty of being complete and accurate or as a confirmation that all health and safety requirements of the Work have been addressed and that it is legislative compliant. Furthermore, Departmental Representative's review of the Plan shall not relieve the Contractor of any of his legal obligations for Occupational Health and Safety provisions specified as part of the Work and those required by provincial legislation.

#### 1.13 SAFETY SUPERVISION AND INSPECTION

- .1 Designate one person to be present on site at all times, responsible for supervising health and safety of the work.
- .1 Person to be competent in Occupational Health and Construction Safety as defined in the Provincial Occupational Health and Safety Act.
- .2 Assign responsibility, obligation and authority to such designated person to stop work as deemed necessary for reasons of health and safety.
- .3 Conduct regularly scheduled informal safety inspections

of work site on a minimum bi-weekly basis.

- .1 Note deficiencies and remedial action taken in a log book or diary.
- .4 Conduct Formal Inspections on a minimum monthly basis.
  - .1 Use standardized safety checklist forms.
  - .2 Prepare written report of each inspection. Document deficiencies, remedial action needed and assign responsibility for rectification to appropriate subcontractor or worker.
  - .3 Distribute monthly reports to subcontractors for their pursuance.
  - .4 Follow-up and ensure appropriate action and corrective measures are taken.
  - .5 Keep inspection reports on site.

#### 1.14 TRAINING

- .1 Ensure that all workers and other persons granted access to site are competently trained and knowledgeable on:
  - .1 Safe use of tools and equipment.
  - .2 How to wear and use personal protective equipment (PPE).
  - .3 Safe work practices and procedures to be followed in carrying out work.
  - .4 Site conditions and minimum safety rules to be observed on site, as given at site orientation session.
- .2 Maintain evidence and records of worker training.

#### 1.15 MINIMUM SITE SAFETY RULES

- .1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements to be obeyed by all persons granted site access:
  - .1 Wear personal protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety footwear, and eye protection.
  - .2 Immediately report unsafe activity or condition at site, near-miss accident, injury and damage.
  - .3 Maintain site in tidy condition.
  - .4 Obey warning signs and safety tags.
- .2 Brief workers on site safety rules and on disciplinary measures to be taken by Departmental Representative for violation or non compliance of such rules. Post rules on site.
- .3 The following actions or conduct by Contractor, workers and sub-contractors will be considered as non conformance

with the health and safety requirements of the contract for which a Non-Compliance Notification will be issued to the General Contractor by the Departmental Representative.

- .1 Failure to follow the minimum site safety rules specified above.
- .2 Negligence resulting in serious injury or major property damage.
- .3 Deliberate non-compliance with Federal and Provincial Acts and Regulations.
- .4 Falsification of information in Workers Compensation Reports, safety reports and other health and safety related documents submitted to Departmental Representative or to Authority having jurisdiction.
- .5 Possession of firearms on site.
- .6 Possession of non-prescriptive illegal drugs or alcohol.
- .7 Action, or lack thereof, resulting in the issuance of Warning, Fines or Stop Work Orders from a Provincial Authority having jurisdiction.
- .8 Violation of other specified health and safety rules and requirements as determined by Departmental Representative.
- .4 See elsewhere in this section for details on Non-Compliance Notifications and resulting disciplinary measures.

#### 1.16 ACCIDENT REPORTING

- .1 Investigate and report the following incidents and accidents:
  - .1 Those as required by Provincial Occupational Safety and Health Act and Regulations.
  - .2 Injury requiring medical aid as defined in the Canadian Dictionary of Safety Terms - 1987, published by the Canadian Society of Safety Engineers (C.S.S.E.) as follows:
    - .1 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by province in which the injury was incurred.
  - .3 Property damage in excess of \$5,000.00.
  - .4 Interruption to Facility operations with potential loss to a Federal Department in excess of \$5,000.00.
  - .5 Those which require notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable law or regulations.
- .2 Send written report to Departmental Representative for



all above cases.

1.17 TOOLS AND EQUIPMENT SAFETY

- .1 Routinely check and maintain tools, equipment and machinery for safe operation.
- .2 Conduct checks as part of site safety inspections. When requested, submit proof that checks and maintenance have been carried out.
- .3 Tag and immediately remove from site items found faulty or defective.

1.18 HAZARDOUS PRODUCTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS).
- .2 Keep MSDS data sheets for all products delivered to site. Post on site. Submit copy to Departmental Representative.

1.19 BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.20 POWDER ACTUATED DEVICES

- .1 Use powder actuated fastening devices only after receipt of written permission from Departmental Representative.

1.21 POSTING OF DOCUMENTS

- .1 Post on site a copy of all health and safety documentation and reports specified to be produced as part of the work and received from authorities having jurisdiction.

1.22 SITE RECORDS

- .1 Maintain on Site a copy of all health and safety related documentation and reports specified to be produced as part of the work and received from authorities having jurisdiction.
- .2 Upon request, make available to Departmental Representative, or authorized Safety Representative, for review. Provide copy when directed by Departmental Representative.

1.23 NON COMPLIANCE AND DISCIPLINARY MEASURES

- .1 Immediately address and correct health and safety violations and non-compliance issues.
- .2 Negligence or failure to follow occupational health and safety provisions specified in the Contract Documents and of those of applicable laws and regulations could result in disciplinary measure taken by the Departmental Representative against the General Contractor.
- .3 Non-compliance Notifications and Disciplinary Measures on

project are as follows:

- .1 A non-compliance notification is issued to the General Contractor, by the Departmental Representative, whenever there is a violation of non compliance of the project's health and safety requirements and of those of Provincial and Federal regulations by any worker, subcontractor or other person to whom the Contractor has granted access to the work site.
- .2 Non-Compliance notifications are progressive in nature resulting in disciplinary measures imposed depending on the frequency, nature and severity of the infraction.
- .3 Disciplinary measures could include:
  - .1 Removal of the offending person or party from site;
  - .2 Financial penalties in the form of progress payment reduction or holdback assessments made against the Contract and;
  - .3 Taking the Work out of Contractor's hands in accordance with the General Conditions.
- .4 Departmental Representative will make final decision as to what constitutes a violation and when to issue a Non-Compliance Notification.
- .5 Non-Compliance Notifications issued by Departmental Representative shall not be construed as to overrule or disregard warning, orders and fines levied against Contractor by a regulatory agency having jurisdiction.
- .6 Each non-compliance notification issued is given a numerical rating based on a three level numbering system. Each level is progressive in nature to reflect:
  - .1 The seriousness of the infraction as viewed by the Departmental Representative.
  - .2 The degree of disciplinary action which will be taken by the Departmental Representative.
- .7 Numerical ratings are as follows:
  - .1 Non-Compliance Notification - Level No. 1 Rating:
    - .1 Situation: Occurrence of a first time infraction by a person or party on site.
    - .2 Action: Verbal warning to general contractor, documented in departmental files and copy sent to the general contractor.
  - .2 Non-Compliance Notification - Level No. 2 Rating:
    - .1 Situation:
      - .1 The second occurrence of a previous infraction by the same person or party on site or;

- .2 Accumulation of several level-1 notifications for different infractions by the same person or party on site or;
- .3 Non-action on the part of the Contractor or subcontractor to rectify non-compliance infractions previously identified in one or several Level-1 notifications or;
- .4 Violation or non observance of a Federal or Provincial Safety law or Regulation by subcontractor or Contractor or;
- .5 Negligence by a person or party resulting in injury or major property damage.
- .2 Action: written notice to General Contractor complete with an order for immediate remedial action to be taken. Depending on the severity of the offense, the order may include request for the immediate removal of the offending person or party from site.
- .3 Non-Compliance Notification - Level No. 3 Rating:
  - .1 Situation:
    - .1 Continued and repeated non-compliance with health and safety requirements by the General Contractor or by subcontractor(s) or;
    - .2 The occurrence of a serious accident on site resulting in serious bodily or death.
  - .2 Action:
    - .1 Formal letter issued to General Contractor with an order to "Immediately Stop Work" until so notified to proceed.
    - .2 Review of all non compliance and/or accident occurrences in the project with possible investigation by the Department of PWGSC.
    - .3 Based on outcome of the review/ investigation, work could be suspended or taken out of the Contractor's hands in accordance with the General Conditions.
  - .3 The term "serious accident" used herein shall have the same meaning as defined in the Canadian Dictionary of Safety Terms - 1987 issue from the Canadian Society of Safety Engineers (C.S.S.E.)
- .8 Decision on which rating level to be placed on any given Non-Compliance Notification will be determined solely by Departmental Representative.
- .9 Be responsible to fully brief workers and subcontractors

on the operation and importance of this system.

END OF SECTION

## PART 1 General

### 1.1 RELATED WORK

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### 1.2 DEFINITIONS

- .1 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.

### 1.3 FIRES

- .1 Fires and burning of rubbish on site not permitted.
- .2 Where fires or burning permitted, prevent staining or smoke damage to structures, materials or vegetation which is to be preserved. Restore, clean and return to new condition stained or damaged work. Be responsible for obtaining all necessary burning permits. Be responsible for any damage which may result from such fires.
- .3 Provide supervision, attendance and fire protection measures as directed.

### 1.4 HAZARDOUS MATERIAL HANDLING

- .1 Store and handle hazardous materials in accordance with applicable federal and provincial laws, regulations, codes and guidelines. Store in location that will prevent spillage into the environment.
- .2 Label containers to WHMIS requirements and keep MSDS data sheets on site for all hazardous materials.
- .3 Maintain inventory of hazardous materials and hazardous waste stored on site. List items by product name, quantity and date when storage began.
- .4 Store and handle flammable and combustible materials in accordance with National Fire Code.
- .5 Transport hazardous materials in accordance with federal Transportation of Dangerous Goods Regulations and applicable Provincial regulations.

### 1.5 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site. Dispose in accordance with project waste management requirements specified in Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Do not dispose of hazardous waste or volatile materials, such as mineral spirits, paints, thinners, oil or fuel

into waterways, storm or sanitary sewers or waste landfill sites.

- .3 Dispose of hazardous waste in accordance with applicable federal and provincial laws, regulations, codes and guidelines.

#### 1.6 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary 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 governing regulations and requirements.
- .4 Provide control devices such as filter fabrics, sediment traps and settling ponds to control drainage and prevent erosion of adjacent lands. Maintain in good order for duration of work.

#### 1.7 SITE AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Departmental Representative.

#### 1.8 WORK ADJACENT TO WATERWAYS

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material.
- .3 Do not dump excavated fill, waste material or debris in waterways.
- .4 At borrow sites, design and construct temporary crossings to minimize erosion to waterways in strict conformance with provincial, federal and environmental regulations.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Blasting is not permitted.

- .8 Do not refuel any type of equipment within 30 meters of a water body. Maintain equipment in good working condition with no fluid leaks, loose hoses or fittings.
- .9 Construct, install and maintain in-water silt containment devices (silt booms) around the construction site to prevent sediment laden water from seeping out beyond the silt boom. Provide suitable anchors, chairs, and other devices. Maintain and repair silt boom on a regular basis and in a like new condition.

1.9 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads and around entire construction site.
- .5 Have appropriate emergency spill response equipment and rapid clean-up kit on site located adjacent to hazardous materials storage area. Provide personal protective equipment required for clean-up.
- .6 Report, spills of petroleum and other hazardous materials as well as accidents having potential of polluting the environment to Federal and Provincial Department of the Environment. 24 hour environment emergencies reporting system 1-800-565-1633
  - .1 Notify Departmental Representative and submit a written spill report to Departmental Representative within 24 hours of occurrence.

1.10 WILDLIFE PROTECTION

- .1 Should nests of migratory birds in wetlands be encountered during work, immediately notify Departmental Representative for directives to be followed.
  - .1 Do not disturb nest site and neighbouring vegetation until nesting is completed.
  - .2 Minimize work immediately adjacent to such areas until nesting is completed.
  - .3 Protect these areas by following recommendations of Canadian Wildlife Service.

END OF SECTION

## PART 1 General

### 1.1 WATER QUALITY MITIGATION

- .1 Visual monitoring of the turbidity near the work site must be undertaken. If any changes occur in the turbidity of the water produced by this activity, the work must be immediately stopped and must notify the Departmental Representative.
- .2 The construction material used must be clean and non-toxic (free of fuel, oil, grease, and/or any contaminants).
- .3 Any debris entering the marine environment will be immediately retrieved when it is safe to do so.
- .4 All work equipment shall be free from loose petroleum fluid or lubricants harmful to the marine environment.
- .5 Any equipment that has been in the marine environment will be cleaned of any sediments, plants or animals and pressure washed with freshwater and/or sprayed with undiluted vinegar prior to being mobilized, and prior to leaving, the project site.
- .6 To minimize and control the release or resuspension of sediments or contaminants resulting from in-water activities the following measures shall be implemented:
  - .1 Work is scheduled so as to avoid periods of heavy precipitation.
  - .2 Any disturbed areas along the shoreline are to be stabilized to prevent erosion.
- .7 Machinery must be checked for leakage of lubricants or fuel and must be in good working order. Refuelling must be done at least 30 m from any water body and on an impermeable surface. Basic petroleum spill clean-up equipment must be on-site. All spills or leaks must be promptly contained, cleaned up and reported to the 24-hour environmental emergencies reporting system (1-800-565-1633).
- .8 Machinery and equipment fuel level must be inspected on a daily basis to ensure there is no leakage to the surrounding environment.
- .9 Storage of fuels and petroleum products shall comply with safe operating procedures, including facilities in case of a spill.
- .10 Careful maintenance and monitoring of all equipment must be carried out to minimize the risk of spills or leaks of petroleum based products.
- .11 Do not use creosote, petroleum and pentachlorophenol timbers. Timber treated with Chromate Copper Arsenate (CCA) or Ammoniac Copper Zinc Arsenate (ACZA) must be CSA



or AWPA approved. Freshly treated wood should be seasoned for at least 30 days before they are to be in contact with water. All newly treated wood must be treated in accordance with the methods outlined in the most recent Canadian version of the document entitled 'Best Management Practices for the Use of Treated Wood in Aquatic Environments'.

#### 1.2 WASTE MANAGEMENT MITIGATION

- .1 Any construction or demolition debris will be disposed of in a Provincially approved manner.

#### 1.3 NOISE AND DISTURBANCE MITIGATION

- .1 All machinery shall be well muffled.
- .2 The contractor must supply adequate signage and safety measures during transportation of materials and equipment to the harbor.

#### 1.4 OTHER MITIGATION

- .1 During the proposed project activities, if hydrocarbon fumes are detected as a result of soil disturbance in the vicinity of Structures being repaired, then PWGSC-ES should be contacted for further advice.
- .2 If any material is excavated (i.e. in the vicinity of repaired structures) then the material shall be tested before it leaves DFO-SCH property.
- .3 Workers who may come in contact with hazardous materials or soil must be provided with and use appropriate personal protective equipment.
- .4 Site access must be restricted to authorized workers only.
- .5 Concentrations of seabirds, waterfowl, or shorebirds shall not be approached when anchoring equipment, accessing wharves, or ferrying supplies.
- .6 Contractors shall ensure that food scraps and garbage are not left at the work site.
- .7 All work to be conducted in accordance with the Migratory Birds Convention Act, which outlines that no migratory bird nests or eggs will be moved or obstructed during the construction or operational phase of the project.
- .8 Project vehicles will keep to Harbour Authority/ Departmental Representative designated transportation routes.
- .9 No staging of vehicles or equipment/material storage will take place on any beach or dune.
- .10 Employees will be trained in health and safety protocols (e.g. safe work practices, emergency response).
- .11 Any and all federal, provincial, or municipal legislation

and regulations and their authorities or their officers must be strictly followed. Any discrepancies must be successfully resolved before the pertinent work may begin.

- .12 Construction will be carried out during daylight hours unless special arrangements are made with the Harbour Authority/Departmental Representative to facilitate work at night.
- .13 Contractor to co-ordinate construction activities with Harbour Authority/Departmental Representative to mitigate any impact to function of Harbour.

END OF SECTION

PART 1 General

1.1 RELATED WORK

- .1 Section 01 35 14 - Special Procedures for Traffic Control.
- .2 Section 01 35 29 - Health and Safety Requirements.

1.2 DESCRIPTION OF WORK

- .1 The work of this Section comprises the supply, installation, maintenance and removal of temporary barricades to isolate the work sites, for the work of this Contract, from both public streets and private property.

1.3 MATERIALS

- .1 Barricades:
  - .1 All pedestrian or vehicular traffic control devices required by Municipal Regulations, as interpreted by the Authority having jurisdiction, to safely direct and/or control all traffic in the areas of construction.
  - .2 All pedestrian or vehicular traffic control devices as required to safely direct and/or control all traffic in the areas of construction on the wharf and as directed by the Departmental Representative.

1.4 INSTALLATION

- .1 Erect temporary barricades as directed and where required before any construction work takes place.
- .2 Barricades to remain in place and be maintained by Contractor during entire construction period, except as noted in Par. 1.5 below.

1.5 REMOVAL

- .1 Barricades may be removed in areas of work where all site work restitution is completed and the area has been accepted by the Departmental Representative.

END OF SECTION

## PART 1 General

### 1.1 GENERAL

- .1 Conduct cleaning, dust control and dirt disposal operations during construction to comply with local ordinances and anti-pollution laws.
- .2 Store volatile wastes in covered metal containers, and remove from premises at end of each working day.
- .3 Prevent accumulation of wastes, which create hazardous conditions.
- .4 Provide adequate ventilation during use of volatile or noxious substances.

### 1.2 MATERIALS

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

### 1.3 CLEANING DURING CONSTRUCTION

- .1 Maintain the site free from accumulations of waste materials and debris on a daily basis.
- .2 Provide on-site metal containers for collection of waste materials, and debris.
- .3 Remove waste materials and rubbish from site on a daily basis.
- .4 Wash down new paved surfaces as required or directed by Departmental Representative to remove mud, dirt and other debris and also existing paved surfaces where mud and dirt has been tracked on to existing roads from the construction area.
- .5 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### 1.4 FINAL CLEANING

- .1 Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from exposed finished surfaces.
- .2 Broom clean and wash all paved surfaces, rake clean other areas.
- .3 Clean catch basin sediment traps affected by construction activity.

END OF SECTION

## PART 1 General

### 1.1 DEFINITIONS

- .1 Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials.
- .2 Materials Source Separation Program (MSSP): Consists of a series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .3 Waste Management Coordinator (WMC): Designate individual who is in attendance on-site, full-time. Designate, or have designated, individuals from each Subcontractor to be responsible for waste management related to their trade and for coordinating activities with WMC.
- .4 Separate Condition: Refers to waste sorted into individual types.

### 1.2 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
  - .1 Waste Reduction Workplan.
  - .2 Material Source Separation Plan.

### 1.3 USE OF WORK SITES AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by existing facility provide temporary security measures approved by Departmental Representative.

### 1.4 SUBMITTAL

- .1 Submit requested submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit the following submittals prior to project start-up:
  - .1 Submit 2 copies of completed Waste Reduction Workplan (WRW).
  - .2 Submit 2 copies of Materials Source Separation Program description.

### 1.5 WASTE REDUCTION WORKPLAN

- .1 Prepare WRW prior to project start-up.
- .2 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .3 Describes management of waste.
- .4 Identify opportunities for reduction, reuse, and/or

recycling (3Rs) of materials. Based on information acquired from WA.

- .5 Post workplan or summary where workers at site are able to review its content.

#### 1.6 MATERIALS SOURCE SEPARATION PROGRAM

- .1 Prepare MSSP and have ready for use prior to start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as approved by Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
- .4 Provide containers to deposit reusable and/or recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition. Transport to approved and authorized recycling facility to users of material for recycling.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition. Ship materials to site operating under Certificate of Approval premises of Departmental Representative. Materials must be immediately separated into required categories for reuse of recycling.

#### 1.7 WASTE PROCESSING SITES

- .1 Province of Prince Edward Island
  - .1 Name: Island Waste Management Corporation
  - .2 Tel: 1-888-280-8111 / Fax: 1-902-882-0520
- .2 Burning of waste is not permitted.

#### 1.8 DISPOSAL OF WASTES

- .1 Burying of rubbish and waste materials is prohibited unless approved by Departmental Representative
- .2 Disposal of waste volatile materials mineral spirits oil paint thinner into waterways, storm, or sanitary sewers is prohibited.

#### 1.9 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal do become Contractor's property.

- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.

1.10 SCHEDULING

- .1 Coordinate work with other activities at site to ensure timely and orderly progress of the work.

1.11 APPLICATION

- .1 Do work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

1.12 CLEANING

- .1 Remove tools and waste materials on completion of work, and leave work area in clean and orderly condition.
- .2 Clean-up work areas as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

1.13 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, to approval of Departmental Representative, and consistent with applicable fire regulations. Mark containers or stockpile areas. Provide instruction on disposal practices.
- .2 On-site sale of salvaged recovered reusable recyclable materials is permitted is not permitted.
- .3 Demolition Waste

Material Type	Recommended Diversion%	Actual Diversion%
-----		
Metals	100	
Rubble	100	
Wood (treated)	100	
Other		

- .4 Construction Waste
- Material Recommended Actual

Type	Diversion%	Diversion%
-----	-----	-----
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		

#### 1.14 WASTE REDUCTION WORKPLAN

.1	(1)	(2)	(3)	(4)	(5)	(6)
	Material Responsible	Total	Actual	Actual	Material	
	Category Persons	Quant.	Reused	Recycled	Destination	
		of	Amount	Amount		
		Waste	(Units)	(Unit)		
		(Unit)	Projected	Projected		
	Wood and					
	Plastic					
	Material					
	Descrip.					
	Chutes					
	Warped					
	Pallet					
	Forms					
	Plastic					
	Packaging					
	Cardboard					
	Packaging					
	Other					
	Doors and					
	Windows					
	Material					
	Descrip.					
	Painted					
	Frames					
	Glass					
	Wood					
	Metal					
	Other					

#### 1.15 CANADIAN GOVERNMENT DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

- .1 Province: Prince Edward Island Department of Agriculture and Fisheries, 11 Kent Street, PO Box 2000, Charlottetown, PEI C1A 7N8 General Inquiries: (902) 368-4800 Fax: (902) 368-4857.

END OF SECTION



## PART 1 General

### 1.1 RELATED WORK

- .1 Health and Safety Requirements: Section 01 35 29.
- .2 Temporary Barriers and Enclosures: Section 01 56 00.

### 1.2 DESCRIPTION OF WORK

- .1 The work of this Section comprises the furnishing of all labour, materials and equipment necessary for all demolition work required to complete the Work of this Contract in accordance with the requirements of this Section and as shown on the Drawings, which includes, but is NOT necessarily limited to:
  - .1 Removal of existing concrete decks, partial removal and total removal (as applicable) of steel sheet piles, tie rods, concrete anchor walls, fish plant foundations, and other related items.
  - .2 Removal of existing curb, and other wharf components indicated to be removed on plans.
  - .3 Removal and reinstatement of site services, electrical, navigation lights, etc. which are located on site as directed by Departmental Representative.

### 1.3 PROTECTION

- .1 Protect existing items designated to remain. In event of damage, immediately replace such items or make repairs to approval of Departmental Representative and at no additional cost to the Owner.
- .2 Prevent movement, settlement or damage of adjacent utilities and structures. Provide bracing, shoring and underpinning required. Make good damage and be liable for injury caused by demolition.
- .3 If safety of structure being demolished or adjacent structure appear to be endangered, cease operations and notify Departmental Representative. Take precautions to support structures.

### 1.4 SAFETY CODE

- .1 Carry out demolition work in accordance with ALL applicable codes and regulations and as outlined in Section 01 35 29 Health and Safety Requirements.

### 1.5 MEASUREMENT FOR PAYMENT

- .1 Demolition and removal of all items indicated shall be paid as a lump sum.

### 1.6 PREPARATION

- .1 Inspect site and verify items designated for removal and items to be preserved.
- .2 Locate and protect all utility services.
- .3 Protect and provide temporary shoring to existing wharf structure and adjacent structures prior to and during the execution of work.
- .4 Any damage to existing structures and utilities and services shall be immediately repaired to the satisfaction of the Departmental Representative and Owner.

