

SPECIFICATIONS
FOR
WHARF REHABILITATION
HOWDENVALE, ONTARIO

PROJECT NO. 722283



Department of Fisheries & Oceans
Small Craft Harbours Branch
Burlington, Ontario

2019

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PART 1 - GENERAL

1.1 MINIMUM STANDARDS

- .1 Execute work to meet or exceed:
- .1 National Building Code of Canada 2015, National Fire Code of Canada 2015, Ontario Building Code 2012 and any other code of provincial or local application, including all amendments up to project date, provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
 - .2 Rules and regulations of authorities having jurisdiction.
 - .3 Fire Commissioner of Canada, No. 301, Standard for Construction Operations, and No. 302, Standard for Welding and Cutting, June 1982 and Fire Protection Standard for Correctional Institutions - Treasury Board Personnel Management Manual, Occupational Safety and Health, Chapter 3-6, Feb. 1992.
 - .4 Occupational Health and Safety Act and Regulations for Construction Projects, Revised Statutes of Ontario 1990, Chapter O.1 as amended, O. Reg. 213/91 as amended, R.R.O. 1990, Reg. 834, Diving Operations, O. Reg. 629/94, as amended.
 - .5 Environmental Protection Act, O. Reg. 102/94 and O. Reg. 103/94.

1.2 TAXES

- .1 Pay applicable Federal, Provincial and Municipal taxes.

1.3 EXAMINATION

- .1 Before submitting bid, examine existing conditions and determine conditions affecting work.
- .2 Obtain all information which may be necessary for proper execution of Contract.

1.4 EXISTING
CONDITIONS

- .1 The geotechnical investigation is bound in Appendix A - Geotechnical Investigations.
- .2 Contractor shall be familiarized with all available data and scope, and price accordingly.

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| <u>1.5 SITE</u> | <ul style="list-style-type: none">.1 Confine work, including temporary structures, plants, equipment and materials to established limits of site..2 Locate temporary buildings, roads, walks, drainage facilities, services as directed and maintain in clean and orderly manner. |
| <u>1.6 CONSTRUCTION & STORAGE AREA</u> | <ul style="list-style-type: none">.1 The limits of the Construction and Storage Area will be designated by the Departmental Representative prior to commencement of work unless otherwise shown on the drawings. |
| <u>1.7 DOCUMENTS</u> | <ul style="list-style-type: none">.1 Keep on site one copy of contract documents, reviewed shop drawings and submissions..2 Specifications shall govern over Drawings..3 Post documents on site conforming to local Occupational Health and Safety Regulations. |
| <u>1.8 CONTRACT METHOD</u> | <ul style="list-style-type: none">.1 Construct Work under a combined price contract. All costs for work not specifically identified as a unit price item shall be included in the lump sum arrangement. |
| <u>1.9 MEASUREMENT PROCEDURES</u> | <ul style="list-style-type: none">.1 Within 48 hours of bid acceptance, submit a list of subcontractors and a detailed breakdown of costs associated with the lump sum arrangement..2 Items measured for payment are in metric (SI) units..3 Submit requests for payment in metric units corresponding with items on the Unit Price Table..4 Submit supporting documents in metric units. Perform all necessary conversions required. |
| <u>1.10 LAYOUT OF WORK</u> | <ul style="list-style-type: none">.1 Immediately upon entering site for purpose of beginning work on this project, locate all general reference points and take proper action necessary to prevent their disturbance..2 Supply stakes and other survey markers required for this work. Employ competent personnel to lay out work in accordance with lines and grades provided. |

- .3 Maintain all reference points and markers for duration of contract.

1.11 CO-OPERATION &
PROTECTION

- .1 Execute work with minimum disturbance to occupants public and normal use of site work area. Make arrangements with Departmental Representative to facilitate execution of work.
- .2 Maintain access and exits.
- .3 Provide necessary barriers, warning lights and signs. Protect work from damage. Replace damaged existing work with material and finish to match original.

1.12 INTERFERENCE
TO NAVIGATION

- .1 Do not impede navigation during progress of work in accordance with the Collision Regulation with Canadian Modifications 1983.
- .2 Obtain schedule of vessel movements and fishery activities in area affected by construction and dredging operations. The area is subject to heavy navigational traffic both commercial and recreational.
- .3 Plan and execute work in manner that will not interfere with fishing operations, marina operations, construction activities at pier sites, or access to piers by land or water.
- .4 No claims for delays will be permitted resulting from the above constraints. No claims are permitted for loss of time, equipment, material or any other cost related to interference with moored vessels in harbour or due to other Contractor's operations.
- .5 Keep Operations Centre, Watchkeeper at 1-800-265-0237, Canadian Coast Guard, (CCG)Transport Canada, Sarnia, Ontario informed of dredging operations in order that necessary Notices to Shipping and Notices to Mariners will be issued. Make arrangements with CCG to relocate and replace buoys for execution of work. Advise nearest Coast Guard Base of any requirements to relocate channel markers/buoys within work area.
- .6 Mark floating equipment with lights in accordance with the Collision Regulations with the Canadian Modifications, 1983, and maintain a VHF marine radio watch of board.

1.13 EXISTING
UTILITIES

- .1 Establish location, protect and maintain existing utility lines.
- .2 Connect to existing utilities with minimum disturbance to pedestrian and vehicular traffic.

1.14 MATERIALS AND
EQUIPMENT

- .1 Use new products unless otherwise specified.
- .2 Deliver and store material and equipment to manufacturer's instructions with manufacturer's labels and seals intact.
- .3 When material or equipment is specified by standard or performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.

1.15 INSPECTION AND
TESTING

- .1 The Departmental Representative may employ an Inspection and Testing company to ensure work conforms with Contract Documents.
- .2 When initial tests and inspections reveal work not to contract requirements, pay for tests and inspections required by Departmental Representative on corrected work.
- .3 Submit timely inspection and test reports to Departmental Representative.

1.16 WORK RESTRICTIONS

- .1 Contractor shall not commence construction prior to December 1st, 2019.
- .2 All in-water work shall be completed prior to March 15, 2020.

1.17 SCHEDULING OF
WORK

- .1 On award of contract submit bar chart construction schedule for work, indicating sufficient detail of required tasks, critical path activities and milestone completion dates, to enable inspection by the Departmental Representative. Update and submit the construction schedule monthly.

1.18 AS-BUILT
RECORD DRAWINGS

- .1 As work progresses, neatly record significant deviations from the Contract drawings using fine, red marker on full size white prints.
- .2 Neatly print lettering and numbers in size to match original. Lines may be drawn free-hand but shall be

neat and accurate. Add at each title block note:
"AS BUILT RECORD".

- .3 Record following significant deviations:
 - .1 Depths of various elements and foundations.
 - .2 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.
 - .3 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
 - .4 Field changes of dimension.
 - .5 Other significant deviations which are concealed in construction and cannot be identified by visual inspection.
- .4 Turn one set of As-Built Record Drawings over to Departmental Representative upon completion of work.
- .5 If project is completed without significant deviations from contract drawings declare this in writing and submit to Departmental Representative in lieu of As-Built Record Drawings.

1.19 ADDITIONAL DRAWINGS

- .1 Departmental Representative may furnish additional drawings to clarify work.
- .2 Such drawings become part of Contract Documents.

1.20 FIRES AND TEMPORARY HEATERS

- .1 Burning of rubbish on site not permitted.
- .2 Only fires for temporary heaters are permitted on site.
- .3 Maintain temperature required to prevent frost damage to work.

1.21 DATUM

- .1 Elevations and soundings shown on Drawings are expressed in metres relative to chart datum.
- .2 Chart datum for Lake Huron is 176.0 metres I.G.L.D (1985).

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| <u>1.22 OPSS AND OPSD</u> | .1 | Ontario Provincial Standard Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD) quoted in these specifications are available online at
http://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage . |
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PART 2 - PRODUCTS

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| <u>2.1 NOT USED</u> | .1 | Not Used. |
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PART 3 - EXECUTION

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| <u>3.1 NAVIGATIONAL AID</u> | .1 | New navigational aid will be supplied to site by others. |
| | .2 | New navigational aid is to be installed in the general location alignment as identified on the contract drawings. Contractor is to obtain approval from the Owner of final alignment prior to fixing to the deck. |

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.
- .11 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward pdf files on CD or through email.

