

PART 1 - GENERAL

1.1 RELATED WORK .1 Section 31 62 16 Steel Sheet Piling.

1.2 REFERENCES .1 American Society for Testing and Materials International ASTM
.1 ASTM A 252-98 2002, Standard Specification for Welded and Seamless Steel Pipe Piles.
.2 ASTM A 307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
.3 ASTM A 325M-05, Standard Specification for Structural Steel Bolts, Steel, Heat Treated 830 Mpa Minimum Tensile Strength [Metric].
.4 ASTM A 490M-04a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3 for Structural Steel Joints [Metric].
.2 Canadian Standards Association (CSA International)
.1 CAN/CSA-G40.20/G40.21-2004, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
.2 CAN/CSA-S16-01, Consolidated (Consists of the CAN/CSA-S16-01, along with S16S1-05 and Updates # 1 and # 2 to CAN/CSA-S16-01).
.1 CAN/CSA-S16-01, Limit States Design of Steel Structures.
.3 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.
.4 CSA W48-01(R2006), Filler Metals and Allied Materials for Metal Arc Welding.
.5 CSA W59-03, Welded Steel Construction (Metal Arc Welding) (metric version).

1.3 SHOP DRAINGS .1 Provide submittals in accordance with Section

01 33 00 - Submittal Procedures.

- .2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.
 - .1 Include product characteristics, performance criteria, and limitations.
- .3 Submit shop drawings and indicate following items (in conjunction with Section 1.4 of 31 62 16).
 - .1 Material.
 - .2 Anchorage, field control and alignment methods.
 - .3 Design parameters.
 - .4 Tolerance for driving pile.
 - .5 Removable members.
 - .6 Alternatives.
 - .7 Equipment.
- .4 Template submittals and design to be stamped by a Professional Engineer registered or licensed to practice in the Province of Prince Edward Island.

1.4 DESIGN CRITERIA

- .1 Design templates to safety withstand following loads:
 - .1 Lateral loads to firmly hold pile in position when driving.

1.5 PROTECTION

- .1 Protect templates from damage. Repair damage to templates arising from operations to satisfaction of Departmental Representative at no extra cost.

1.6 MEASUREMENT FOR PAYMENT

- .1 No measurement will be made under this section. No payment will be made.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel Sections: to CAN/CSA-640.20 and

CAN/CSA-640.21, Type 350W.

- .2 Steel Plates: to CAN/CSA-640.20 and CAN/CSA-640.21, Type 300W.
- .3 Welding materials: to CSA W59.
- .4 Bolts, nuts and washers: to ASTM A 325M

PART 3 - EXECUTION

3.1 FABRICATIONS

- .1 Fabricate structural steel for templates in accordance with CAN/CSA-S16 and approved shop drawings.
- .2 Welding in accordance with CSA W59.
- .3 Welding companies shall be qualified under provisions of CSA W47.1.

3.2 POSITIONING

- .1 Position and hold template in location to receive piles with an accuracy which will ensure piles are within tolerances specified in submittals.
- .2 Secure templates to vertical piles in accordance with shop drawings.

3.3 REMOVAL OF TEMPLATES

- .1 Avoid damage to piling when removing templates.
- .2 When instructed by Departmental Representative, remove templates from Project site.

END OF SECTION

PART 1 - GENERAL1.1 Description of Work

- .1 This Section includes but is not limited to the following:
 - .1 All normal removals as required to complete the work.
 - .2 The removal of existing steel sheet pile breakwater shown in plan and section on S01, as indicated. Included is the removal of steel sheet piling, wale systems, tie rods and connectors, timber wheelguards and spacers, mooring cleats and bollards, concrete deck and anchor walls, ladders, fenders, all buried creosote timber and steel wharf structures contained within breakwater, buried utilities, sandstone and gravel fill, and other miscellaneous materials. All steel sheet piles must be fully removed or cut as indicated.
 - .3 Removal and relocation of exist shoreline armour protection as indicated on the drawings.
 - .4 Removal and reuse of inland existing laydown area sandstone fill and/or select borrow.
 - .5 All creosote timber to be removed and disposed of off-site.
 - .6 All timber, concrete, steel and other construction or debris type materials to be removed and disposed of off-site.

