

PART 1 - GENERAL

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| 1.1 | <u>Related Work</u> | .1 | Section 31 23 33 - Excavating, Trenching and Backfilling. |
| 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

2.1 Materials

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances.
- .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

- 1.1 Related Work
 - .1 Section 31 61 13 - Pile Foundations - General.
 - .2 Section 31 61 26 - Steel Pipe Piles
- 1.2 References
 - .1 ASTM A252-2010, Specification for Welded and Seamless Steel Pipe Piles.
 - .2 ASTM A307-14, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .3 ASTM F3125-15a, Standard Specification for High Strength Steel Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi, Min. Tensile Strength.
 - .4 ASTM A490M-14A, Specification for High-Strength Steel Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
 - .5 CAN/CSA-G40.20-13, General Requirements for Rolled or Welded Structural Quality Steel.
 - .6 CAN/CSA-G40.21-13, Structural Quality Steels.
 - .7 CAN/CSA-S16-14, Design of Steel Structures.
 - .8 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.
 - .9 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .10 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- 1.3 Shop Drawings
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submissions/Shop Drawings, stamped by professional engineer registered to practice in New Brunswick.
 - .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 Design Criteria
 - .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 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 300 W, minimum.
 - .2 Welding Materials: to CSA W59.
 - .3 Bolts, nuts and washers: to ASTM F3125.

PART 3 - EXECUTION

- 3.1 Fabrication
 - .1 Fabricate structural steel for templates in accordance with CAN/CSA-S16 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 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 "Removable".
- 3.4 Removal of Templates .1 Avoid any damage to piling when removing templates.
- .2 When instructed by Departmental Representative move templates from project site.

END OF SECTION

PART 1 - GENERAL

- 1.1 Description of the Work
- .1 This Section includes but is not limited to 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 by contacting the Project Manager.
 - .2 Any derricks, gas lines or buildings to be removed by others unless otherwise indicated.
 - .3 Excavation and removal of all materials within the defined limits to the lines and grades as indicated on the project drawings.
 - .4 Removal and disposal off-site of assorted excavated materials within the defined excavation/removals limits that do not meet the contract specifications.
 - .5 Removal, salvage and reinstatement existing rubber tire and rubber D-fenders.
 - .6 Salvage excavated rock material within the defined excavation /removal limits that meet the Contract specifications, and incorporated in new work, upon approval by the Departmental Representative. Dispose of all other rock material excavated within the defined excavation/removal limits that do not meet Contract specifications. Removal and dispose off-site all other debris.
- 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 Repair damage to existing structures, roadways, pipelines, electrical systems not specified for removal at the no additional cost to the Contract and the satisfaction of the Departmental Representative.
- .4 Provide marine environmental protection in accordance with Section 01 35 44. Install and maintain environmental protection measures in accordance with Section 31 15 53.

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 - 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 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 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 Transport and disposed 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

PART 1 - GENERAL

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| 1.1 <u>General</u> | .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 Consultant. Do not remove control features until authorized by the Departmental Representative. |
| | .2 Do erosion control in accordance with approved Environmental Protection Plan. |

PART 2 - PRODUCTS

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| 2.1 Sediment Control
<u>Fence</u> | .1 Sediment Control fence: preassembled sediment control fence with industrial woven geotextile fabric pre-stapled to wood posts spaced as indicated.
.1 Acceptable product; Terrafence by Terrafix, or approved equivalent. |
| 2.2 <u>Silt Curtain</u> | .1 High strength woven geotextile, UV protected, floating boom.
.2 Acceptable product: Terrafix 400W, or approved equivalent. |
| 2.3 <u>Oil Boom</u> | .1 UV resistant, vinyl coated polyester or nylon, ballasted minimum 300m submerged.
.1 Acceptable product: Oil Containment Boom by Boom Environmental Products, or approved equivalent. |

PART 3 - EXECUTION

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| 3.1 Temporary Soil
<u>Covers</u> | .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
<u>Fence</u> | .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.