1.7 DEMOLITION

- .1 Demolish items in accordance with Section 01 74 21 - Construction/Demolition and Waste Management.
- .2 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.
- .3 At end of each day's work, leave work in safe and stable condition.
- .4 Only dispose of material specified by selected alternative disposal option as directed in Section 01 74 21 - Construction/Demolition and Waste Management.
- .5 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

1.8 REMOVAL OF SALVAGED ITEMS

- .1 Remove items designated for salvage and stockpile on site as designated by Departmental Representative. The Departmental Representative is responsible for the removal of these items off site at its convenience.
- .2 Items not designated for salvage and re-use shall be removed and dispose of off-site.

1.9 DISPOSAL OF MATERIAL

- .1 Dispose of all removed materials off-site.
- .2 Pay all fees that may be charged to dispose of materials at licensed disposal sites.
- .3 Remove all soil contaminated with oil, gasoline, calcium chloride or other toxic or dangerous materials and dispose of in manner to minimize danger at site and to a location off site approved by Provincial Authority governing such disposal.

1.10 RESTORATION

- .1 Upon completion of work, remove debris, trim surfaces and

leave work site clean.

- .2 Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.

## PART 2 Products

### 2.1 NOT USED

- .1 Not used.

## PART 3 Execution

### 3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework are required.

1.2 RELATED SECTIONS

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-Place Concrete

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA-A23.1-2014, Concrete Materials and Methods of Concrete Construction.
  - .2 CAN/CSA-O86.1-M89, Engineering Design in Wood (Limit States Design).
  - .3 CSA O121-17, Douglas Fir Plywood.
  - .4 CSA O151-17, Canadian Softwood Plywood.
  - .5 CSA O153-13(R2017), Poplar Plywood.
  - .6 CAN3-0188.0, Standard Test Methods for Mat-Formed Wood Particleboards and Waferboard.
  - .7 CSA O437 Series-93,(R2013) Standards for OSB and Waferboard.
  - .8 CSA S269.1-2016, Falsework for Construction Purposes.
  - .9 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings for formwork and falsework in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings.
- .3 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.
- .4 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of PEI, Canada.

1.5 QUALITY CONTROL

- .1 Pre-Pour Meeting
  - .1 Attend a quality control meeting including all relevant sub-trades to review the quality of the

formwork reinforcement installation, exposed concrete finishes, under floor services, pour sequence and related issues.

#### 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal.
- .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

### PART 2 Products

#### 2.1 MATERIALS

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-0121.
  - .2 For concrete with special architectural features, use formwork materials to CAN/CSA-A23.1.
- .2 Form ties:
  - .1 High tensile strength fiberglass ties (Guenette) fixed or adjustable length free of devices leaving holes larger than 25mm diameter in concrete surface.
- .3 Form release agent: non-toxic, chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.
- .4 Falsework materials: to CSA-S269.1.

### PART 3 Execution

#### 3.1 FABRICATION AND ERECTION

- .1 Examine lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Hand trim sides and bottoms of excavation and remove loose earth from earth forms before placing concrete.
- .3 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.
- .4 Do not place shores and mud sills on frozen ground.
- .5 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within

tolerances required by CAN/CSA-A23.1.

- .6 Align form joints and make watertight. Keep form joints to minimum.
- .7 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .10 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

### 3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete:
  - .1 3 days for walls and sides of beams.
  - .2 3 days for columns.
  - .3 28 days for beam soffits, slabs, decks and other structural members, or 7 days when replaced immediately with adequate shoring to standard specified for falsework.
  - .4 3 days for footings and abutments.
- .2 Remove formwork when concrete has reached 80% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

END OF SECTION

PART 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 No measurement will be made under this Section. Include costs in items of work for which cast-in-place concrete is required.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 30 00 - Cast-in-Place Concrete

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
  - .1 ACI 315R-2018, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .2 American National Standards Institute American Concrete Institute (ANSI/ACI)
  - .1 ANSI/ACI 315-99, Details and Detailing of Concrete Reinforcement.
- .3 American Society for Testing and Materials (ASTM)
  - .1 ASTM A775/A775M-91c, Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 Canadian Standards Association (CSA)
  - .1 CAN/CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction.
  - .2 CAN3-A23.3-14, Design of Concrete Structures for Buildings.
  - .3 CSA G30.3-M1983 (R1998), Cold Drawn Steel Wire for Concrete Reinforcement.
  - .4 CSA G30.5-M1983(R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
  - .5 CAN/CSA-G30.18-09 (R2014), Billet-Steel Bars for Concrete Reinforcement.
  - .6 CAN/CSA-G40.21-13, Structural Quality Steels.
  - .7 CAN/CSA-G164-2018, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .8 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.4 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.
- .2 Upon request inform Department Representative of proposed source of material to be supplied.

### 1.5 SHOP DRAWINGS

- .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.
- .3 Design detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated. Provide type A tension lap splices where indicated.
- .4 Each drawing shall bear the signature and stamp of qualified professional engineer registered to practice in Prince Edward Island.

### 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Dispose of waste materials in appropriate on-site bins in accordance with Waste Management Plan, Section 01 74 21.

## PART 2 Products

### 2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to CSA G30.3.
- .4 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.
  - .1 All 152 x 152 MWE x 18.7 x 18.7
- .5 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1. Chairs and bar supports shall be plastic on stainless steel.
- .6 Mechanical splices: subject to approval of Departmental Representative.
- .7 Plain Round Bars: to CAN/CSA-G40.21.

### 2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.



- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

### PART 3 Execution

#### 3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

#### 3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
- .2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Provide concrete half-bricks to support welded wire mesh in proper position in floor slabs during placing of concrete.

#### 3.3 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

PART 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 Refer to Section 01 29 00 - Measurement for Payment.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 10 00 - Concrete Forming and Accessories.
- .3 Section 03 20 00 - Concrete Reinforcing.
- .4 Section 31 23 10 - Excavation, Trenching and Backfilling.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM C109/C109M-16, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50mm Cube Specimens).
  - .2 ASTM C 260-10a (2016), Specification for Air-Entraining Admixtures for Concrete.
  - .3 ASTM C 309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .4 ASTM C 332-17, Specification for Lightweight Aggregates for Insulating Concrete.
  - .5 ASTM C 494-17, Specification for Chemical Admixtures for Concrete.
  - .6 ASTM C 827-16, Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
  - .7 ASTM C 939-16a, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
  - .8 ASTM D1751-04(2013), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .9 ASTM D1752-04a(2013), Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
  - .2 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing, and for Roof Coatings.
  - .3 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA):
  - .1 CAN/CSA-A5 Portland Cement.

- .2 CAN/CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction.
- .3 CAN/CSA-A23.2-14, Methods of Test for Concrete.
- .4 CAN/CSA A3000-18, Cementitious Materials Compendium.

#### 1.4 CERTIFICATES

- .1 Submit certificates in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

#### 1.5 TESTING AND INSPECTION

- .1 Testing and inspection of concrete and concrete materials will be carried out by testing laboratory engaged and paid for by the Departmental Representative. Frequency of tests will be determined by the Departmental Representative.
- .2 Remove defective concrete and embedded debris and repair as directed by Departmental Representative.

#### 1.6 QUALITY ASSURANCE

- .1 Pre Pour Meeting:
  - .1 Convene a pre-pour meeting 2 weeks prior to beginning concrete works.
  - .2 Ensure concrete forming, finishing and concrete supplier personnel, attend.
  - .3 Verify project requirements.
  - .4 Review all aspects of the work including construction sequence, access to work by other Trade Contractors, Quality of falsework for trueness to dimensions, quality of finish expected at exposed concrete and all other aspects of the work.
- .2 Submit to Departmental Representative, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
- .3 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Departmental Representative on following items:
  - .1 Falsework erection
  - .2 Hot weather concrete
  - .3 Cold weather concrete
  - .4 Curing

- .5 Finishes
- .6 Formwork removal
- .7 Joints

#### 1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Dispose of waste material in appropriate on-site bins in accordance with Waste Management Plan, Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Designate a cleaning area for tools and concrete trucks to limit water use and runoff.
- .3 Carefully coordinate the specified concrete work with weather conditions.
- .4 Ensure emptied containers are sealed and stored safely for disposal.
- .5 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
- .6 Choose least harmful, appropriate cleaning method which will perform adequately.

### PART 2 Products

#### 2.1 MATERIAL

- .1 Portland cement: to CAN/CSA-A5.
- .2 Supplementary cementing materials: to CAN/CSA A3000-13.
- .3 Cementitious hydraulic sag: to CAN/CSA A3000-03.
- .4 Water: to CAN/CSA-A23.1.
- .5 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.
- .6 Air entraining admixture: to ASTM C 260.
- .7 Chemical admixtures: to ASTM C 494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
  - .1 Compressive strength: 50 MPa at 28 days.
  - .2 Consistency:
    - .1 Fluid: to ASTM C 827. Time of efflux through flow cone (ASTM C939), under 30s.
    - .2 Flowable: to ASTM C 827. Flow table, 5 drops in 3s, (ASTM C109, applicable portion) 125 to

- 145%.
- .3 Plastic: to ASTM C 827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125 %.
- .4 Dry pack to manufacturer's requirements.
- .3 Net shrinkage at 28 days: maximum 0%.
- .9 Curing compound: to CAN/CSA-A23.1 white and to ASTM C 309, Type 1-chlorinated rubber.
- .10 Premoulded joint fillers:
  - .1 Bituminous impregnated fiber board: to ASTM D 1751.
- .11 Weep hole tubes: PVC on galvanized steel.
- .12 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .13 Dampproofing:
  - .1 Emulsified asphalt, mineral colloid type, unfilled to: CAN/CGSB-37.2.
- .14 Polyethylene film: 6 mil and 10 mil thickness to CAN/CGSB-51.34.
- .15 Joint Sealer: chemical curing, multi-component, Class B, Type I for horizontal joints, Type II for vertical joints to CAN/CGSB 19.24.
- .16 Silane Sealer: Self penetrating, 100% silane, clear, breathable. Hydrozo 100 or equal.

## 2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1. Alternative 1 to give the following properties:
  - .1 All Concrete for dredge platform deck, pile cap, retaining walls, and slab-on-grade:
    - .1 Cement: use Type 10 Portland Cement. Cement coated 386 kg/m<sup>3</sup> of concrete.
    - .2 Minimum compressive strength at 28 days: 35 MPa.
    - .3 Class of exposure: C-1.
    - .4 Nominal size of coarse aggregate: 20mm.
    - .5 Slump at point and time of discharge: Mass Concrete 40mm +/-20 & Structural Concrete 80mm +/-20
    - .6 Air content: 5-8% and to Table 4 in CSA A23.1.
- .2 Concrete for pile jackets (Tremie Concrete):
  - .1 Cement: use Type 10 Portland Cement. Cement coated 386 kg/m<sup>3</sup> of concrete.
  - .2 Minimum compressive strength at 28 days: 35 MPa.
  - .3 Class of exposure: C-1.

- .4 Nominal size of coarse aggregate: 13mm.
- .5 Slump at point and time of discharge: 150mm +/- 25mm
- .6 Air content: 5-8% and to Table 4 in CSA A23.1.
- .7 Additional Class Fiber to mix at a rate of 2% of volume.
- .2 Provide certification that plant, equipment, and all materials to be used in concrete comply with the requirements for CAN/CSA-A23.1.
- .3 Use of calcium chloride not permitted.
- .4 Use of alkali-silica reactive aggregates shall not be permitted.

### 2.3 ADMIXTURES

- .1 Admixtures will be permitted only to correct deficiency in mixture or to make correct placement requirements as recommended by Testing Laboratory and approved by Departmental Representative.
- .2 Use of accelerating admixtures, if approved by Departmental Representative, will not relax cold weather placement requirements of CAN/CSA-A23.1.
- .3 Provide and install epoxy anchor as indicated to secure ladders to concrete and suitable for marine work. Adhesive to be injectable, high strength epoxy to ASTM C881, Type IV, Grade 3.

## PART 3 Execution

### 3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Pumping of concrete will be permitted. Place concrete in accordance with CAN/CSA-A23.1 to meet all requirements of mix design at point of placement.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack

solidly with shrinkage compensating grout to anchor and hold dowels in positions as indicated.

- .7 Do not place load upon new concrete until authorized by Departmental Representative.
- .8 Cold joints will not be allowed.

### 3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.
- .2 Sleeves and inserts.
  - .1 No sleeves, pipes or other openings shall pass through concrete elements, except where indicated or approved by Departmental Representative.
  - .2 Where approved by Departmental Representative, set sleeves, ties, hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Departmental Representative.
  - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.
  - .4 Check locations and sizes of sleeves and openings shown on drawings.
- .3 Anchor bolts.
  - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
- .4 Dowels: In locations where new concrete is dowelled to existing concrete drill holes in existing concrete to depths, diameters and spacing indicated and install dowels using natural aggregate grout mixed to flow consistency to suit application, in strict accordance with manufacturers instructions.
- .5 Finishing.
  - .1 Finish concrete in accordance with CAN/CSA-A23.1.
  - .2 Deck surfaces and slab-on-grade to have uniform broom finish.
  - .3 Rub exposed edges of concrete with Carborundum to produce 3mm radius edges unless otherwise detailed.
- .6 Joint Fillers:
  - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling

or other positive fastening.

- .2 Locate and form isolation joints as indicated.  
Install joint filler.

### 3.3 CURING

- .1 Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete in accordance with CAN/CSA A23.1.
- .2 Wet cure dredge platform and concrete slabs on grade.
- .3 Wet curing shall be continued for at least seven (7) days. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, moisture retention measures may be terminated when the average compressive strength has reached seventy percent (70%) of the specified concrete strength.
- .4 Perform curing of concrete by moist curing. Provide moisture curing by one of the following methods:
  - .1 Keep concrete surface continuously wet by covering with water.
  - .2 Use continuous water-fog spray.
  - .3 Cover concrete surface with moisture retaining cover. Place cover to provide coverage of concrete surfaces and edges with four- (100mm) lap over adjacent moisture retaining covers, and seal using waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- .5 Provide liquid membrane curing compound specified to other concrete surfaces as follows:
  - .1 Apply specified curing compound to concrete surfaces within one (1) hour of final finishing operations or within one (1) hour of form removal. Apply uniformly in continuous operation by spray or roller in accordance with manufacturer's directions. Maintain continuity of coating and repair damage during curing period.

### 3.4 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Departmental Representative in accordance with CAN/CSA-A23.1.
- .2 Departmental Representative will pay for costs of tests as specified.



- .3 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .5 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

### 3.5 DEFECTIVE CONCRETE

- .1 Remove defective concrete and repair as directed by the Departmental Representative.

### 3.6 SITE TOLERANCE

- .1 Concrete tolerance in accordance with CAN/CSA-A23.1 straight edge method.

END OF SECTION

## PART 1 General

### 1.1 MEASUREMENT FOR PAYMENT

- .1 Refer to Section 01 29 00 - Measurement for Payment.

### 1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management & Disposal.
- .3 Section 03 30 00 - Cast-in-Place Concrete.

### 1.3 DESCRIPTION OF WORK

- .1 The work of this Section comprises the furnishing of all labour, materials and equipment necessary for the supply and installation of items of work specifically listed under Part 2 - PRODUCTS of this Section, as specified in this Section and shown on the Drawings.

### 1.4 REFERENCES

- .1 American Welding Society (AWS)
  - .1 AWS D3.6M:2017, Underwater Welding Code.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM F3125 Grade 325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .3 Canadian Standards Association (CSA)
  - .1 CSA-G40.20/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steels.
  - .2 CSA G164-18 Hot Dipped Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16-14, Design of Steel Structures.
  - .4 CSA-W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.
  - .5 CSA-W47.2-11 (R2015), Certification of companies for fusion welding of aluminum.
  - .6 CSA-W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
  - .7 CSA-W55.3-2008 (R2013), Certification of companies for resistance welding of steel and aluminum.
  - .8 CSA-W59-18, Welded Steel Construction (Metal Arc Welding).

### 1.5 SOURCE QUALITY CONTROL

- .1 The Contractor is to provide written documentation from the Canadian Welding Bureau certifying that all welders used for this work are qualified to the requirements of

CSA-W47.1, Division 1 or 2.1 and CSA-W47.2.

- .2 Provide written procedures to Department Representative for review and approval indicating methods to be used for all welding on this project.
- .3 Provide evidence to the Department Representative of current qualifications of welders.

#### 1.6 SHOP DRAWINGS

- .1 Submit fabrication and erection documents and material lists in accordance with Section 01 33 00 Submittal Procedures.
- .2 It is the responsibility of this Contractor to field confirm the exact locations and construction of related work to which work under this section connects to, or is supported on.
- .3 Each drawing submission shall bear signature and stamp of qualified Professional Engineer registered or licensed to practice in the Province of Prince Edward Island, for all assemblies, components, details and connections not shown on the drawings.
- .4 Review of procedure and erection drawings will extend to general design concept only. This review does not relieve the Contractor of the responsibility for accuracy of the detail dimensions, general fit-up of parts to be assembled, adequacy of proposed methods and procedures or for errors or defects contained in the details.

#### 1.7 QUALITY ASSURANCE

- .1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### 1.8 PROCEDURE AND WELDER QUALIFICATION FOR UNDERWATER WELDING

- .1 No underwater welding is to proceed until qualification of welding procedure and performance qualifications to Section 5, "Qualification" and verification of procedure and performance qualification to Section 6, "Inspection" as per AWS D3.6M:2010, has taken place.
- .2 Contractor is responsible to provide satisfactory evidence to the Department Representative that the procedure and welders have been qualified and a verification of procedure and performance qualification has been carried out. No production welding is to be done prior to this submission being approved by the Department Representative.

## 1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused metal materials from landfill to an approved metal recycling facility approved by Department Representative.

## PART 2 Products

### 2.1 MATERIALS

- .1 Steel Sections, Plates, Angles and Rods: to CAN/CSA-G40.2/G40.21, Grade 350W.
- .2 HSS: to ASTM A500, Grade C.
- .3 Welding Electrodes, (above water): to CSA W48 Series.
- .4 Welding Electrodes, (underwater): to be wet welding electrodes, Thyssen Nautica 20, Hydroweld FS, or approved equal.
- .5 Anchor Studs: to conform to CSA W59 Appendix H. Nelson Studs or approved alternate.

### 2.2 FABRICATION - GENERAL

- .1 Fabricate steel plate panels, wheel guard angles and plates, and ladder assemblies as indicated, in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

### 2.3 MISCELLANEOUS METAL

- .1 Steel sections and plates: to CAN/CSA G40.21, Grade 350W except where specified otherwise.
- .2 Steel pipe and handrails: to ASTM A53, CSA S16.1, Schedule 40 and as indicated on drawings.
- .3 Ladder rungs: to CSA C-40.21 round bars to size as indicated.
- .4 Welding materials: to CSA W59.
- .5 Bolts and anchor bolts to ASTM F3125 Grade 325.

### 2.4 FINISHES

- .1 Unless noted otherwise, all metal fabrications shall be hot dipped galvanized to CAN/CSA G164, minimum zinc coating of 760 g/m2 suitable for marine environment.

## PART 3 Execution

### 3.1 GENERAL

- .1 Do steel work in accordance with CAN/CSA-S16.
- .2 Do welding work in accordance with CSA W47.1 and CSA W47.2 unless specified otherwise.
- .3 Erect metalwork square, plumb, square, and true, accurately fitted, with tight joints and intersections.

### 3.2 PREPARATION AND CLEANING

- .1 Clean all fouling, marine growth and corrosion from full outer surface of existing steel sheet piling.
- .2 Cleaning of existing steel sheet piling surfaces to be by waterjet or other approved method.
- .3 Degree of cleaning to be as required for proper fit and welding of new work to existing as per CSA W59-03, and AWS D3.6M:2010.

### 3.3 INSTALLATION

- .1 Install new work as indicated and in accordance with CAN/CSA-S16 and reviewed shop drawings.
- .2 Provide temporary bracing, clamping or other approved means of holding the new steel panel section tight to the prepared flange of the existing steel sheet piling as required until permanent welded connections are complete.

### 3.4 WELDING

- .1 Do welding in accordance with CSA-W59 for above water welding and AWS D3.6:2010 for underwater welding.
- .2 Companies to be certified under Division 1 or 2.1 of CSA-47.1 for fusion welding of steel structures and/or CSA-W55.3 for resistance welding of structural components.
- .3 In addition to requirements of 3.4.1 and 3.4.2, all underwater welding to be in strict accordance with AWS D3.6M:2010, Specification for Underwater Welding.
- .4 All underwater welds to be Class 'B' in accordance with AWS D3.6M:2010, Specification for Underwater Welding.

### 3.5 WELDING INSPECTION

- .1 The contractor is responsible to assure that materials, fabrication, and examination procedures for all welding conforms to CSA W59 and AWS D3.6M:2010.
- .2 Quality assurance inspection and testing of welds will be carried out by a Testing Agency designated by Department Representative.
- .3 Provide safe access and working areas for inspection and testing on site, as required by Testing Agency and as authorized by Department Representative.
- .4 Inspection or testing by Department Representative will

not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

### 3.6 MISCELLANEOUS METALS

- .1 Do miscellaneous steel work in accordance with CAN/CSA S16.1.
- .2 Welding in accordance with CSA W59. Install miscellaneous site items as indicated on drawings.

### 3.7 FABRICATION GENERAL

- .1 Fabricate steel, as indicated, in accordance with CAN/CSA-S16.1 and in accordance with reviewed shop drawings.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .3 Use welded connections for both interior and exterior metal work unless otherwise indicated or approved by Departmental Representative.
- .4 Use self-tapping, shake-proof countersunk flat headed screws on items requiring assembly by screws, or as indicated.
- .5 Where possible, fit and shop assemble work, ready for erection.
- .6 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .7 Grind and polish all exposed edges and corners to leave smooth surface free from burrs or other sharp protrusions.
- .8 All holes shall be punched or drilled. Burning holes in any steel member is NOT permitted.

### 3.8 CONNECTION TO EXISTING WORK

- .1 Examine dimensions, alignment, elevations and condition of work before commencing fabrication and report any discrepancies and potential problem areas to Departmental Representative and await instructions.

END OF SECTION

## PART 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 Refer to Section 01 29 00 - Measurement for Payment.

1.2 DESCRIPTION

- .1 This Section specifies the requirements for the supply and installation of pressure treated timber, fenders, blocking, wheelguard and other items where required, to repair existing wharf components disturbed by the work of this Contract, as indicated on the contract drawings.

1.3 REFERENCES

- .1 ASTM International
  - .1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
  - .3 ASTM A653/A653M-09a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
  - .4 ASTM C1396/C1396M-09a, Standard Specification for Gypsum Board.
  - .5 ASTM D1761-06, Standard Test Methods for Mechanical Fasteners in Wood.
  - .6 ASTM D5456-10, Standard Specification for Evaluation of Structural Composite Lumber Products.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .3 CSA International
  - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
  - .2 CSA O112 Series-M1977(R2006), CSA Standards for Wood Adhesives.
  - .3 CSA O121-08, Douglas Fir Plywood.
  - .4 CSA O141-05(R2009), Softwood Lumber.
  - .5 CSA O151-09, Canadian Softwood Plywood.
  - .6 CSA O153-M1980(R2008), Poplar Plywood.
  - .7 CSA O325-07, Construction Sheathing.
  - .8 CSA O437 Series-93(R2006), Standards on OSB and Waferboard.
  - .9 CAN/CSA-O80 Series-15, Wood Preservation
- .4 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2007.

PART 2 Products

2.1 MATERIALS

- .1 Timber: Use timber graded and stamped in accordance with applicable grading rules and standards of associations or agencies approved to grade lumber by Canadian Lumber Standards Administration Board of CSA.
- .2 Species:
  - .1 Softwood timber: Coast Douglas Fir, Eastern Hemlock, Eastern Hemlock, Pacific Coast Hemlock, White or Red Pine conforming to CSA 0141-1970 for softwood lumber, Group A, select grade, free from splits, checks and wane.
- .3 Preservative Treatment: treat lumber to CSA 080-Series 15, using chromated copper arsenate (CCA) or ammoniacal copper arsenate (ACA) preservative with minimum retention of 24.0 kg/m<sup>3</sup>. Use of creosote oil NOT permitted.
- .4 Miscellaneous steel: Bolts, nuts, washers: to ASTM A307-14. All steel material shall be hot dipped galvanized.
- .5 Form Release Agent: Chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.

