

PART 1 - GENERAL

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|-----|--------------------------------|----|---|
| 1.1 | <u>Related Work</u>            | .1 | Granular Base: Section 32 11 23.  |
|     |                                | .2 | Granular Sub-Base: Section 32 11 19.  |
| 1.2 | <u>Source Approval</u>         | .1 | Source of materials to be incorporated into work or stockpiled requires acceptance.   |
|     |                                | .2 | Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least four weeks prior to commencing production.   |
|     |                                | .3 | If, in opinion of Departmental Representative, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, procure an alternative source to demonstrate that materials from source in question can be processed to meet specified requirements. |
|     |                                | .4 | Should a change of material source be proposed during work, advise Departmental Representative four weeks in advance of proposed change to allow sampling and testing.  |
|     |                                | .5 | Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.   |
| 1.3 | <u>Production Sampling</u>     | .1 | Aggregate will be subject to continual sampling during production.  |
|     |                                | .2 | Provide Departmental Representative with ready access to source and processed material for purpose of sampling and testing.   |
| 1.4 | <u>Measurement for Payment</u> | .1 | This item will not be measured separately.  |

PART 2 - PRODUCTS

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| 2.1 | <u>Materials</u> | .1 | Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances. |
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- .2 Flat and elongated particles are those whose greatest dimension exceeds four times their least dimension.
- .3 Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:
  - .1 Natural sand
  - .2 Manufactured sand
  - .3 Screening produced in crushing of quarried rock, boulders, gravel or slag
  - .4 Coarse aggregates satisfying requirements of applicable section shall be one of following:
    - .1 Crushed rock or slag
    - .2 Gravel composed of naturally formed particles of stone.

### PART 3 - EXECUTION

#### 3.1 Development of Aggregate Source

- .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by the Departmental Representative.
- .2 Clear, grub and strip an area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
- .3 When operating in stratified deposits use excavation equipment and methods that will produce a uniform, homogeneous aggregate.
- .4 When excavation is completed, provide drains or ditches as required to prevent surface standing water.
- .5 Trim off and dress slopes of waste material piles and leave site in a neat condition.

#### 3.2 Processing

- .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
- .2 Blend aggregate if required to obtain gradation requirements specified. Use approved methods and equipment.

- .3 Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.
- .4 Wash aggregates if required to meet specifications. Use only equipment accepted by Departmental Representative.
- 3.3 Handling
  - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- 3.4 Stockpiling
  - .1 Stockpiling aggregates on stabilized, clean and well drained surfaces.
  - .2 To ensure that no material other than stockpiled aggregate is used, do not incorporate bottom 250 mm of stockpile into work, if aggregates are stockpiled on ground.
  - .3 Stockpile far enough apart to prevent intermixing.
  - .4 Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection.
  - .5 Stockpile materials in uniform layers of thickness as follows:
    - .1 Max 1 m for coarse aggregate and base course materials.
    - .2 Max 2 m for fine aggregate and subbase materials.
    - .3 Max 1.5 m for other materials.
  - .6 Complete each layer over entire stockpile area before beginning next layer.
  - .7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
  - .8 Coning of piles or spilling of material over edges of pile will not be permitted.
  - .9 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

**END OF SECTION**

PART 1 - GENERAL

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|-----|-------------------------|----|---|
| 1.1 | <u>Related Sections</u> | .1 | Pile Foundations - General: Section 31 61 13  |
| 1.2 | <u>References</u>       | .1 | CSA S16-2014, Limit States Design of Steel Structures.  |
|     |                         | .2 | CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.  |
|     |                         | .3 | CSA W59-2013, Welded Steel Construction (Metal Arc Welding).  |
|     |                         | .4 | ASTM A307-2014, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.  |
|     |                         | .5 | ASTM F3125-15a, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 and 150 ksi Minimum Tensile Strength.   |
| 1.3 | <u>Shop Drawings</u>    | .1 | Submit shop drawings in accordance with Section 01 33 00 - Submittals.  |
|     |                         | .2 | Indicate the following items:   |
|     |                         | .1 | Material.   |
|     |                         | .2 | Anchorage, field control and alignment methods.   |
|     |                         | .3 | Design parameters.  |
|     |                         | .4 | Tolerance for driving pile.   |
|     |                         | .5 | Removable members.  |
|     |                         | .6 | Alternatives.   |
| 1.4 | <u>Design Criteria</u>  | .1 | Design templates to safely withstand following loads:   |
|     |                         | .1 | All gravity loads to which template will be subjected.  |
|     |                         | .2 | Lateral loads to firmly hold pile in position when driving.   |
| 1.5 | <u>Protection</u>       | .1 | Protect templates from damage. Repair damage to templates, formwork or concrete arising from operations to satisfaction of the Departmental Representative at no additional cost to the Contract. |

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Steel sections and plates: to CSA G40.20 and CSA G40.21, Type 350W.
  - .2 Welding Materials: to CSA W59.
  - .3 Bolts, nuts and washers: to ASTM F3125, Grade A325.

PART 3 - EXECUTION

- 3.1 Fabrication
- .1 Fabricate structural steel for templates in accordance with CSA S16.1 and reviewed shop drawings.
  - .2 Do welding in accordance with CSA W59.
  - .3 Welding companies must 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 bring piles to within tolerances specified.
  - .2 Before driving batter piles set templates to within 10mm of elevations indicated on shop drawings.
- 3.3 Placing Batter Piles
- .1 Remove members in templates as necessary to place batter piles. Replace members prior to placing other batter piles or driving of batter piles. Indicate members to be removed for this operation on shop drawings. Mark them as "Removable".
- 3.4 Removal Of Templates
- .1 Avoid any damage to piling when removing templates.
  - .2 When instructed by the Departmental Representative, move templates from project site.

**END OF SECTION**

PART 1 - GENERAL1.1 Description of  
the Work

- .1 This Section includes but is not limited to the following:
  - .1 Excavation and removal of all materials including the removal and temporary storage of sediment, all normal removals as required to complete the work within the defined limits to the lines and grades as indicated on the project drawings.
  - .2 Removal and disposal off-site of assorted excavated materials within the defined excavation/removals limits that do not meet the contract specifications.
  - .3 Refer to Section 01 74 21 for waste management guidelines.

1.2 Submissions

- .1 Methodology:
  - .1 When requested provide methodology for carrying out the work
- .2 Provide submission in accordance with Section 01 33 00.

1.3 Protection

- .1 Prevent movement, settlement or damage of adjacent structures. Provided bracing and shoring as required. In event of damage, immediately replace such items or make repairs to approval of Departmental Representative and at no additional cost to Departmental Representative.
- .2 Prevent debris from going adrift and becoming a menace to navigation.
- .3 All damage to existing structures, roadways, pipelines, electrical systems not specified for removal to be repaired at the Contractor's cost to the satisfaction of the Departmental Representative.

1.4 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 - EXECUTION3.1 Preparation

- .1 Inspect site and verify with Departmental Representative items designated for removal and items to be preserved.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.
- .3 Provide temporary power and lighting as shown on the plan or as required by the Departmental Representative.
- .4 Protect existing fill and vent pipes, oil waste tanks and underground storage tanks from any damages. Repairs all damages caused as a result of the Work at no additional cost to the Contract and to the satisfaction of the Departmental Representative.