1.2 Related Work

- .1 Refer to Section 01 33 00 for Shop Drawing/Submission requirements.

1.3 Submissions

- .1 Provide methodology for carrying out the demolition and removal of work.

1.4 Protection

- .1 Any harbour structures including the existing berlin wall wharf (structure 406) are not permitted to be used or loaded. Nor

are materials are to be placed or stored on the existing structure.

- .2 Prevent movement, settlement or damage of adjacent structures. Provided bracing and shoring as required.

1.5 Measurement
For Payment

- .1 Sitework, demolition and removals will be measured in accordance with Section 01 29 00.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 Preparation

- .1 Verify with Departmental Representative items designated for removal and items to be preserved.
- .2 Locate and protect utility lines and all buried utilities. Preserve in operating condition active utilities traversing site.
- .3 Provide temporary power and lighting as required.

3.2 Removal

- .1 Remove items indicated.
- .2 At end of each day's work, leave work in safe condition so no part is in danger of toppling or falling.
- .3 Protection of the east breakwater is paramount so removal of the west breakwater is to be performed in such a manner as to assure the same.

END OF SECTION

PART 1 - GENERAL

- 1.1 Description .1 This section specifies requirements for excavating above chart datum, trenching and backfilling for concrete anchor wall, underground infrastructure and tie rods.
- 1.2 Reference Standards .1 ASTM D698-12E1, Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft) - Method C.
- .2 AASHTO T99-15, Moisture-Density Relations of Soils Using a 5.5-lb. Rammer and a 305mm Drop.
- 1.3 Related Work .1 Section 35 20 23 Underwater Excavation and Site Preparation.
- .2 Section 35 31 23.13 Rubblemound Breakwater.
- 1.4 Measurement For Payment .1 Work performed under this Section will be incidental to work involved in other sections of this specification.

PART 2 - PRODUCTS

- 2.1 Products .1 Sandstone fill in accordance with PEI Department of Transportation, Infrastructure and Energy (DOTIE) Specifications for Select Borrow or suitable on site material approved by a Geotechnical Engineer registered or licensed in the Province of Prince Edward Island.
- .2 Granular surface material in accordance with Section 32 11 23.

PART 3 - EXECUTION

North Lake Breakwater

305 Reconstruction

North Lake, Kings Co., PEI

Project No. R.088162.001

Excavating, Trenching and Backfilling Page 2

- 3.1 Site Preparation .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- 3.2 Stockpiling .1 Stockpile fill materials in areas approved by Departmental Representative. Stockpile granular materials in manner to prevent segregation.
- 3.3 Excavation .1 Excavate to lines, grades, elevations and dimensions indicted or as directed by Departmental Representative.
- .2 Dispose of surplus and unsuitable excavated material in approved location off site.
- .3 Do not obstruct flow of surface drainage or natural watercourses.
- .4 Stockpile suitable excavated materials required for backfill for behind SSP wall in approved location.
- .5 Dispose of surplus and unsuitable excavated fill/soil materials on site as per Appendix B.
- 3.4 Backfilling .1 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.
- .2 Areas to be backfilled must be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Backfilling around installations:
- .1 Place bedding and surround material as specified elsewhere.
- .2 Place material by hand under, around, and over installations until 300 mm of cover is provided. Dumping material directly on installations will not be permitted.

- .5 Place backfill material in uniform layers not exceeding 150 mm in thickness up to subgrade elevation or top of trench. Compact each layer before placing succeeding layer.
- .6 Compact common backfill and sandstone fill materials:
 - .1 In all areas, compact to a minimum 100% of Standard Proctor maximum dry density, maximum density ASTM D698, AASHTO T99, Method C.
- .7 No fill shall be placed against SSP wall or adjacent berling wall panels or timber lagging until the tie rods are installed and tightened. Fill will be brought up evenly along the length of wall.
- .8 Initial fill placement activities to be scheduled during low tide periods to minimize the amount of fill to be placed directly in water.
- .9 Filling below the chart datum (L.N.T.) may be carried out by the simple end dumping process. Do not allow large pieces, which will not render good consolidation and compaction to enter the work.
- .10 Commence infill above the chart datum (L.N.T.) as soon as possible with maximum 300 mm layers. Bring each layer to its required degree of compaction before the next layer is placed. When using hand operated tamping devices, deposit backfill material in uniform layers not exceeding 100 mm loose thickness.
- .11 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction. Take care when compacting near Berlin walls to prevent disturbance of the H-piles and wall panels.