PART 3 Execution

3.1 INSTALLATION

- .1 Construct softwood timber curbing and blocking to dimensions and configurations indicated on plans and connect to Steel Sheet Piles to the elevation shown on the plans using steel plates connection detailed on the plans.
- .2 Curbing & Blocking:
  - .1 The work comprises the furnishing of all equipment, labour and materials necessary for the provision of all curbing, blocks, etc. and related work as specified herein and indicated on the drawings.
  - .2 Blocking shall be pressure treated.
- .3 Hardware including pins, bolts, washers, nails and all other items necessary to be incorporated into the work shall be as specified and as indicated.
- .4 Construct softwood timber fenders as per existing dimensions and configurations, and bolt to timber walls as required.



- .5 All washers and bolt heads will be countersunk such that the bolt heads do not extend past the harbour side plan of the timbers or the contractor may use carriage-head bolts to fasten the fenders and ladders to the timber wales.
- .6 Drill holes in timber sections to have same diameter as bolts.
- .7 Where it is necessary to cut or countersink pressure treated timber on site, treat sawn face with two (2) liberal coats of brush applied copper naphthanate preservative. Allow first coat to fully penetrate wood before applying second coat.
- .8 Treat cut surfaces of preservative treated material with surface applied wood preservative, before installation, and as follows:
  - .1 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
  - .2 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
  - .3 Treat all materials as indicated.

END OF SECTION

PART 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 Measurement for payment under this section, shall be as per Section 01 29 00 - Measurement for Payment.

1.2 RELATED WORK

- .1 Submittal Procedures: Section 01 33 00.
- .2 Health and Safety Requirements: Section 01 35 29.
- .3 Environmental Procedures: Section 01 35 43.
- .4 Construction/Demolition Waste Management and Disposal: Section 01 74 21.
- .5 Environmental Protection Plan: Section 01 35 44.

1.3 DESCRIPTION OF WORK

- .1 The work of this Section comprises the furnishing of all labour, materials and equipment necessary for all excavation, trenching, backfilling, compaction including saw cutting of existing asphalt paving and concrete surface, required to complete the work of this Contract, as specified in this Section and as shown on the Drawings.
- .2 The requirements of the following Prince Edward Island, Department of Transportation, Infrastructure & Energy (TIE) Specifications are to be followed for all work relating to the material specifications for fill materials and bedding sand.

1.4 REFERENCES

- .1 ASTM C117-13, Standard Test Method for Material Finer Than: 0.075mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil using Standard Effort.
- .4 ASTM D1557-12, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- .5 CAN/ULC -S701-11, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .6 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .7 CAN/CGSB-71-GP-24M Adhesive, Flexible for Bonding Cellular Polystyrene Insulation.

1.5 DEFINITIONS

- .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior

to its removal, was integral with its parent mass and was unable to be removed by a Caterpillar 235 Excavator, or equivalent, machine.

- .2 Common excavation: excavation of materials of whatever nature, which are not included under the definition of rock excavation, including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.
- .3 Top Soil: Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .4 Cohesionless soil: For compaction purposes, cohesionless soil is:
  - .1 Materials having less than 20% passing 75 micrometres sieve, regardless of plasticity of fines.
- .5 Cohesive soil: For compaction purposes, cohesive soil is soil not having properties to be classified as cohesionless.

#### 1.6 PROTECTION OF EXISTING FEATURES

- .1 Existing buried utilities and structures:
  - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only; completeness and accuracy are not guaranteed.
  - .2 Prior to commencing any excavation work, notify applicable Departmental Representative or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.
  - .3 Confirm locations of buried utilities by careful test excavation.
  - .4 Maintain and protect from damage, water, sewer, gas, electric or other utilities encountered. Obtain direction of Departmental Representative before moving or otherwise disturbing utilities or structures.
  - .5 Where indicated re-route existing lines in area of excavation. Pay costs for such work.
  - .6 Remove abandoned utility lines to distance of 1.5m from foundations. Cap or otherwise seal lines at cut-off points.
  - .7 Record locations of maintained, re-routed and abandoned underground lines on "As-Built" drawings.
  - .8 Make good and pay for damage to any lines resulting from work.
- .2 Existing surface features:

- .1 Protect existing surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.
- .2 Where excavation necessitates root or branch cutting do so only under direct control of Departmental Representative.
- .3 Provide adequate protection around bench markers, layout markers, survey markers, geodetic monuments and signage.

#### 1.7 SHORING, BRACING AND UNDERPINNING

- .1 Comply with Section 01 35 29 - Health and Safety Requirements and applicable local regulations and to protect existing features.
- .2 Whenever shoring, sheeting, timbering and bracing of excavations or underpinning is required engage services of a Professional Engineer registered in Canada, to design and assume responsibility for adequacy of shoring, bracing and underpinning.
- .3 Design and supporting data submitted to bear the stamp and signature of qualified Professional Engineer registered in Canada.

#### 1.8 COMPACTION DENSITIES

- .1 Compaction densities indicated are Standard Proctor Maximum Dry Densities.

#### 1.9 SITE CONDITIONS

- .1 The Contractor is responsible to visit the site, assess the setting and become familiar with the existing site conditions.
- .2 Before visiting the site the BIDDERS MUST APPLY FOR AND RECEIVE PERMISSION TO VISIT THE SITE from the Project Officer at Departmental Representative office.
- .3 No extra payment will be made to the Contractor, above the Contract Price, for costs resultant from failure to determine the conditions that affect the work.

### PART 2 Products

#### 2.1 MATERIALS

- .1 Crushed rock composed of hard sound, durable uncoated, cubical fragments of consistent quality produced from non-sedimentary bedrock or non-sedimentary boulders, to comply with the PEI Dept of TI&E Specification 401 - Aggregate, for Class "A" material graded within the following limits:

ASTM Sieve Size	Percent Passing
31.5mm	100
25.0mm	95-100
12.5mm	50-83
4.75mm	30-60
1.18mm	15-40
600um	10-32
300um	5-22
75um	3-9

- .2 Imported, classified as Common Fill, or material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen, free from rocks larger than 75mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Natural sand or crushed rock screening, free from clay, shale or organic matter, to comply with PEI Dept of TI&E Specification 402 - Bedding Sand, graded with the following limits.

ASTM Sieve Size	Percent Passing
9.5mm	100
4.75mm	87-98
2.36mm	55-95
1.18mm	30-90
600um	10-70
300um	0-35
150um	0-15
75um	0-8

- .4 Select Borrow: to requirements of PEI Dept of TIE Specification #206.02.02 - Select Borrow as follows: Borrow shall be non-plastic and composed of clean, uncoated particles free from lumps of clay or other deleterious material with a maximum particle size of 100mm, and a maximum of 30% of the material passing the 4.75 sieve shall pass the 0.075 mm sieve.
- .5 Clean, washed coarse sand free from clay, shale and organic matter and graded within the following limits:

ASTM Sieve Size	Percent Passing
12.5mm	100
4.75mm	90-100
0.85mm	40-100
0.35mm	0-75
0.25mm	0-38
0.75mm	0-8

- .6 Crushed rock, composed of hard, sound, durable, uncoated, cubical fragments of consistent quality produced from non-sedimentary bedrock or non-sedimentary boulders,

graded within the following limits, to comply with the  
PEI Dept of TI&E Specification 401 - Aggregate for Class  
"D" Material.

ASTM Sieve Size	Percent Passing
50.0mm	100
38.0mm	60-100
31.5mm	50-100
25.0mm	35-70
19.0mm	20-50
12.5mm	10-35
9.5mm	5-25
4.75mm	0-10

- .7 Geotextile filter fabric: Refer to Section 31 32 21 -  
Geotextiles.

### PART 3 Execution

#### 3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Where applicable, strip topsoil from within limits of excavation and stockpile as directed by Departmental Representative, for re-spreading.
- .3 Sawcut pavement or concrete neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

#### 3.2 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination and freezing.

#### 3.3 DEWATERING OF EXCAVATIONS

- .1 Keep excavations free of water while work is in progress.
- .2 Protect open excavations, trenches and completed installations against damage due to rainwater, surface run-off, spring water, groundwater, backing up of drains, sewers, flooding from watermain and all other water. Provide pumps, equipment and enclosures required for such protection.
- .3 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction, and in accordance with the requirements of the Environmental Protection Plan.
- .4 All new and existing work damaged by failure to provide protection shall be removed and replaced with new work at

the expense of the Contractor.

### 3.4 SAW CUTTING

- .1 Existing pavement to be saw cut to produce neat, straight vertical cuts at interface between existing asphalt roadway and new pavement, where excavation meets with asphalt driveways, and at limits of Contract, or as directed by Departmental Representative.

### 3.5 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions indicated or required to construct roadways and to install site services.
- .2 Remove demolished foundations, rubble and other obstructions encountered during excavation.
- .3 Excavations must not interfere with normal 45° splay of bearing from bottom of any footing.
- .4 Do not obstruct flow of surface drainage or natural watercourses.
- .5 Earth bottoms of excavations to be dry undisturbed soil, level, free from loose or organic matter.
- .6 Notify Departmental Representative when soil at bottom of excavation appears unsuitable and proceed as directed by Departmental Representative.
- .7 Obtain Departmental Representative's approval of completed excavation.
- .8 Remove unsuitable material from bottom of excavation to extent and depth directed by Departmental Representative.
- .9 Where required due to unauthorized over-excavation, correct as follows:
  - .1 Fill under other areas with Type 2 compacted to 98% density.
- .10 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed compact foundation soil to density at least equal to undisturbed soil.
- .11 Rock excavation: For the purpose of bidding it is to be assumed that solid sandstone bedrock, as defined under Par. 1.4 above, will not be encountered during the work of this Section.

### 3.6 FILL TYPES AND COMPACTION

- .1 Dimensions specified in following paragraphs are minimum dimensions of fill after compaction.
- .2 Paved areas:
  - .1 Use fill types and thickness as indicated on drawings. Compact sandstone (select borrow) sub-base

and granular base to 100% SPMD.

- .3 Slab-on-Grade:
  - .1 Use Class 'A' gravel to underside of concrete areas compacted to 100% SPMD.
  - .2 Use select borrow to minimum thickness of 300mm or as indicated on Drawings, or as required to achieve design grades. Compact to 100% SPMD.

### 3.7 BACKFILLING

- .1 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.
- .2 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow, or debris.
- .4 Backfilling around site installations.
  - .1 Place bedding and surround material as specified and indicated in applicable Section for service or utility to be installed.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing.
  - .3 Place layers simultaneously on both sides of installed work to equalize loading.
  - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum of 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval has been obtained from Departmental Representative or;
    - .2 If approved by Departmental Representative erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
  - .5 Place material by hand under, around and over installations until 600mm of cover is provided, except where specifically permitted otherwise. Dumping material directly on installations will not be permitted.
- .5 Place backfill material in uniform layers up to grades indicated. Compact each layer before placing succeeding layer. Use methods to prevent damage to installations.

### 3.8 RESTORATION

- .1 Upon completion of work, remove surplus materials and debris, trim slopes and correct defects noted by



Departmental Representative.

- .2 Clean and reinstate areas affected by work to satisfaction of Departmental Representative.

### 3.9 SURPLUS MATERIAL

- .1 Remove all surplus material from site, and pay all fees as may be charged at disposal site.
- .2 Remove all soil contaminated with oil, gasoline, calcium chloride or other toxic or dangerous materials and dispose of in manner to minimize danger at site and in a manner and to a location off site approved by Provincial Authority governing such disposal.

END OF SECTION

## PART 1 General

### 1.1 MEASUREMENT FOR PAYMENT

- .1 Geotextile filter fabric will be measured in square metres of material incorporated in this work.
- .2 Supply and installation of accessories and other attachments will not be measured but considered incidental to work.

### 1.2 RELATED WORK

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling.

### 1.3 REFERENCES

- .1 CAN/CGSB-4.2-2004 (2013), Textile Test Methods.
- .2 CAN/CGSB-148.1-92, Methods of Testing Geotextiles and Geomembranes.
- .3 ASTM D4595-11, Test Method for Tensile Properties of Geotextiles by the Wide Width Strip Method.
- .4 ASTM D4751-99a, Test Method for Determining the Apparent Opening Size of a Geotextile.

### 1.4 DELIVERY AND STORAGE

- .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 Geotextile: non-woven synthetic fibre fabric, supplied in rolls of minimum 3.5 meters width and in one length.
  - .1 Standard of Acceptance: Synthetic Industries 1001 or an approved equal.
- .2 Synthetic fibre to be rot proof, unaffected by action of oil or salt water and not subject to attack of insects or rodents.
- .3 Seams or joints to be constructed in accordance with manufacturer's recommendations.
- .4 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.
- .5 Physical properties:
  - .1 Thickness: minimum 2.54 mm.
  - .2 Mass per unit area: minimum 600 g/m<sup>2</sup>.
  - .3 Tensile strength and elongation (in any principal direction):
    - .1 Tensile strength: minimum 1000 N, wet condition.

- .2 Elongation at break: 50%.
- .3 Mullen burst strength: minimum 3600 kPa.
- .4 Apparent opening size (AOS): 50 to 250 micrometres.
- .6 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m<sup>2</sup> to CSA G164.

### PART 3 Execution

#### 3.1 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface and against panels in orientation, manner and locations indicated and retain in position with weights.
- .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 Place geotextile material behind concrete panel surfaces in one continuous length from bottom of harbour to upper extent of panels as indicated.
- .5 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.

#### 3.2 PROTECTION

- .1 Do not permit passage of any vehicle directly on geotextile at any time.

END OF SECTION

## PART 1 General

### 1.1 MEASUREMENT PROCEDURES

- .1 No separate measurement for payment will be made under this section. Include costs in piling items.

### 1.2 RELATED SECTIONS

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Section 31 62 16.13 - Steel Sheet Piles
- .3 Section 31 62 16.16 - Steel H Piles.

### 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and handle steel H piles and steel sheet piling in accordance with Sections 31 62 16.13 and 31 62 16.16.
- .2 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .3 Replace damaged piles to satisfaction of Departmental Representative.
- .4 Load transport and deliver piles.
- .5 Supply piles as required to complete work.

### 1.4 PROTECTION

- .1 Protect public and construction personnel, adjacent structure, services and work of other sections from hazards due to pile driving operations.

### 1.5 EXISTING CONDITIONS

- .1 Sub-surface investigation reports are bound into Specification in Appendix 'A'.
- .2 Notify Departmental Representative in writing if subsurface conditions at site differ from those indicated and await further instructions from Departmental Representative.

### 1.6 SCHEDULING OF WORK

- .1 Submit schedule of planned sequence of driving to Departmental Representative and Departmental Representative for review, not less than 2 weeks prior to commencement of pile driving.

### 1.7 SUBMITTALS

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

## PART 2 Products

### 2.1 MATERIALS

- .1 Material requirements for piles are specified in Sections 31 62 16.13 and 31 62 16.16.
- .2 Supply full length piles and provide equipment of sufficient capacity to handle full length piles without cutting and splicing.
- .3 Piles to be driven to bedrock and as required by Geotechnical investigation and indicated on drawings.
- .4 Do not splice piles without written permission of Departmental Representative.

## PART 3 Execution

### 3.1 EQUIPMENT

- .1 Prior to commencement of pile installation, submit to Departmental Representative for approval, details of equipment for installation of piles.
- .2 Hammer: Use hammers capable of developing a blow at operating speed with sufficient energy to drive tip of piles to required penetration. For Impact Hammer, provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer and mass of driving cap. For non-impact methods of installation such as auguring, jacking, vibratory hammers or other means, give full details of characteristics necessary to evaluate performance.
- .3 Leads: Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means approved means, to ensure support to pile while being driven.

### 3.2 PREPARATION

- .1 Prior to commencement of pile installation inspect the harbour bottom for obstructions, and clear obstructions found on the pile installation alignment.
- .2 Ensure that ground conditions at pile locations are adequate to support pile driving operation. Make provision for access and support of piling equipment during performance of work.
- .3 Protect adjacent structures, services and sites.

### 3.3 FIELD MEASUREMENT

- .1 Maintain accurate records of driving for each pile, including:
  - .1 Type and make of hammer, stroke or related energy.
  - .2 Other driving equipment including water jet, driving cap, cushion.
  - .3 Pile size, length and location.

- .4 Sequence of driving piles in group.
- .5 Number of blows per metre for entire length of pile and number of blows per 100mm for last 1000mm.
- .6 Final tip and cut-off elevations.
- .7 Other pertinent information such as interruption of continuous driving, pile damage.
- .8 Record elevation taken on adjacent piles during driving of each pile.
- .9 Provide Departmental Representative with three copies of records.

### 3.4 DRIVING

- .1 All piles must be driven to established resistance in one continuous operation to avoid freeze.
- .2 Use driving caps and cushions to protect piles. Reinforce pile heads if necessary. Piles with damaged heads will be rejected by Departmental Representative.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows along axis of pile.
- .5 Do not drive piles within 8m of concrete which has been in place less than 3 days.
- .6 Ensure no contact between pile and structure takes place when driving batter piles adjacent to existing structures.
- .7 Redrive piles lifted during driving of adjacent piles.
- .8 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.
- .9 Use of water jet not permitted.
- .10 Cut off piles neatly and squarely at elevations as indicated. Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.
- .11 Remove cut-off lengths from site on completion of work.

### 3.5 CAPACITY AND PENETRATION

- .1 Required pile penetration depth to refusal and as indicated.
- .2 Installation of each pile will be subject to approval of Departmental Representative. Departmental Representative will be sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration or other criteria used to determine capacity and penetration depth.
- .3 Drive each pile to bedrock and to pile tip elevation as indicated. Do not overdrive to cause damage to piles in bedrock. Departmental Representative will determine

refusal criteria for piles driven to rock based on type of piles and driving equipment.

- .4 Virtual refusal is defined as ten (10) blows per 25mm with an approved pile hammer by the Departmental Representative.
- .5 Refer to geotechnical investigation for soil conditions and recommendations in Appendix 'A'.

### 3.6 TEST PILES

- .1 With a view to determining the required lengths of the piling requirements the contractor may, at his discretion, carry out test driving of piles. The location and number of test piles is left to the discretion of the contractor.

### 3.7 DRIVING TOLERANCES

- .1 Install piles to the following tolerances: pile heads to be within 50mm of locations shown on drawing and where required to permit installation of concrete pile caps.
- .2 Top of piles to be aligned to approval of Departmental Representative. Take measure to correct alignment as required.

### 3.8 DAMAGED OR DEFECTIVE PILES

- .1 Departmental Representative will reject any pile that is driving out of position, twisted or is damaged during driving or handling.
- .2 Remove rejected pile and replace with a new, and if necessary, a longer pile.
- .3 No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles.

END OF SECTION

PART 1 General

1.1 MEASUREMENT PROCEDURES

- .1 Refer to Section 01 29 00 - Measurement for Payment.

1.2 RELATED SECTIONS

- .1 Section 31 61 13 - Pile Foundations, General.

1.3 REFERENCES

- .1 ASTM International
  - .1 ASTM A6/A6M-17, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
  - .2 ASTM A325, Standard Specification for Structural Bolts, 120 KSI Tensile.
  - .3 ASTM A1011/A1011M-10, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra High Strength.
  - .4 ASTM A328/A328M-13a (2018), Standard Specification for Steel Sheet Piling.
  - .5 ASTM A857/A857M-07 (2013), Standard Specification for Steel Sheet Piling, Cold Formed, Light Gage.
- .2 CSA International
  - .1 CSA G40.20/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
  - .2 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for piles and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit shop drawings for the following items:
  - .1 A plan layout of sheet piling sections indicating all dimensions.
  - .2 Details of the sheet piling sections.
  - .3 Layout and details of the waler indicating location of splices, splice details, tie bolt details and sheet washer plate details.
  - .4 Details of steel tie rods, steel plate washers, nuts, lock nuts and couplers.



.3 Certificates:

- .1 Submit 2 weeks prior to fabrication, 2 copies of steel producer certificates in accordance with ASTM A1011/A1011M, and mill test reports in accordance with CSA G40.20/G40.21.
- .2 Submit copy of certification for fusion welding in accordance with CSA W47.1.

1.5 QUALITY ASSURANCE

- .1 Inspection and testing of steel sheet piling material will be carried out by testing laboratory designated by Departmental Representative at any time during course of Work.
- .2 Materials inspected or tested by Departmental Representative which fail to meet contract requirements will be rejected.
- .3 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, Contractor to pay costs for additional tests and/or inspections.

1.6 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. Store and protect sheet piles from nicks, scratches, and blemishes.
  - .2 Replace defective or damaged materials with new.
- .4 Use slings for lifting piling, and ensure mass is evenly distributed such that piling is not subjected to excessive bending stresses.
- .5 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .6 Replace or repair damaged piles with steel to CSA G40.20/G40.21.
- .7 Store sheet piling on level ground or provide supports so that sheet piling is level when stored.
  - .1 Provide blocking at spacing not exceeding 5 m so that there is no excessive sagging in piling.
  - .2 Overhang at ends not to exceed 0.5 m.
  - .3 Block between lifts directly above blocking in lower

lift.

- .8 If material is stock-piled on structure, ensure structure is not overloaded.

## PART 2 Products

### 2.1 MATERIALS

- .1 Steel sheet piles: to CSA G40.2, Grade 350W, and following:
- .2 Continuous interlocking Z section:
  - .1 Minimum effective section modulus: 1,815 cm<sup>3</sup>/wall m.
  - .2 Minimum sheet thickness: 12.2 mm.
  - .3 Minimum section area = 131.0 cm<sup>2</sup>
  - .4 Interlocks: to be such that section of interlock bar of 1 m minimum length will pass along full length of pile without binding.
  - .5 Mark each piece of sheet piling legibly by stenciling or die-and-stamping with information as follows:
    - .1 Heat number.
    - .2 Manufacturer's name.
    - .3 Length and section number. Do not precut lifting or slinging holes in sheet piles.
- .3 Structural steel for wales, bearing plates, wales splices, steel pipes, capping channels, support angles and miscellaneous steel: to CSA G40.21, Grade 350 W.
- .4 Tie rods, sleeve nuts and turnbuckles:
  - .1 Tie rods: diameter as indicated on Drawings, to ASTM A615, Grade 520.
  - .2 Tie rods: to continuously threaded bar with double corrosion protection.
  - .3 Sleeve nuts, to have load capacity in excess of capacity of tie rod.
  - .4 Preassemble, mark and test tie rod assemblies in shop. Align threaded connection to following tolerances at sleeve nut or connector sleeve: 1/80 of normal rod diameter, deviation of centreline, 1 in 160.
- .5 Nuts and bolts: hexagon nuts, bolts, and washers: to ASTM F3125 Grade 325.
- .6 Backfill material: to Section 31 23 10 - Excavating, Trenching and Backfilling.

### 2.2 SOURCE QUALITY CONTROL: HOT ROLLED SHEET STEEL PILING

- .1 Provide results of tests of sheet piling material to be used on project as follows:

- .1 One tension test and 1 bend test from each heat for quantities of finished material less than 50 tonnes.
- .2 Two tension tests and 2 bend tests from each heat for quantities of finished material exceeding 50 tonnes.
- .2 Tension tests in accordance with CSA G40.20/G40.21. Bend tests: to ASTM A6/A6M.

### PART 3 Execution

#### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for steel sheet piles installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

#### 3.2 INSTALLATION

- .1 Do pile installation Work in accordance with Section 31 61 13 - Pile Foundations, General except where otherwise specified.
- .2 Do welding in accordance with CSA W59.
- .3 Do not begin pile installation until required quality control tests have been completed and test results approved by Departmental Representative.
- .4 Submit full details of method and sequence of installation of piling to Departmental Representative for approval prior to start of pile installation work. Details must include templates, bracing, setting and driving sequence and number of piles in panels for driving.
- .5 When installation is complete, face of wall at top of sheet piles to be within 75 mm of location as indicated and deviation from vertical not to exceed 1 in 100.
- .6 Maintain piles in specified alignment and position until connection to permanent tie rod anchorage system is made.