3.2 Removal

- .1 Remove items indicated.
- .2 Handle, stockpile and protect material destined for removal off Site in accordance with Section 01 35 44, subsection 1.6.
- .3 Do not disturb adjacent structures designated to remain in place.
- .4 At end of each day's work, leave work in safe condition so no part is in danger of toppling or falling.
- .5 Protect stockpile of removed sediment by placing polyethylene sheets below and over sediment in area designated by the Departmental Representative.

3.3 Disposal of Material

- .1 Disposal of materials not designated for salvage or re-use in work, will be the contractor's responsibility, and must be disposed of off-site.
- .2 Transport and dispose of material in an environmentally acceptable manner to the satisfaction of the Departmental Representative, and in accordance with any local, Municipal, Provincial and Federal restrictions and regulations.

3.4 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. Match condition of adjacent, undisturbed areas.

**END OF SECTION**

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PART 1 - GENERAL

- 1.1 General
- .1 Provide and maintain silt boom, oil boom and sediment control devices where required or as directed, prior to and during construction. Coordinate locations with Departmental Representative. Do not remove control features until authorized by the Departmental Representative.
  - .2 Do erosion control in accordance with approved Environmental Protection Plan.
- 1.2 References
- .1 ASTM D4632-15a, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - .2 ASTM D3786-13, Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method.
  - .3 ASTM D4833-07(R2013), Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
  - .4 ASTM D4355-14, Standard Test Method for Deterioration of Geotextile by Exposure to Light, Moisture and Heat in a Xenon Type Apparatus.

PART 2 - PRODUCTS

- 2.1 Sediment Control Fence
- .1 Sediment Control fence: preassembled sediment control fence with industrial woven geotextile fabric pre-stapled to wood posts spaced as indicated.
    - .1 Grab Tensile Strength (MD): 120lbs to ASTM D4632.
    - .2 Grab Tensile Strength (CD): 105lbs to ASTM D4632.
    - .3 Grab Tensile Elongation: 19% to ASTM D4632.
    - .4 Mullen Burst Strength: 225 lbs to ASTM D3786.
    - .5 Puncture Strength: 75lbs to ASTM D4833.
    - .6 UV resistance: 80% strength retained after 500 hours to ASTM D4355.
- 2.2 Silt Curtain
- .1 High strength woven geotextile, UV protected, floating boom.

- 2.3 Oil Boom .1 UV resistant, vinyl coated polyester or nylon, ballasted minimum 300m submerged.
- PART 3 - EXECUTION
- 3.1 Temporary Soil Covers .1 If blown straw or hay is to be used as temporary soil cover for sediment and erosion control of exposed soils, a 100% cover should be required to ensure soil erosion is minimized.
- 3.2 Sediment Control Fence .1 Attach fence with roofing nails and roofing tins. Provide wood strapping along top of fence.
- .2 Excavate 150mm x 150mm trench along length of fence. Lay fabric bottom in trench and backfill with selected excavated material.
- 3.3 Oil Boom Installation .1 Install oil boom in segments as the Work progresses while maintaining complete containment. Do not impede the marine traffic on Site.
- 3.4 Silt Curtain Installation .1 Install oil boom in segments as the Work progresses while maintaining complete containment. Do not impede the marine traffic on Site.
- .2 Anchor the silt curtain to the seafloor.
- .3 Minimum depth of silt curtain to be 5m.
- 3.5 Maintenance of Silt And Sediment Control Features .1 Maintain siltation control features throughout the construction period. Repair damage to original condition.
- .2 Remove accumulated sediment from behind silt fence.
- .3 Maintain vertical alignment of silt fence and boom such that it is always plumb and straight.
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3.6 Removal of Silt and  
Sediment Control  
Features

- .1 Remove sediment control features at upon  
Completion of the Work.

**END OF SECTION**

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## PART 1 - GENERAL

### 1.1 References

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C 117-13, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-63(R2007), Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).
  - .5 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m<sup>3</sup>).
  - .6 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .2 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

### 1.2 Definitions

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
    - .1 Rock: solid material in excess of 1.00 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.
    - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
  - .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
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- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .6 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
    - .2 Table:

<u>Sieve Designation</u>	<u>% Passing</u>
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

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

- .7 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

### 1.3 Action and Informational Submittals

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Quality Control:
  - .1 Submit condition survey of existing conditions as described in Existing Conditions article of this Section.
  - .2 Submit for review by Departmental Representative proposed dewatering and heave prevention methods as described in PART 3 of this Section.
  - .3 Submit to Departmental Representative written notice when bottom of excavation is reached.

.4 Submit to Departmental Representative testing inspection results as described in PART 3 of this Section.

.3 Preconstruction Submittals:

.1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.

.2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field clearance record from utility authority and location plan of relocated and abandoned services, as required.

.4 Samples:

.1 Inform Departmental Representative at least four (4) weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

1.4 Quality Assurance

.1 Qualification Statement: submit proof of insurance coverage for professional liability.

.2 Where Departmental Representative is employee of Contractor, submit proof that Work by Departmental Representative is included in Contractor's insurance coverage.

.3 Submit design and supporting data at least two (2) weeks prior to beginning Work.

.4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Nova Scotia, Canada.

.5 Keep design and supporting data on site.

.6 Engage services of qualified professional engineer who is registered or licensed in Province of Nova Scotia, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

.7 Do not use soil material until written report of soil test results are reviewed by the Departmental Representative.

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### 1.5 Existing Conditions

- .1 Buried services:
  - .1 Before commencing Work verify location of buried services on and adjacent to site.
  - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
  - .3 Remove obsolete buried services within 2m of foundations: cap cut-offs.
  - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .5 Prior to beginning excavation Work, notify Departmental Representative or authorities having jurisdiction. Establish location and state of use of buried utilities and structures. Departmental Representative or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
  - .6 Confirm locations of buried utilities by careful test excavations.
  - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .8 Where utility lines or structures exist in area of excavation, obtain direction of the Departmental Representative before removing or re-routing.
  - .9 Record location of maintained, re-routed and abandoned underground lines.
  - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
  - .1 Conduct condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing structures and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by the Departmental Representative at no additional cost.
- .3 Where required for excavation, cut roots or branches as approved by the Departmental Representative.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Aggregate base and aggregate subbase fill: to Nova Scotia Transportation and Infrastructure Renewal standard specification.
  - .2 Unshrinkable fill: proportioned and mixed to provide:
    - .1 Maximum compressive strength of 0.4 MPa at 28 days.
    - .2 Maximum cement content of 25 kg/m<sup>3</sup> with 40% fly ash replacement: to CSA-A3001, Type GU.
    - .3 Minimum strength of 0.07MPa at 24 h.
    - .4 Concrete aggregates: to CSA-A23.1/A23.2.
    - .5 Cement: Type GU.
    - .6 Slump: 160 to 200 mm.

PART 3 - EXECUTION

- 3.1 Temporary Erosion And Sedimentation Control
- .1 Provide temporary erosion and control sedimentation measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- 3.2 Site Preparation
- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- 3.3 Preparation/Protection
- .1 Protect existing features from drainage and in accordance with applicable local regulations.
  - .2 Keep excavations clean, free of standing water, and loose soil.
  - .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.