1.2 SHOP DRAWINGS
AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work. Refer to individual specification sections for submission requirements.
- .2 Where required by specifications, submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 5 days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:

- .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit 3 prints and 1 electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit 3 hard copies and 1 electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit 3 hard copies and 1 electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit 3 hard copies and 1 electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible

- officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit 3 hard copies and 1 electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit 3 hard copies and 1 electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
- .1 This review shall not mean that the Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication

processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 CERTIFICATES
AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Safety and Insurance Board Experience Report.
- .2 Submit transcription of insurance immediately after award of Contract.

1.4 FEES, PERMITS
AND CERTIFICATES

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates and permits required.
- .3 Furnish certificates and permits.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Ontario
 - .1 Occupational Health and Safety Act, R.S.O. [1990 Updated 2017].

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
- .3 Submit 1 digital copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
- .4 Submit copies of reports or directions issued by safety inspectors of authority having jurisdiction.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should

not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.4 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessments related to project.

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

- .1 Comply with the Acts and regulations of the Province of Ontario.
- .2 Comply with specified standards and regulations to ensure safe operation at site.

1.7 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Work around water.

1.8 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or rejecting improvements.

- .3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .3 The Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act for the Province of Ontario.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Health and Safety Act, R.S.O.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORESEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.
- .2 Follow procedures in place for Employee's Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have working knowledge of occupational safety and health regulations.
 - .2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .4 Be on site during execution of Work and

report directly to and be under direction of
site supervisor.

1.13 POSTING OF
DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative. The following criteria is to be posted on site:
 - .1 Contractor's Safety Policy.
 - .2 Constructor's Name.
 - .3 Notice of Project.
 - .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
 - .5 Ministry of Labour Orders and reports.
 - .6 Occupational Health and Safety Act and Regulations for Construction Projects for the Province of Ontario.
 - .7 Address and phone number of nearest Ministry of Labour office.
 - .8 Material Safety Data Sheets.
 - .9 Written emergency Response Plan.
 - .10 Site Specific Safety Plan.
 - .11 Valid certificate of first aider on duty.
 - .12 WSIB "In Case of Injury At Work" poster.
 - .13 Location of toilet and cleanup facilities.

1.14 CORRECTION OF
NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 BLASTING

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

1.16 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Assign responsibility and obligation to health and safety coordinator to stop or start Work when, at health and safety coordinator's discretion, it is

necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

PART 2 - PRODUCTS

<u>2.1 NOT USED</u>	.1	Not used.
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PART 3 - EXECUTION

<u>3.1 NOT USED</u>	.1	Not used.
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PART 1 - GENERAL

1.1 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities or delivery of materials to site, provide Environmental Protection Plan for review and approval by Departmental Representative.
- .3 Ensure Environmental Protection Plan includes comprehensive overview of known or potential environmental issues to be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls

to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Ensure plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Ensure plan includes measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

.9 Spill Control Plan including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.13 Waste Water Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.15 Pesticide treatment plan to be included and updated, as required.

1.3 FIRES

- .1 Fires and burning of rubbish on site not permitted.

1.4 DRAINAGE

- .1 Provide Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls provided. Ensure plan includes monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Storm Water Pollution Prevention Plan to be substituted for erosion and sediment control plan.
- .3 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.5 SITE CLEARING
AND PLANT
PROTECTION

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

1.6 WORK ADJACENT
TO WATERWAYS

- .1 Construction equipment to be operated on land only unless placed on barges.
- .2 Do not use waterway beds for borrow material without Departmental Representative's approval.
- .3 Do not allow any debris, fill or other foreign material to enter the waterway.

- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Blasting to be above water and 100 m minimum from indicated spawning beds.

1.7 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
 - .1 Provide temporary enclosures where indicated or directed by Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .5 Fueling of machinery must take place at a safe distance from the waterway as designated by the Departmental Representative.
- .6 Prevent spillage of gasoline, diesel and other oil products into the waterway and on land. Develop Spill Control Plan and in the event of a spill of a deleterious substance:
 - .1 Immediately contain, limit spread and clean up spill in accordance with regulatory requirements, at own cost.
 - .2 Report any fuel spills immediately to Departmental Representative and Ontario's Spills Action Centre: 1-800-268-6060.

1.8 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by

Departmental Representative.

.1 Do not take action until after receipt of written approval by Departmental Representative.

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CLEANING

.1 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

PART 1 - GENERAL

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|-------------------------------------|----|---|
| <u>1.1 SECTION INCLUDES</u> | .1 | Access and Construction aids. |
| | .2 | Office Trailers. |
| | .3 | Parking. |
| | .4 | Project identification. |
| <u>1.2 REFERENCES</u> | .1 | National Building Code of Canada. |
| | .2 | Provincial Legislation. |
| | .1 | Ontario Traffic Manual Book 7. |
| | .2 | Ontario Building Code. |
| | .3 | Occupational Health and Safety Act |
| <u>1.3 SUBMITTALS</u> | .1 | Provide submittals in accordance with Section 01 33 00. |
| <u>1.4 INSTALLATION AND REMOVAL</u> | .1 | Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation. |
| | .2 | Identify areas to receive a granular base to prevent tracking of mud. |
| | .3 | Indicate use of supplemental or other staging areas. |
| | .4 | Provide construction facilities in order to execute work expeditiously. |
| | .5 | Remove from site all such work after use. |
| <u>1.5 HOISTING</u> | .1 | Provide, operate and maintain hoists/cranes required for moving of workers, materials and equipment. |
| <u>1.6 SITE STORAGE/LOADINGS</u> | .1 | Confine work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products. |
| | .2 | Do not load or permit to load any part of Work with a weight or force that will endanger the Work. |

1.7 CONSTRUCTION
STAGING AND PARKING

- .1 A site storage and construction staging area is permitted as illustrated on the Contract Drawings. The Contractor shall take responsibility for the use, maintenance and reinstatement of the staging areas.
- .2 Provide and maintain adequate access to project site.
- .3 Parking will be permitted on site provided it does not disrupt performance of Work.
- .4 Build and maintain temporary roads as required to undertake the Work and provide snow removal during period of Work.
- .5 When using existing public and private roads for access to project site, maintain such roads for duration of Contract and repair damage resulting from Contractors' use of the roads.

1.8 SITE ACCESS

- .1 Provide access to pier via the land side or water side as required.
- .2 Minimize disruption to normal marina functions.
- .3 Provide snow clearing of the work site as required to undertake the work. Maintain the parking area and road leading up to the work site where the laydown area impedes snow clearing by others.

1.9 OFFICES

- .1 Provide a climate-controlled office with lighting and ventilation, of sufficient size to accommodate site meetings, and furnished with desk, chairs and drawing laydown table.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.
- .4 Maintain in clean condition.

1.10 EQUIPMENT, TOOL
AND MATERIALS STORAGE

- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.11 SANITARY
FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.12 CONSTRUCTION
SIGNAGE

- .1 Provide and erect, within 3 weeks of signing Contract, two project identification signs in locations designated by Departmental Representative.
 - .1 Indicate on sign, name of Owner, Consultant and Contractor, of a design style approved by Departmental Representative.
 - .2 Provide 1200 x 2400 mm identification site sign comprising of foundations and framing.
- .2 Provide and erect all local construction safety, notice and warning signage around the site.
- .3 Provide and erect construction signage on public and private roads leading to the project site, to provide advance warning of a work zone for long duration operations.
- .4 No other signs or advertisements, other than warning signs, are permitted on site.
- .5 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

1.13 PROTECTION AND
MAINTENANCE OF TRAFFIC

- .1 Provide access to temporary facilities as applicable.
- .2 Maintain and protect traffic on affected roads during construction period.
- .3 Provide measures for protection and temporary diversion of traffic, including provision of flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site shall interfere as little as possible with public traffic.