#### 3.3 OBSTRUCTIONS

- .1 If obstruction encountered during driving, leave

obstructed pile and proceed to drive remaining piles.  
Return and attempt to complete driving of obstructed pile later.

- .2 Advise Departmental Representative immediately if impossible to drive pile to full penetration, and obtain direction from Departmental Representative on further steps required to complete Work.

### 3.4 CUTTING

- .1 When flame cutting tops of piles, and flame cutting holes in piles approved by Departmental Representative, use following procedure:
  - .1 When air temperature is above 0 degrees C, no pre-heat is necessary.
  - .2 When air temperature is below 0 degrees C, pre-heat until steel 25 mm on each side of line of cut has reached a temperature very warm to hand (approximately 35 degrees C). Temperature indicating crayon marks may be used to measure temperature.
  - .3 Use torch guiding device to ensure smooth round holes or straight edges.
  - .4 Make cut smooth and free from notches throughout thickness. If grinding is employed to remove notch or crack, finished radius to be minimum 5 mm.

### 3.5 TIE ROD ANCHORAGE SYSTEM

- .1 Support tie rods at intervals along their length.
- .2 Fit and adjust tie rod systems so that connections at both waling ends of tie rods are tight before backfilling.
- .3 Brace steel sheet pile with waling strips in accordance with shop drawings. Make wales one length between corners and bolt to piles.

### 3.6 WHARF CLOSURE

- .1 Install wharf closure to details indicated on drawings.
- .2 Fill top walers with concrete to the details shown on drawings.

### 3.7 BACKFILLING

- .1 Backfill in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling and as indicated.
- .2 Protect piling tie rods anchorage system from damage or displacement during backfilling operations.

### 3.8 WORK ON VICINITY OF STRUCTURES

- .1 Care must be taken when carrying out construction operations adjacent to existing dockwalls and structures

to avoid any damage or undercutting. Repair and make good any damage at no cost to Departmental Representative.

### 3.9 COOPERATION AND ASSISTANCE

- .1 Furnish use of such boats, equipment, labour and materials as may be reasonably necessary to allow Departmental Representative to inspect, monitor and supervise work. Equip boats with approved life jackets, navigation lights and all other safety devices required.
- .2 Cooperate with Departmental Representative on inspection and monitoring work, and provide assistance as requested.

### 3.10 MONITORING OF WORK

- .1 Contractor is responsible to monitor effectiveness and productivity of his own work on an ongoing basis.
- .2 Contractor to identify and demonstrate effectiveness of proposed monitoring methods prior to commencement of work.

END OF SECTION

## PART 1 General

### 1.1 MEASUREMENT FOR PAYMENT PROCEDURES

- .1 Refer to Section 01 29 00 - Measurement for Payment.

### 1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 03 20 00 - Concrete Reinforcing
- .3 Section 03 30 00 - Cast in Place Concrete
- .4 Section 31 61 13 - Pile Foundations, General Requirements
- .5 Section 05 50 00 - Metal Fabrications

### 1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.171-98, Inorganic Zinc Coating.
  - .2 CAN/CGSB-1.184-98, Coal Tar-Epoxy Coating.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.
  - .3 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
  - .4 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
  - .5 CAN/CSA S16-14, Design of Steel Structures.
  - .6 CSA W59-18, Welded Steel Construction, (Metal Arc Welding).
- .3 Stantec Geotechnical Report No. 121621050, Dated June 25, 2018.

### 1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Submit shop drawings and indicate: pile shoes, splice detail, pile cap details, tip reinforcement.
  - .1 Each drawing stamped and signed by professional engineer registered or licensed in Province of Prince Edward Island, Canada.
- .4 Quality Assurance: Test Reports:
  - .1 Prior to fabrication, and, if requested, provide Departmental Representative with two copies of steel producer's certificates in accordance with CSA-

G40.20/G40.21.

- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Submit details of pile stock material to be used, as described in Section 2 - Products, for review by Departmental Representative.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle to prevent damage to products.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Deliver new, undamaged materials to site, accompanied by certified test reports, with manufacturer's logo and mill identification mark provided on H piling.
- .4 Storage and Protection:
  - .1 Store and handle H piling in accordance with manufacturer's written instructions to prevent permanent deflection, distortion or damage to piles.
  - .2 Support H piling on level blocks or racks spaced not more than 3 m apart and not more than 0.60 m from ends.
  - .3 Store H piling to facilitate required inspection activities and prevent corrosion prior to installation.
- .5 Waste Management and Disposal:
  - .1 Separate waste materials for disposal in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

### PART 2 Products

#### 2.1 MATERIALS

- .1 Steel HP310x152 vertical (plumb) piles as indicated to CSA G40.20/G40.21 - 350W.
- .2 Where indicated pile cap plate to CSA-G40.20/G40.21, Grade 350W.
- .3 Compatibly sized H pile driving shoes: to CSA-G40.20/G40.21, Grade 300W.
- .4 Splices: to CSA-G40.21/G40.21, Grade 350W
- .5 Welding electrodes: to CSA W48.
- .6 Welding and weld testing to CSA W59.

## PART 3 Execution

### 3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 Connect approved H pile driving shoe to H pile as per manufacturer's recommendations.

### 3.2 FABRICATION

- .1 Fabricate full length piles to eliminate splicing during installation wherever possible.
- .2 Submit details of planned use of pile material stock to Departmental Representative for approval prior to start of fabrication. Re-use cut-off lengths as directed by Departmental Representative.
- .3 Allowable tolerance on axial alignment to be 0.25% as measured by 3 m straight edge.
- .4 Allowable deviation from straight line over total length of fabricated pile to be 50 mm.
- .5 Install pile cap reinforcement, splices and driving shoes as indicated.
- .6 Repair defective welds as directed by Departmental Representative.
  - .1 Repairs: to CSA W59.
  - .2 Unauthorized weld repairs may be rejected.

### 3.3 INSTALLATION

- .1 Install piling in accordance with Section 31 61 13 - Pile Foundations, General Requirements.
- .2 Perform internal visual inspection of steel H piles, joints and cap prior to placing of concrete. Ensure enough pile cut-off length is provided such that the remaining pile has not been damaged during pile driving operations.
- .3 Assemble and install reinforcement cages for integral abutments as indicated.
- .4 Install driving shoes during shop fabrication.
- .5 Piles shall be driven within  $\pm 75$  mm of theoretical position.

### 3.4 WELDING

- .1 Weld to CSA W59.
- .2 Welding certification of companies: to CSA W47.1.
- .3 Welding certification of companies welding steel reinforcing bars placed in reinforced concrete: in



accordance with CSA W186.

END OF SECTION

PART 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 Refer to Section 01 29 00 - Measurement for Payment.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 DESCRIPTION OF WORK

- .1 This Section specifies the requirements for the materials, equipment and methods to be followed for production, placement and compaction of hot mix, hot laid asphalt concrete for pavement construction for the parking areas, including access driveways.
- .2 The following Prince Edward Island Department of Transportation, Infrastructure & Energy Specifications will be followed for all work related to Hot Mix Asphalt Concrete Paving.
  - .1 501 Asphalt Cement
  - .2 502 Asphalt Prime
  - .3 503 Asphalt Emulsions
  - .4 601 Tack Coat Application
  - .5 602 Prime Coat Application
  - .6 603 Hot Mix Asphaltic Concrete
  - .7 705 Cold Plane Construction Joint
  - .8 907 Vehicle Configurations and Restrictions

1.4 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
  - .2 ASTM D1559-89, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus, was withdrawn in 1998 with no replacement.
- .2 Asphalt Institute (AI)
  - .1 AI MS-2-1993, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.
  - .2 CAN/CGSB-16.3-M90, Asphalt Cements for Road Purposes.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse in accordance with Waste Management Plan.
- .2 Divert unused asphalt materials from landfill.
- .3 Divert unused aggregate materials from landfill for reuse as approved by Departmental Representative.
- .4 Unused protective coating material must be disposed of at an official hazardous material collections site as approved by Departmental Representative.
- .5 Unused protective coating material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

## PART 2 Products

### 2.1 MATERIALS

- .1 Asphalt paving mixture: The current Prince Edward Island Department of Transportation, Infrastructure & Energy Specifications 603 and 501 for hot-mixed, hot-laid asphalt concrete shall govern the materials and composition of the asphalt concrete pavements.
  - .1 Base: Mix designation 'A' - as per Specification 501
  - .2 Seal: Mix designation 'B' - as per Specification 501
- .2 Asphalt prime: In accordance with the PEI Department of Transportation, Infrastructure & Energy Specification 502.
- .3 Asphalt emulsions: In accordance with the PEI Department of Transportation, Infrastructure & Energy Specification 503.

## PART 3 Execution

### 3.1 ASPHALT PRIME

- .1 Apply asphalt prime over imported granular base in accordance with the requirements of PEI Department of Transportation, Infrastructure & Energy Specification 602, Paragraphs 602.01 to 602.04 inclusive.

### 3.2 ASPHALT CONCRETE PAVING

- .1 Place and compact asphalt concrete base and seal courses in accordance with the requirements of PEI Department of Transportation, Infrastructure & Energy Specification 603 to thickness indicated on drawings.

### 3.3 ASPHALT TACK

- .1 Apply asphalt tack between base and seal courses and

elsewhere as applicable in accordance with the requirements of PEI Department of Transportation, Infrastructure & Energy Specification 601.

### 3.4 JOINTS

- .1 Provide cold plane joint at intersection with existing roads and elsewhere as required in accordance with PEI Department of Transportation, Infrastructure & Energy Specification 705, Paragraphs 705.01 and 705.02.

### 3.5 VEHICLE REQUIREMENTS

- .1 In accordance with PEI Department of Transportation, Infrastructure & Energy Specification 907.

### 3.6 TESTING AND INSPECTION

- .1 Testing of asphalt materials and inspection and testing of placement and compaction to be carried out by testing laboratory engaged and paid by the Contractor. Frequency of tests to be determined by the testing laboratory.

### 3.7 SURPLUS MATERIALS

- .1 Remove all surplus materials from site.
- .2 Dispose off site at a location approved by Provincial Authority governing such disposal and pay all fees that may be charged to dispose of materials.

### 3.8 ASPHALTIC CURBS

- .1 Form asphalt curbs by machine to profiles as indicated. Curve curbs uniformly.

### 3.9 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C. Do not permit stationary loads on pavement until 24 hours after placement.
- .2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

END OF SECTION

PART 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 Dust Control will be considered incidental to the work and not measured separately for payment.

1.2 DESCRIPTION OF WORK

- .1 The work of this Section comprises the furnishing of all labour, materials and equipment necessary for the supply and application of water for prevention of dust nuisance caused by traffic, and/or weather conditions.

PART 2 Products

2.1 MATERIALS

- .1 Water: to Departmental Representative's approval.

2.2 SUPPLY

- .1 At least one mobile unit of at least 4.5 KL capacity for applying water shall be available on the project at all times.
- .2 The intake hose to the tank shall be equipped with a device satisfactory to the Departmental Representative to prevent fish from being pumped into the tank.

PART 3 Execution

3.1 APPLICATION

- .1 Apply water, when and where required, in location directed by Departmental Representative, with distributors equipped with a spray system that will ensure uniform application and with positive means of shut-off.

END OF SECTION

PART 1 General

1.1 MEASUREMENT PROCEDURES

- .1 Riprap material will be paid for at the unit bid price in tonne and this shall be full compensation for supplying and placing rocks, hauling, shaping of underlying material, equipment, tools, labour and incidentals necessary to complete the work in acceptable manner to Departmental Representative and shall be based on weigh slips.
- .2 Toeing in of the stone will be incidental to the supply and placement of the Stones.
- .3 Armour stone will be measured in tonnes of material supplied and placed to the final dimensions indicated on the drawings and incorporated into the completed work and shall include all labour, equipment and materials necessary to complete the work.
- .4 Filter stone will be measured in tonnes of material supplied and placed to the final dimensions indicated on the drawings and incorporated into the completed work and shall include all labour, equipment and materials necessary to complete the work.
- .5 Core stone will be measured in tonnes of material supplied and placed to the final dimensions indicated on the drawings and incorporated into the completed work and shall include all labour, equipment and materials necessary to complete the work.
- .6 Weigh all stones placed in the Work at the quarry on an approved and certified scale. Provide the Departmental Representative with a copy of the certificate and display certificate in prominent location. Costs for maintenance and operation of scale shall be considered incidental to the work.
- .7 All labour, equipment and material necessary to complete the following will be considered part of the sum lump arrangement:
  - .1 Removal and disposal off site of concrete decks over the existing jetties;
  - .2 Removal of navigational aid light and base and turned over to Departmental Representative;
  - .3 Salvaging, retaining and placement of existing displaced riprap and armour stones at the east end of the existing jetties;
  - .4 Excavating, removal and disposal off site of unsuitable and surplus materials within the existing steel sheet pile jetties;
  - .5 Cutting off top sections of existing steel sheet

piling to limits and elevations indicated on drawings. Removal of tie rods wales and other items and disposal offsite of all surplus material.

- .8 Provide the Departmental Representative with weigh tickets at time of delivery to site.
- .9 Construction, maintenance and removal of haul roads are to be considered incidental to this work.

#### 1.2 DESCRIPTION OF WORK

- .1 The work of this Section comprises the furnishing of all labour, materials and equipment necessary for the supply and installation of imported riprap for the construction of breakwaters and slope protections as indicated, as specified and to lines, grades and typical cross sections shown on drawings.

#### 1.3 RELATED WORK

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Section 31 32 21 - Geotextiles.

#### 1.4 SOURCE SAMPLING

- .1 Inform Departmental Representative of proposed source of materials and, if requested, provide access for sampling at least 2 weeks prior to commencing work.

### PART 2 Products

#### 2.1 MATERIALS

- .1 Rock materials:
  - .1 To the requirements of PEI Department of Transportation, Infrastructure and Energy Specification # 213 (General Provisions and Contract Specifications for Highway Construction latest edition) as it relates to imported metamorphic or igneous rock.
  - .2 The rock material is subject to Los Angeles Abrasion Test (ASTM C131), shall have a loss not greater than 35%.
  - .3 When tested for soundness, five cycles of magnesium sulphate (ASTM C88), the rock material shall have a loss not greater than 15%.
  - .4 Stone: Imported metamorphic or igneous stones. Random riprap shall consist of clean hard, durable quarried stone, free from seams, cracks or other structural defects having a density of not less than 2.65 tonne/m<sup>3</sup>. Stones are to be fractured and angular. Field stone is not acceptable.
    - .1 Armour stone:

- .1 The largest dimension of each stone is not to exceed two times the smallest dimension.
- .2 Armour stone A1: 4 to 6 tonnes each by weight.
- .3 Armour stone A2: 3 to 5 tonnes each by weight.
- .2 Filter stone:
  - .1 The largest dimension of each stone is not to exceed two times the smallest dimension.
  - .2 Quarry Run Stone: 400kg to 800kg each by weight with 60 percent of the total volume to be at the midpoint of the specified size range.
- .3 Core stone:
  - .1 Quarry Run Stone: 0.1kg to 400kg each by weight with 60 percent of the total volume to be at the midpoint of the specified size range, and not more than a maximum 5 percent content less than 25mm.
- .4 Rock Fill:
  - .1 Rock Fill to be hard durable crushed quarried rock, free from silt, clay, organic matter and other foreign substances and free from splits, seams or defects likely to impair its soundness during handling or under action of water. Rock Fill shall be imported, well graded and free from fines. The following materials will not be considered acceptable for use as rock fill: slate, siltstone, sandstone, shale, conglomerate, and mudstone. The material is to be blended to ensure a homogeneous mix of smaller and larger stone sizes will be obtained. Rock Fill to be placed and compacted to 100% Standard Proctor maximum dry density. Rock fill shall meet the following gradation:

ASTM Sieve Designation	% Passing by Mass
112 mm	100
40 mm	60-85
5 mm	25-50
.315 mm	5-15
.080 mm	2-7



- .5 Conglomerates will not be accepted.
- .5 Geotextile in accordance with Section 31 32 21 - Geotextiles.

## PART 3 Execution

### 3.1 EXCAVATING

- .1 Excavate and stockpile native infill material that is suitable for reuse as core material in new breakwater and wharf protection. Unsuitable material is to be disposed of off-site.
- .2 Suitable native fill material is to be free of roots and other deleterious material.
- .3 Reinstall rock materials as indicated on drawings.

### 3.2 PLACEMENT OF CORE STONE

- .1 Place core stone to lines, grades and dimensions as indicated on the drawings.
- .2 Place core stone in thickness courses to total layer thickness, as shown on the drawing.
- .3 Place core stone on a slope of 1.5 horizontal to 1 vertical unless noted otherwise.
- .4 No allowance made for material placed outside specified limits.

### 3.3 PLACEMENT OF FILTER STONE

- .1 Place filter stone to lines, grades and dimensions as indicated on the drawings.
- .2 Place each filter stone in stable position.
- .3 Place filter stone on a slope of 1.5 horizontal to 1 vertical unless noted otherwise.
- .4 Place filter stone in thickness courses to total layer thickness, as shown on the drawing.

### 3.4 PLACEMENT OF ARMOUR STONE

- .1 Place armour stone to lines, grades and dimensions as indicated on the drawings.
- .2 Place each armour stone in stable position.
- .3 Place armour stone in thickness courses to total layer thickness, as shown on the drawing.
- .4 Sort, fit and tightly key each rock to ensure stability of faces.
- .5 Placement not deemed acceptable must be removed and replaced.

### 3.5 TOLERANCES

- .1 Completed component layers to be within following

tolerances of lines and grades as indicated:

- .1 Armour: plus or minus 300 mm.
- .2 Filter: plus or minus 200mm.
- .3 Core: plus or minus 150 mm.

### 3.6 PLACEMENT FOR SHORE PROTECTION

- .1 Where rip-rap is to be placed on slopes, excavate toe in slope in accordance with dimensions as indicated or as directed by Departmental Representative.
- .2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface. Place rip-rap on geotextile so as to avoid puncturing geotextile. Do not drive vehicles directly on geotextiles.
- .4 Place riprap in accordance with thickness and details as indicated or as directed by Departmental Representative.
- .5 Place riprap in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes and face of slopes.

### 3.7 TEMPORARY ROADS

- .1 Be solely responsible for construction and maintenance of temporary roads for the construction of the breakwaters and shore protection. Remove temporary roads from site upon completion of project. No separate payment to be made for construction, maintenance and removal of temporary roads.

END OF SECTION

## PART 1 General

### 1.1 REFERENCES

- .1 PEI Department of Transportation, Infrastructure, and Energy:
  - .1 General Provisions and Contract Specifications For Highway Construction (latest Revision).
- .2 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB 148.1, No. 2-M85, Methods of Testing Geotextiles and Geomembranes - Mass per Unit Area.
  - .2 CAN/CGSB 148.1, No. 3-M85, Methods of Testing Geotextiles and Geomembranes - Thickness of Geotextiles.
  - .3 CAN/CGSB 4.2, No. 11.2-M89(R2013), Textile Test Methods Bursting Strength- Ball Burst Test.
- .3 American Society for Testing and Materials (ASTM):
  - .1 ASTM D4595-11, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

### 1.2 SUBMITTALS

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

### 1.3 MEASUREMENT PROCEDURES

- .1 Supply and installation of turbidity curtain for environmental protection for all in-water work, maintenance of turbidity curtain during work, and removal of turbidity curtain after all in-water work is completed is part of the lump sum arrangement and will not be measured as separate items.

### 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 Geotextile: woven synthetic fibre fabric, supplied in rolls.
  - .1 Composed of: minimum 85% by mass of polypropylene polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
- .2 Physical properties:

- .1 Thickness: to CAN/CGSB-148.1, No. 3, minimum 0.8 mm.
- .2 Mass per unit area: to CAN/CGSB-148.1, No. 2, minimum 220 g/m<sup>2</sup>.
- .3 Tensile strength and elongation (in any principal direction): to ASTM D4595.
  - .1 Tensile strength: minimum 900 N, wet condition.
  - .2 Elongation at break: minimum maximum 25%.
  - .3 Seam strength: minimum 900 N equal to or greater than tensile strength of fabric.
  - .4 Mullen burst strength: to CAN/CGSB-4.2, No. 11.2, minimum 2400 N, equal to or greater than tensile strength of fabric.
- .4 Seams: sewn in accordance with manufacturer's recommendations.
- .5 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.
- .6 Curtain height: to suit water depth and be bottom-weighted to maintain its vertical position.

### PART 3 Execution

#### 3.1 GENERAL

- .1 Supply, install, maintain and remove turbidity curtains when instructed by the Departmental Representative.
- .2 Monitoring of water turbidity outside the turbidity curtain will be done by the Departmental Representative. Turbidity shall not exceed 25 mg/l total suspended solids.

#### 3.2 INSTALLATION

- .1 Turbidity curtains shall consist of geosynthetic, load line, flotation, ballast, anchors, mooring buoys, mooring lines, adjustment lines, and tie-downs.
- .2 Design to conform to PEI Department of Transportation, Infrastructure and Energy General Provisions and Contract Specifications, as a minimum.
- .3 Turbidity curtains shall be constructed as follows:
  - .1 The flotation shall provide support along the length of the turbidity curtain.
  - .2 A sleeve shall be formed and heat-sealed or sewn along the entire bottom edge of the turbidity curtain geosynthetic, to contain the ballast in the sleeve. Breaks may be made in the sleeve to facilitate pulling, provided they are a minimum 100 mm in size and spaced at minimum 3 m intervals.
  - .3 Where turbidity curtain geosynthetic is joined to provide a continuous run, the sections shall be

connected to provide a continuous seal and prevent the escape of turbid water between the sections.

- .4 Turbidity curtain, as prepared for installation, shall be of sufficient width to account for water depth and wave action.
- .5 Turbidity curtain shall be of sufficient length to permit work inside the area enclosed by the curtain without restricting equipment operations, and personnel from working.
- .6 Seal the ends of the turbidity curtain where it terminates at the existing structure face.

### 3.3 OPERATION AND MAINTENANCE

- .1 Turbidity curtains shall be installed to prevent sediment passage, from the area enclosed by the curtain, to the remaining water body. Turbidity curtains shall be installed and maintained in a manner that avoids entry of equipment, other than hand-held equipment or boats, to the remaining water body.
- .2 Equipment is permitted in the work area enclosed by the turbidity curtain.
- .3 Turbidity curtains shall be operated and maintained in the specified location, with the entire top edge above the water surface.
- .4 The curtain shall be free of tears and gaps, and the bottom edge of the curtain is to be continuously in contact with the water course bed so that sediment passage from the area enclosed is prevented.
- .5 Any folds in the turbidity curtain which form next to the flotation collar shall be regularly monitored and freed of collected sediment.
- .6 Monitor and maintain the turbidity curtains booms both during and outside normal working shifts as required. Provide all personnel, materials and equipment necessary to maintain, repair or relocate the turbidity curtain system.
- .7 Carry out construction operations to minimize impact on fish habitat from both disturbed sediments and fill materials.
- .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .9 Remove turbidity curtain when authorized by the Departmental Representative after completion of the work.

END OF SECTION

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Harbour Structures  
304, 305 & 306  
Reconstruction  
Grahams Pond Harbour, Kings Co., PEI

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## **APPENDIX A**

**GEOTECHNICAL REVIEW  
PROPOSED BREAKWATER RECONSTRUCTION (STRUCTURE 305)  
GRAHAM'S POND SMALL CRAFT HARBOUR, KINGS COUNTY, PEI**

**JOOSE ENVIRONMENTAL PROJECT NO. JE0160-A**





Joose Environmental Consulting Inc.  
P.O. Box 19  
North Wiltshire PE C0A 1Y0

March 29, 2016

Joose Environmental Project No. JE0160-A

Ms. Brenda Victor, P. Eng., Project Manager  
Public Works and Government Services Canada  
3 Queen Street (Cambridge Building)  
PO Box 1268  
Charlottetown PE C1A 8R4

Dear Ms. Victor:

**Reference:      Geotechnical Review - Proposed Breakwater Reconstruction (Structure 305)  
                     Graham's Pond Small Craft Harbour, Kings County, Prince Edward Island**

### **Introduction**

This report presents the results of the geotechnical review carried out for the above-noted project, in accordance with your request. The purpose of the review was to assess all available geotechnical information for the specified area of the subject site and to compile all of the pertinent data into this summary report.