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- .4 Protect natural and man-made features required to remain undisturbed.
      - .5 Protect buried services that are required to remain undisturbed.
  - 3.4 Stockpiling
    - .1 Stockpile fill materials in areas designated by Departmental Representative.
      - .1 Stockpile granular materials in manner to prevent segregation.
    - .2 Protect fill materials from contamination.
    - .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.
  - 3.5 Cofferdams, Shoring Bracing and Underpinning
    - .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Health and Safety Act for the Province of Nova Scotia.
    - .2 Obtain permit from authority having jurisdiction for temporary diversion of water course.
    - .3 Construct temporary Works to depths, heights and locations as approved by Departmental Representative.
    - .4 During backfill operation:
      - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
    - .5 When sheeting is required to remain in place, cut off tops at elevations as indicated.
    - .6 Upon completion of substructure construction:
      - .1 Remove cofferdams, shoring and bracing.
      - .2 Remove excess materials from site.
  - 3.6 Dewatering and Heave Prevention
    - .1 Keep excavations free of water while Work is in progress.
    - .2 Provide for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
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- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

### 3.7 Excavation

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation off site.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .5 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by the Departmental Representative.
- .6 Restrict vehicle operations directly adjacent to open trenches.
- .7 Dispose of surplus and unsuitable excavated material off site.
  - .1 Prior to hauling surplus excavated soils from site, provide copy of disposal permit to the Departmental Representative.
  - .2 Temporary stockpiling of excavated material will be considered incidental to the contract.

- .8 Do not obstruct flow of surface drainage or natural watercourses.
  - .9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
  - .10 Notify the Departmental Representative when bottom of excavation is reached.
  - .11 Obtain the Departmental Representative approval of completed excavation.
  - .12 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by the Departmental Representative.
  - .13 Correct unauthorized over-excavation as follows:
    - .1 Fill under bearing surfaces and footings with, concrete specified for footings, fill concrete or aggregate subbase compacted to not less than 100% of corrected Standard Proctor maximum dry density. As directed by Departmental Representative.
    - .2 Fill under other areas with aggregate subbase compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
  - .14 Hand trim, make firm and remove loose material and debris from excavations.
    - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
    - .2 Clean out rock seams and fill with concrete mortar or grout to approval of the Departmental Representative.
- 3.8 Fill Types and Compaction
- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698 and ASTM D 1557.
    - .1 Sides of walls: use aggregate subbase to subgrade level. Compact to 100% of corrected maximum dry density.
    - .2 Under concrete slabs: provide compacted base course and sub-base course of aggregate to

underside of slab, thickness as noted on drawings. Compact base course to 100% of corrected maximum dry density.

.3 Under roadways to subgrade level. Use aggregate subbase fill, compact to 100% of corrected maximum dry density.

.4 Place unshrinkable fill in areas as indicated.

3.9 Bedding and  
Surround of  
Underground

.1 Place and compact granular material for bedding and surround of underground services as indicated on the drawings and as indicated in subsection 3.2.

.2 Place bedding and surround material in unfrozen condition.

3.10 Backfilling

.1 Do not proceed with backfilling operations until completion of following:

.1 Departmental Representative has inspected and approved installations.

.2 Departmental Representative has inspected and approved of construction below finish grade.

.3 Inspection, testing, approval, and recording location of underground utilities.

.4 Removal of concrete formwork.

.5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 600mm.

.4 Where temporary unbalanced earth pressures

are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval 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.

.6 Place unshrinkable fill in areas as indicated.

.7 Consolidate and level unshrinkable fill with internal vibrators.

### 3.11 Restoration

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

.3 Reinstate all site features to preconstruction condition and match into surrounding materials, to satisfaction of Departmental Representative.

.4 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.5 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

PART 1 - GENERAL

- 1.1 Related Work .1 Section 31 37 10 - Rockfill, Rip Rap and Corestone.
- 1.2 References .1 ASTM D4595-11, Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- .2 CAN/CGSB-148.1-03, Complete Set - Methods of Testing Geotextiles and Geomembranes.
- .3 ASTM D4751-12, Determining Apparent Opening Size of a Geotextile.
- 1.3 Mill Certificates .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 Approval .1 Obtain written approval of Departmental Representative for filter fabric before installation of material in work.
- 1.5 Measurement for Payment .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: sewn in accordance with manufacturer's recommendations.
- .4 Physical properties: to ASTM D4595, CAN/CGSB-148.1 and ASTM D4751:
- .1 Tensile Strength: 900 N
- .2 Tear Strength 360 N
- .3 Elongation at break 50%
- .4 Filtration Opening Size = 100 - 80um.
- .5 Permeability =  $2 \times 10^{-1}$  cm sec.

PART 3 - EXECUTION

3.1 Preparation  
of Base

- .1 Fine grade area to be covered with filter fabric to a uniform surface area. Fill depressions with suitable material.

3.2 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 seems will have a minimum of 450 mm overlap and will be pinned every 600 mm with 100 mm nails.
- .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.

**END OF SECTION**

PART 1 - GENERAL

- |     |  |    |  |
|-----|--|----|--|
| 1.1 | <u>Related Requirements</u>                | .1 | Section 06 05 73 - Dimension Timber.   |
| 1.2 | <u>References</u>                          | .1 | American Society for Testing and Materials International (ASTM)<br>.1 ASTM A123-15, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.<br>.2 ASTM A 307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.<br>.3 ASTM C 136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. |
|     |  | .2 | American Wood-Preserver's Association (AWPA)<br>.1 AWPA M4-02, Standard for the Care of Preservation - Treated Wood Products.  |
|     |  | .3 | Canadian Standards Association (CSA International)<br>.1 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.<br>.2 CSA-080 Series-15, Wood Preservation.  |
|     |  | .4 | Canadian General Standards Board (CGSB)<br>.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.   |
|     |  | .5 | Canadian Wood Council<br>.1 Wood Design Manual - 2015.   |
|     |  | .6 | National Lumber Grades Authority (NLGA)<br>.1 Standard Grading Rules for Canadian Lumber 2013 edition.   |
| 1.3 | <u>Action And Informational Submittals</u> | .1 | Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.   |
|     |  | .2 | Shop Drawings:<br>.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.<br>.2 Submit proposed placing method for ballast to Departmental Representative for approval, prior to placing of ballast  |



- 1.4 Quality Assurance
- .1 Quality Assurance: in accordance with Section 01 41 00 - Testing Laboratory services.
  - .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 28 - Health and Safety Requirements.
  - .3 Worker protection:
    - .1 Workers must wear gloves, respirators, dust masks, long sleeved clothing, eye protection, and protective clothing when handling, drilling, sawing, cutting or sanding preservative treated wood and applying preservative materials.
    - .2 Workers must not eat, drink or smoke while applying preservative material.
    - .3 Clean up spills of preservative materials immediately with absorbent material. Safely discard of adsorbent material to sanitary landfill.
- 1.5 Waste Management
- .1 Separate waste materials for reuse and recycling.
  - .2 Place materials defined as hazardous or toxic in designated containers.
  - .3 Seal emptied containers and store safely.
  - .4 Do not dispose of preservative treated wood through incineration.
  - .5 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.
  - .6 Dispose of treated wood, end pieces, wood scraps and sawdust at a sanitary landfill.