3.4 Removal of Silt
and Sediment
Control Features

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

END OF SECTION

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/m³).
 - .5 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m³).
 - .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 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ 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.

- .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.
- .3 Provide the Departmental Representative a temporary shoring plan for approval. Plan must be stamped and signed by a professional engineer licensed to practice in the Province of New Brunswick.

.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 New Brunswick, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified professional engineer who is registered or licensed in Province of New Brunswick, 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.
- 1.5 Existing Conditions
 - .1 Soil sampling has been carried out at the Site. Dillon Consulting Limited Report #16-4652 dated December 14, 2016 is attached as Appendix A herein. The Departmental Representative assumes no liability for the content of the report and any interpretation or extrapolation of its findings are at the sole discretion of the Contractor.
 - .2 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.
 - .3 Existing buildings and surface features:
 - .1 Conduct condition survey of existing

buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

- .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by the Departmental Representative at no additional cost.
- .4 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 item 201 of the Province of New Brunswick's Department of Transportation Standard Specifications, Metric Edition.
- .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/m³ 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.
- .3 150 minus: crushed and screened, hard, durable stone free from clay and organic matter and graded as follows:

<u>Sieve Designation (mm)</u>	<u>% Passing</u>
200	100
150	90-100
112	20-35
80	0-20
20	0-10

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.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

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.
- .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,

- .1 Maintain sides and slopes of excavations in safe

Shoring, Bracing
and Underpinning

condition by appropriate methods and in accordance with Health and Safety Act for the Province of New Brunswick.

- .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.
- .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. All existing tie rod anchorages for existing wharf to be maintained. Install temporary shoring as required to ensure stability of existing wharf structure at all times.
- .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. Existing soil test results found in Appendix A.
 - .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 Exterior side of perimeter 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 concrete walks and asphalt 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.
- .2 Replace topsoil as directed by Departmental Representative.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

PART 1 - GENERAL

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| 1.1 | <u>Related Work</u> | .1 | Section 31 23 33 - Excavating and Backfilling. |
| 1.2 | <u>References</u> | .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 | <u>Mill Certificates</u> | .1 | At least two (2) weeks prior to start of work, furnish Departmental Representative with copies of mill test data and certificate that filter fabric delivered to job site meets requirements of this section. |
| 1.4 | <u>Approval</u> | .1 | Obtain written approval of Departmental Representative for filter fabric before installation of material in work. |
| 1.5 | <u>Measurement for Payment</u> | .1 | Filter fabric will be measured in accordance with Section 01 29 00. |

PART 2 - PRODUCTS

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| 2.1 | <u>Materials</u> | .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 = 2×10^{-1} cm sec.

PART 3 - EXECUTION

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|------------------------------|----|--|
| 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

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|-----|--|----|---|
| 1.1 | <u>Related Work</u> | .1 | Pile Driving Templates: Section 31 09 18 |
| | | .2 | Steel Sheet Piles: Section 31 62 00. |
| 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 | Notify the Departmental Representative immediately if subsurface conditions at site differ from those indicated. |
| | | .2 | Should pre-existing oily waste be encountered as a result of pile driving and or other construction related activities, inform the Consultant immediately. The Departmental Representative, along with the Contractor will determine the methodology required to remediate the spill and a determination of additional compensation will made at that time. |
| 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.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing. Supply or fabricate full length piles.
 - .2 Do not splice piles without written permission of the Departmental Representative. When permitted, provide details for the Departmental Representative's review. Design details of splice to bear dated signature stamp of professional engineer registered or licensed in the Province of New Brunswick, Canada.
 - .3 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 advancing pile tips to practical refusal on bedrock seating piles a minimum of 300mm into bedrock. The pile driving system selected will be of sufficient energy so as not to damage the piles. 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 piling inspector in conjunction with the Departmental Representative.
 - .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.