For the purposes of our review, we have assumed that the existing geotechnical information serves as a good representation of the present conditions, and we have provided our comments and preliminary recommendations accordingly.

### **Methodology**

The available information reviewed for this project consisted of:

- Jacques Whitford Report No. 2636, issued December 1982;
- WS Langley Report No. L580, issued December 1983;
- Jacques Whitford Report No. 71595, issued September 2002; and
- Jacques Whitford Report No. 71647, issued June 2003.

Five (5) of the boreholes, BH 1, BH 17, BH 21, BH 22, and BH 103 that were drilled in close proximity to Structure 305 during the above noted investigations, were used for this report .

The Jacques Whitford boreholes, BH 22, BH 1 and BH 103, were drilled at the site in 1982, 2002, and 2003, respectively. The WS Langley boreholes (BH 17 and BH 21) were drilled at the site in 1983. All five (5) boreholes were undertaken using a drill rig mounted on a floating barge platform. The boreholes were advanced to depths ranging from 8.5 to 15.1 m below harbour bottom. The borehole locations are shown in relation to Structure 305 on the appended Drawing No. 1.

Samples of the overburden soils encountered were taken at regular intervals by means of a conventional split spoon sampler during the performance of Standard Penetration Tests (SPT). Bedrock was proven at



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each borehole location, with the exception of BH 22, by rotary core drilling in BX-size (42 mm core diameter) or NQ-size (48 mm core diameter)

The original Borehole Records for BH 1, BH 103, are BH 22, showing the subsurface conditions encountered at the site and the sampling/testing carried out, are included in the Appendix. Although Borehole Records for BH 17 and BH 21 were not available, the conditions encountered at these two locations were obtained from a drawing excerpt (Public Works Canada, Harbour Reconstruction Graham's Pond, Reconstruction of North Breakwater, Drawing No. 1 of 8, dated January 13, 1984).

The elevations for BH 22 (Jacques Whitford Report No. 2636) are referenced to LWOST (low water of ordinary spring tides). LWOST datum is essentially synonymous to Low Normal Tide (LNT) Datum and Chart Datum. The elevations for BH 1 (Jacques Whitford Report No. 71595) were initially determined with respect to an Assumed Datum but this has been adjusted to LNT Datum for ease of reference. LNT/Chart Datum are more commonly used today, and are therefore used within this report.

### Subsurface Conditions

The subsurface conditions encountered at the boreholes are described below and are shown in detail on the appended Borehole Records, with a summary provided on Table 1 (also appended). The subsurface conditions encountered at the site are also depicted on the Stratigraphic Section included on Drawing No. 1 in the Appendix.

For the purposes of this report, the compact gravelly sand layer (BH 22) and the compact silty sand layer (BH 17 and BH 21) have been designated as till.

### Marine Deposit

Marine deposited soils, ranging in composition from sand to organic silt were encountered at the surface (i.e., harbour bottom) at each borehole location. The total thickness of the marine deposit was found to range from 1.7 m at BH 17 to 8.4 m at BH 1.

Standard Penetration Test N-values within the marine deposit were found to range from 0 (i.e., sampler sunk under weight of rods) to 29 indicating highly variable, very loose/very soft to compact, conditions.

Following is a summary of the various marine soil layers encountered at the boreholes with the corresponding N-values and the relative density/consistency (the borehole information is presented from west to east across the site):

Borehole No.	Depth/Marine Soil Description	N-value(s)	Relative Density/Consistency
BH 22	0.0 to 2.0 m - grey brown silty sand, organics, shells	1	Very Loose
BH 17	0.0 to 1.5 m - silty sand, some organics	-	Very Loose (inferred)
	1.5 to 1.7 m - grey organic silt	-	Very Soft (inferred)

Borehole No.	Depth/Marine Soil Description	N-value(s)	Relative Density/Consistency
BH 21	0.0 to 5.5 m - grey organic silt, trace sand	2/2	Very Soft
BH 103	0.0 to 2.9 m - greyish brown sand, trace to some silt, gravel, sandstone cobbles, trace shell fragments	29/13/13/3	Compact to Very Loose
	2.9 to 5.9 m - olive grey sandy clayey silt, trace shell fragments, organic matter	2/0	Soft to Firm
	5.9 to 7.8 m - reddish brown sand, trace to some silt, gravel	15/13/14	Compact
BH 1	0.0 to 2.3 m - brown to dark grey sand, some silt, trace shell fragments	7/8	Loose
	2.3 to 4.4 m - olive grey sandy clayey silt, trace shell fragments, organic matter	1/1	Very Soft
	4.4 to 8.4 m - reddish brown sand, trace to some silt, gravel	27/16	Compact

A grain size analysis carried out on a sample of the clayey silt recovered from BH 1 shows this material to contain 1 percent gravel, 27 percent sand, and 72 percent fines (silt and clay sizes). An Atterberg Limit determination performed on the same sample shows the clayey silt to contain fines of high plasticity based on liquid and plastic limits of 94 percent and 50 percent, respectively. The natural moisture content of selected samples of the clayey silt recovered from BH 1 and BH 103 was found to range from 59 to 85 percent with an average of 73 percent.

To assess the undrained shear strength of the clayey silt, field vane tests and laboratory penetrometer tests were carried out on samples recovered from BH 103. The results of the field vane tests are shown on the appended Borehole Record and show the insitu shear strength (undrained) to range from 24 to 96 kPa with an average of 60 kPa. The results of the laboratory penetrometer tests show the undrained shear strength to range from 22 to 31 kPa with an average of 26 kPa.

The following parameters may be assigned to the clayey silt/organic silt:

Total Unit Weight	17 kN/m <sup>3</sup>
Submerged Unit Weight	7 kN/m <sup>3</sup>
Effective Friction Angle	28 degrees
Undrained Shear Strength	25 kPa

A grain size analysis carried out on a sample of the compact reddish brown sand recovered from BH 1 shows it to contain 15 percent gravel, 70 percent sand, and 15 percent fines. The sand sample was found to have a natural moisture content of 14 percent.

The following parameters may be assigned to the very loose to loose sand/silty sand and the compact sand/silty sand layers:

	Very Loose to Loose Sand/Silty Sand	Compact Sand/Silty Sand
Total Unit Weight	18 kN/m <sup>3</sup>	21 kN/m <sup>3</sup>
Submerged Unit Weight	8 kN/m <sup>3</sup>	11 kN/m <sup>3</sup>
Effective Friction Angle	28 degrees	32 degrees

#### Glacial Till

A glacial till stratum, generally comprised of reddish brown silty sand, was encountered below the marine soils at each borehole location. The till contains varying amounts of gravel, sandstone cobbles/layers and occasional clay partings. The thickness of the till stratum was found to range from 1.2 m at BH 1 to in excess of 6.5 m at BH 22. The elevation of the till surface was found to range from a low of el. -10.16 m at BH 1 to a high of el. -2.72 m at BH 17. The till surface profile is depicted on the appended stratigraphic section.

The N-values obtained within the till were found to range from 10 to in excess of 50 with an overall average of 23 (excluding the >50 values) indicating a variable, but predominantly compact, relative density. The greater than 50 N-values may be attributed to the presence of gravel, and sandstone cobbles/layers within the till.

Grain size analyses performed on split spoon samples of the till recovered from other boreholes located in the general vicinity of Structure 305 show it to contain an average of 18 percent gravel, 55 percent sand, and 27 percent fines. Selected till samples were found to have an average natural moisture content of 12 percent.

The following parameters may be assigned to the till stratum for design purposes:

Total Unit Weight	22 kN/m <sup>3</sup>
Submerged Unit Weight	12 kN/m <sup>3</sup>
Effective Friction Angle	32 degrees

## Bedrock

Sandstone bedrock was encountered directly below the till stratum at each borehole location with the exception of BH 22 which was terminated within the till. The depth below the harbour bottom to the bedrock surface was found to range from 7.6 m at BH 21 to 9.7 m at BH 103. The elevation of the bedrock surface was found to range from a high of el. -8.58 m at BH 21 to a low of el. -11.33 m at BH 1. The bedrock surface profile is depicted on the appended stratigraphic section.

The rock core recovered consisted predominantly of sandstone with occasional mudstone partings/seams/layers. The bedrock is horizontally bedded with extremely close (< 20 mm) to close (60 to 200 mm) joints which predominantly occur along the bedding planes. An average RQD (Rock Quality Designation) value of 14 indicates very poor quality, very severely fractured bedrock.

The following parameters may be assigned to the bedrock for design purposes:

Total Unit Weight	23 kN/m <sup>3</sup>
Submerged Unit Weight	13 kN/m <sup>3</sup>
Effective Friction Angle	35 degrees

## **Discussion and Recommendations**

It is understood that the original breakwater consisted of a timber pile wharf which was replaced primarily with a double walled steel sheet pile (SSP) structure in 1984; a tied back SSP was utilized for the west end of the structure. It is assumed that the proposed reconstruction will likely involve a similar sheet pile or steel pile-supported structure.

The presence of compressible marine soils along the full length of Structure 305 would pose a problem if any new fills (e.g., armour protection) are to be placed near the wharf. If left in place, the compression of this soil under the weight of new fills will subject the wharf structure to high lateral loads that must be accounted for in the wharf design. Furthermore, since none of the existing boreholes were drilled through the existing wharf and fill, the presence/condition of the marine soil within the wharf footprint is not known. Depending on the design details for the new wharf, it may be prudent to drill some boreholes through the existing wharf fill to obtain design parameters for the marine soil.

In the event that new fills are to be placed at the site, the removal of the compressible marine soils, to the depth of more competent soil, would be recommended. Other concerns associated with leaving this soil in place could include:

- settlement of the new infill/wharf deck;
- over-stressing of the tie-rods; and
- downdrag loads on the piles.

Preliminary recommendations are provided below for the design and construction of SSP and pile-supported wharf structures based on the available subsurface information. More specific geotechnical design input can be provided, if requested, during the design stage for this project.



### Steel Sheet Piling

The penetration of steel sheet piling into the sandstone bedrock is difficult to predict and would likely be variable. A review of the Department's construction records for the existing wharf may be beneficial to estimate the expected SSP penetration into bedrock. It is recommended that steel sheet piling be installed using a pile driving hammer with a rated energy of 450 joules per cm<sup>2</sup> of pile cross-sectional area.

As noted above, the presence of potentially compressible soils within the wharf footprint could represent a lateral loading and settlement concern. Although such soils located within the present wharf footprint should have compressed and gained some strength under the weight of the existing fills, their present condition is unknown. The potential lateral loading and settlement concerns associated with the marine soil would be minimized if existing grades are maintained (i.e., no new fill loads applied).

Geotechnical parameters for preliminary bulkhead design are provided in the following section.

### Design Parameters

The following geotechnical design parameters may be assigned to the various strata encountered for preliminary bulkhead design. These parameters would also be applicable in the case of a pile supported wharf that is subjected to a lateral fill loading.

Parameter/Soil Type	Marine (clayey silt/organic silt)	Marine (very loose/loose sand/silty sand)	Marine (compact sand/silty sand)	Glacial Till	Bedrock (Sandstone)
Total Unit Weight, kN/m <sup>3</sup>	17	18	21	22	23
Submerged Unit Weight, kN/m <sup>3</sup>	7	8	11	12	13
Effective Friction Angle, degrees	28	28	32	32	35 <sup>2</sup>
Undrained Shear Strength, kPa	25	-	-	-	-
Active Earth Pressure Coefficient, Ka	0.36	0.36	0.31	0.31	0.27
Passive Earth Pressure Coefficient, Kp <sup>1</sup>	2.77	2.77	3.25	3.25	3.70

Notes:

<sup>1</sup> neglecting the effects of wall friction

<sup>2</sup> based on bedrock zone fragmented by pile penetration

Ka and Kp values provided are based on a vertical wall and horizontal backfill

### Pile-Supported Structure

For the conditions encountered, steel piles (H or pipe) could be considered for use at the site. It is expected that piles would be driven to/into the underlying sandstone bedrock to develop the required capacity. Timber piles could also be considered but would likely be a less appropriate alternative in view of the various

obstructions associated with the previous site structure. Such obstruction (e.g., timber members) could also result in some difficult driving areas for steel piles.

Steel piles should be driven using a hammer with a rated energy of at least 350 J/cm<sup>2</sup> of net steel cross sectional area. Previous experience has shown that an actual delivered energy in the order of 200 J/cm<sup>2</sup> is required to attain the allowable contact stress/bearing pressures given below. Refusal may be taken as 10 blows for the last 25 mm of pile penetration.

Actual penetration depths of steel piles into the sandstone bedrock will depend on the driving energy delivered and the bedrock condition/strength at the pile locations. Previous experience has shown that penetration depths can vary significantly from site to site or within the same site, depending on the rock quality and strength, and can range from less than 1 m to 2 m or more.

The vertical capacity of steel piles driven to refusal, as defined above, may be determined using an allowable contact stress of 50 MPa (based on net steel area) for steel H and open end pipe piles. An allowable bearing pressure of 7 MPa may be used for design of closed end pipe piles (based on gross end area).

Re-tapping of some piles (e.g., 20 percent) within a 48-hour period is recommended to assess relaxation effects, and the requirement to re-tap additional piles.

The settlement of piles installed as outlined above and proportioned for the expected loads would be negligible. For the analysis of lateral resistance, an effective pile width of two times the pile diameter may be used.

For driven piles, some uplift resistance will be obtained through shaft friction (typically 50 percent of the shaft friction available in compression is assumed for uplift). The actual magnitude of the uplift resistance would depend on the type/size of the pile selected for use and the depth driven. Additional uplift resistance, if required, could be obtained through the use of socketed piles and/or rock anchors.

### **Closing Comments**

It is important to note that, although the available information was obtained by reputable geotechnical firms, two of the previous investigations were undertaken over 30 years ago. It is possible that some conditions may have changed at the site as a result of natural processes such as sedimentation or scour, or human activities such as infilling or dredging. It is recommended that the Department's records be reviewed to determine if any such activities may have occurred, or are suspected to have occurred. Furthermore, as discussed previously, none of the existing boreholes were drilled through the wharf to permit an assessment of the presence/condition of potentially compressible marine soils below the fill.

Some additional boreholes may be necessary at this site depending on the design details for the new structure and on the review of the Department's records as noted above. It is important to note that since the available geotechnical information was obtained by others, we cannot attest to the correctness or present day relevance of this information.

Ms. Brenda Victor  
March 29, 2016  
Page 8

We trust this letter contains all of the information required at this time, and we are available at your convenience should you have any questions. We would be pleased to provide further geotechnical input for this project on an as required, as requested basis.

Sincerely,

**JOOSE ENVIRONMENTAL CONSULTING INC.**

A handwritten signature in blue ink, appearing to read 'George W. Zafiris', with a stylized flourish at the end.

George W. Zafiris, P. Eng.  
Geotechnical Engineer  
georgez@bellaliant.net

GWZ/g



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# APPENDIX



## Symbols and Terms used on Borehole and Test Pit Records

The following information is intended to assist in the interpretation of terms and symbols used on the borehole logs, test pit logs and reports.

### Soils Description

#### Terminology describing common soil genesis:

<i>Topsoil</i>	- mixture of soil and humus capable of supporting vegetative growth
<i>Peat</i>	- mixture of visible and invisible fragments of decayed organic matter
<i>Till</i>	- unstratified glacial deposit which may range from clay to boulders
<i>Fill</i>	- material below the surface identified as placed by humans (excluding buried services)

#### Terminology describing soil structure:

<i>Desiccated</i>	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
<i>Fissured</i>	- having cracks, and hence a blocky structure
<i>Varved</i>	- composed of regular alternating layers of silt and clay
<i>Stratified</i>	- composed of alternating successions of different soil types, e.g. silt and sand
<i>Layer</i>	- > 75 mm in thickness
<i>Seam</i>	- 2 mm to 75 mm in thickness
<i>Parting</i>	- < 2 mm in thickness

#### Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Modified Unified Soil Classification System (MUSCS) and in accordance with the Canadian Foundation Engineering Manual Fourth Edition (Canadian Geotechnical Society, 2006). The classification excludes particles larger than 75 mm (3 inches). The MUSCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

#### Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter and construction debris) is based upon the proportion of these materials present:

<i>Trace, or occasional</i>	Less than 10%
<i>Some</i>	10-20%
<i>Frequent</i>	> 20%

## Symbols and Terms used on Borehole and Test Pit Records

The list on the following table provides an explanation of terms and symbols used on the geotechnical borehole, test pit and penetrometer logs.

Test Results				Test Symbols	
PI	Plasticity Index	$c'$	Effective Cohesion	DCP	Dynamic Cone Penetrometer
LL	Liquid Limit	$c_u$	Undrained Cohesion	SPT	Standard Penetration Test
LI	Liquidity Index	$c'_R$	Residual Cohesion	CPTu	Cone Penetrometer (Piezocone) Test
DD	Dry Density	$\phi'$	Effective Angle of Internal Friction	PANDA	Variable Energy DCP
WD	Wet Density	$\phi_u$	Undrained Angle of Internal Friction	PP	Pocket Penetrometer Test
LS	Linear Shrinkage	$\phi'_R$	Residual Angle of Internal Friction	U50	Undisturbed Sample 50 mm (nominal diameter)
MC	Moisture Content	$c_v$	Coefficient of Consolidation	U100	Undisturbed Sample 100mm (nominal diameter)
OC	Organic Content	$m_v$	Coefficient of Volume Compressibility	UCS	Uniaxial Compressive Strength
WPI	Weighted Plasticity Index	$c_{sc}$	Coefficient of Secondary Compression	Pm	Pressuremeter

Test Results				Test Symbols	
WLS	Weighted Linear Shrinkage	$e$	Void Ratio	FSV	Field Shear Vane
DoS	Degree of Saturation	$\phi'_{ov}$	Constant Volume Friction Angle	DST	Direct Shear Test
APD	Apparent Particle Density	$q_t / q_c$	Piezocone Tip Resistance (corrected / uncorrected)	PR	Penetration Rate
$s_u$	Undrained Shear Strength	$q_d$	PANDA Cone Resistance	A	Point Load Test (axial)
$q_u$	Unconfined Compressive Strength	$I_{a(50)}$	Point Load Strength Index	D	Point Load Test (diametral)
R	Total Core Recovery	RQD	Rock Quality Designation	L	Point Load Test (irregular lump)

### Sample Type

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameters tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ,NQ, BQ, etc	Rock core samples obtained with the use of standard size diamond coring bits.












### Water Level Measurement

 Measurement in standpipe, piezometer, or well

 Inferred

### Strata Plot

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

										
Boulders Cobbles Gravel	Sand	Silt	Clay	Organics	Asphalt	Concrete	Fill	Igneous Bedrock	Meta- morphic Bedrock	Sedi- mentary Bedrock

# BOREHOLE RECORD

BOREHOLE No. 22

CLIENT Public Works Canada

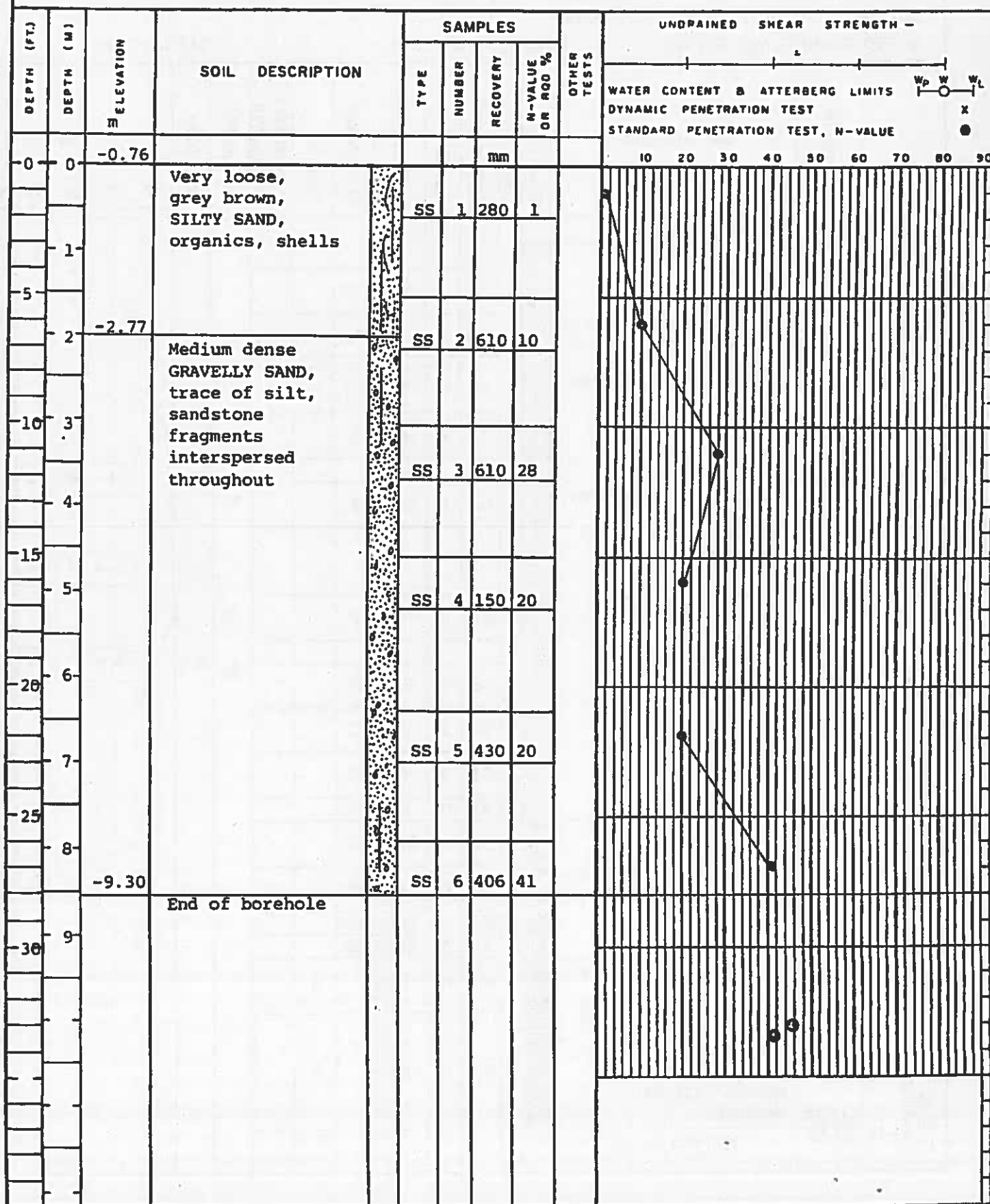
PROJECT No. 2636

LOCATION Graham's Pond, Prince Edward Island

CASING SIZE B

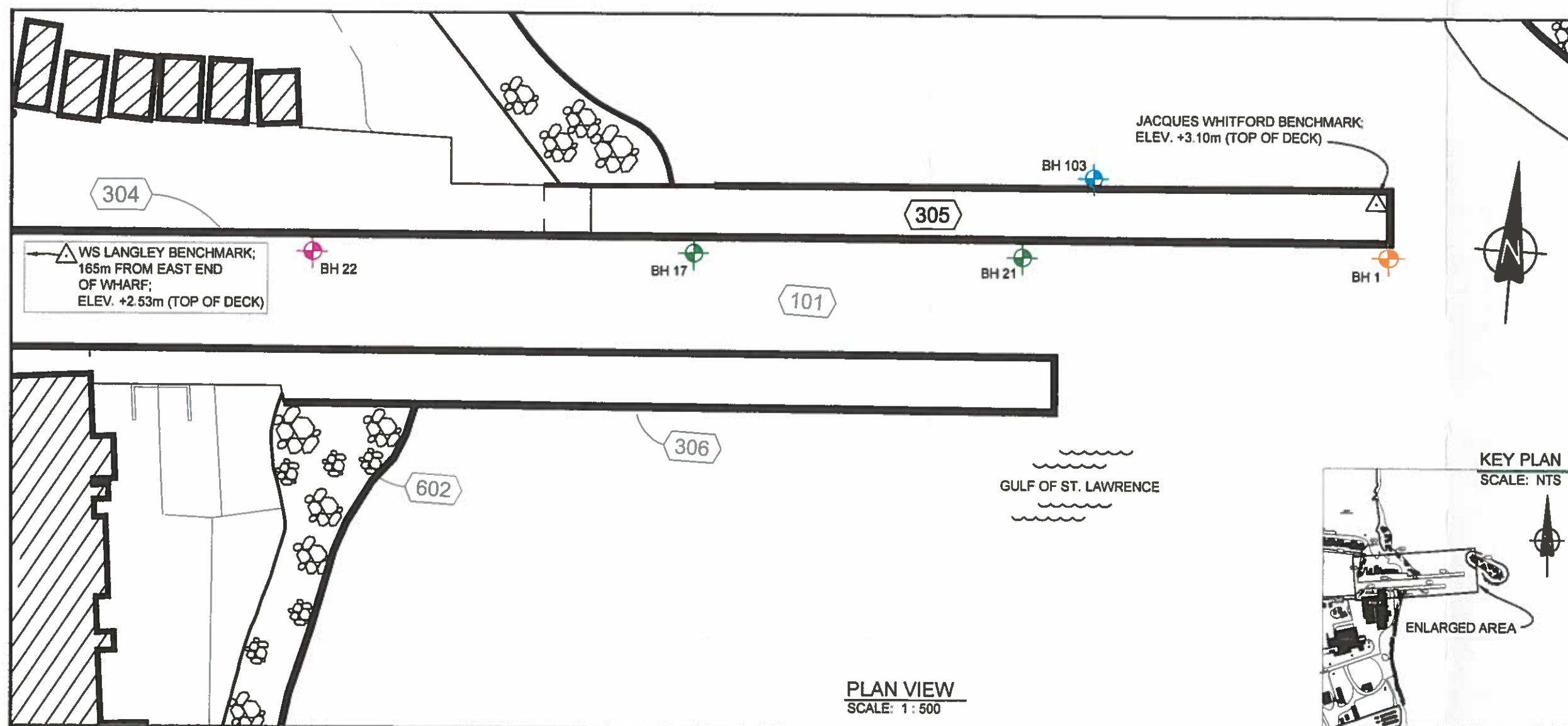
DATE: BORING December 1, 1982 WATER LEVEL           