## PART 2 - PRODUCTS

- 2.1 Materials
- .1 Timber: graded and stamped to National Lumber Grading Authority (NLGA) No. 1 structural. Eastern Hemlock, Western Hemlock, or Douglas Fir species, only, will be used.
  - .2 Preservative treatment: to Section 06 05 73 - Dimension Timber.
  - .3 Miscellaneous steel:
    - .1 Hot dip galvanized: to ASTM A123.

- .2 Wire nails, spikes, staples: to CSA-B111.
- .3 Bolts, nuts, washers: to ASTM A307.
- .4 Ogee washers: to Wood Design Manual and as follows: ogee washers to be of cast iron free from injurious defects or impurities.
- .4 Ballast for filling cribs to following requirements:
  - .1 Well graded quarried stone, consisting of hard durable particles free from clay lumps, organic material and other deleterious materials.
  - .2 Specific gravity: minimum 2.65.
  - .3 Material to be open graded with maximum sizes not exceeding 400mm on any side and minimum size not less than 250mm on any side.
  - .4 Salvaged ballast stone must meet the requirements above and be approved by the Departmental Representative before incorporating into the Work.
- .5 Crushed rock mattress: to following requirements:
  - .1 Crushed angular quarry stone consisting of hard durable particles free from clay lumps, frozen materials and other deleterious materials, and free from splits, seams or defects likely to impair its soundness during handling or under action of water.
  - .2 Relative density: to ASTM C127, not less than 2.65.
  - .3 Gradations: well graded 50-150mm angular rock, free from fines, with 50-70% passing the 100mm sieve. Top 50mm thick surface may be smaller, to approval of the Departmental Representative, to facilitate levelling.
  - .4 Mattress to be founded on solid bedrock. Review the condition of the base after removal of the existing timber crib and prior to placement of the mattress for the new timber crib.
- .6 Granular sub-base (Type 2) material to Section 32 11 19.

### PART 3- EXECUTION

#### 3.1 Preparation

- .1 Excavate area of crib base to sound bedrock. Remove rock as required to prepare base.
- .2 Depth of excavation to be verified by Departmental Representative's Geotechnical Engineer.

- .3 Do not commence placement of crushed rock mattress until approval of removal limits have been provided by the Departmental Representative.
- .4 Place level crushed rock mattress as directed by the Departmental Representative.
- .5 Level top of levelling course using a sweep beam capable of covering the entire mattress width in a single pass.
- .6 Take closely spaced accurate soundings, precisely located by template, to surface of mattress, to determine actual configuration of base area of crib.
- .7 Construct crib bottom to match base configuration.
- .8 Have the diver carry out an inspection following sweeping to locate any bumps, hollows, extent of mattress and verify the slope's stability. Touch-up, re-sweep and re-inspect until the mattress is within the tolerance specified.

### 3.2 Crib Construction

- .1 Precut timber prior to preservative treatment.
- .2 Bore holes for drift bolts 1.5 mm smaller diameter than bolt and for full length of bolt. Bore holes for machine bolts to same diameter as bolts.
- .3 Construct timber cribwork to full height prior to sinking in final position in work.
- .4 Levelling pieces:
  - .1 Place timber levelling pieces beneath bottom timbers to conform to shape of base area.
  - .2 Place levelling pieces horizontally.
  - .3 Secure succeeding pieces at intersections of bottom timbers and vertical posts, and other levelling pieces with machine bolts.
- .5 Bottom timbers:
  - .1 Place bottom timbers lengthwise, and crosswise to form bottom three courses of cribs.
  - .2 Splice timbers in lengthwise direction at centre of 1.2 m long splice block
  - .3 Stagger butt joints in bottom timbers; joints maximum 0.6 m from crosswise timber; do not locate in same bay as joint in course below.

- .4 Secure three courses of bottom timbers together with machine bolts at every intersection with each other and with vertical posts.
- .6 Ballast floor:
  - .1 Place ballast floor on pockets on bottom course of bottom timbers.
  - .2 Secure each ballast floor timber to bottom timbers with drift bolts securing adjacent ballast floor timbers to same bottom timber.
- .7 Longitudinals:
  - .1 Butt join exterior and interior longitudinals in centre of 1.2 m block.
  - .2 Secure block to lower timber with drift bolt at centre and secure longitudinals and splice at ends to block with drift bolts.
  - .3 Stagger joints in longitudinal timbers: do not join in same bay or on same vertical post.
  - .4 Secure longitudinals to intersection of cross ties with drift bolt and to intersection of vertical posts with machine bolt as noted.
  - .5 Countersink machine bolts on exterior face from elevation 0.00 m chart datum to elevation of highest face timber.
- .8 Cross ties:
  - .1 Secure cross ties to intersection of longitudinals with drift bolt and to intersection of vertical posts with machine bolt as noted.
  - .2 Do not splice cross-ties; only full length timbers are to be used.
- .9 Vertical posts: one length from bottom of cribwork to top of cribwork.
- .10 Fillers: place filler timber as indicated.
  - .1 Secure fillers with drift bolts to timbers immediately below as shown on the Project Drawings.
- 3.3 Handling
  - Treated Timber
    - .1 Handle treated material without damaging original treatment.
      - .1 Replace treated timber with major damage to original treatment, as instructed by Departmental Representative.
      - .2 Field treatment: apply and saturate cuts, minor surface damage, abrasions, and nail and spike holes with preservative to CAN/CSA-080 Series.

- 3.4 Ballast
- .1 Use salvaged ballast stone to the greatest extent possible, supplement with new as required.
  - .2 Place ballast to avoid damage to timber cribwork. As a minimum, protect the top course of timbers with planks.
  - .3 Place ballast so that differential height of fill between adjacent cells, at any time, will be less than 1 m.
  - .4 When placing, ballast cells with ballast floors sufficiently to just start to set crib. Check crib for bearing and alignment prior to ballasting these cells sufficiently and evenly to prevent floatation. Then ballast remaining cells to lowest natural tide unless noted otherwise. Thereafter, ballast all cells uniformly.
- 3.5 Placing Sub-Base
- .1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow or ice.
  - .2 Place granular subbase to full width in uniform layers not exceeding 150mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
  - .3 Shape each layer to a smooth contour and compact to specified density before the succeeding layer is placed.
  - .4 Remove and replace portion of a layer in which material has become segregated during spreading.
- 3.6 Compacting of Sub-Base
- .1 Compact subbase material to density of not less than 100% maximum dry density in accordance with ASTM D698.
  - .2 Shape and roll alternately to obtain a smooth, even and uniformly compacted subbase.
  - .3 Apply water as necessary during compaction to obtain specified density. If subbase 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.
- 3.7 Finish Tolerances of Sub-Base
- .1 Granular subbase compacted thicknesses will be as follows: thickness as indicated on the Project Drawings.
- .2 Compact backfill materials to the thickness as required to attain the grades indicated on the drawings.
- .3 Finish compacted surface to within plus or minus 25mm of established grade but not uniformly high or low.
- .4 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- 3.8 Crib Tolerance
- .1 1 in 300 in overall dimensions.
- .2 Locate cribs within 50 mm of location as indicated.
- .3 Adjoining cribs to line up exactly.
- .4 Cribs out of alignment or not correctly located will be refloated and replaced to their correct positions.
- .5 Final bottom elevation of fully ballasted crib to be 0 to 100mm below the elevation indicated on the Project Drawings.
- .6 Refloat a crib out of alignment, not correctly located or at the wrong elevation. Repair mattress prior to resetting.
- .7 Some settlement of the crib structure is anticipated into the mattress. Prior to installation of the upper course of timbers and the concrete deck, check the elevations and provide any concrete haunch beams as required to meet the elevations as shown on the Project Drawings.
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3.9 Cleaning