- 3.3 Field Quality Control and Field Measurement
 - .1 Measurement:
 - .1 Maintain accurate records of driving for each pile, including:
 - .1 Type and make of hammer, stroke or related energy.
 - .2 Other driving equipment including driving cap and cushion.
 - .3 Pile size and length, location of pile in pile group, location or designation of pile group.
 - .4 Sequence of driving piles in group.
 - .5 Number of blows per metre for entire length of pile and number 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.

3.4 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 Water jetting is not permitted.
- .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. The Departmental Representative will be sole judge of acceptability of each pile with respect to final driving resistance and depth of penetration. The Departmental Representative will accept final driving of all piles prior to removal of pile driving rig from site.

- 3.5 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.

- 3.6 Obstructions
- .1 Remove all obstructions from the surface prior to installing piles and install piles to the specified depth and/or pile resistance.
 - .2 Where an obstruction is encountered that causes sudden and unexpected change in penetration resistance or deviation from specified tolerances, advise the Departmental Representative and submit for their review the 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.
- 3.7 Damaged or Defective Piles
- .1 Remove rejected pile and replace with a new and if necessary, a longer pile.
 - .2 No extra compensation will be made for removing and replacing or other work made necessary through rejection of a defective pile.
- 3.8 Penetration
- .1 Protect adjacent structures, services and work of other section from hazards due to pile driving operations.
 - .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 Description .1 This section specifies the requirements for the installation of supply and install of Z section hot rolled steel sheet piles. Supply and install sheet pile cutting shoes and other hardware.
- 1.2 References .1 American Society for Testing and Materials International, (ASTM):
.1 ASTM A6/A6M-16, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
.2 ASTM A572/A572M-15, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
.3 ASTM A1011/A1011M-15, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
.4 ASTM A328/A328M-13, Standard Specification for Steel Sheet Piling.
.2 American Welding Society:
.1 AWS D1.1:2015, Structural Welding Code - Steel, Includes Errata.
.3 Canadian Standards Association (CSA International).
.1 CSA G40.20/G40.21-2013, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA W59-2013, Welded Steel Construction (Metal Arc Welding).
.3 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel.
- 1.3 Related Sections .1 Pile Foundations - General: Section 31 61 13
.2 Pile Driving Templates: Section 31 09 18
- 1.4 Submittals .1 Submit a shop drawing showing the welding and details of the SSP cutting shoes.
.2 Submit shop drawings for the following items:
.1 Splice details and additional connector plates as per the Project Drawings.

- .2 Wale systems, including all connectors and hardware.
- 1.5 Existing Sub-
Surface Conditions
 - .1 Notify the Departmental Representative immediately if subsurface conditions at site differ from those indicated.
 - .2 Should pre-existing oily waste be encountered as a result of pile driving and or other construction related activities, inform the Departmental Representative immediately. The Departmental Representative, along with the Contractor will determine the methodology required to remediate the spill and a determination of additional compensation will made at that time.
- 1.6 Protection
 - .1 Protect public and construction personnel, adjacent structures and work of other sections from hazards due to pile driving operations or any other operations.
- 1.7 Quality Assurance
 - .1 Inspection and testing of piling material may be carried out by testing laboratory designated by Departmental Representative at any time during course of Work.
 - .2 Materials inspected or tested by the Departmental Representative which fail to meet specified requirements will be rejected.
 - .3 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, Supplier to pay costs for additional tests or inspections. Departmental Representative to approve corrected Work.
 - .4 Conduct all shop welding in accordance with CSA W59, AWS D1.1 or other equivalent international standard. Use welders certified to CSA W47.1 or other equivalent international standard.
- 1.8 Delivery, Storage
and Handling
 - .1 Use slings for lifting piling so that mass is evenly distributed and piling is not subjected to excessive bending stresses.
 - .2 Store sheet piling on level ground or provide supports so that sheet piling is level when stored.
 - .1 Provide blocking at spacing not exceeding 5 m

so that there is no excessive sagging in piling.