DATUM LWOST



**DATUM:** Assumed





- ### LEGEND
- ✕ BOREHOLE LOCATION;  
JACQUES WHITFORD REPORT  
NO. 2636,  
ISSUED DECEMBER, 1982
  - ✕ BOREHOLE LOCATION;  
WS LANGLEY REPORT  
NO. L580,  
ISSUED DECEMBER, 1983
  - ✕ BOREHOLE LOCATION;  
JACQUES WHITFORD REPORT  
NO. 71595,  
ISSUED SEPTEMBER, 2002
  - ✕ BOREHOLE LOCATION;  
JACQUES WHITFORD REPORT  
NO. 71647,  
ISSUED JUNE, 2003
  - A BENCHMARKS:  
CHART (LOW NORMAL TIDE)  
DATUM, AS NOTED



## BOREHOLE LOCATION PLAN AND STRATIGRAPHIC SECTION

STRUCTURE 305

GRAHAM'S POND SMALL CRAFT HARBOUR,  
KINGS COUNTY, PEI

CLIENT:  
PUBLIC WORKS AND  
GOVERNMENT SERVICES CANADA

SCALE:  
AS SHOWN

DWN BY:  
MLJ

APPD BY:  
GWZ

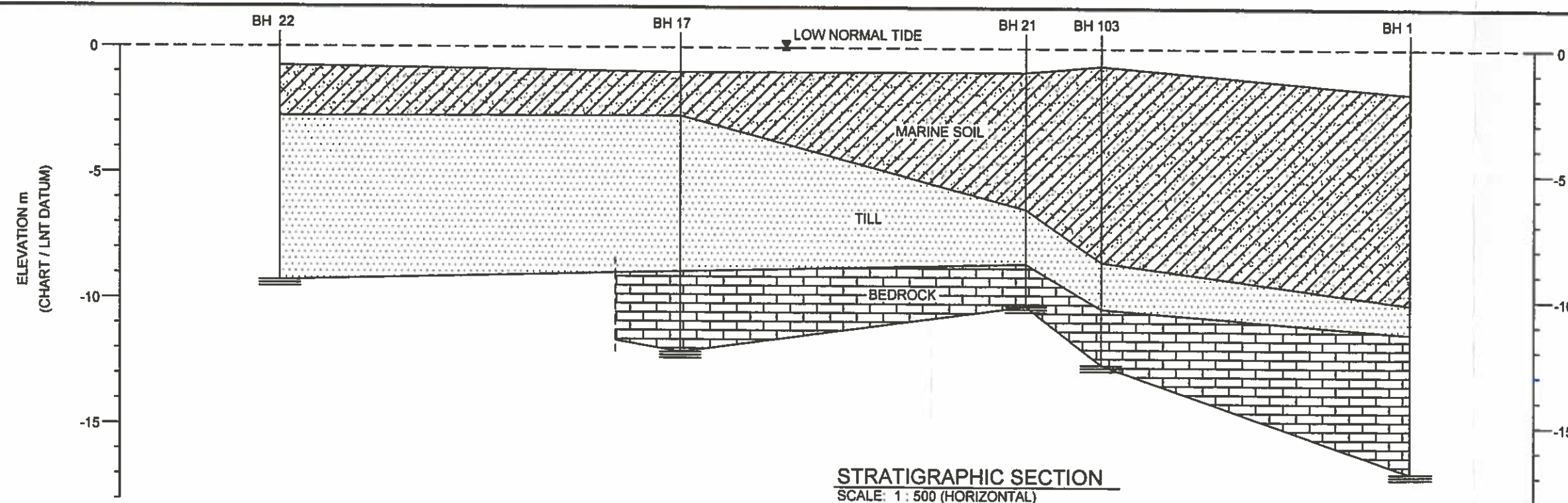
JOB NO.:  
JE0160A

DWG NO.:

DATE:  
2016/03/24

1

STRATIGRAPHIC SECTION  
SCALE: 1:500 (HORIZONTAL)  
1:200 (VERTICAL)





## **Geotechnical Investigation**

Geotechnical Study - Graham's Pond  
Breakwater, Graham's Pond Harbour,  
Gaspereaux, PE

Project No. 121621050

June 25, 2018

Prepared for:

Small Craft Harbours  
Fisheries and Oceans Canada  
343 University Avenue  
Moncton NB E1C 9B6

Prepared by:

Stantec Consulting Ltd.  
165 Maple Hills Avenue  
Charlottetown PE C1C 1N9



**Stantec Consulting Ltd.**  
165 Maple Hills Avenue, Charlottetown, PE C1C 1N9

June 25, 2018  
File: 121621050

**Attention: Mr. Patrick Mazerolle, P.Eng.**  
Small Craft Harbours  
Fisheries and Oceans Canada  
343 University Avenue  
Moncton, NB E1C 9B6

Dear Mr. Mazerolle,

**Reference: Geotechnical Study - Graham's Pond Breakwater, Graham's Pond Harbour, Gaspereaux, PE**

## **1. INTRODUCTION**

We are pleased to provide the results of our geotechnical investigation performed at the above-referenced site. The purpose of the geotechnical investigation was to obtain subsurface soil, bedrock and groundwater information for input into design and construction of the proposed structure. Our services were completed in general accordance with our proposal dated April 26, 2018.

## **2. SITE AND PROJECT DESCRIPTION**

The project site is located at the existing Graham's Pond Harbour in Gaspereaux, Prince Edward Island. The project involves replacement of the existing South Breakwater. The current structure consists of driven steel sheet piles (SSP), infilled with imported fill and a cast-in-place slab on grade. The current structure is exhibiting signs of failure, including openings in the SSP and large voids below the cast-in-place slab on grade. The current structure is approximately 6 meters in width and extends approximately 75 meters off shore. Details regarding the proposed replacement structure are not known at this time.

## **3. SUBSURFACE INVESTIGATION PROGRAM**

Three boreholes, identified as BH-01 to BH-03 were advanced at the site on April 26, May 8 and May 9, 2018 by Logan Drilling Group of Moncton, New Brunswick. BH-01 was a land-based borehole and was advanced using a track-mounted drilling rig. Due to risks associated with the structural integrity of the existing breakwater structure, BH-02 and BH-03 were not drilled with the track-mounted drilling rig. Their locations were revised and completed with a barge-mounted drilling rig. The boreholes were advanced to depths ranging from approximately 11.51 to 17.12 meters below existing grade (BH-1) or harbour bottom (BH-2 and BH-3) at the approximate locations shown on the attached Drawing No. 1 – Borehole Location Plan.

Borehole locations were established in the field by Stantec Consulting Ltd. (Stantec) personnel located by tape referencing from existing site features. Ground surface elevations were surveyed with a level following completion of the drilling program. The borehole elevations were referenced to the top of the SSP adjacent to BH-02. The elevation of the top of the SSP is taken to be 3.20 meters Chart Datum and is based on an as-built drawing titled "Plan, North and South Elevations", Drawing No. 5 of 9, and dated October 1, 1987. The ground surface elevations are included in Table 1 and presented on the attached Borehole Records.

June 25, 2018

Mr. Patrick Mazerolle, P.Eng.

Page 2

**Reference: Geotechnical Study - Graham's Pond Breakwater, Graham's Pond Harbour, Gaspereaux, PE**

Personnel from our Charlottetown office supervised the drilling activities and logged the subsurface conditions encountered at the borehole locations. The overburden soils at the borehole locations were generally sampled at standard intervals using Standard Penetration Test (SPT) techniques with a 50-millimeter, outside-diameter split-barrel sampler in general accordance with the standard test method American Society for Testing and Materials (ASTM) D1586 (*Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*). SPT N-values were recorded for each split-barrel sample obtained. The determination of soils density and consistency as indicated on the Borehole Records, are based on the results of the SPT. Soil samples were stored in moisture-tight containers and returned to our laboratory for further classification and testing. Bedrock samples were retrieved from each borehole in accordance with ASTM D2113 (*Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*).

### 3.1. SOIL AND BEDROCK CONDITIONS

The soil and bedrock strata encountered at the site during the subsurface investigation program are described in detail on the attached Borehole Records and are summarized herein. The attached Symbols and Terms used on Borehole and Test Pit Records provide a brief explanation of the terminology and graphics used by Stantec.

Soil classification was based on the procedures described in ASTM D2487 (*Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)*) and ASTM D2488 (*Standard Practice for Description and Identification of Soils, Visual-Manual Procedure*). A summary of the subsurface conditions encountered are provided in Table 1 and discussed in the following subsections.

**Table 1: Subsurface Conditions Summary**

Borehole ID	Ground Surface Elevation (m)	Concrete Thickness (mm)	FILL Thickness (m)	MARINE Thickness (m)	TILL Thickness (m)	TILL Elevation (m)	Depth to Bedrock (m)	Bedrock Elevation (m)
BH-01	3.62	180	3.78	2.03	7.83	-2.37	13.82	-10.20
BH-02	-2.03	NE	NE	2.16	5.54	-4.19	7.70	-9.73
BH-03	-1.16	NE	NE	4.93	4.67	-6.09	9.60	-10.76

NE – Not Encountered



**Reference: Geotechnical Study - Graham's Pond Breakwater, Graham's Pond Harbour, Gaspereaux, PE**

Subsurface soil and bedrock conditions encountered generally include:

- CONCRETE
- FILL
- MARINE
- TILL
- SANDSTONE

#### **3.1.1. CONCRETE**

Surficial concrete was observed at BH-01 and was approximately 180 millimeters thick. Reinforcing steel was not encountered at the borehole location but was observed at other locations within the concrete slab.

#### **3.1.2. FILL**

A fill layer approximately 3.96 meters thick was observed below the concrete at BH-01. The composition of the fill ranged from grey well-graded gravel with silt and sand (crushed rock) at the surface to reddish brown silty sand with gravel (Class B) below. N-values from SPT performed within the fill layer ranged from 9 to 21, with an average of 14, indicating a predominantly compact compactness ranging from loose to compact.

One sample was submitted for gradation testing and the results are presented in Table 2 and appended. The moisture content of the samples averaged 16 percent, ranged from approximately 14 to 19 percent, and are presented on the Borehole Records.

**Table 2: FILL - Laboratory Testing Summary**

<b>Borehole ID, Sample ID</b>	<b>Moisture Content (%)</b>	<b>Gravel (%)</b>	<b>Sand (%)</b>	<b>Silt / Clay (%)</b>
BH-01, SS3	13.7	29.2	54.2	16.6

#### **3.1.3. MARINE: Silty SAND (SM)**

A layer of native marine soil classified as silty SAND (SM) was observed below the fill at BH-01 and at the ground surface of BH-02 and BH-03. The deposit ranged in color from reddish brown to brown to dark brown to grey to greyish green. The thickness of the deposit ranged from approximately 0.74 to 2.03 meters, with an average of 1.55 meters. Trace organics were noted within the deposit. N-values from SPT performed within the layer ranged from 1 to 18, with an average of 6, indicating a predominantly loose compactness ranging from very loose to compact.

One sample was submitted for gradation testing and the results are presented in Table 3 and appended. The moisture content of the samples averaged 32 percent, ranged from approximately 27 to 38 percent, and are presented on the Borehole Records.

**Reference: Geotechnical Study - Graham's Pond Breakwater, Graham's Pond Harbour, Gaspereaux, PE**

**Table 3: MARINE - Laboratory Testing Summary**

Borehole ID, Sample ID	Moisture Content (%)	Gravel (%)	Sand (%)	Silt / Clay (%)
BH-02, SS6	26.7	2.5	81.5	16.0

#### 3.1.4. MARINE: Fat CLAY (CH) with sand

A layer of native marine soil classified as greenish grey fat CLAY (CH) with sand was observed below the marine deposited sand at BH-02 and BH-03. The thickness of the deposit ranged from approximately 1.42 to 3.05 meters, with an average of 2.24 meters. Trace organics were noted within the deposit. N-values from SPT performed within the layer ranged from 3 to 5, with an average of 4, indicating a predominantly soft consistency ranging from soft to firm. Very soft zones were also noted within the deposit where the split-spoon sampler was advanced into the deposit under the weight of the hammer.

One sample was submitted for gradation testing and the determination of Atterberg limits and the results are presented in Table 4 and appended. The moisture content of the samples averaged 66 percent, ranged from approximately 64 to 67 percent, and are presented on the Borehole Records.

**Table 4: MARINE - Laboratory Testing Summary**

Borehole ID, Sample ID	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Gravel (%)	Sand (%)	Silt / Clay (%)
BH-03, SS5	66.8	81.0	34.8	46.2	0.0	16.9	83.1

#### 3.1.5. TILL

A layer of reddish brown silty, clayey sand (SC-SM) to silty, clayey sand (SC-SM) with gravel, geologically classified as glacial till, was observed below the marine deposit at each borehole. Trace cobbles were noted within the deposit. Please note, till can be a heterogeneous mixture of soil sizes ranging from clay to silt to sand to gravel to cobbles and boulders. The portions of the various soil sizes can vary widely in the deposit. The thickness of the till ranged from 4.67 to 7.83 meters, with an average of 6.01 meters. The till surface was observed at elevations ranging from -2.37 to -6.09 meters. N-values from SPT performed within the till ranged from 6 to 37, with an average of 19, indicating a predominantly compact compactness, ranging from loose to dense.

Three samples were submitted for gradation testing and one for the determination of Atterberg limits. The results are presented in Table 5 and appended. The moisture content of the samples averaged 12 percent, ranged from approximately 11 to 14 percent, and are presented on the Borehole Records.

**Reference: Geotechnical Study - Graham's Pond Breakwater, Graham's Pond Harbour, Gaspereaux, PE**

**Table 5: TILL - Laboratory Testing Summary**

Borehole ID, Sample ID	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Gravel (%)	Sand (%)	Silt / Clay (%)
BH-01, SS13	13.6	-	-	-	9.2	55.1	35.7
BH-02, SS7	11.3	16.1	10.9	5.2	14.8	51.7	33.5
BH-03, SS9	11.3	-	-	-	20.3	48.0	31.7

### 3.1.6. SANDSTONE BEDROCK

SANDSTONE bedrock was encountered at each borehole at depths ranging from approximately 7.70 to 13.82 meters below existing grades. The bedrock elevation ranged from approximately -9.73 to -10.76 meters, chart datum. Bedrock was confirmed by rock coring at each borehole. Photos of the bedrock core are shown on the appended rock core photo log.

Rock core samples indicate the bedrock consists of sandstone. The RQD (Rock Quality Designation) of the bedrock averaged 32 percent and ranged from 0 to 50, indicating a very poor to poor quality. The rock mass was predominantly reddish brown with some whitish red, fine to coarse grained, slightly weathered, with very weak to strong strength. Discontinuities were spaced very close to moderately and were predominantly horizontal and parallel to bedding.

The results of point load tests carried out on selected bedrock core samples are presented on Table 6, appended. The point load index (Is) was determined from both diametral and axial tests. The unconfined compressive strength (Qu) was estimated from the point load data using the relationship  $Qu = 24 \times Is$  (axial). The point load test data indicate that the sandstone core samples tested fall within the weak (5 to 25 MPa) to strong (50 to 100 MPa) strength classifications. It should be noted that the weakest rock is often not recovered during coring operations and that intact core samples are required for testing. Consequently, a very weak to strong classification would be more representative of the overall rock mass at the site and is used on the Borehole Records.

**Reference: Geotechnical Study - Graham's Pond Breakwater, Graham's Pond Harbour, Gaspereaux, PE**

#### **4. DESIGN PARAMETERS**

As previously discussed, details regarding the proposed replacement structure are not known at this time. We would be pleased to provide additional input and recommendations regarding design and construction of the proposed structure when details are available. The following parameters may be assigned to the various strata encountered for design purposes:

<b>Parameter/Soil Type</b>	<b>MARINE: Silty SAND</b>	<b>MARINE: Fat CLAY</b>	<b>TILL</b>	<b>SANDSTONE (bedrock)</b>	<b>Select Borrow (imported)</b>
Total Unit Weight, kN/m <sup>3</sup>	18.0	16.0	20.0	22.0	21.0
Submerged Unit Weight, kN/m <sup>3</sup>	8.2	6.2	10.2	12.2	11.2
Effective Friction Angle, degrees	28	24	30	32	32
Undrained Shear Strength, kPa	0	0	0	0	0
Active Earth Pressure Coefficient, K <sub>a</sub>	0.36	0.42	0.33	0.31	0.31
Passive Earth Pressure Coefficient, K <sub>p</sub> <sup>1</sup>	2.77	2.37	3.00	3.25	3.25

Notes: 1. Neglecting the effects of wall friction

#### **5. CLOSING COMMENTS**

Use of this report is subject to the Statement of General Conditions provided in the Appendix. It is the responsibility of Small Craft

Harbours, identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction



June 25, 2018

Mr. Patrick Mazerolle, P.Eng.

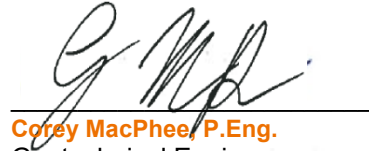
Page 7

**Reference: Geotechnical Study - Graham's Pond Breakwater, Graham's Pond Harbour, Gaspereaux, PE**

We trust the information contained in this report meets your current needs. Should you have questions about the contents of this report, or if we can be of further assistance, please contact the undersigned.

Regards,

**STANTEC CONSULTING LTD.**


A handwritten signature in black ink, appearing to read "Corey MacPhee", written over a horizontal line.

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Senior Associate, Geotechnical Engineer

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mark.macdonald@stantec.com



June 25, 2018

Mr. Patrick Mazerolle, P. Eng.

**Reference: Geotechnical Study - Graham's Pond Breakwater, Graham's Pond Harbour, Gaspereaux, PE**

## **APPENDIX**

## **STATEMENT OF GENERAL CONDITIONS**

**USE OF THIS REPORT:** This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

**BASIS OF THE REPORT:** The information, opinions, and/or recommendations made in this report are in accordance with Stantec Consulting Ltd.'s present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec Consulting Ltd. is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

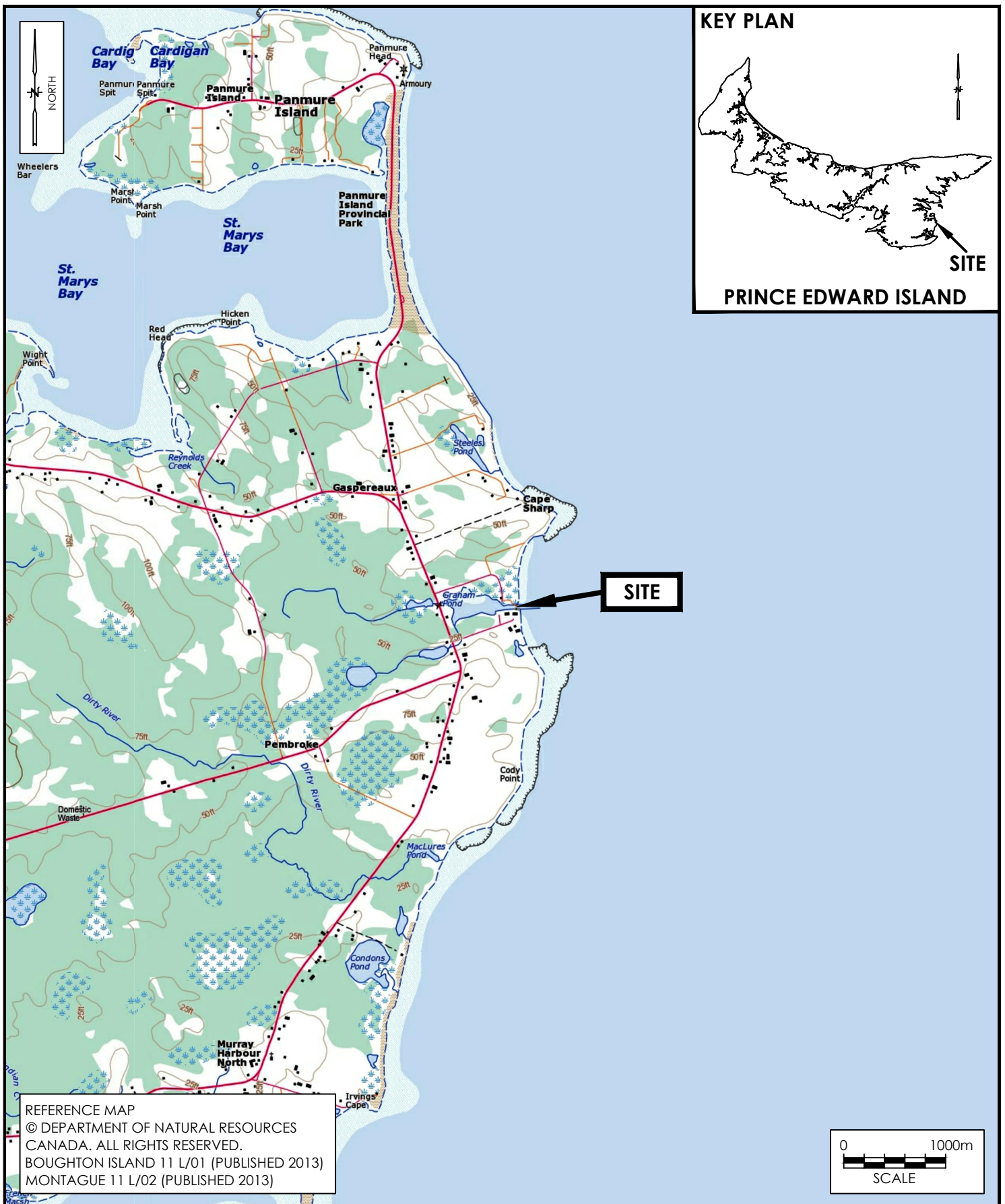
**STANDARD OF CARE:** Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

**INTERPRETATION OF SITE CONDITIONS:** Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Consulting Ltd. at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

**VARYING OR UNEXPECTED CONDITIONS:** Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec Consulting Ltd. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec Consulting Ltd. will not be responsible to any party for damages incurred as a result of failing to notify Stantec Consulting Ltd. that differing site or sub-surface conditions are present upon becoming aware of such conditions.