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

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PART 1 - GENERAL

- |     |  |    |  |
|-----|--|----|--|
| 1.1 | <u>Related Work</u>                    | .1 | Pile Driving Templates: Section 31 09 18   |
|     |  | .2 | Steel Pipe Piles: Section 31 62 26.  |
| 1.2 | <u>Submissions</u>                     | .1 | Methodology: provide methodology statement including type of pile driving equipment to carry out the Work.   |
|     |  | .2 | Provide submissions in accordance with Section 01 33 00.   |
| 1.3 | <u>References</u>                      | .1 | CSA W48.1-M1991(R1998), Carbon Steel covered Electrodes for Shielded Metal Arc Welding.  |
| 1.4 | <u>Existing Sub-Surface Conditions</u> | .1 | Record sub-surface investigation reports are available for inspection, upon request to Departmental Representative.  |
|     |  | .2 | Notify the Departmental Representative immediately if sub-surface conditions at site differ from those indicated.  |
|     |  | .3 | Design is based on subsurface information inferred from the surrounding site records. Pile installation details are based on this information. Have installation procedures reviewed by the Departmental Representative's geotechnical engineer to confirm conformance with design assumptions. Coordinate all work to facilitate the Departmental Representative's observations and review. |
| 1.5 | <u>Protection</u>                      | .1 | Protect public and construction personnel, adjacent structures and work of other sections from hazards due to pile driving operations or any other operations.   |
| 1.6 | <u>Scheduling Of Work</u>              | .1 | Submit schedule of planned sequence of pile driving to the Departmental Representative for review, not less than two (2) weeks prior to commencement of pile driving for structure.  |
| 1.7 | <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.
- 1.8 Inspection of Work
- .1 Coordinate pile installation procedures with the Departmental Representative's geotechnical engineer minimum two (2) weeks prior to the pile installation. The method of advancing the pile to bedrock, seating, and subsequent refusal criteria will reviewed and must be approved prior to starting work.
- .2 The Departmental Representative's geotechnical engineer will inspect the work during advancement of the piles to competent bedrock and coordinate with the contractor to determine a suitable depth to terminate the pile.
- .3 The pipe pile tip elevation and seating in competent bedrock and refusal must be approved by the Departmental Representative's geotechnical engineer prior cutoff.

## PART 2 - PRODUCTS

- 2.1 Materials
- .1 For material requirements refer to Section 31 62 26, Steel Pipe Piles.
- .2 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing.
- .3 Splicing of piles will not be permitted unless specifically agreed to by the Departmental Representative. When permitted, provide details for Departmental Representatives review. Design details of splice to bear dated signature stamp of a Professional engineer registered or licensed in the Province of Nova Scotia, 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 the 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 Pile driving System:

.1 Supply a pile driving system capable of mobilizing an ultimate geotechnical resistance of 2700 kN (each pile) in axial compression. The pile driving system selected will be of sufficient energy so as not to damage the piles. The minimum hammer energy used for finalizing the piles and for re-tapping them is 100kJ (73,826 ft-lb). The actual energy required to finalize the piles could vary depending on the performance of the pile driving system. The driving criteria for finalizing piles will be established in the field at the onset of the pile driving Work, as determined by the Contractor's Geotechnical engineer based on Pile Driving Analyzer tests that will be carried out by the Contractor. The final penetration per blow for each pile will be with a pile driving system compatible with the use of the pile driving analyzer to confirm the design pile capacities are obtained. Acceptance of the pile driving system chosen by the Contractor will be on confirmation of pile capacities as determined by the pile driving analyzer.

.2 When required penetration is not obtained by use of a pile driving system complying with minimum requirements, either provide a more powerful pile driving system or take other measures, acceptable to the 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 the 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. Have method reviewed by the Departmental Representative.

.4 Followers: 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 operation. Make provision for access and support of piling equipment during performance of work.
- .2 Provide notice of readiness to the Departmental Representative when the Work is ready for PDA tests to take place. Provide this notice at least 72 hours prior to testing taking place on Site. Provide assistance as required and access to the Work so the Departmental Representative's geotechnical engineer can conduct PDA testing.

3.3 Pile Driving Analyzer

- .1 The Contractor's geotechnical engineer will conduct testing using a Pile Driving Analyzer and Wave Equation Analysis to determine and confirm pile driving criteria such as adequacy of pile driving system and variation in impact, suitability of driving cap and cushions, and penetration resistance relative to set on at least three (3) piles at start-up of pile placement. Confirm criteria during pile installation by using Pile Driving Analyzer and Wave Equation Analysis on additional piles when requested by the Departmental Representative. Departmental Representative will select piles. Allow for at least 10% of production piles to be tested throughout construction using the PDA equipment. Supply of PDA testing equipment and PDA testing to be performed by the Contractor's geotechnical engineer.
- .2 Dynamic monitoring of the pile driving using the pile driving analyzer will form the basis of determining pile capacities and determining final penetration resistance in initial driving and in re-striking.
- .3 The dynamic monitoring consists of attaching strain transducers and accelerometers to the pile, usually close to the pile head, and connecting these to a monitoring station nearby by means of a cable. Contractor must take care to ensure that no damage is done to the transducers, cables, or equipment.

- 
- .4 Prepare the pile head as required by the Contractor's geotechnical engineer.
- 3.4 Field Quality Control And Field Measurement
- .1 Pile Driving Analyzer:  
.1 A Pile Driving Analyzer and Wave Equation Analysis will be used to determine and confirm driving criteria.  
.1 Work to be performed by geotechnical engineer registered or licensed in Province of Nova Scotia.
- .2 Prepare piles to be instrumented by drilling and tapping holes for installation of strain transducers and accelerometers, as directed by the Contractor's geotechnical engineer.
- .3 Provide assistance, as required, in instrumentation process during initial set-up and during test.
- .4 Make allowance for probable interruption in driving for:  
.1 Changing/modifying hammer, cap, cushions, or other equipment;  
.2 Replacing/adjusting of transducers and accelerometers;  
.3 Assessing of monitored results.
- .5 Replace/adjust hammer and modify cap, cushions, and other equipment, as deemed necessary.
- .6 Confirm that final set has been achieved, when instructed by re-striking instrumented piles as approved by the Departmental Representative.
- .7 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 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 of 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 the Departmental Representative with an electronic copy of records in PDF file format.

### 3.5 Driving

.1 Use driving caps to protect piles. Reinforce pile heads if necessary. Piles with damaged heads, as determined by Departmental Representative, will be rejected.

.2 Use steel drive shoes to protect pile toes during driving to the approval of the Departmental Representative.

.3 Hold piles securely and accurately in position while driving.

.4 Deliver hammer blows in direct axis of pile.

.5 Do not drive piles within a radius of 8 m of concrete which has been in place less than three (3) days.