END OF SECTION

PART 1 - GENERAL

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| 1.1 <u>Related Work</u> | .1 | Section 01 33 00 for Shop Drawings/Submissions Requirements. |
| | .2 | Section 31 23 10 - Excavating, Trenching and Backfilling. |
| | .3 | Section 35 31 23.13 - Rubblemound Breakwater. |
| 1.2 <u>References</u> | .1 | ASTM D4632-15A, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles. |
| | .2 | CAN/CGSB-4.2 No.4.2-M87, Textile Test Methods. |
| | .3 | CAN/CGSB-148.1 No 14-M93, Methods of Testing Geotextiles and Geomembranes. |
| | .4 | ASTM D4751-16, Determining Apparent Opening Size of a Geotextile. |
| 1.3 <u>Mill Certificates</u> | .1 | At least two (2) weeks prior to start of work, furnish Departmental Representative with copies of mill test data and certificate that filter fabric delivered to job site meets requirements of this section. |
| 1.4 <u>Approval</u> | .1 | Obtain written approval of Departmental Representative for filter fabric before installation of material in work. |
| 1.5 <u>Measurement For Payment</u> | .1 | Filter fabric will be measured in accordance with Section 01 29 00. |

PART 2 - PRODUCTS

2.1 Materials

- .1 Synthetic fiber: rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents.
- .2 Fabric: nonwoven polyester and/or polypropylene fabric.
- .3 Seams: lapped in accordance with manufacturer's recommendations.
- .4 Physical properties: to ASTM D4533, CAN/CGSB-4.2 No.4.2, CAN/CGSB-148.1 No 14 and ASTM D4632; ASTM D4491
 - .1 Tensile Strength 1330 N
 - .2 Tear Strength 500 N
 - .3 Elongation at break 50 - 100%
 - .4 Filtration Opening Size = 50-250 um.
 - .5 Permittivity = 1.00 sec^{-1}

PART 3 - EXECUTION

3.1 Placing
Filter Fabric

- .1 Place filter fabric on prepared surface loosely from top of the slope to the bottom allowing fabric to conform easily to contours of the slope.
- .2 Allow one (1) metre of fabric for overlapping and anchoring purposes, 700 mm at the top and 300 mm at the bottom of the slope.
- .3 Longitudinal seams will have a minimum of 600 mm overlap and will be pinned every 450 mm with securing pins.
- .4 Anchor top of fabric at 1 metre intervals with 15mm diameter steel rods 600 mm in length. Anchor bottom of fabric by folding fabric and placing fill on top.
- .5 No equipment will be permitted on fabric.

- .6 Install geotextile along rubblemound breakwater and behind lagging panels of existing berlin wall structure as indicated on the drawings.
- .7 Install geotextile at end of existing berlin wall structure full height as required to prevent loss of fill material behind existing Structure 406.

END OF SECTION

PART 1 - GENERAL

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| 1.1 | <u>Related Work</u> | .1 | Section 01 33 00 Shop Drawings/Submissions requirements. |
| | | .2 | Section 31 62 16 Steel Sheet Piling. |
| 1.2 | <u>Submissions</u> | .1 | Methodology:
.1 Provide methodology including type of pile driving equipment to carry out the work.
.2 Provide submissions in accordance with Section 01 33 00. |
| 1.3 | <u>Existing Sub-Surface Conditions</u> | .1 | Sub-surface investigation reports are appended to the specifications. Relevant borehole logs are included on the drawings. |
| | | .2 | Notify the Departmental Representative immediately if subsurface conditions at site differ from these indicated. |
| 1.4 | <u>Protection</u> | .1 | Protect public and construction personnel, adjacent structures and work of other sections from hazards attributes to pile driving operations or any other operations. |
| 1.5 | <u>Scheduling of Work</u> | .1 | Submit schedule of planned sequence of pile driving to Departmental Representative for review, not less than two (2) weeks prior to commencement of pile driving for structure. |
| 1.6 | <u>Delivery, Storage And Handling</u> | .1 | Protect piles from damage due to excessive bending stresses impact, abrasion or other damages during storage and handling. |
| | | .2 | Replace damaged piles to the satisfaction of the Departmental Representative. |