- .2 Overhang at ends not to exceed 0.5 m.
- .3 Block between lifts directly above blocking in lower lift.
- .4 Do not allow stored piling sections to be in contact with the ground.

- .3 If material is stockpiled on structure, do not overload structure.

1.9 Waste Management and Disposal

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

PART 2 - PRODUCT

2.1 Steel Sheet Piles

- .1 Steel sheet piles: to ASTM A572, Grade 55 and as specified below (380 MPa).
- .2 Continuous interlocking Z section consisting of the following minimum section properties:
 - .1 Minimum effective elastic section modulus of 4955 cm³ per metre of wall.
 - .2 Minimum flange thickness of Z section of 23.0mm.
 - .3 Minimum web thickness of Z section of 16.0mm
 - .4 System width of 1400mm per steel sheet pile pair.
 - .5 Z Sections to be delivered to site assembled in pairs.
- .3 Mark each piece of sheet piling legibly by stenciling or die-and-stamping with the following information:
 - .1 Heat number.
 - .2 Manufacturer's name.
 - .3 Length and section number.
- .4 Do not precut lifting or slinging holes in sheet piles.
- .5 Special corners: provide fabricated special corners as specified by pile manufacturer for specific pile being installed.

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| 2.2 | <u>Sheet Piling Cutting Shoe</u> | .1 | Sheet Piling Cutting Shoe: supply one (1) of the following sheet pile cutting shoes for field installation: <ul style="list-style-type: none">.1 Associated Pile and Fitting LLC Company: X-09800 Sheet Pile Protector (762mm lengths).2 Approved equivalent. |
| 2.3 | <u>Tie Rods, Wales and Connection Hardware</u> | .1 | Structural steel for wales, bearing plates, wales splices, capping channels, support angles and miscellaneous steel: to CSA G40.21, Grade 350W. |
| | | .2 | Tie rods, sleeve nuts and turnbuckles: <ul style="list-style-type: none">.1 Tie rods: to ASTM A722 Grade 150, unless noted otherwise..2 Tie rods: to be continuously threaded bar, 75mm nominal diameter upset to 82.6mm, unless noted otherwise..3 Sleeve nuts, connector sleeves, articulating connectors and all other hardware: to have load capacity in excess of capacity of tie rod..4 Preassemble, mark and test tie rod assemblies in shop. Align threaded connection to following tolerances at sleeve nut or connector sleeve: 1/80 of normal rod diameter, deviation of centerline, 1 in 160. |
| | | .3 | Nuts and bolts: hexagon nuts, bolts, and washers: 25mm diameter A325 to ASTM F3125/F3125M unless noted otherwise. |
| | | .4 | Tie back bolts: 47.6mm (1 7/8") diameter ASTM A449 threaded rod Type 1 complete with A563DH heavy hex nuts. |
| 2.4 | <u>Fabrication Steel Sheet Piles</u> | .1 | Fabricate full length piles to eliminate splicing during installation. |
| | | .2 | Full length piles may be fabricated from piling material by splicing lengths together where approved by the Departmental Representative. Use complete joint penetration groove welds. Conform to requirements of piling system manufacturer. |
| | | .3 | Submit details of planned use of pile material stock to the Departmental Representative for approval prior to start of fabrication. Re-use cut-off lengths as directed by the Departmental Representative. |

- .4 Allowable tolerance on axial alignment to be as required by the piling system manufacturer.
- .5 Allowable deviation from straight line over total length of fabricated pile to be 30mm.
- .6 Repair defective welds as approved by the Departmental Representative. Repairs to CSA W59. Unauthorized weld repairs may be rejected.