.6 Re-drive piles lifted during driving of adjacent piles.

.7 Use of water jet:

.1 Use water jets only with written permission of the Departmental Representative.

.2 When water jets are permitted number of jets and volume and pressure of water must be sufficient to freely erode material immediately adjacent to pile. Plant must be capable of delivering water pressure of at least 690kPa as measured at two 20 mm nozzles.

.3 Restriction: stop jetting at a minimum of 1 m above tip elevation of piles previously driven within 2 m of jet, except where piles are to be carried to rock surface. Drive piles down beyond depth of jetting until required resistance is obtained. If there is evidence that jetting has disturbed load-bearing capacities of previously installed piles, restore bearing capacity of those piles by re-driving. Re-drive where necessary

after jetting operations in area have been completed.

- .8 Cut off piles neatly and either squarely or at an angle at elevations indicated. Provide sufficient length above cut-off elevation so that the part damaged during driving is cut off.
- .9 Remove cut-off lengths from site on completion of work.
- .10 Installation of each pile will be subject to acceptance by the Departmental Representative. Departmental Representative will be sole judge of acceptability of each pile with respect to final driving resistance and depth of penetration. Departmental Representative to accept final driving of all piles prior to removal of pile driving rig from site.
- .11 Drive each steel pipe pile to refusal in bedrock. Refusal criteria to be determined by the Contractor's geotechnical engineer, ensuring that specified ultimate geotechnical resistance in axial compression is achieved.
- .12 Batter piles are to be advanced to sound bedrock and seated using the minimum amount of energy required to achieve seating as required to support rock socket installation while maintaining the pile shape without damaging. Contractor is solely responsible for any damage and associated effects on rock socket installation, and must remedy any such damage to Departmental Representative's approval at no additional cost to project.

3.6 Driving Tolerances

- .1 Pile heads to be within 75mm of locations as indicated.
- .2 Piles not to be more than 1% of length out of vertical or specified batter alignment.

3.7 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 Contractor's 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.

3.8 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.

3.9 Penetration

- .1 Protect adjacent structures, services and work of other section from hazards due to pile driving operations.
- .2 Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at no additional cost to the Contract.

**END OF SECTION**

PART 1 - GENERAL

- |     |                            |    |   |
|-----|----------------------------|----|---|
| 1.1 | <u>Related Work</u>        | .1 | Section 31 09 18 - Pile Driving Templates.  |
|     |                            | .2 | Section 31 61 13 - Pile Foundations General   |
| 1.2 | <u>Reference Standards</u> | .1 | ASTM A123-15, Standard Specification for Zinc Hot-Dip Galvanized Coatings on Iron and Steel Products  |
|     |                            | .2 | ASTM A307-14, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.   |
|     |                            | .3 | CAN/CSA-G40.21-13, Structural Quality Steels.   |
|     |                            | .4 | CAN/CSA-080 Series-15, Wood Preservation.   |
|     |                            | .5 | CSA O56-10(R2015), Round Wood Piles   |
|     |                            | .6 | CSA W59-13, Welded Steel  |
|     |                            | .7 | NLGA standard grading rules for Canadian Lumber 2013.   |
| 1.3 | <u>Submissions</u>         | .1 | At least two (2) weeks prior to finalizing timber order, submit a schedule of pile lengths for review.  |
|     |                            | .2 | Submit methodology for field treatment.   |
|     |                            | .3 | Provide submissions in accordance with Section 01 33 00.  |
| 1.4 | <u>Protection</u>          | .1 | Avoid dropping, bruising or breaking of wood fibres.  |
|     |                            | .2 | Avoid breaking surfaces of treated piles.   |
|     |                            | .3 | Do not damage surfaces of treated piles below cut-off elevation by boring holes or driving nails or spikes into them to support temporary material or staging. Support staging in rope slings carried over tops of piles or by attaching to pile clamps of approved design. |
|     |                            | .4 | Treat cuts, breaks or abrasions on surfaces of treated piles, bolt holes and field cuts in accordance with CAN/CSA-080, using approved project or material.   |



- 1.5 Inspection .1 Have all timber piles inspected and accepted by Departmental Representative prior to being incorporated in the work.
- 1.6 Measurement for Payment .1 Consider shoes and cap plates incidental to installation of piles.
- .2 Supply of timber piling will be measured in accordance with Section 01 29 00.
- .3 Installation of timber piling will be measured in accordance with Section 01 29 00.
- .4 Mobilization and demobilization of equipment will be lump sum item in accordance with Section 01 29 00.
- .5 Base tender on number and lengths of piles indicated on the plan.
- .6 Adjustments in contract price due to changes in number and lengths of piles will be based on unit prices established in Contract.

PART 2 - PRODUCTS

- 2.1 Materials .1 Round Wood Piles: Red pine, with minimum butt size of 300 mm and tip diameter in accordance with Table A-1. Order length to suit conditions indicated. Departmental Representative shall be sole judge as to quality and dimension of piles and that they are in accordance with CSA-056.
- .2 Timber Treatment:  
.1 Preservative treatment to CAN/CSA-080 Series for Marine Construction Coastal Waters. Where assay retentions are not indicated, they are to be taken as 1.5 times the indicated gauge retention. Creosote preservative will not be permitted for fender piles.  
.2 Make arrangements for timber testing by:  
.1 Plant Inspection: Provide treatment plant identification, date of treatment, list of various pieces in the charge, charge number, plant assay testing results, concentration and type of preservative used, duration of treatment, gauge retention, species of wood; and make

arrangements with the treatment plant to locate bundles, move bundles, break open bundles and carry out other measures to facilitate the inspection.

.2 Field Inspection: Providing same information as above and facilitating the inspection in the field.

.3 Filling in and submitting a pre-printed form, agreed to by the Departmental Representative, containing the above information.

.3 The Departmental Representative may test in the plant or in the field or may choose to not test some charges at either the plant or the field.

.4 Timber will be protected during handling, shipping, offloading and field handling, by use of suitable equipment and procedures. Use rope or fabric strap slings on site for moving bundles or individual timbers, rather than metal grabs, chains or cables.

.5 Field treatment: P7 creosote.

.3 Miscellaneous Hardware: Hardware must meet the following specifications:

.1 Machine bolts, drift bolts, nuts, round plate washers: to ASTM A307

.2 Spikes: to CSA B111

.3 Pile shoes: fabricated from steel plate minimum 6 mm thickness. Steel plate to CSA-G40.21, Grade 300W. Welding to CSA W59. No galvanizing required.

.4 Hot dip galvanize bolts, nuts, washers and spikes to ASTM A123 with minimum zinc coating of 600 g/m<sup>2</sup>.

.5 All hardware to be hot-dipped galvanized unless otherwise shown on plans or specified.

## 2.2 Wood Preservation

.1 Treat wood piles with wood preservative treatment as specified.

## PART 3 - EXECUTION

### 3.1 Handling Timber

.1 Timber will be protected during handling, shipping, offloading and field handling, by use of suitable equipment and procedures. Use rope or fabric strap slings on site for moving bundles or individual timbers, rather than metal grabs, chains or cables.