**PLANNING, DESIGN, OR CONSTRUCTION:** Development or design plans and specifications should be reviewed by Stantec Consulting Ltd. , sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc.), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec Consulting Ltd. cannot be responsible for site work carried out without being present.

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THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

**SITE LOCATION PLAN**  
GRAHAM'S POND BREAKWATER  
GRAHAM'S POND, GASPEREAUX, PE

Job No.: 121621050  
Scale: 1 : 50 000  
Date: 25-JUN-2018  
Dwn. By: MDC  
App'd By: CM

Dwg. No.: 1



Client: SMALL CRAFT HARBOURS

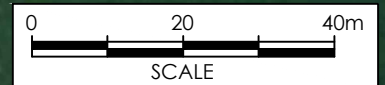


**LEGEND**



BOREHOLE (BH-01)

ArcGIS Online Bing Imagery:  
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THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

## EXPLORATION LOCATION PLAN (BH-01-BH-03)

GRAHAM'S POND BREAKWATER  
GRAHAM'S POND, GASPEREAUX, PE

**Client:** SMALL CRAFT HARBOURS

**Job No.:** 121621050

**Scale:** 1 : 1000

**Date:** 25-JUN-2018

**Dwn. By:** MDC

**App'd By:** CM

**Dwg. No.:** 2



## SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

### SOIL DESCRIPTION

#### Terminology describing common soil genesis:

<i>Rootmat</i>	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
<i>Topsoil</i>	- mixture of soil and humus capable of supporting vegetative growth
<i>Peat</i>	- mixture of visible and invisible fragments of decayed organic matter
<i>Till</i>	- unstratified glacial deposit which may range from clay to boulders
<i>Fill</i>	- material below the surface identified as placed by humans (excluding buried services)

#### Terminology describing soil structure:

<i>Desiccated</i>	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
<i>Fissured</i>	- having cracks, and hence a blocky structure
<i>Varved</i>	- composed of regular alternating layers of silt and clay
<i>Stratified</i>	- composed of alternating successions of different soil types, e.g. silt and sand
<i>Layer</i>	- > 75 mm in thickness
<i>Seam</i>	- 2 mm to 75 mm in thickness
<i>Parting</i>	- < 2 mm in thickness

#### Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4<sup>th</sup> Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

#### Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

<i>Trace, or occasional</i>	Less than 10%
<i>Some</i>	10-20%
<i>Frequent</i>	> 20%

#### Terminology describing compactness of cohesionless soils:

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
<i>Very Loose</i>	<4
<i>Loose</i>	4-10
<i>Compact</i>	10-30
<i>Dense</i>	30-50
<i>Very Dense</i>	>50

#### Terminology describing consistency of cohesive soils:

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
<i>Very Soft</i>	<0.25	<12.5	<2
<i>Soft</i>	0.25 - 0.5	12.5 - 25	2-4
<i>Firm</i>	0.5 - 1.0	25 - 50	4-8
<i>Stiff</i>	1.0 - 2.0	50 - 100	8-15
<i>Very Stiff</i>	2.0 - 4.0	100 - 200	15-30
<i>Hard</i>	>4.0	>200	>30

## ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

### Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	Very Poor Quality
25-50	Poor Quality
50-75	Fair Quality
75-90	Good Quality
90-100	Excellent Quality

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	Crushed
Severely Fractured	Shattered or Very Blocky
Fractured	Blocky
Moderately Jointed	Sound
Intact	Very Sound

**RQD (Rock Quality Designation)** denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

**SCR (Solid Core Recovery)** denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

**Fracture Index (FI)** is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

### Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	Extremely Wide	-
2000-6000	Very Wide	Very Thick
600-2000	Wide	Thick
200-600	Moderate	Medium
60-200	Close	Thin
20-60	Very Close	Very Thin
<20	Extremely Close	Laminated
<6	-	Thinly Laminated

### Terminology describing rock strength:

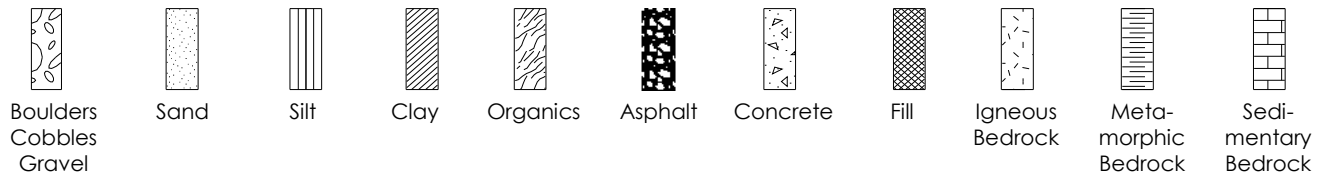
Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

### Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

## STRATA PLOT

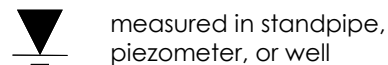
Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



## SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

## WATER LEVEL MEASUREMENT



measured in standpipe, piezometer, or well



inferred

## RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

## N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

## DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

## OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
y	Unit weight
G <sub>s</sub>	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q <sub>u</sub>	Unconfined compression
I <sub>p</sub>	Point Load Index (I <sub>p</sub> on Borehole Record equals I <sub>p</sub> (50) in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

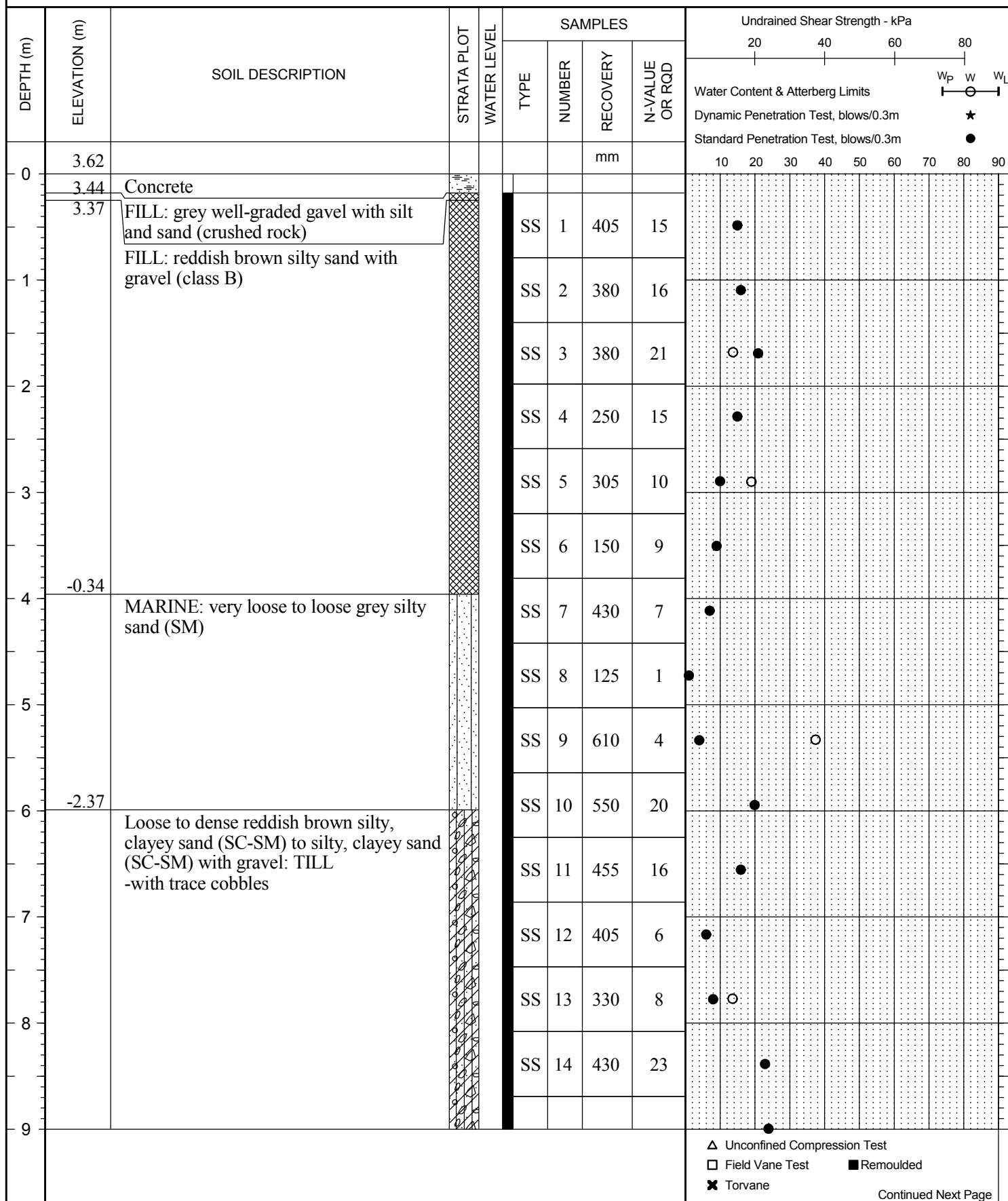


## BOREHOLE RECORD

BH-01

CLIENT Small Craft HarboursPROJECT No. 121621050LOCATION Graham's Pond Harbour, Gaspereaux, PEBOREHOLE No. BH-01DATES: BORING 2018/04/26

WATER LEVEL \_\_\_\_\_

DATUM Chart

Continued Next Page



# BOREHOLE RECORD

## BH-01

CLIENT Small Craft Harbours

PROJECT No. 121621050

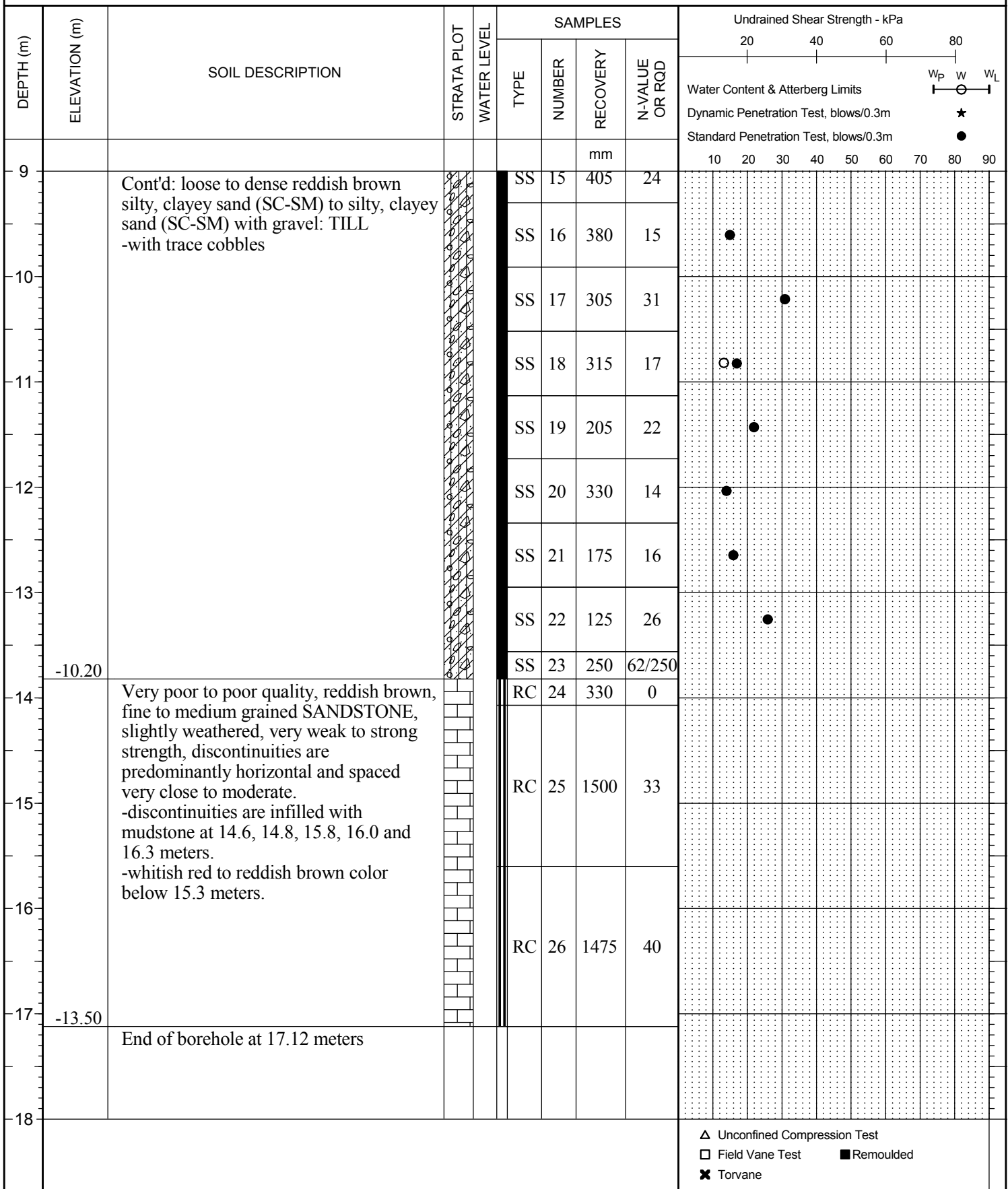
LOCATION Graham's Pond Harbour, Gaspereaux, PE

BOREHOLE No. BH-01

DATES: BORING 2018/04/26

WATER LEVEL \_\_\_\_\_

DATUM Chart





# BOREHOLE RECORD

## BH-02

CLIENT Small Craft Harbours

PROJECT No. 121621050

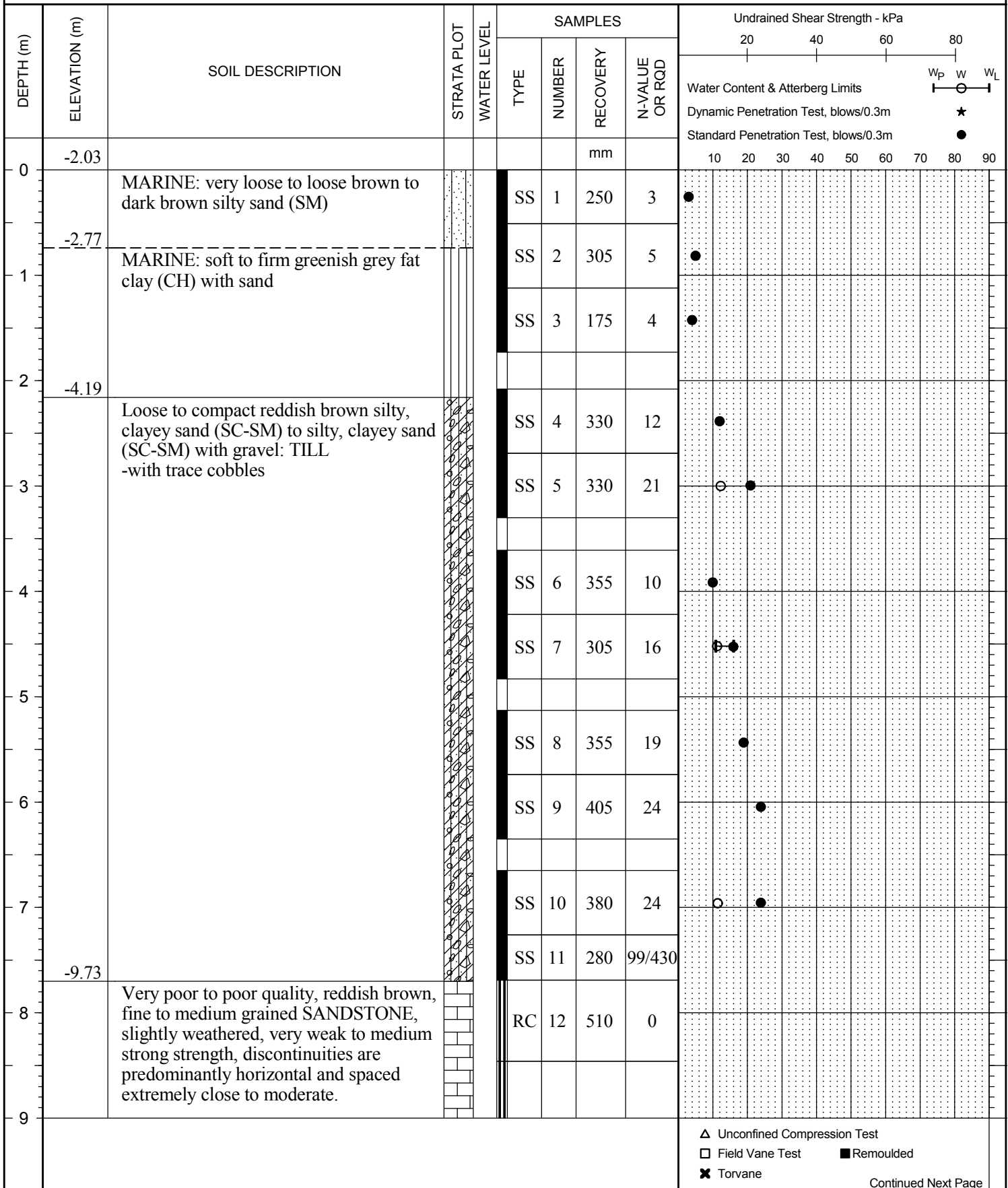
LOCATION Graham's Pond Harbour, Gaspereaux, PE

BOREHOLE No. BH-02


DATES: BORING 2018/05/08

WATER LEVEL \_\_\_\_\_

DATUM Chart



Continued Next Page

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES				Undrained Shear Strength - kPa									
					TYPE	NUMBER	RECOVERY	N-VALUE OR RQD	<div> <div>20406080</div> <div> <div>W<sub>P</sub></div> <div>W</div> <div>W<sub>L</sub></div> </div> </div>									
9							mm		<div> <div>102030405060708090</div> </div>									
9		-discontinuities are infilled with mudstone at 9.0, 9.2 and 9.8 meters. -whitish red color from 9.2 to 9.5 meters.			RC	13	1525	50	<div> <div>102030405060708090</div> </div>									
10									<div> <div>102030405060708090</div> </div>									
10					RC	14	810	27	<div> <div>102030405060708090</div> </div>									
11	-13.54								<div> <div>102030405060708090</div> </div>									
11		End of borehole at 11.51 meters							<div> <div>102030405060708090</div> </div>									
12									<div> <div>102030405060708090</div> </div>									
13									<div> <div>102030405060708090</div> </div>									
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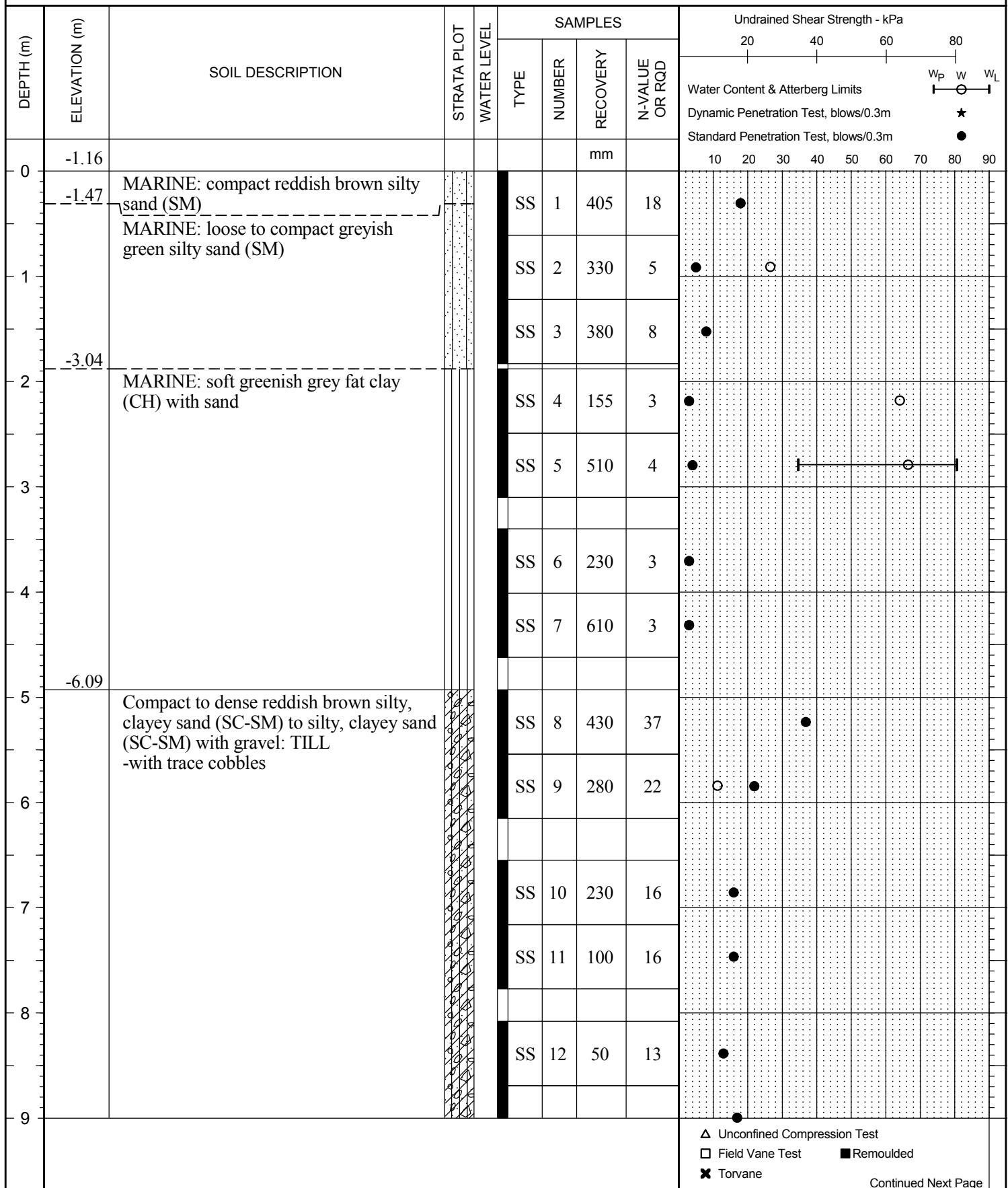