- .6 Verify adequacy of existing roads and allowable load limit on these roads. The Contractor shall be responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary with suitable grades and widths.
- .8 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .9 Dust control: adequate to ensure safe operation at all times.
- .10 Provide snow removal where required during period of Work.
- .11 Remove, upon completion of work, all temporary facilities required to undertake the work.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control 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 from removal.

3.2 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.

PART 1 - GENERAL

<u>1.1 SECTION INCLUDES</u>	.1	Barriers.
	.2	Environmental Controls.
	.3	Traffic Controls.
	.4	Fire Routes.
<u>1.2 RELATED SECTIONS</u>	.1	Section 01 52 00 - Construction Facilities.
<u>1.3 REFERENCES</u>	.1	National Building Code of Canada.
	.2	Provincial Legislation:
	.1	Ontario Building Code.
	.2	Occupational Health and Safety Act.
<u>1.4 INSTALLATION AND REMOVAL</u>	.1	Provide temporary controls in order to execute Work expeditiously.
	.2	Remove from site all such work after use.
<u>1.5 PROTECTION</u>	.1	Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.
	.2	Maintain barriers in good working order. Inspect barriers daily and repair expeditiously.
<u>1.6 SECURITY</u>	.1	Provide temporary site enclosure around the Work areas and construction staging area, using modular freestanding fencing.
	.1	Galvanized, 1.8 m high chain link or welded steel mesh with pipe rails.
	.2	Provide spaced lockable entrances for equipment and workers, with locks and keys.
	.2	Maintain barriers in good working order. Daily inspect barriers and repair expeditiously.
<u>1.7 GUARD RAILS AND BARRICADES</u>	.1	Provide secure, rigid guard rails and barricades around deep excavations and open edges as required by governing authorities.

- | | | |
|--|----|--|
| <u>1.8 ACCESS TO SITE</u> | .1 | Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work. |
| <u>1.9 PUBLIC ACCESS ROUTES AND PROPERTY</u> | .1 | Maintain and safeguard public access to areas outside of the Work area. Temporary utilization or obstruction of public areas are not permitted unless approved by Departmental Representative. |
| | .2 | Protect surrounding private and public property from damage during performance of Work. |
| | .3 | Be responsible for damage incurred. |
| <u>1.10 FIRE ROUTES</u> | .1 | Maintain access to properties including overhead clearances for use by emergency response vehicles. |

PART 2 - PRODUCTS

- | | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

- | | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 1 - GENERAL

- | | | |
|--|----|---|
| <u>1.1 SCOPE</u> | .1 | This Section covers the requirements for management of construction/demolition materials. |
| <u>1.2 REFERENCES</u> | .1 | Canadian Environmental Protection Act (CEPA 1999) |
| | .2 | Ontario Regulations |
| | .1 | Ontario Regulation 102/94. |
| | .2 | Ontario Regulation 103/94. |
| | .3 | Ontario Regulation 347 / 558. |
| | .4 | Ontario Regulation 213/91 (Occupational Health and Safety Act, OHSA). |
| <u>1.3 CONSTRUCTION AND DEMOLITION WASTE</u> | .1 | Carefully remove, deconstruct, source separate materials and divert, from D&C waste destined for landfill to maximum extent possible. Reuse, recycle, compose, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted. |
| | .2 | Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94. |
| | .1 | Provide facilities for collection, handling and storage of source separated wastes. |
| | .2 | Source separate the following waste: |
| | .1 | Concrete |
| | .2 | Wood |
| | .3 | Steel |
| | .4 | Aggregate |
| | .5 | Bituminous Pavement |
| | .6 | Organic vegetation |
| | .3 | Identify opportunities for reduction, reuse, and recycling of materials, where possible. |
| | .4 | Accomplish maximum control of solid construction waste. |
| | .5 | Preserve environment and prevent pollution and environment damage. |

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to removing materials, provide written authorization from the third-party property owner(s) accepting disposal materials as non-hazardous solid waste.
- .3 Provide a summary report of the disposed material (by quantity or weight) sent to third party property owner(s) versus material that was reused, sold or recycled.
- .4 Submit a Waste Reduction Work Plan indicating the materials and quantities of material that will be recycled and diverted from landfill, where possible.

1.5 WASTE PROCESSING SITES

- .1 Contact local and Provincial governments for information on are waste management facilities.
- .2 For the Province of Ontario, contact the Ministry of Environment and Climate Change, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
- .3 Contact the Recycling Council of Ontario (www.rco.on.ca) for listings of companies and agencies providing services and products related to the waste diversion and recycling.

1.6 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal do become Contractor's property. Contractor is responsible for disposing of these materials and choosing authorized landfill site.
- .3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .4 Protect, stockpile, store and catalogue salvaged items.
- .5 Protect structural components not removed for demolition from movement or damage. In the event of damage, make repairs and replacements to the approval of, and at no additional cost, to the Departmental Representative.
- .6 Support affected structures. If the safety of any component is endangered, cease operations and

immediately notify Departmental Representative.

- .7 Separate and store materials produced during dismantling of structures in designated areas.
- .8 Store treated wood on site in a temporary containment area set up for this purpose to prevent streaming water from reaching aquatic environment.

1.7 DISPOSAL OF WASTES

- .1 Do not bury or burn rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil or paint thinner into waterways, storm, or sanitary sewers.
- .3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .4 All waste materials should be disposed of in a legal manner at a site approved by Local Authorities.
- .5 Evacuate waste materials out of site along with work progress.
- .6 Prepare project summary to verify destination and quantities on a material-by-material basis as identified.
- .7 Recover, sort and separate waste generated by demolition into categories in preparation for transfer to various licensed sites. Contractor shall recover (reuse and/or recycle) non contaminated materials before disposal:

.1 Rock and other granular materials to be removed from existing structures will be recovered and reused for the construction of new structures, if they meet the specification requirements.

.2 Wood residues from construction must be managed according to the best practices and standards in effect.

1.8 SCHEDULING

- .1 Co-ordinate Waste management and Source Separation with other activities at site to ensure timely and orderly progress
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil or paint thinner into waterways, storm, or sanitary sewers.
- .3 Remove materials from deconstruction as

deconstruction/disassembly Work progresses.

- .4 All waste materials should be disposed of in a legal manner at a site approved by Local Authorities.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 GENERAL

- .1 It is the responsibility of the Contractor to arrange for a suitable storage yard for their materials and equipment.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- .3 Source separate materials to be reused/recycled into specified sort areas.

3.2 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.

PART 1 - GENERAL

1.1 SCOPE

- .1 This Section covers all work related to demolition, salvage, removal, and in-place abandonment, either completely or partially, of materials and structures.

1.2 MEASUREMENT
PROCEDURES

- .1 All items for removal will be covered under the lump sum arrangement, including but not limited to specific items as outlined below.
- .1 Removal of timber superstructure to top of CSP pipe piles including decking, framing, anchors, steel angles, curbs, fenders, bumpers, connections, other steel appurtenances.
- .2 Partial depth removal of concrete abutment to suit new construction.
- .3 Removal of top portions of CSP/timber piles, including connections and concrete encasement.
- .4 Removal of entire piles to harbor bed at northeast end of existing structure (8).
- .5 Removal of steel mooring bollards (14).
- .6 Removal of materials identified for salvage as described in Section 1.9.
- .2 Payment at the Contract price of unit rate tender items shall be full compensation for all labour, permits, equipment and material to do the work.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 National Building Code of Canada
- .3 Occupational Health and Safety Act, OHSA / O. Reg. 213/91

1.4 RELATED
REQUIREMENTS

- .1 Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .2 Section 35 59 14 - Miscellaneous Metals.

1.5 UNDERSTANDING
THE SITE

- .1 As part of the tender process, the Contractor shall become familiar with the site. Sufficiently assess all relevant information and constraints of the site to provide a clear understanding of the state and condition of the site.
- .2 Assess access routes those are safe and convenient to use, to / from and around the site.
- .3 Contractors should be satisfied that they have all the information necessary to undertake the work in a safe and efficient manner, including the development of a Health and Safety Plan.