3.2 Handling  
Treated Timber

- .1 Handle treated material to avoid damage causing alteration in original treatment.
- .2 Treat in field, spike holes, boreholes, plugged holes, cuts and any damage to treated material, using approved product or material, regardless of plant treatment type.
- .3 Provide methodology pertaining application of field treatment. Apply to dry surfaces, wherever possible.
- .4 Treat boreholes, using a pressurized container with an extension rod, to produce a fine spray in the holes with one application. Alternately a cylindrical brush may be used.
- .5 Treat field cuts and any abrasions with minimum of two liberal applications, using either spray or brush.
- .6 Environmental Concern: allow for no spillage or excess application of field preservative. Provide workmen with sufficient training and protective gear to properly and safely handle the treated materials and to apply field treatment, so as to prevent undue hazard to themselves, others, or the environment.
- .7 Contain all debris and leachates (films on water surface) within the area of the work by using containment facilities such as floating booms or screens.

3.3 Preparation

- .1 Protect pile heads during driving and hold in position by using a combination cushion-driving head and pilot. Closely fit driving heads to top of pile, and extend down sides of pile for at least 75 mm. Where necessary protect pile heads by means of heavy steel straps of wrought iron rings.

3.4 Installation

- .1 Install piles in accordance with Section 31 61 13.
- .2 During driving restrain lateral movement of piling at intervals not exceeding 6 m over length between ground surface and driving head.

.3 Cut off fender piles giving a bevel of 4H:1V.

**END OF SECTION**

PART 1 - GENERAL

- |     |                                    |    |  |
|-----|------------------------------------|----|--|
| 1.1 | <u>Related Work</u>                | .1 | Section 31 09 18 - Pile Driving Templates.   |
|     |                                    | .2 | Section 31 61 13 - Pile Foundations General  |
| 1.2 | <u>References</u>                  | .1 | API 5L-2009, Line Pipe (American Petroleum Institute).   |
|     |                                    | .2 | ASTM A252-10, Welded and Seamless Steel Pipe Piles.  |
|     |                                    | .3 | CGSB 1-GP-171M-79 (amended 1982 - or latest edition), Coating, Inorganic Zinc.   |
|     |                                    | .4 | CAN/CSA-G40.21-13, Structural Quality Steels.  |
|     |                                    | .5 | CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.   |
|     |                                    | .6 | CSA W59-13, Welded Steel Construction (Metal Arc Welding).   |
|     |                                    | .7 | CSA-Z245.1-14, Steel Line Pipe.  |
| 1.3 | <u>Transportation and Delivery</u> | .1 | Upon arrival at the site promptly inspect pipe piles and give written report to Departmental Representative on condition of all piles received. Mark pipe piles in accordance with Clause 2.1.2.3 of this section. |
| 1.4 | <u>Measurement for Payment</u>     | .1 | Supply of steel pipe piles will be measured in accordance with Section 01 29 00 and will include all incidental costs for handling, testing, marking and transportation of pipe piles from supplier to site.       |
|     |                                    | .2 | Installation of steel pipe piles will be measured in accordance with Section 01 29 00.   |
|     |                                    | .3 | Consider pile shoes and caps as incidental to supply of piles.   |
|     |                                    | .4 | Mobilization of equipment will be considered incidental to installation of piles.  |
|     |                                    | .5 | Churn drilling or any other methods employed to reach specified tip elevation will be incidental to work.  |

- 1.5 Quality Assurance
- .1 Inspection and testing of steel piling material may be carried out by a testing laboratory designated by Departmental Representative at any time during course of work. When undertaken by Departmental Representative, inspection and testing of pipe pile materials will in accordance with ASTM A252.
  - .2 Materials inspected or tested by Departmental Representative which fail to meet contract requirements will be rejected.
  - .3 Materials failing to meet contract requirements may be rejected at any time in course of work.
  - .4 Where tests or inspections by designated testing laboratory reveal that the pipe pile material fails to meet the specified requirements, cover all costs associated with this inspection and/or testing. Pay costs for any additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.
- 1.6 Shop Drawings
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submissions/Shop Drawings.
  - .2 Indicate the following items:
    - .1 Steel driving shoe details.
    - .2 Pile cap details.

## PART 2 - PRODUCTS

- 2.1 Materials
- .1 Steel pipe: butt-straight longitudinal seam or spiral butt, plain cut ends to API 5L and ASTM A252, grade 3.
  - .2 Pipe material to have following minimum properties:
    - .1 Yield strength: 310 MPa.
    - .2 Tensile strength: 455 MPa.
    - .3 Each length of pile will be marked at the supplier either by stencilling or other means to show manufacturer's name, heat number, kind of pipe, size, weight, length, wall thickness, specification number and grade. Pipe pile material not marked in this way will be rejected.
  - .3 Pipe chemical composition: to CAN/CSA-Z245.1 and ASTM A252, grade 3.

- .4 Pipe allowable tolerances:
  - .1 Deviation from straight line, specified diameter, wall thickness and out-of-roundness on body of pipe and at pipe ends to conform to API 5L. Pipe to be checked for deviations before leaving supplier.
- .5 Piles conforming to ASTM A252 specifications must also meet the following provisions:
  - .1 Conduct flattening tests for ductility according to the procedure and frequency stipulated in CSA Z245.1.
  - .2 Unless spiral or longitudinal welds are certified as conforming to the requirements of ASTM A53, CSA Z245.1 or API 5L-1088 to the satisfaction of the Departmental Representative, at no additional expense to the Contract, have welds 100 percent inspected by an independent third party inspection firm according to CSA W59, Clause 11, with the exception that the outside weld will be 100% visually inspected and the inside weld will be visually inspected as far into the end of the pile as is physically possible. Provide reports to the Departmental Representative.
  - .3 At no additional expense to the Contract, have radiographic inspection performed by an independent third party inspection firm according to CSA W59, Clause 11, and provide certification to the Departmental Representative with a minimum of two (2) shots per pile. Each radiographic shot must be a minimum length of 100mm with one (1) shot at or near each end of each length of pile.
- .6 Pile driving shoes: to CAN/CSA-G40.21, Grade 350 WT, open ring type, with same internal diameter as pipe piles.
- .7 Steel pile caps: to CAN/CSA-G40.21, Grade 350W.
- .8 Welding electrodes: to CSA W48 series.

### PART 3 - EXECUTION

#### 3.1 Fabrication

- .1 Fabricate full length piles to eliminate splicing during installation wherever possible. Splicing during installation shall not be done without written permission of Departmental Representative.

- .2 If permitted, only one splice per pile will be considered and it must be located on sections of the pile that will be buried below the mudline. All welds to be full penetration butt welds with backing plate, to the Departmental Representative's approval.
- .3 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.
- .4 Allowable tolerance on axial alignment to be 0.25% as measured by a 3m straight edge.
- .5 Allowable deviation from straight line over total length of fabricated pile to conform to the applicable CSA standard.
- .6 Install pile shoes in accordance with the manufacturer's details, as required and as reviewed on shop drawings.
- .7 Repair defective welds only on authority of Departmental Representative. Welds which show evidence of having been repaired without authorization may be rejected. Make repairs in accordance with CSA W59 and CSA W59S1.
- .8 All pipe pile splices, if permitted, to be full penetration butt welds.