PART 3 - EXECUTION

3.1 Installation of
Steel Sheet Piles

- .1 Install piling in accordance with Section 31 61 13 - Pile Foundations, General Requirements.
- .2 If approved by the Departmental Representative, splice piles in place during installation by welding. To prevent distortion of sheet pipe piles. Hold members in alignment during splicing operation. Make splice by complete joint penetration groove welds as indicated on shop drawings.
- .3 Do welding in accordance with CSA W59.
- .4 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 and number of piles in panels for driving. Details must also include a temporary shoring plan, stamped by a Professional engineer registered in New Brunswick, required to safely install tie rods between new west wall and new SSP anchor wall, specifically addressing conflict with existing reinforced concrete anchor block and stability of existing structure during construction.
- .5 Drive sheet piles to the depths and dimensions shown on the Drawings using vibratory or impact hammers. As a general guideline, vibratory hammers should have a minimum dynamic force of nine (9) times the combined weight of the pile, hammer and clamp. The rated energy of impact hammers should be a minimum of 4.18MJ per square metre (2700J (2000 ft.lbs) per square inch) of steel cross-sectional area. As a minimum, sheets to practical

refusal on bedrock, seating piles a minimum of 300mm into bedrock. Coordinate driving energy requirements on site with pile inspector in conjunction with the Departmental Representative to ensure the piles are not damaged during installation, confirm refusal criteria and seating into bedrock. Review all pile penetration depths. Report anomalies to the Departmental Representative. The Departmental Representative will determine acceptance or rejection.

- .6 When installation is complete, face of wall at top of sheet piles to be within 75mm of location as indicated and deviation from vertical not to exceed 1 in 100.
- .7 Cut drain holes and install steel pipe elbows as indicated. Include filter material in area of drain holes as indicated.

3.2 Obstructions

- .1 If obstruction encountered during driving, advise the Departmental Representative immediately and submit proposed remedial measures for his review. Incorporate the Departmental Representative's review comments in the proposed work method and proceed with the Work.
- .2 Clear and remove any debris from the surface of the driving interface before commencing driving operations. Drill pile through all naturally occurring materials including stone and rocks. If any non-native objects are encountered beneath the surface, immediately inform the Departmental Representative who along with the Contractor will determine the methodology required to pass through the objects and a determination will be made for additional compensation at that time. Do not proceed with work until instructed to do so in writing by the Departmental Representative.
- .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 in piling. Each case will be reviewed and approved by the Departmental Representative by means of the RFI process.

- 3.3 Holes
 - .1 Patch holes in sheet pile wall, except where permanent holes are indicated.
 - .2 Use material equal to that of piling to patch holes and overlap not less than hole diameter.
 - .3 Weld to develop full strength of plate.
 - .4 Drill any required holes in piling. Do not use flame cutting without permission of the Departmental Representative.
- 3.4 Welding
 - .1 Weld in accordance with CSA W59 and CSA W59S1.
 - .2 Welding certification of companies must be in accordance with CSA W47.1 and CSA W47.1S1.
- 3.5 Cutting
 - .1 When flame cutting tops of piles, and flame cutting holes in piles 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 0 degrees C, pre-heat until steel 25 mm on each side of line of cut has reached a temperature very warm to hand (approximately 35 degrees C). Temperature indicating crayon marks may be used to measure temperature.
 - .3 Use torch guiding device to ensure smooth round holes or straight edges.
 - .4 Make cut smooth and free from notches throughout thickness. If grinding is employed to remove notch or crack, finished radius to be minimum 5mm.
- 3.6 Tie Rod Anchorage System
 - .1 Do not place backfill behind anchored bulkhead or remove material from behind bulkhead until piles have been completely driven, adjusted and secured in final position by anchorage system.
 - .2 Support tie rods directly on rock fill of existing wharf structure. Supplement with new gravels as required to ensure continuous bearing under tie rods.
 - .3 Fit and adjust tie rod systems so that connections at waling and anchor ends of tie rods are tight before backfilling.
 - .4 Protect tie rods and anchor systems from damage

during backfill operations.

- .5 Confirm articulating joints, as noted on drawings, area sleeved to allow for vertical movement as indicated.

END OF SECTION