1.6 PROTECTION

- .1 Prevent movement, settlement or damage of existing structure during construction. Do not use equipment that will compromise the integrity of the existing structure prior to removal.
- .2 The structural competency of the existing structures is not guaranteed in undertaking any removal or new construction. The Contractor shall undertake his/her own evaluations and plan the work accordingly with or without access on the existing structures.
- .3 Perform removals with methods and equipment as to leave undisturbed and undamaged any portion not designated for removal or salvage. All damaged or disturbed portions shall be corrected and repaired to the satisfaction of the Departmental Representative. Broken edges of components to be left in place shall be squared and neatly trimmed.
- .4 The Contractor shall fully review the scope of work at the existing structure for planning, operational constraints and movement of equipment.
- .5 The Contractor shall be held responsible for damage to adjacent facilities (such as parking lot and boat launches) caused through the performance of the work.
- .6 The Contractor may use the existing structure at their own risk to complete removals. The Department will not be held liable for the structural competency of the existing structure during demolition.

- .7 Provide area utility locates prior to removals.

1.7 PERSONAL PROTECTION

- .1 Provide appropriate Personal Protective Equipment (such as gloves, long-sleeve shirt, dust masks and eye protection, etc.) for workers handling designated substances including, but not limited to:
 - .1 chemicals found in treated timbers.
 - .2 quartz silica found in common construction materials.
 - .3 benzene found in equipment fuels.
 - .4 zinc found in galvanized materials.
 - .5 vinyl chloride found in PVC duct work.
 - .6 other hazards and substances which may be present on the site.
- .2 Ensure that sufficient ventilation is provided where sawcutting is occurring.
- .3 Provide suitable hand washing stations for workers to wash hands immediately after handling and prior to eating or drinking.

1.8 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit a Removals and Operational Plan to the Departmental Representative a minimum of 7 working days prior to the commencement of removals, including:
 - .1 Work drawings showing the extents of removals.
 - .2 Layout and description of removal sequences and proposed equipment.
 - .3 The locations, loadings, and detailed descriptions of heavy equipment and vehicles to be supported on existing structure.
 - .4 Access methodologies, planned vehicle routes and all equipment.
 - .5 Movement and storage of materials on-site prior to removal off site.
 - .6 Dust and debris control
- .3 Refer to Section 01 74 21 for additional requirements.

1.9 MATERIALS FOR
SALVAGE

- .1 Any material designated for salvage in the Contract Documents shall remain the property of the Owner and shall be maintained in a reasonable condition and stockpiled in a manner acceptable to the Department Representative.
- .2 Materials to be removed, salvaged and reinstated are identified in the Contract Drawings and include:
 - .1 Rip-rap at existing abutment to accommodate sheet piling.
- .3 Materials to be removed, refinished and reinstated are identified in the Contract Drawings and include:
 - .1 steel vehicle bollards (2).
- .4 Materials to be removed and salvaged are identified in the Contract Drawings and include:
 - .1 timber materials limited to existing decking and stringers to be carefully removed free from angles and fasteners to be temporarily stored on site for others.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Utilize appropriate equipment and machinery for the performance of the work. Use alternative equipment and machinery when they product to be insufficient
- .2 Restrict the size of equipment and machinery being used for materials being salvaged, to ensure best condition possible.
- .3 Provide equipment and machinery such as barges for access, as required.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements and CSA 350.

.2 Protection:

- .1 Prevent movement, settlement, or damage to structure prior to removal. Provide bracing and shoring as required.
- .2 Keep noise, dust, and inconvenience to occupants to minimum.
- .3 Provide temporary dust screens, covers, railings, supports and other protection as required.

3.2 GENERAL DEMOLITION
SALVAGE AND DISPOSAL

- .1 Remove the existing superstructure and portions of the substructure to permit new construction. Sort materials into piles for reuse and recycling.
- .2 Legally dispose all removed materials off the site.
- .3 Neatly demolish and remove all components within the limits of removal as indicated on the drawings.
- .4 During and after construction, all remaining scraps, cuttings, wood chips and sawdust must be collected efficiently and in a timely manner. All wood waste must be collected and disposed of in accordance with local and provincial regulations.

3.3 MATERIALS FOR
SALVAGE

- .1 Remove and adequately store identified materials identified for salvage.
- .2 Take all precautions possible to remove components without damage and to suitably store the components on at a designated location on site as determined by the Departmental Representative.

3.4 STRUCTURAL
COMPETENCY

- .1 Limit the weight of rig-mounted breakers, concrete crushers, cranes, vehicles and other heavy equipment used for removals.
- .2 The structural competency of the existing piers is not guaranteed in undertaking any removal or new construction. Undertake an assessment and load evaluation to plan the work.
- .3 Utilize barges as required to minimize loading on the existing structures.

3.5 CLEANING AND
RESTORATION

- .1 Keep site clean and organized throughout demolition procedure. Upon completion of project, reinstate areas affected by Work to condition which existed prior to beginning of Work or better subject to the approval of Departmental Representative.

PART 1 - GENERAL

1.1 SCOPE

- .1 This Section covers all work related to Cast in Place Concrete including concrete material, accessories, placement, finishing, curing and protection.

1.2 MEASUREMENT
PROCEDURES

- .1 Concrete in deck will be measured by volume in cubic metres of concrete placed, as calculated from neat dimensions as indicated on drawing.
- .2 Concrete for Navigational Aid base as identified on the contract drawings, including all anchorage, base plates, anchor bolts and levelling grout will be paid for in the lump sum arrangement.
- .1 There will be no separate payment for the installation of new navigational aid (supplied by the Departmental Representative).
- .3 Payment at the Contract price of unit rate tender items shall be full compensation for all labour, equipment and material to do the work, including reinforcing steel.
- .4 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, or piles.
- .5 Expansion joints, control joints, reinforcing steel, splices, wire ties, bar supports, chairs, spacers, dowels, anchor bolts, nuts and washers and bolt grouting shall be considered included in the placing of concrete and will not be measured separately for payment.
- .6 Hot and cold weather protection will be considered included in the placing of concrete and will not be measured separately for payment.
- .7 Concrete tickets may be submitted for reference only but will not form the basis of volume. No allowance for concrete wastage will be included in the volume for payment.

1.3 PAYMENT

- .1 Concrete work will be valued for payment in accordance with the following schedule, subject to any applicable holdbacks.

- .1 60 percent at completion of casting (times volume times tender item unit rate)
- .2 30 percent at completion of curing (times volume times tender item unit rate)
- .3 10 percent at completion of final finishing after curing (times volume times tender item unit rate)

1.4 REFERENCES

- .1 Reference Standards:
 - .1 Reinforcing Steel Manual of Standard Practice, Reinforcing Steel Institute of Canada
 - .2 ASTM International
 - .1 ASTM A 82/A 82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A 185/A 185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM C 260/C 260M-10 (R2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .4 ASTM C 494/C 494M-17, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C 1017/C 1017M-07 (E2015), Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM D 1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .7 ASTM D 1752-18, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - .3 CSA International
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .3 CSA-G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186-M1990 (R2016), Welding of

Reinforcing Bars in Reinforced Concrete Construction.

.6 CSA S269.1-16, Falsework and formwork.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork, where required.
- .3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Prepare and submit detailed reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .5 Submit detailed shop drawings indicating the placement of reinforcement steel including:
 - .1 Layout of steel reinforcement including sizing, spacing, lap lengths and bar mark.
 - .2 General dimensions of the structure upon which the bar details were based upon.
 - .3 Bar lists including sizes, bends details, and quantities
 - .4 Bar identification, marks, etc. for organizing placement
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers
 - .6 Provide type B tension lap splices unless otherwise indicated.
 - .7 Pour limits shall be indicated.
- .6 Concrete Pour Release forms (filled prior to each pour).
- .7 Provide concrete supplier certification that the plant is certified with Concrete Ontario (formerly the Ready-Mix Concrete Association of Ontario).
- .8 Provide concrete mix design including statement that the admixtures are compatible with each other.
- .9 Provide documentation that the aggregates comply with CSA A23.1 and are from an MTO approved source. Submit gradation of the coarse and fine aggregates.
- .10 Weather Protection Plans (hot and cold temperature weather conditions)
 - .1 It shall be the full responsibility of the Contractor to review the schedule, anticipate the impacts of work / concreting, and incorporate the

costs for such weather protection schemes and associated works. (For example, this may include incorporating measures such as ice or liquid nitrogen for concrete in hot weather concrete).