PART 2 - PRODUCTS

2.1 Materials

- .1 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing. Supply or fabricate full length piles.
- .2 Pile lengths indicated are based on lengths estimated to remain in completed structure, plus a 1.0 metre cut-off allowance.
- .3 Do not splice piles without written permission of Departmental Representative. When permitted, provide details for Departmental Representative review. Design details of splice to bear dated signature stamp of professional engineer registered or licensed in the Province of Prince Edward Island, Canada.
- .4 Welding materials: to CSA W48.1

PART 3 - EXECUTION

3.1 Equipment Requirements

- .1 Equipment information: prior to commencement of pile installation operation, submit to Departmental Representative for review, details of equipment for installation of piles. For impact hammers give manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer and mass of driving cap.
- .2 Hammer:
 - .1 Supply a hammer of suitable size to advance the piles to achieve necessary bedrock penetration and tip elevation. H-piles shall be driven with a hammer rated to deliver approximately 350 joules per square cm of steel cross sectional area. The hammer selected

will be of sufficient energy so as not to damage the piles.

- .2 When required penetration is not obtained by use of hammers complying with minimum requirements, either provide larger hammer or take other measures, acceptable to Departmental Representative. Drop hammers are permitted. Replace all piles damaged due to over driving at no additional cost to the Contract.

.3 Leads:

- .1 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 reviewed by Departmental Representative, to ensure support to pile while being driven.
- .2 Length: except for piles driven through water, provide length of leads so that use of a follower is unnecessary.
- .3 Swing leads: firmly guy top and bottom to hold pile in position during driving operation. Method to be reviewed by Departmental Representative.

.4 Followers:

- .1 When permitted, provide followers of such size, shape, length and mass to permit driving pile in desired location to required depth and resistance. Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.

3.2 Preparation

- .1 Verify conditions at pile locations are adequate to support pile driving operations. Make provision for access and support of pile driving equipment during performance of work.

3.3 Field Quality
Control and Field
Measurement

- .1 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 driving cap and cushion.
 - .3 Pile size and length, location of pile in pile group, location or designation of pile group.
 - .4 Sequence of driving piles in group.
 - .5 Number of blows per metre for entire length of pile and number per blows per 25 mm for last 300 mm.
 - .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 before and after driving of each pile.
- .2 Provide Departmental Representative with an electronic copy of records in PDF file format.

3.4 Driving

- .1 Use driving caps to protect piles. Reinforce piles heads if necessary. Piles with damaged heads, as determined by Departmental Representative, will be rejected.
- .2 Hold piles securely and accurately in position while driving.
- .3 Deliver hammer blows in direct axis of pile.
- .4 Re-drive piles lifted during driving of adjacent piles.
- .5 Use of water jet:
 - .1 Water jetting is not permitted.

- .6 Cut off piles neatly and either squarely or at an angle at elevations indicated.
- .7 Remove cut-off lengths from site on completion of work.
- .8 Installation of each pile will be subject to acceptance by the Departmental Representative.
- .9 Drive steel sheet piles to minimum bottom elevation as shown on the drawings.

3.5 Driving Tolerances

- .1 Pile heads must be within 50 mm of locations indicated.
- .2 Piles must not be more than 2% of length out of alignment.

3.6 Obstructions

- .1 Remove all obstructions from the surface prior to installing piles and install piles to the specified depth and/or pile resistance.
- .2 Where an obstruction is encountered that causes sudden and unexpected change in penetration resistance or deviation from specified tolerances, advise the Departmental Representative and submit for their review the proposed method(s) for achieving specified penetrations and tolerances. Incorporate review comments in the proposed method(s) and proceed with the work.
- .3 Consideration will be made for additional compensation for non-native material and or situations that are encountered under the surface, over and above what could be reasonably anticipated from soils information available and causes delays/additional costs in piling. Each case will be reviewed and approved by the Departmental Representative by means of the RFI process.

