PART 1 – GENERAL

1.1 Related Work

.1 Refer to other Specifications Sections for related information.

.2 Refer to **Section 01 33 00** for Shop Drawing/Submissions requirements.

1.2 References

.1 ASTM A252-10 (or latest edition), Specification for Welded and Seamless Steel Pipe Piles.

.2 ASTM A307-14 (or latest edition), Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.3 ASTM F3125/F3125M-15 (of latest edition), Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

.4 CAN/CSA-G40.20-13 (or latest edition), General Requirements for Rolled or Welded Structural Quality Steel.

.5 CAN/CSA-G40.21-13 (or latest edition), Structural Quality Steel.

.6 CAN/CSA-S16.1-14 (or latest edition), Design of Steel Structures.

.7 CSA W47.1-09 (R2014) (or latest edition), Certification of Companies for Fusion Welding of Steel.

.8 CSA W48-14 (or latest edition), Filler Metals and Allied Materials for metal Arc Welding.

.9 CSA W59-13 (or latest edition), Welded Steel Construction (Metal Arc Welding).

.10 CGSB 1-GP-171M-98 (or latest edition), Inorganic Zinc Coating.

1.3 Shop Drawings

.1 Submit shop drawings in accordance with **Section 01 33 00** - Submissions/Shop Drawings.

.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

.3 Shop drawings to bear dated signature stamp of a Professional Engineer registered or licensed in the Province of Nova Scotia, Canada.

1.4 Design Criteria

.1 Design templates to safely withstand following loads:

.1 All gravity loads to which template shall be subjected.
.2 Lateral loads to firmly hold pile in position when driving.

1.5 Protection

.1 Protect templates from damage. Repair damage to templates, formwork or concrete 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. Include costs in items of work that require templates.

PART 2 - PRODUCTS

2.1 Materials

.1 Steel sections and plates: to CAN/CSA-G40.20 and CAN/CSA-G40.21, Type 350 W.

.2 Welding Materials: to CSA W59.

.3 Bolts, nuts and washers: to ASTM A307 or ASTM F3125/F3125M.

PART 3 - EXECUTION

3.1 Fabrication

.1 Fabricate structural steel for templates in accordance with CAN/CSA-S16.1 and reviewed 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.

3.3 Removal of Templates

.1 Avoid any damage to piling when removing templates.

.2 When instructed by *Departmental Representative* move templates from project site.

PART 1 - GENERAL

1.1 Description of Work

This Section includes but is not limited to the the following:

.1 All normal removals as required to complete the work. All items to be verified by a site visit prior to submission of a tender. All available plans of the existing structure are available for viewing upon request to the Departmental Representative.

1.2 Related Work

.1 Refer to other specification sections for related information.

.2 Refer to **Section 01 33 00** for Shop Drawing/Submission requirements.

1.3 Submissions

.1 Methodology:
.1 When requested provide methodology for carrying out the work

.2 Provide submission in accordance with **Section 01 33 00.**

1.4 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*.

1.5 Measurement for Payment

.1 Site work, 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 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 Existing fill and vent pipes, oil waste tanks and underground storage tanks to be protected from any damages. All repairs to damages as a result of Contractor's operations to be at his cost and to the satisfaction of the *Departmental Representative*.

3.2 Removal

.1 Remove items indicated.

.2 Do not disturb adjacent structures designated to remain in place.

.3 At end of each day's work, leave work in safe condition so no part is in danger of toppling or falling.

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 The material to be disposed is to be transported and disposed of 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.

PART 1 - GENERAL

1.1 Related Work

.1 Refer to other Specification Section for related information.

.2 Refer to **Section 01 33 00** for Shop Drawings/Submissions requirements.

1.2 Submissions

.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 References

.1 CSA W48-14, Welding and Structural Metals.

1.4 Existing Sub-Surface Conditions

.1 Sub-surface investigation reports may be available for inspection. Available reports will be provided for review 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. Installation must be reviewed by the Departmental Representative to confirm design assumptions and final acceptance criteria. Coordinate all work to facilitate the Departmental Representative’s observations and review.

1.5 Protection

.1 Protect public and construction personnel, adjacent structures and work of other sections from hazards attributes to pile driving operations or any other operations.

1.6 Scheduling of Work

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

1.7 Inspection of Work

.1 Pile Installation procedures are to be coordinated with the Departmental Representative minimum two (2) weeks prior to the pile installation. The method of advancing pile to specified tip elevation and penetration into competent bedrock must be reviewed and approved by the Departmental Representative prior to starting work.

.2 The Departmental Representative will review Work during the advancement of piles. Contractor to provide access and assistance as required to facilitate the review. Pile tip elevation and driving records must be reviewed by the Departmental Representative prior to acceptance, pile cut-off, and subsequent demobilization from site.

1.7 Measurement for Payment

.1 This item will not be measured separately.

PART 2 - PRODUCTS

2.1 Materials

.1 For material requirements refer to related specification sections.
.1 Section 31 62 26 – Steel Pipe Piles

.2 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing.

.3 Pile lengths indicated are based on lengths estimated to remain in completed structure.

.4 Splicing of piles will not be permitted unless specifically agreed to by the Departmental Representative. If permitted, provide details for Departmental Representatives review. Deign details of splice to bear dated signature stamp of

a Professional Engineer registered or licensed in the Province of Nova Scotia, Canada.