.2 When concrete is to be placed and cured in extreme temperature conditions (less than 5 degrees Celsius and more than 25 degrees Celsius), the Contractor shall submit written descriptions of proposed methods of providing appropriate concreting conditions and preventing cold weather damage (with drawings or sketches, as required).

.3 Incorporate modifications (from comments provided) for protective measures before placing concrete.

- .11 Provide a concrete finishing plan including procedures for curing and final finishing.
- .12 Provide a concrete repair submission as required to address defects in the poured concrete.

1.6 QUALITY ASSURANCE

- .1 Provide certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, prior to beginning reinforcing work.
- .2 Provide The concrete supplier shall be certified member of the Concrete Ontario (formerly the Ready-Mix Concrete Association of Ontario).
- .3 No water is to be added to the mix following initial batching at the plant without the consent of the Concrete Supplier designated representative and the Departmental Representative

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Concrete Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- .1 Establish the proportions of cementing materials, aggregates, water, and admixtures required to produce consistent / workable concrete that has the required strength and other properties required for improved durability, reduced shrinkage and reduced cracking.
- .2 Performance Method for specifying concrete: Performance criteria according to this specification as permitted by CSA Standard A23.1.

2.2 QUALITY CONTROL PLAN

- .1 The Contractor and Concrete Supplier shall implement a Quality Control Plan to ensure verification and compliance that the concrete meets performance criteria established in this specification.

2.3 MATERIALS

- .1 Concrete
 - .1 Cementing materials to CSA Standard A3000:
 - .1 Type GU.
 - .2 Slag (as a cement replacement 20% to 35% by mass of the quantity of total cement content) is permitted
 - .2 Compressive strength: 30 MPa at 28 days.
 - .3 Exposure class: F-1 to CSA-A23.1/A23.2.
 - .4 Aggregate conforming to CSA Standard A23.1 with sizes:
 - .1 20 mm for standard mixes.
 - .5 Admixtures:
 - .1 Air entraining.
 - .2 Water reducing agents, as required.
 - .2 Plant added.
 - .2 Calcium chloride not permitted.
 - .6 Water: to CSA-A23.1/A23.2.
 - .7 Slump: 80 mm at time of deposit, ± 20 mm or as amended by the Contractor to suit the work.
- .2 Grout shall be flowable course fill cementitious grout, with a compressive strength of 15 MPa at 28 days and a slump of 120 mm ± 30 mm.

- .3 Reinforcing steel bars: carbon steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .5 Chairs, bolsters, bar supports, spacers: to CSA Standard A23.1/A23.2.
- .6 Formwork materials: Wood product formwork materials to CSA Standard O86.
- .7 Form ties: To be removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .8 Form release agent: non-toxic, biodegradable, and low VOC.
- .9 Bituminous impregnated fiber board: to ASTM D 1751.
 - .1 Joint sealant: Cold applied, single component, chemically curing silicone to ASTM D5893
 - .1 low modulus
 - .2 weather and UV resistant
 - .3 unprimed adhesion (primer not required for adhesive to concrete)
- .10 Anchors into concrete shall be chemical adhesive.
 - .1 Hilti HIT HY 200 or Redhead A7+ Adhesive Fastening System with zinc plated threaded rods.
 - .2 Hilti HIT-RE 500 V3 or Redhead C6+ Adhesive Fastening System with zinc plated threaded rods.
 - .3 Alternate anchoring systems may be substituted in place as specified above, with the approval of the Departmental Representative.
 - .4 Expansion type anchors are not permitted.
- .11 Anchorage for navigational aid shall be ASTM A307 or greater.
- .12 Joint Filler and Sealant:
 - .1 Sheet for joints: Flexible foam expansion joint filler comprised of a closed-cell structure, which is ultraviolet resistant.
 - .2 Caulking for joints: single component, non-staining, silicone sealant, grey.

2.4 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel

Institute of Canada.

- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Do not weld reinforcement unless otherwise approved by the Departmental Representative.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.5 SOURCE QUALITY CONTROL

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

2.6 MIXES

- .1 Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
- .2 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
 - .2 Provide a completed Concrete Pour Release Form (to be provided) prior to each pour and allow the Departmental Representative 2 hours for inspection. Have each trade sign to indicate its work is complete and ready for checking, as well as the General Contractor's representative. The use of the pour release form does not relieve the Contractor of his responsibility to complete the work accurately.
 - .3 Do not order concrete until the Concrete Pour Release Form has been signed by the Contract Administrator.

- .2 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .5 Protect previous Work from staining.
- .6 Clean and remove stains prior to application for concrete finishes.
- .7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .8 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .9 Thoroughly clean joints to receive sealant. Place foam backer rod. Do not apply sealant to wet or damp concrete.
- .10 Do not place load upon new concrete until authorized by Departmental Representative.
- .11 Comply with CSA Standard A23.1 'Concrete Materials and Methods of Concrete Construction.'

3.2 PREPARATION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework. Ensure dimensions and elevations agree with drawings.
 - .1 Form 12 mm chamfers at formed concrete edges, unless shown otherwise on the Drawings.
 - .2 Laterally brace formwork and falsework and prevent displacement during concrete placement. Form chases, openings, projections, recesses, expansion joints and construction joints. Incorporate frames, castings, pipes, sleeves and similar items into the formwork.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.

- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect formwork to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1.
- .5 Verify concrete elevations in advance of the pour. Mark on forms, install screed markers or provide other means establishing final elevations during concrete pours.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 Align form joints and make watertight. Keep form joints to minimum
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 Build in anchors, sleeves, and other inserts required to suit Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .10 Remove all waste material, cut tie wire and other materials from the pour area. Clean formwork in accordance with CSA-A23.1 before placing concrete.
- .11 Coordinate the requirements of all trades and assume responsibility for location, installation and quality of all items which affect the work of this section.

3.3 FIELD BENDING OF REINFORCEMENT

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

3.4 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

- .3 Ensure cover to reinforcement is maintained during concrete pour.

3.5 PLACING CONCRETE

- .1 Undertake cast-in-place concrete work conforming to CSA A23.1/A23.2.
- .2 Plan concrete pours to suit the weather conditions. Adjust pour sequences or schedules to avoid adverse weather conditions. Do not cast concrete during rainfalls. Do not cast slabs during high winds. Follow cold weather and hot weather procedures when those temperatures exist or may be expected.
- .3 Do not commence concrete placing until sufficient manpower and equipment is available to complete the placement expeditiously preventing the formation of cold joints, and to produce the specified surface finish.
- .4 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form isolation joints as indicated.
 - .4 Install joint filler.
 - .5 Install joint sealant where indicated on the drawings.
- .5 Verify that accessories, inserts, bollards, and reinforcement are set correctly and are not disturbed during concrete placement.
- .6 Place concrete on dry and clean substrate.
- .7 Place concrete within 1 metre of its final position. In formed sections, provide sufficient elephant trunks to meet this requirement.
- .8 Do not move concrete laterally with the vibrators. Lower the vibrators vertically, and vibrate within 1 m of the point of placement.
- .9 Depositing and consolidation.
 - .1 Deposit concrete in a manner that prevents segregation in accordance with CSA A23.1.
 - .2 Consolidate the concrete during and immediately after depositing, thoroughly and uniformly by means of tamping, hand tools, finishing machines, and vibrators in order to

obtain dense, watertight, homogeneous concrete well bonded to reinforcing bars. Carefully vibrate concrete around appertenances to ensure thorough contact.

3.6 SURFACE
TOLERANCE

- .1 Finish unformed surfaces true to grade and free of surface irregularities exceeding 3 mm under a 3 metre straight edge in any direction.

3.7 POUR LIMITS

- .1 To reduce shrinkage induced cracking, the Contractor shall plan for the following limitations in pour lengths.
 - .1 25 m maximum horizontally
 - .2 Pour deck in segments along the piers to increase daily production.
 - .3 Allow 3 days between adjacent segments.