### 3.2 Installation

- .1 Install piling in accordance with Section 31 61 13 - Pile Foundations, General
- .2 Driving shoes may be installed during shop fabrication or as part of field work.
- .3 Drive steel bearing piles to the specified refusal criteria, pile penetration into bedrock, and Ultimate Capacity of 2700kN (factored capacity of 1350kN which includes a geotechnical resistance factor of 0.50).
- .4 Drive steel batter piles to bedrock and seat as required to facilitate rock socket installation.
- .5 If approved by Departmental Representative, splice piles in place by welding. To prevent



distortion, tack opposite points first and then weld opposite sections, weld against a backup ring. Hold member in alignment during splicing operation. Make splice by complete penetration groove welds only and to details of reviewed shop drawings stamped by a Professional Engineer registered to practice in the province of Nova Scotia.

- .6 Submit full details of method and sequence of installation of piling to the Departmental Representative for review prior to start of pile installation work. Details must include templates, bracing, handling, setting, and driving sequence.

### 3.3 Obstructions

- .1 If obstruction is encountered during driving, advise the Departmental Representative immediately and submit proposed remedial measures for review. Incorporate review comments into proposed work, but do not complete associated work until authorized by Departmental Representative in writing.

### 3.4 Control of Refusal

- .1 Confirm refusal has been achieved, when instructed by re-striking instrumented piles as approved by the Departmental Representative.

### 3.5 Welding

- .1 Weld in accordance with CSA W59 and CSA W59S1.
- .2 Welding certification of companies shall be in accordance with CSA W47.1 and CSA W47.1S1.

### 3.6 Cutting

- .1 When flame cutting tops of piles, and flame cutting holes approved by the Departmental Representative, use the following procedure:
  - .1 When air temperature is above 0 degrees C, no pre-heat is necessary.
  - .2 When air temperature is below zero degrees C, pre-heat until steel 25mm on each side of line of cut has reached a temperature of 35 degrees C. Temperature indicating crayon marks may be used to measure temperature.
  - .3 Use a torch guiding device to ensure smooth round holes and 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 5mm.

**END OF SECTION**

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 31 61 13: Pile Foundations General
  - .2 Section 31 62 26: Steel Pipe Piles
- 1.2 Measurement Procedures
- .1 Sockets for batter piles will be measured in accordance with Section 01 29 00. The following items will be considered incidental to the work and will not be measured separately:
    - .1 Removal of material from interior of pipe piles by number of piles.
    - .2 Drilling of sockets, socket clean-out, sounding and pile re-driving.
    - .3 Anchors and spacers for rock sockets acceptably placed and remaining in completed Work.
    - .4 Supply and installation of grout or concrete.
    - .5 Sounding and diver inspection.
    - .6 Pile shoes are incidental to the supply of pipe piles.
- 1.3 References
- .1 American Society for Testing and Materials International (ASTM)
    - .1 ASTM A252-2010, Standard Specification for Welded and Seamless Steel Pipe Piles.
  - .2 Canadian Standards Association (CSA International)
    - .1 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel Structures.
    - .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
    - .3 CAN/CSA-G30.18-09(R2014), Billet-Steel Bars for Concrete Reinforcement.
    - .4 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
- 1.4 Submittals
- .1 Provide submittals in accordance with Section 01 33 00 - Submissions/Shop Drawing.
  - .2 Product data: submit manufacturer's printed product literature, specifications and datasheet.
  - .3 Shop Drawings:
    - .1 Indicate: reinforcing.
    - .2 Submit each drawing complete with signature and stamp of qualified professional engineer registered or licensed in Province of Nova

Scotia, Canada.

- .4 Quality assurance submittals:
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 Instructions: submit manufacturer's installation instructions.
  - .3 Submit for review by Departmental Representative three copies of pile driving records as described in PART 3 - FIELD QUALITY CONTROL.
  - .4 Equipment lists: submit to Departmental Representative, list of equipment for installation of anchor dowels before beginning work.
    - .1 Provide details sufficient to evaluate performance of equipment.
    - .2 Include details of equipment for excavating, drilling, cleaning out piles and rock sockets, installation of anchor dowels and grouting of sockets.
  - .5 Submit to Departmental Representative for approval a list of equipment for installation of anchor dowels before commencing work. Provide sufficient details to evaluate performance of equipment. Include details of equipment for excavating, drilling, cleaning out of piles and rock sockets, installation of anchor dowels and grouting of rock sockets.

- 1.5 Waste Management and Disposal
  - .1 Separate waste materials for reuse and recycling.
  - .2 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
  - .3 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.

## PART 2 - PRODUCTS

- 2.1 Materials
  - .1 Grout: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
  - .2 Anchor dowels: as indicated, additional material such as spacers, spiders, and guides to install

and hold anchor dowels in location during grouting as required and reviewed by the Departmental Representative.

PART 3 - EXECUTION

- |     |  |    |   |
|-----|--|----|---|
| 3.1 | <u>Manufacturer's Instructions</u>     | .1 | Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets. |
| 3.2 | <u>Preparation/<br/>Pile Clean-Out</u> | .1 | After pile is driven to bedrock, remove overburden inside pile down to tip of pile.   |
|     |  | .2 | Clean out material adhering to inside surface of pile by high pressure water jets and airlifts.   |
|     |  | .3 | Protect open piles from intrusion of foreign materials.   |
| 3.3 | <u>Installation<br/>of Sockets</u>     | .1 | Secure equipment in position during drilling.   |
|     |  | .2 | Drill sockets into sound bedrock as indicated.  |
|     |  | .3 | Departmental Representative to determine elevation of top of sound rock and depth of socket required.   |
|     |  | .4 | Drill socket to minimum depth as indicated.   |
|     |  | .5 | After drilling is completed, clean out socket.  |
|     |  | .6 | After socket has been cleaned out and inspected, allow to stand for 24 h and inspect again for intrusion of material.   |
|     |  | .1 | Re-drive pile, as required to seal socket and repeat drilling, cleaning out and inspection process.   |
| 3.4 | <u>Installation/<br/>Anchor Dowel</u>  | .1 | Install fabricated anchor dowels in drilled socket and in pile.   |
|     |  | .2 | Locate relative to pile tip as indicated.   |
|     |  | .3 | Use locating devices for centering anchor dowels in pile and rock socket.   |
| 3.5 | <u>Welding</u>                         | .1 | Weld in accordance with CSA W59.  |
|     |  | .2 | Welding certification of companies in accordance with CSA W47.1.  |

- 3.6 Grouting
- .1 Grout in accordance with Section 03 30 00 - Cast-in-Place Concrete.
  - .2 Grout anchor dowels, in drilled socket and up to elevation as indicated, as soon as possible after installing anchor dowels.
  - .3 Use grout mix that has been demonstrated to produce required strength at temperature prevailing in socket and pile in specified time.
    - .1 Grout mix and grouting pressure to approval of Departmental Representative.
  - .4 Hold pile securely in position so that it does not move during grouting and until grout has attained specified strength.
  - .5 Place grout in one continuous operation to fill socket up to specified level.
- 3.7 Field Quality Control
- .1 Site Tests and Inspection:
    - .1 Provide method and equipment for inspection of each pile to ensure that pile and socket are properly cleaned out.
    - .2 Co-operate with and assist Departmental Representative to inspect each pile and socket.
- 3.8 Cleaning
- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
  - .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**