- 3.7 Damaged or
Defective Piles
- .1 Remove rejected pile and replace with a new, and if necessary, a longer pile.
 - .2 No extra compensation will be made for removing and replacing or other work made necessary through rejection of a defective pile.
- 3.8 Penetration
- .1 Protect adjacent structures, services and work of other section from hazards due to pile driving operations.

END OF SECTION

PART 1 - GENERAL

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| 1.1 <u>Work</u> | .1 This section describes the work necessary to place granular surface "Class A" (as per PEI DOTIE Specifications (latest edition)), granulars as shown on the drawings and as indicated in the specifications. It includes all labour, equipment and material necessary to execute the work. | | | | | | | | | | |
| 1.2 <u>Related Work</u> | .1 Refer to Section 31 23 10 Excavating, Trenching and Backfilling. | | | | | | | | | | |
| 1.3 <u>Measurement
For Payment</u> | .1 Granular surface will be measured in accordance with Section 01 29 00. | | | | | | | | | | |
| 1.4 <u>References</u> | <table border="0"><tr><td style="vertical-align: top; padding-right: 10px;">.1</td><td>ASTM C 117-13, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.</td></tr><tr><td style="vertical-align: top; padding-top: 10px;">.2</td><td>ASTM C 131-14 (No. 200), Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.</td></tr><tr><td style="vertical-align: top; padding-top: 10px;">.3</td><td>ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.</td></tr><tr><td style="vertical-align: top; padding-top: 10px;">.4</td><td>ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³ (600kN-m/m³)).</td></tr><tr><td style="vertical-align: top; padding-top: 10px;">.5</td><td>ASTM D 1557-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³ (2,700kN-m/m³)).</td></tr></table> | .1 | ASTM C 117-13, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing. | .2 | ASTM C 131-14 (No. 200), Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine. | .3 | ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. | .4 | ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft ³ (600kN-m/m ³)). | .5 | ASTM D 1557-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft ³ (2,700kN-m/m ³)). |
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| .3 | ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. | | | | | | | | | | |
| .4 | ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft ³ (600kN-m/m ³)). | | | | | | | | | | |
| .5 | ASTM D 1557-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft ³ (2,700kN-m/m ³)). | | | | | | | | | | |

- .6 ASTM D 1883-14, Standard Test Method for California Bearing Ratio of Laboratory Compacted Soils.
- .7 ASTM D 4318-10e1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .8 PEI Department of Transportation, Infrastructure and Energy General Provisions and Contract Specifications for Highway Construction (latest edition).

PART 2 - PRODUCTS

2.1 Materials

- .1 Granular Surface: Material to meet the following requirements:
 - .1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 - .2 Class "A" granular fill gradation will be within following limits:

ASTM SIEVE SIZE	% PASSING BY MASS
31.5 mm	100
25.0 mm	95 - 100
12.5 mm	50 - 83
4.75 mm	30 - 60
1.18 mm	15 - 40
0.600 mm	1 - 32
0.300 mm	5 - 22
0.075 mm	3 - 9

PART 3 - EXECUTION

- 3.1 Inspection of Underlying Fill
- .1 Do not place granular surface until finished sub-grade surface is inspected and approved by Departmental Representative.
- 3.2 Placing
- .1 Before and after placing granular surface, provide a table of cross section elevations at 15 metre intervals showing the design and as constructed elevations, demonstrating that the surfaces are not uniformly high or low and within grading tolerance.
- .2 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.
- .3 Place using methods which do not lead to segregation or degradation of aggregates.
- .4 Place material to full width in uniform layers not exceeding 100mm compacted thickness.
- .5 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.
- 3.3 Compacting
- .1 Compact to density not less than 98% maximum dry density in accordance with ASTM D698.
- .2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.
- .3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying

with suitable equipment until moisture content is corrected.

- .4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 Finish Tolerances

- .1 Finished surface shall be within plus or minus 10 mm of established grade but not uniformly high or low.
- .2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 Maintenance

- .1 Maintain finished surface in a condition conforming to this section until acceptance.

END OF SECTION