3.8 FINISHING AND
CURING

- .1 Finish concrete to CSA A23.1/A23.2.
- .2 In addition to cold weather requirements listed in CSA-A23.1, protect concrete against drying shrinkage and plastic shrinkage for slabs. Take special precautions to control and eliminate initial drying shrinkage and plastic shrinkage for slabs. Provide wind breaks, shelters or shades.
- .3 Keep concrete surfaces moist continuously while the concrete is protected.
- .4 For unformed surfaces, provide means to maintain concrete surface thoroughly wet for a period of 4 days after concrete is place.
- .5 Initial finishing shall be by bull floats and darbies, sloped as indicated on drawings.
- .6 Finish finishing for air entrained concrete shall be using a magnesium float for slabs or other means as approved by the Departmental Representative. Use a concrete broom on deck slabs for a non-slip finish.
- .7 During curing period, uncover only such areas as are immediately needed for finish treatment. Recover and continue curing.
- .8 When concrete has set sufficiently, give surface a uniform broom finish free from porous spots, irregularities, depressions, small pockets or rough spots

- .9 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

3.9 FIELD QUALITY CONTROL

- .1 Concrete testing: to CSA A23.1/A23.2 by CSA certified concrete testing laboratory independent of the concrete supplier and paid for by the Contractor.
- .2 Every load of concrete shall be tested for air content and slump.
- .3 One complete set of test cylinders shall be cast at the commencement of each concrete pour and every 75 cubic metres thereafter, to determine the 7 day and 28 day compressive strength.

3.10 CURING

- .1 Immediately after placing fresh concrete and until finishing, maintain 100% humidity in the air at the concrete surface with a spray fogging device (or other means) to prevent plastic shrinkage cracks in the concrete surface. The fresh concrete surface must be kept damp, but with no standing water, until finishing is complete.
- .2 When the finishing is complete immediately cover the concrete with a continuous polyethylene sheet.
- .3 Continuously wet cure concrete for 5 days. Provide the equipment necessary for the proper curing adjacent to the Work before commencing pouring.
- .4 Be responsible for protection of concrete from damage by all trades and the public. Do not pile or store materials on slabs nor wheel nor handle materials over slabs until concrete has been in place for 7 days (under normal conditions).
- .5 Leave formwork in place for 5 days following placing of concrete.
- .6 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .7 Re-use formwork subject to requirements of CSA-A23.1/A23.2.

3.11 HOT WEATHER WORK

- .1 Take hot weather precautions when the concrete temperature at any time exceeds 25 degrees Celsius

and do not place concrete, whose temperature exceeds 30 degrees Celsius in the mixer.

- .2 Incorporate the cost of these measures between (and including) the months of June and August.
- .3 Concrete, whose temperature in the mixer is between 27 degrees Celsius and 30 degrees Celsius must contain a retarder which reduces mixing water requirements and increases strength and must contain high early strength cement.
- .4 Protect forms and equipment, including both mixing and placing equipment, from the rays of the sun and cool by wetting as necessary to maintain a temperature of not more than 5 degrees Celsius in excess of ambient temperature nor more than 40 degrees Celsius.
- .5 Keep mixing time to the minimum, consistent with the production of the quality of concrete specified and place mixed concrete immediately.
- .6 Provide wind breaks, sun shades, plastic sheeting or other materials as required by CSA Standard A23.1 when the evaporation is expected to exceed the limits shown.
- .7 Commence continuous wet curing as soon as the concrete has hardened sufficiently to prevent surface damage.

3.12 COLD WEATHER WORK

- .1 Take cold weather precautions whenever the ambient temperature is, or is expected to be, at or below 5 degrees Celsius.
- .2 Incorporate the cost of these measures between (and including) the months of October and April.
- .3 Have protective measures in place, or adjacent to the Work, and approved by the Contract Administrator before any concrete is mixed or ordered.
- .4 Maintain concrete temperatures between 10 degrees Celsius and 20 degrees Celsius for a minimum of 3 days for unloaded areas, and 6 days for areas receiving partial load.
- .5 At the termination of the protection period, do not drop the concrete temperature more than 20 degrees Celsius in the first 24 hours.

3.13 REPAIRS

- .1 Upon review of concrete finish, undertake all

preventative and correction actions to prevent further concrete defects from occurring.

- .2 Concrete elements having one or more defects and deficiencies (identified below) shall be repaired according to an acceptable procedure with the Department Representative. Standard finishing shall be completed after such repairs are carried out.
- .3 Concrete defects are defined as
 - .1 Air voids, honeycombing, cavities, spalling, delamination, greater than 5 mm in size in any direction.
 - .2 Bugholes greater than 10 mm in diameter or 5 mm in depth
 - .3 Plastic shrinkage cracking with a width greater than 0.4 mm.
 - .4 General shrinkage cracking with a width greater than 0.7 mm.

3.14 JOINTS

- .1 Sawcut control joints within 24 hours of the final concrete set time. Install 25 mm bead of silicone sealant in each joint.
- .2 Install joint filler between each pour at expansion joints. Install 25 mm bead of silicone sealant in each joint.

3.15 DOWELS INTO CONCRETE

- .1 Drill holes to the required dimensions.
- .2 The holes shall be cleaned using compressed air to remove all deleterious material including dust, debris and water prior to placing the epoxy adhesive.
- .3 The handling and placement of the epoxy adhesive shall conform to the manufacturer's written instructions. All excess epoxy adhesive shall be struck-off flush with the concrete surface and removed from the surrounding concrete surface area.
- .4 Doweling operations shall not cause spalling, cracking or other damage to the surrounding concrete. Concrete spalled or otherwise damaged shall be repaired in a manner acceptable to the Departmental Representative.
- .5 Dowels shall be clean and free of deleterious material.
- .6 The Contractor shall maintain dowels within the specified dimensions during the setting of the epoxy adhesive. Prevent the loss of epoxy adhesive

from the holes.

.7 Pull testing of dowels is not required.

3.15 CLEANING

.1 Promptly as the Work proceeds and upon completion, clean-up and remove from the site, rubbish and surplus material resulting from the Work of this Section.

PART 1 - GENERAL

1.1 SCOPE

- .1 This Section covers aggregate fill materials for structures.

1.2 MEASUREMENT PROCEDURES

- .1 Clear Stone fill will be measured in tonnes of material placed.
- .2 Granular A will be measured in tonnes of material placed.
- .3 New rock protection will be measured in tonnes of materials placed.
- .4 Excavation, stock-piling and reuse of rock protection will be considered as part of the Lump Sum arrangement.
- .5 Excavation, stock-piling and reuse of native fill will be considered as part of the Lump Sum arrangement.
- .6 Payment at the Contract price of unit rate tender items shall be full compensation for all labour, equipment and material to do the work.
- .7 Aggregate weigh tickets may be submitted in support of material placed, provided that the material is confirmed installed.

1.3 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Section 31 32 19.01 - Geotextiles
- .3 Section 31 62 16.13 - Steel Sheet Piles.

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 4791-[99], Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 1004 November 2012, Ontario Provincial Standard Specification, Material Specification for Aggregate - Miscellaneous.
 - .2 OPSS 1010 April 2013, Ontario Provincial

Standard Specification, Material
Specification for Aggregate - Base, Subbase,
Select Subgrade, and Backfill Material.

1.5 SAMPLES

- .1 Allow sampling by Departmental Representative as required.
- .2 Provide Departmental Representative with access to source and processed material for sampling.
- .3 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

1.6 SUBMITTALS

- .1 Provide the source of aggregates and provide access for sampling at least 2 weeks prior to commencing production.
- .2 Four weeks in advance of aggregate delivery, provide an Aggregate Management Plan (AMP) outlining local haul routes, storage locations, schedules and planned movement plans within the site. With the assistance of the Department Representative, the AMP will be review with various area stakeholders. Cooperate and modify the AMP according to the comments returned.
- .3 Provide an Aggregate Placement Procedures for all aggregate installed below water.

1.7 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Divert unused granular materials from landfill to local facility as approved by Departmental Representative.

1.8 COORDINATION

- .1 Protect the public, the private launching ramp, the boats, and the boaters from adverse effects from all construction activities.
- .2 Keep the Department Representative advised of the installation activities and schedule. Propose and submit an Access and Procedures Work Program outlining a safety related work area and control of access by facility users for the duration required.