# BOREHOLE RECORD

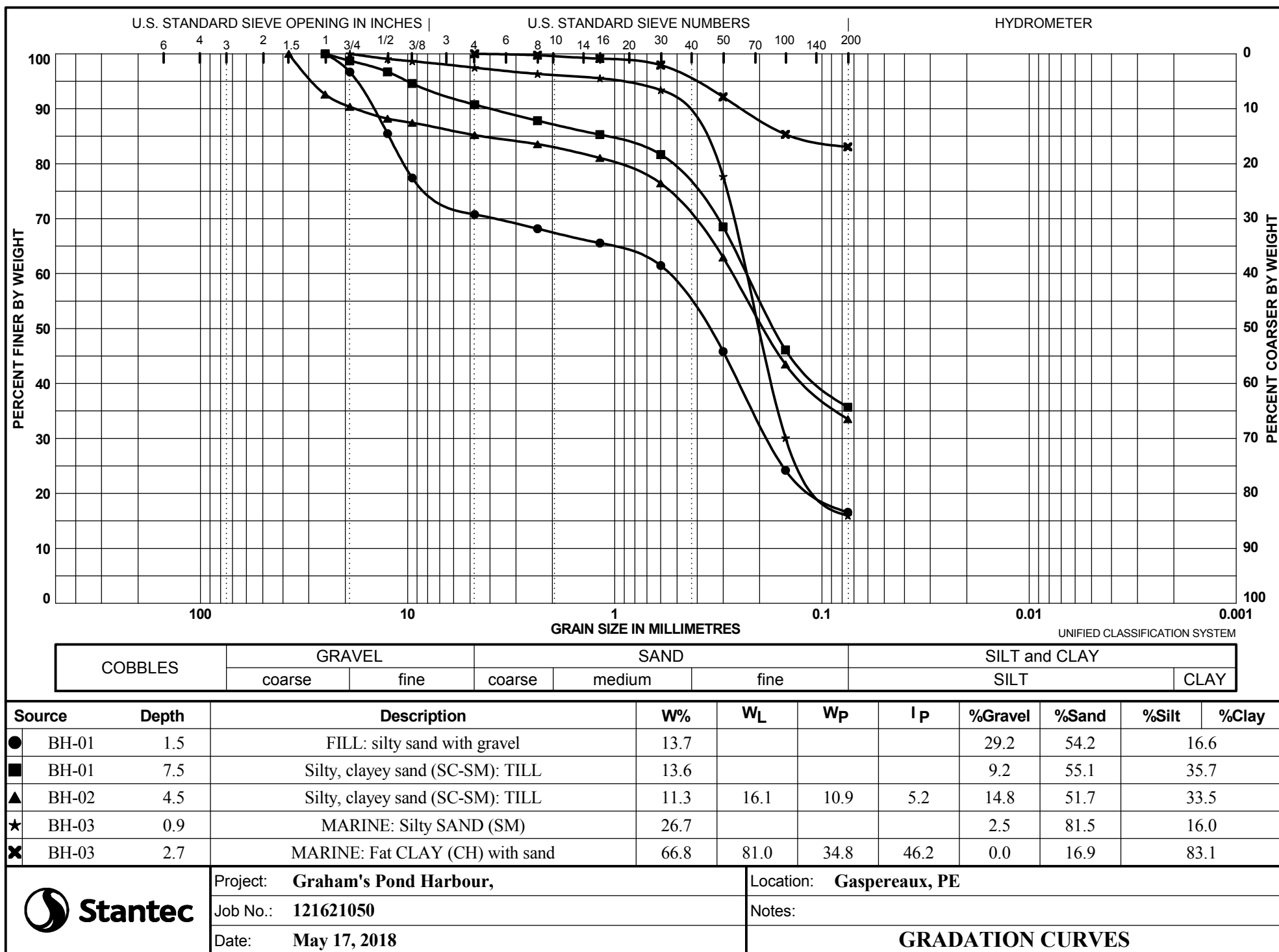
## BH-03

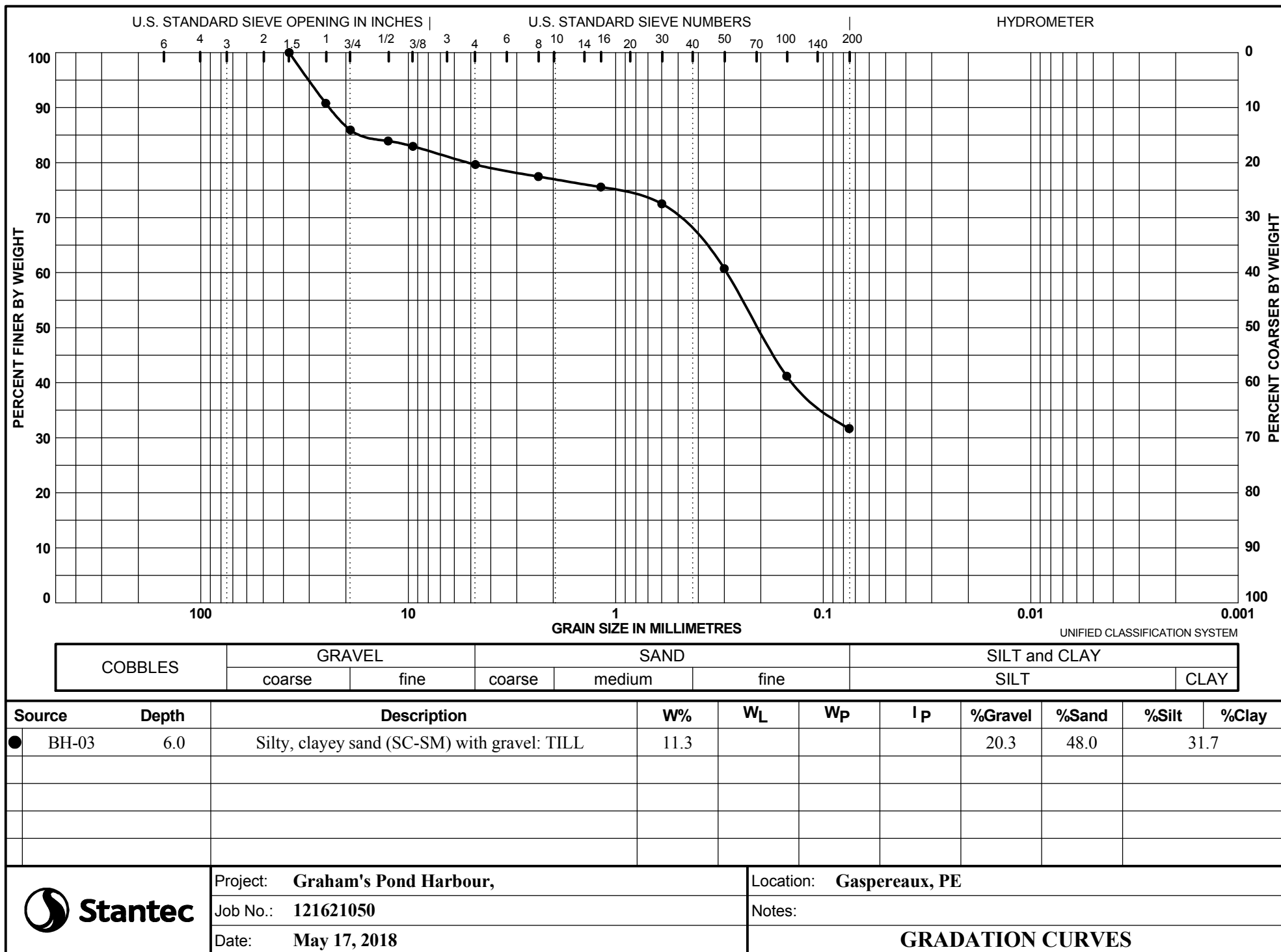
CLIENT Small Craft HarboursPROJECT No. 121621050LOCATION Graham's Pond Harbour, Gaspereaux, PEBOREHOLE No. BH-03DATES: BORING 2018/05/09

WATER LEVEL \_\_\_\_\_

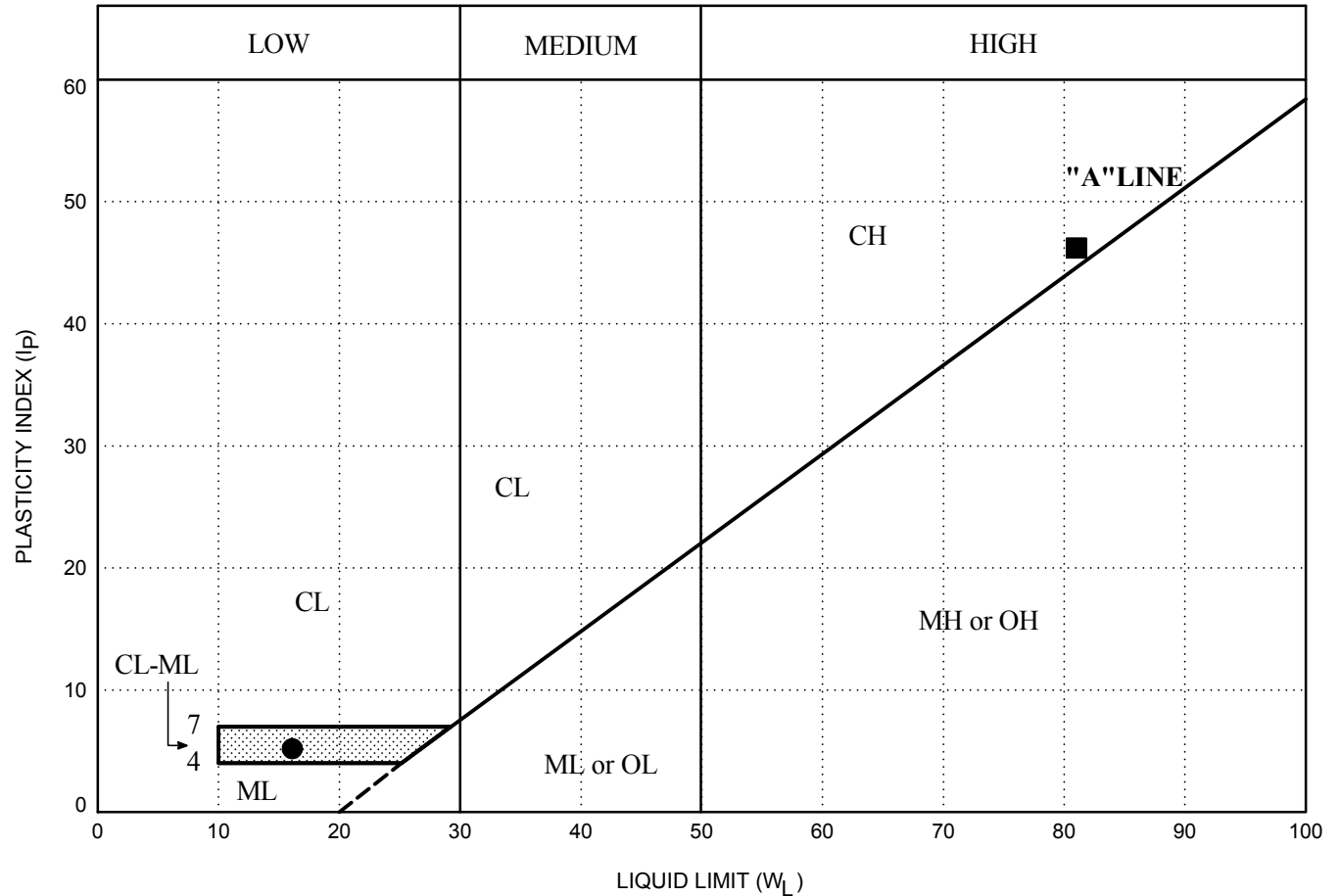
DATUM Chart







## PLASTICITY CHART



SYM.	SOURCE	DEPTH (m)	LL	PL	PI	W%	DESCRIPTION
●	BH-02	4.5	16.1	10.9	5.2	11.3	Silty, clayey sand (SC-SM): TILL
■	BH-03	2.8	81.0	34.8	46.2	66.8	MARINE: Fat CLAY (CH) with sand

	Project: <b>Graham's Pond Harbour</b>	Location: <b>Gaspereaux, PE</b>
	Job No.: <b>121621050</b>	Notes:
	Date: <b>June 25, 2018</b>	<b>SOIL PLASTICITY</b>

**Table 6 - Point Load Test Summary, Graham's Pond Harbour, Gaspereaux, PE**

Borehole Number	Sample Depth, m	Test Type	Is(50), MPa	UCS (Qu), MPa	Rock Type
BH-01	14.2	A	0.6	14	MGSS
	15.1	D	0.8		MGSS
	15.1	A	0.9	21	MGSS
	15.5	D	1.0		MGSS
	15.5	A	2.2	54	MGSS
	16.2	D	0.6		MGSS
	16.2	A	1.2	28	MGSS
	17.1	D	1.5		MGSS
	17.1	A	1.9	46	MGSS
BH-02	8.7	D	0.9		MGSS
	8.7	A	1.1	26	MGSS
	9.3	D	1.2		MGSS
	9.3	A	1.6	38	MGSS
	10.2	D	0.4		MGSS
	10.2	A	0.7	16	MGSS
	10.4	D	0.4		MGSS
	10.4	A	0.9	22	MGSS
BH-03	9.9	D	0.3		MGSS
	9.9	A	0.7	16	MGSS
	10.2	D	0.7		MGSS
	10.2	A	1.2	29	MGSS
	12.2	D	1.9		CGSS
	12.2	A	2.9	69	CGSS
	12.6	D	0.9		MGSS
	12.6	A	2.1	50	MGSS

Legend:

- A- axial test
- D- diametral test
- UCS- unconfined compressive strength
- FGSS- fine grained sandstone
- MGSS- medium grained sandstone
- MS- Mudstone

Note: USC is estimated based on relationship  $Qu = 24 \times Is50$  (axial)



**Photo 1: BH-01, RC24 – RC26 (13.82 to 17.12 m)**



Photo 2: BH-02, RC12 – RC14 (7.69 to 11.51 m)





Photo 3: BH-03, RC15 – RC17 (9.63 to 12.85 m)

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Harbour Structures  
304, 305 & 306  
Reconstruction  
Grahams Pond Harbour, Kings Co., PEI

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## **APPENDIX B**

Diversified Divers Inc.

**DIVERSIFIED DIVERS INC.**  
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### GRAHAMS POND INSPECTION



Diversified Divers Inc.

### **Introduction**

On September 8<sup>th</sup>, 2016 Diversified Divers Inc. (DDI) was on site at Graham's Pond, PEI completing an underwater inspection of the South face of the North Breakwater.

During this inspection, all information was documented and will be discussed in the report below.

Please call/fax or e-mail me at the contact information listed above to discuss any concerns or ask any additional questions. I would like to thank you for the opportunity of performing this structure inspection.

### **Results**

The dive inspection started at the South West corner of the run and worked East, measurements, photos, and thickness readings are noted below, showing minimal to moderate pitting through out the anodic zone. All pictures and information were recorded on September 8<sup>th</sup>, 2016.

**Anodic Zone 30m**



**\*P1**

\*Mild pitting in steel

**Anodic Zone 60m**



**\*P2**

\*Moderate pitting in steel



**Anodic Zone 75m**



**\*P3**

**\*Moderate pitting in steel**

**Anodic Zone 105m**



**\*P4**

**\*Heavy pitting in steel**

**Anodic Zone 165m**



**\*P5**

**\*Heavy pitting in steel**

**Legend:**

T.SSP – Top of Steel Sheet Pile  
T.C.Z – Top of Cathodic Zone  
T.A.Z – Top of Anodic Zone  
B.A.Z – Bottom of Anodic Zone  
S.F. – Sea Floor

***\*Estimated original steel thickness = 12mm*** ✓

***\*Measurements indicate remaining steel thickness*** ✓

**Station 30m**

Elevations

	O.P.	Web	I.P.
T.SSP - +2.65m	U.T. 10.20mm	U.T. 10.45mm	U.T. 8.85mm
T.C.Z - +1.9m	10.5mm	11.70mm	10.45mm
T.A.Z - +.7m	(*P1) 8.20mm	5.85mm	7.25mm
B.A.Z - -.17m	6.40mm	7.50mm	9.45mm
	8.00mm	8.45mm	9.65mm
S.F. - -1.95m	11.35mm	10.75mm	11.20mm

*\*not to scale*

**Station 60m**

Elevations

	O.P.	Web	I.P.
T.SSP - +2.65m	U.T. 8.45mm	U.T. 9.30mm	U.T. 9.10mm
T.C.Z - +1.9m	11.50mm	11.70mm	12.20mm
T.A.Z - +.7m	(*P2) 8.15mm	7.95mm	7.30mm
B.A.Z - -.3m	9.95mm 11.30mm	10.20mm 11.20mm	10.50mm 11.15mm
S.F. - -1.75m	11.75mm	11.40mm	11.35mm

*\*not to scale*

**Station 75m**

**Elevations**

	O.P.	Web	I.P.
T.SSP - +3.20m	U.T. 10.20mm	U.T. 11.2mm	U.T. 9.90mm
T.C.Z - +1.95m	11.51mm	11.35mm	12.1mm
T.A.Z - +.65m	(*P3) 6.60mm	9.15mm	7.70mm
B.A.Z - -.1m	8.00mm 7.45mm	6.95mm 10.00mm	6.30mm 10.15mm
S.F. - 2.0m	10.85mm	10.35mm	7.6mm

***\*not to scale***



**Station 105m**

Elevations

	O.P.	Web	I.P.
T.SSP - +3.20m	U.T. 11.45mm	U.T. 10.50mm	U.T. 11.25mm
T.C.Z - +1.8m	11.95mm	12mm	12.05mm
T.A.Z - +.5m	(*P4) 9.90mm	7.40mm	7.50mm
B.A.Z - -.43m	6.50mm	6.05mm	9.90mm
	10.35mm	10.30mm	11.10mm
S.F. - 2.21m	8.70mm	8.20mm	8.15mm

*\*not to scale*

**Station 135m**

Elevations

	O.P.	Web	I.P.
T.SSP - +3.20m	U.T. 11.2mm	U.T. 9.15mm	U.T. 11.75mm
T.C.Z - +1.8m	11.4mm	10.15mm	11.2mm
T.A.Z - +.67m	(*P5) 8.05mm	7.90mm	8.25mm
B.A.Z - -.32m	7.40mm 10.9 mm	8.95mm 10.35mm	10.40mm 10.90mm
S.F. - 2.38m	11mm	10.60mm	11mm

*\*not to scale*

**Station 165m**

**Elevations**

	O.P.	Web	I.P.
T.SSP - +3.20m	U.T. 10.15mm	U.T. 10.10mm	U.T. 10.35mm
T.C.Z - +1.7m	11.5mm	11.40mm	10.35mm
T.A.Z - +.68m	(*P6) 6.05mm	8.45mm	7.5mm
B.A.Z - -.21m	5.05mm 9.00mm	8.35mm 10.25mm	9.25mm 11.10mm
S.F. - 1.54m	11.50mm	11.35mm	11.70mm

***\*not to scale***

Diversified Divers Inc.

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June 21, 2018

**SECTION 412/306 INSPECTION**  
**GRAHAMS POND**



## **Introduction**

On June 21<sup>th</sup>, 2018 Diversified Divers Inc. (DDI) was on site at Graham's Pond, PEI completing an underwater inspection of Section 412 and 306.

During this inspection, all information was documented and will be discussed in the report below.

Please call/fax or e-mail me at the contact information listed above to discuss any concerns or ask any additional questions. I would like to thank you for the opportunity of performing this structure inspection.

## **Visual Inspection Notes:**

- Full structure 140m long
- 37m elevation change at top of SSP
- 40m end of building(old factory)
- UT taken at 10m,35m, and 95m
- 48m North wall 125mmx125mm hole(web)
- 140m North corner flange separated to bottom(multiple holes in splash zone)
- 80m South wall to rocks holes found on webs and in pans from corner to rocks(75% gone)
- East end 4.4m top SSP to HB
- Distribution bolts missing along 306 at various locations

\* Field notes attached.

**Location #10m**

Elevations

	O.P.	Web	I.P.
T.SSP – +2.7m	U.T	U.T.	U.T.
S.Z. – +1.6m	9.35mm	10mm	9.65mm
C.Z. -	11.35mm	11.65mm	11.55mm
T.R. – +.85m			⊕
T.A.Z – +.15m			
B.A.Z – -.8m	7.05mm	8.05mm	7.15mm
Sub.Z. -	9.20mm	8.35mm	9.45mm
H.B. – -1.8m			

***\*not to scale***

June 21<sup>st</sup>, 2018

**Location #35m**

Elevations

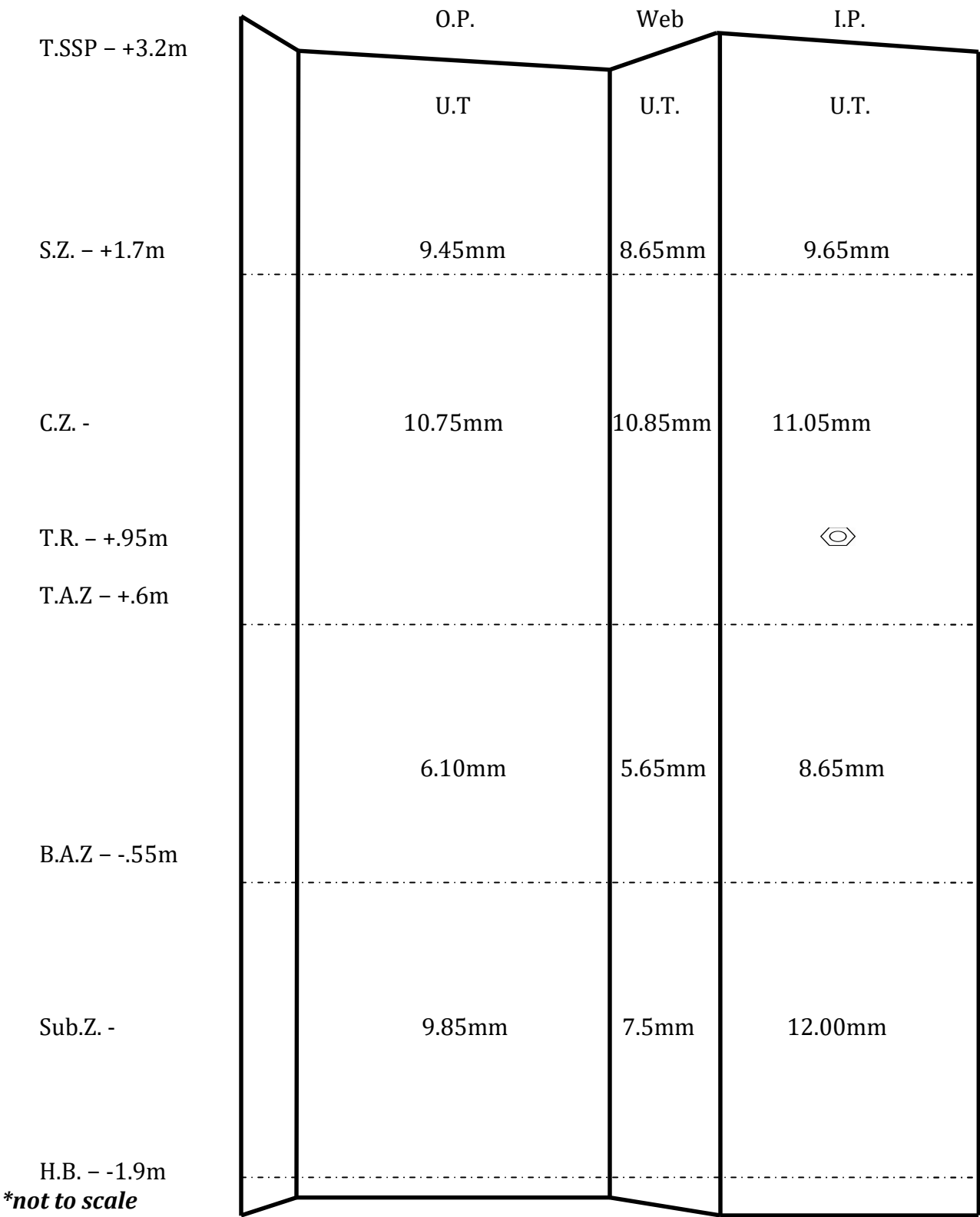
	O.P.	Web	I.P.
T.SSP – +2.7m	U.T	U.T.	U.T.
S.Z. – +1.4m	9.55mm	9.65mm	9.4mm
C.Z. -	10.35mm	11.00mm	10.50mm
T.R. – +.85m			⊕
T.A.Z – +.2m			
B.A.Z – -.9m	6.10mm	7.85mm	7.10mm
Sub.Z. -	8.30mm	9.85mm	11.00mm
H.B. – -1.8m			

***\*not to scale***

June 21<sup>st</sup>, 2018

**Location #95m**


Elevations





Diversified Divers Inc.

Legend:

O.P. – Out pan  
I.P. – In pan  
U.T. – Ultrasonic thickness  
T.SSP – Top of Steel Sheet Pile  
S.Z. – Splash Zone  
C.Z. – Cathodic Zone  
T.R. – Tie Rod elevation  
T.A.Z – Top of Anodic Zone  
B.A.Z – Bottom of Anodic Zone  
H.B. – Harbor Bottom  
Sub.Z. – Submerged zone (Suction dredge used to achieve lowest achievable elevation)  
 – Tie Rod

**\* Inspection starts at West end of 412.**

**\* Top of SSP measurements are noted Section 412@+2.7m/Section 306@+3.2m**

**Conclusion:**

Section 306

After review we would recommend excavation and extraction of section 306 by means of vibratory hammer and diver assistance for burning and rigging.

Section 412

After review we would recommend a full plate repair from top of SSP to -1m with reinforced concrete in fill.

**Thank you for the opportunity to work with you on this project and should you have any questions or comments in regard to this proposal please do not hesitate to contact me at any time.**

**Respectfully submitted,**

**James Landrigan  
General Manager**

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June 21<sup>st</sup>, 2018

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