.5 Welding materials: to CSA W48.1.

PART 3 - EXECUTION

3.1 Equipment Requirements

.1 Equipment information:

.1 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 Installation Equipment and Methods:

.1 Examine all available site information and record geotechnical data. Select appropriate equipment to advance the piles to specified tip elevation and minimum penetration into rock without damage to piles.

.2 Detailed procedures and methods of the proposed installation methods shall be submitted to the Departmental Representative for approval prior to pile installation. Approval of the equipment and installation methods selected by the Contractor will be on confirmation of reaching required pile tip elevation, as determined by the Departmental Representative.

.3 When the required penetration is not obtained, provide alternate equipment and measures acceptable to the Departmental Representative to achieve required tip elevations. All piles damaged during installation to be replaced at no additional cost to the

Contract. Reinforce pile tip and head as required to resist driving forces.

.4 Pile installation methods shall minimize removal of soil surrounding the piles to maintain lateral soil support and shall ensure piles are installed to the design tip elevations and minimum penetrations into rock without damage or deformation to the pile cross section.

.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 approved by *Departmental Representative*, to ensure support to pile while being driven.

.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 Ensure that conditions at pile locations are adequate to support pile driving operation. Make provision for access and support of piling equipment during performance of work.

3.3 Field Measurement

.1 Maintain accurate records of driving / installation for each pile, including:

.1 Type and make of installation equipment. If driven installation, include hammer, stroke or related energy. If drilled installation, include bit, fittings, preparations and any other pertinent information.

.2 Other driving equipment including water jet, driving cap, cushion.

.3 Pile size, length and location.

.4 Sequence of driving piles.

.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 during driving of each pile.
.9 Any other pertinent information required to confirm final tip elevation and penetration into bedrock.

.2 Provide *Departmental Representative* with three copies of records.

3.4 Driving

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

.2 Use steel driving 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 3 days.

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

.7 Use of water jets will not be permitted.

.8 Cut off piles neatly and squarely at elevations indicated. Provide sufficient length above cut-off elevation so that 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 *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 pile cut-off or removal of pile driving equipment from site.

.11 Shape bottom of pile so that shoe will have full bearing on pile prior to driving.

.12 Drive each pile to minimum penetration into competent bedrock as indicated on the drawings, or as determined by the *Departmental Representative*.

3.5 Driving Tolerances

.1 Pile heads to be within 50 mm of locations indicated.

.2 Piles not to be more than 2% of length out of alignment.

.3 Confirm alignment of pile(s) does not restrict movement of floating wharf and gangway at full tidal range.

3.6 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.

PART 1 - GENERAL

1.1 Related Work

.1 Refer to other Specification Sections for related information.

1.2 References

.1 API 5L-2012 (or latest edition), Specification for Line Pipe (American Petroleum Institute).

.2 ASTM A252-10 (or latest edition), Standard Specification for Welded and Seamless Steel Pipe Piles.

.3 CAN/CSA-G40.20-13/G40.21-13 (or latest edition), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.

.4 CSA W47.1-09 (R2014) (or latest edition), Certification of Companies for Fusion Welding of Steel.

.5 CSA W59-13 (or latest edition), Welded Steel Construction (Metal Arc Welding).

.6 CSA-Z245.1-14 (or latest edition), Steel Pipe.

1.3 Transportation and Delivery

.1 Upon arrival at the site promptly inspect pipe piles and give written report to *Departmental Representative* on condition of all piles received. Ensure pipe piles are properly marked in accordance with **Clause 2.1.2.3** of this section.

1.4 Measurement for Payment

.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 and minimum penetration into competent bedrock 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, the Contractor shall be responsible for all costs associated with this inspection and/or testing. The Contractor shall 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.
- .3 Reinforcement details, if required, to prevent damage during installation.

PART 2 - PRODUCTS

2.1 Materials

.1 Steel pipe: seamless or straight longitudinal seam, of sizes and wall thicknesses indicated, plain cut ends to API 5L and ASTM A252 Grade 3 (Mod). Spiral weld pipe will not be accepted.

.2 Pipe material to have following minimum properties:
- .1 Yield strength: 345 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 (Mod).

.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 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 Pile caps: to CAN/CSA-G40.21, Gr. 350W.

.8 Welding electrodes: to CSA W48 series.

PART 3 - EXECUTION

3.1 Fabrication

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

.2 If permitted, maximum of 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, and must develop the full strength of the pile section.

.2 Submit details of planned use of pile material stock to *Departmental Representative* for approval prior to start of fabrication. Re-use cut-off lengths as directed by *Departmental Representative*.

.3 Allowable tolerance on axial alignment to be 0.25% as measured by a 3m straight edge.

.4 Allowable deviation from straight line over total length of fabricated pile to conform to the applicable CSA standard.

.5 Install pile shoes and caps in accordance with the manufacturer's details, as required and as reviewed on shop drawings.

.6 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.

.7 All pipe pile splices, if permitted, to be full penetration butt welds to details of reviewed shop drawings stamped by a Professional Engineer registered to practice in the province of Nova Scotia.

.8 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.

3.2 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 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.

3.3 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.

3.4 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.