1.9 LAYOUT

- .1 The Contractor shall be responsible for all the layout of all new construction.

1.10 DIVERS

- .1 The Contractor shall employ divers during the duration of work to complete the work. The diver shall be on site for the installation of filter fabric, placement of rock, cutting of timber piles, and verification of work.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D 4791.
 - .1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand.
 - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
 - .3 Light weight aggregate, including slag and expanded shale.
- .5 Clear stone: to Ontario Provincial Standard Specification OPSS.MUNI.1004.
 - .1 Size 19 mm, uniformly graded.
 - .2 Size range 19 mm to 75mm, with gradation:

<u>Sieve Designation</u>	<u>% Passing</u>
75 mm	100
40 mm	20
19 mm	0
- .6 Granular A: to Ontario Provincial Standard Specification OPSS.MUNI.1010.
- .7 Rock Protection: to Ontario Provincial Standard Specification OPSS.MUNI.1004.
 - .1 Angular stone with specific gravity of 2.4.
 - .2 Size range 300 mm to 600 mm.

2.2 SOURCE QUALITY
CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Departmental Representative 4 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Processing
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.
 - .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.
 - .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
- .2 Handling
 - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 Stockpiling
 - .1 Do not stockpile aggregates on site approved otherwise by Departmental Representative.
- .4 Secure the areas of work from public access.

3.2 PLACEMENT

- .1 Where indicated on the drawings, place geotextiles free of wrinkles and support until covered with aggregate. Provide a minimum overlap of 1 m.
- .2 Carefully place stone uniformly to the sizes as indicated on the Contract Drawings.
- .3 Do not drop the stone from excessive heights. End dumping of aggregate is not permitted.
- .4 Generally work from the lower elevations and working progressively up the slope. Place materials according to the accepted Aggregate Placement Procedures.

3.3 CLEANING

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Promptly as the work proceeds and upon completion, clean-up and remove from the site, rubbish and surplus material resulting from the Work of this Section.

PART 1 - GENERAL

1.1 SCOPE

- .1 Minor clearing and grubbing is required to suit new work. The extents are not identified on the drawings, but is required at the end of the earth embankment connecting to the Wharf.
- .2 Clearing involves removal of brush vegetative growth. Grubbing consists of excavation to clear roots, boulders and rock fragments of specified size, to a depth below existing ground surface required to suit new work.

1.2 MEASUREMENT PROCEDURES

- .1 Clearing and grubbing is considered part of the lump sum arrangement.

1.3 STORAGE AND PROTECTION

- .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses and root systems of trees which are to remain. Repair damaged items to approval of Departmental Representative.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Obtain area locates and protect affected utility services in the area.

- .3 Notify Departmental Representative immediately of unknown existing utility lines.
- .4 Keep roads and walks free of dirt and debris.

3.2 CLEARING

- .1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
- .2 Remove cleared materials and dispose off site.

3.3 GRUBBING

- .1 Remove and dispose off site stumps and roots larger than 2.5 cm in diameter, in the designated working areas.
- .2 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.4 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for excavation work and other operations to approval of Departmental Representative.

3.5 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 SCOPE

- .1 This Section covers Work related to excavation, trenching and backfilling.

1.2 MEASUREMENT PROCEDURES

- .1 Excavation, stock-piling and reuse of native fill will be considered as part of the lump sum arrangement.
- .2 Underwater excavation, including handling, dewatering and transporting of materials to disposal site, as well as confirmation of excavation grade depth will be considered as part of the lump sum arrangement. The estimated quantity of underwater excavation within the marked areas on the drawings (Dredge Area A and Dredge Area B) is 200m3. Estimated quantity does not include side slopes required for neat dimension of the marked areas.
- .3 Clearing of the driveline will be considered part of the lump sum arrangement, and will include clearance of miscellaneous obstructions necessary to prepare the surface for sheet pile work, including, but not limited to, rocks and timber piles.
- .4 Excavation and legal disposal of fill materials will be considered as part of the lump sum arrangement.
- .5 Removal, salvage and re-installation of rock protection at the wharf approach is considered part of the lump sum arrangement.
- .6 Supply and installation of environmental protection is considered incidental to excavating and backfilling of native fill and will not be measured separately for payment.
- .7 Payment at the Contract price of unit rate tender items shall be full compensation for all labour, equipment and material to do the work.
- .8 Compaction shall be considered incidental and not measured separately for payment.

1.3 RELATED REQUIREMENTS

- .1 Section 01 35 43 - Environmental Procedures.
- .2 Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .3 Section 02 41 16 - Structure Demolition.

- .4 Section 31 05 16 - Aggregate Materials.
- .5 Section 31 11 00 - Clearing and Grubbing.
- .6 Section 31 32 19.01 - Geotextiles.

1.4 REFERENCES

- .1 Ontario Provincial Standard Specifications (OPSS) /Ontario Ministry of Transportation
 - .1 OPSS 1004 November 2012, Ontario Provincial Standard Specification, Material Specification for Aggregate - Miscellaneous.
 - .2 OPSS 1010 April 2013, Ontario Provincial Standard Specification, Material Specification for Aggregate - Base, Subbase, Select Subgrade, and Backfill Material.

1.5 SUBMITTALS

- .1 Provide the source of all materials.
- .2 Submit to Departmental Representative for approval, four weeks prior to excavation, the proposed location of disposal.
- .3 Submit a summary of the proposed underwater excavation procedure, including:
 - .1 Equipment for underwater excavation and material handling.
 - .2 Detailed description of the general approach and methods of work.
 - .3 Proposed means of access.
 - .4 Method and travel of overland movement of the material.
 - .5 Requirements for dewatering as required.
 - .6 Schedule and sequence of the work.
 - .7 Environmental control measures.

1.6 REGULATORY REQUIREMENTS

- .1 Comply with Federal, Provincial and Municipal laws and regulations relating to project.
- .2 Comply with Environmental Requirements in accordance with Section 01 35 43 - Environmental Procedures.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 SURVEY AND ACCEPTANCE OF WORK

- .1 Provide, at own expense, survey vessel, equipment and crew to set up and maintain control for location of underwater excavation limits and to

sound areas immediately after excavation to verify that grade depth has been attained.

- .2 Contractor to excavate as necessary to remove all material within limits which are found to be above grade.
- .3 All sounding depths obtained by Departmental Representative must be within +/- 0.2 m of the specific grade depth before the area will be considered completed.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Refer to Section 31 05 16 - Aggregate Materials
- .2 Native fill: excavated soil, free from roots and debris. Departmental Representative to approve excavated materials before use as backfill.
- .3 Results of prior soundings are included on the drawings, and geotechnical investigation is included in Appendix A, and are made available for tendering purposes only. It should be noted that this information may differ from site condition. Take this into consideration when submitting tender.
- .4 Sediment Sample Locations are indicated on drawings. Appendix A - Sediment Sample Grain Size Analysis is attached to the end of the specifications. Grain size analysis is limited to the depth of core samples as specified and may not be indicative of the overall soil conditions

2.2 EQUIPMENT

- .1 Contractor to determine required equipment necessary to carry out underwater excavation, handling and disposal of the material and locations specified for removal.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Immediately upon entering site for purpose of beginning work on this project, locate reference points and take proper action necessary to prevent their disturbance.
- .2 Lay out Work from benchmarks and baselines established by Departmental Representative. Be responsible for accuracy of work relative to established benchmarks. Provide and maintain

electronic position fixing and distance measuring equipment, laser transits and such other equipment required for accurate underwater excavation control.

3.1 UTILITY LOCATES

- .1 Before commencing work, establish location and extent of underground utility lines in area of excavation. Notify Departmental Representative of findings.
- .2 Arrange for and de-energize existing electrical lines. Retain, protect and support, as required, existing conduit and lines.
- .3 Record and submit the locations of all lines.

3.2 EXCAVATION

- .1 Excavate and stockpile native material as required.
- .2 Remove concrete, masonry, paving, walks, demolished foundations, rubble and other obstructions encountered during excavation in accordance with Section 02 41 16 - Structure Demolition.
- .3 Keep excavated and stockpiled materials safe distance away from edge of excavations.
- .4 Dispose of surplus and unsuitable excavated material off site.
- .5 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .6 Correct over-excavation by backfilling with an approved material (without cost to the Owner), to the satisfaction of the Departmental Representative.
- .7 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.

3.3 UNDERWATER EXCAVATION

- .1 Remove materials in Dredge Areas A and B, shown on drawings, above grade depth of 2.2 metres below chart datum. Chart datum for soundings indicated is 176.0 metres above International Great Lakes Datum (IGLD) 1985. Material removed from below grade depth is not part of the Work.

- .2 Remove spillage, shoaling or infilling which occurs prior to acceptance by Departmental Representative.
- .3 Immediately notify Departmental Representative upon encountering object which might be classified as obstruction. By-pass object after clearly marking its location and continue Work.
- .4 The Contractor shall install all protection measures required prior to initiating underwater excavation activities.
- .5 On completion of underwater excavation, Contractor to confirm, in presence of Departmental Representative, that grade depth has been achieved.
- .6 The Contractor may utilize a 10 m x 20 m location in the existing parking lot for temporary dewatering purposes. The precise location of this area will be determined on site with the Departmental Representative.
- .7 Dispose of material by depositing in off-site location approved by Departmental Representative. Do not dispose of material in waterways. Contractor is responsible for any required testing, such as Toxicity Characteristic Leaching Procedure (TCLP) to determine disposal location.
- .8 Contractor is to transport material to the disposal site using appropriate equipment.
- .9 Truck boxes to be watertight to prevent spillage of material during transit from site to disposal location. Clean up spillage as directed and take necessary action to prevent reoccurrence.
- .10 Do not dispose of debris in lake.
- .11 Dispose of debris in containment facility or at approved land disposal site.

3.4 BACKFILLING

- .1 Do not proceed with backfilling until tie rod and waler installation has been inspected and approved by Departmental Representatives.
- .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 Backfill all spaces not occupied by parts of the structure, or other permanent works, with specified material, placed as shown on the drawings.

- .5 Place Clear Stone in areas as indicated.
- .6 Place Granular A materials in areas as indicated.
Place material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated and be uniformly compacted to at least 98% SPMD.
- .7 Place new rock protection in areas as indicated.
- .8 When geotextile is shown in the Contract Drawings, place granular fill in a manner so as not to damage the geotextile.

3.5 ROCK PROTECTION

- .1 Remove existing rock protection for sheet pile installation in areas as indicated along the Wharf approach.

PART 1 - GENERAL

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| <u>1.1 SCOPE</u> | .1 | This Section covers Work related to Geotextiles. |
| <u>1.2 MEASUREMENT AND PAYMENT</u> | .1 | Measure geotextiles in square metres of surface covered by material. No allowance will be made for seams and overlaps. |
| <u>1.3 REFERENCES</u> | .1 | Ontario Provincial Standard Specifications (OPSS) |
| | .1 | OPSS 1860, April 2011, Material Specification for Geotextiles. |
| <u>1.4 SUBMITTALS</u> | .1 | Submit in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Product Data: |
| | .1 | Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations. |
| <u>1.5 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle materials in accordance with manufacturer's written instructions. |
| | .2 | Storage and Handling Requirements: |
| | .1 | Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. |
| | .2 | Store and protect geotextiles from direct sunlight and UV rays. |
| | .3 | Replace defective or damaged material. |

PART 2 - PRODUCTS

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| <u>2.1 MATERIAL</u> | .1 | Geotextile: non-woven synthetic fibre fabric, supplied in rolls. |
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- .2 Physical properties:
 - .1 OPSS 1860 Table 1 (Class II)
- .3 Hydraulic properties:
 - .1 Filtration opening size (FOS): 75 to 150 um.
- .4 Factory seams: sewn in accordance with manufacturer's recommendations.
- .5 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Place geotextile materials as indicated on drawings.
- .2 Place geotextile materials smooth and free of tension stress, folds, wrinkles and creases.
- .3 Overlap each successive strip of geotextile 1 m over previously laid strip.
- .4 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .5 After installation, cover with overlying layer within 4 hours of placement.
- .6 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .7 Place and compact soil layers.

3.2 CLEANING

- .1 Upon completion remove surplus materials, rubbish, tools and equipment.

3.3 PROTECTION

- .1 Heavy equipment is not permitted directly on geotextile.

PART 1 - GENERAL

1.1 SCOPE

- .1 This Section covers Work related to steel sheet piles including tie rods, anchor walls, wales, closure ends, toe anchors and quality assurance testing requirements.

1.2 MEASUREMENT PROCEDURES

- .1 Steel sheet pile will be measured by length in linear metres of steel sheet pile installed, as calculated from neat dimensions measured on-site along the centerline. The measurement will not include bends of the actual steel sheet pile section or bends in the arrangement.
- .1 The length of steel sheet pile is based on the supplied length of the sheet pile as detailed on the Contract Drawings, plus a 0.1 m added length for cutoff (used for lifting holes and potential pile damage during installation).
- .2 There will be not separate payment for drilled holes and cutting of sheet piles.
- .3 There will be not separate payment for tack welding sheets during driving, to avoid down drag.
- .4 There will be not separate payment for custom or standard corner pieces.
- .2 Steel sheet pile deadman anchor system will be measured by number of complete units supplied, delivered, stored, and erected including plates, walers, sheets, bolts and welding.
- .3 Steel wales will be measured by length in linear metres of wales installed, as measured on-site along the centerline of the wale.
- .1 Splices, bolts, nuts, tapered plates/washers, washers, spacer plates, field welding, and field drilling of holes shall be considered included in the unit price of wales and will not be measured separately for payment.
- .4 Tie rods will be measured by length in linear metres of tie rod installed, as calculated from neat dimensions measured on-site from fill/inside edges of sheet pile to sheet pile (or anchor wall).
- .1 Turnbuckles, nuts, tapered plates/washers, washers, shall be considered included in the unit price of tie rods and will not be measured separately for payment.

- .5 Closure plates will be measured by each end suitably installed.
 - .1 Steel member, field welds, custom sheet pile sheets, anchors, and concrete shall be considered included in the unit price of closure end and will not be measured separately for payment.
- .6 Toe anchors will be measured by each toe anchor suitably installed.
 - .1 Field welds, steel forms, steel sections (plates, W-sections and/or tubes), rock coring, excavation and tremie concrete shall be considered included in the unit price of toe anchors and will not be measured separately for payment.
- .7 Payment at the Contract price of unit rate tender items shall be full compensation for all labour, equipment and material to do the work.
- .8 Mobilization and de-mobilization of equipment, including access for installation will be considered part of the Lump Sum Arrangement

1.3 RELATED SECTIONS

- .1 Section 03 30 00 - Cast in Place Concrete
- .2 Section 31 05 16 - Aggregate Materials.
- .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .4 Section 35 59 14 - Miscellaneous Metals

1.4 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A6/A6M-17a, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - .2 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod, 60,000 PSI Tensile Strength.
 - .3 ASTM A328/A328M-13, Standard Specification for Steel Sheet Piling.
 - .4 ASTM A615/A615M-18, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - .5 ASTM A857/A857M-19, Standard Specification for Steel Sheet Piling, Cold Formed, Light Gage.
 - .6 ASTM F3125/F3125M-15a, Standard Specification

for High Strength Structural Bolts and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 105 ksi (1040 MPa) Minimum Tensile Strength.
.7 ASTM A 1011/A 1011M-17, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

.2 Canadian Standards Association (CSA International)

- .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA Standard S16.1-14
- .3 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.
- .4 CSA W59-2018, Welded Steel Construction (Metal Arc Welding).

1.5 SUBMITTALS

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

.2 General sheet pile submission requirements.

- .1 A plan layout of steel sheet piling sections indicating all dimensions.
- .2 Details of sheet piling sections including lengths.
- .3 Layout and details of the steel double channel waler indicating location of splices, splice details, tie bolt details and steel washer plate details.
- .4 For end and corner locations not suitable for a prefabricated corner section, provide a suitable fully welded custom corner detail.
- .5 Details of steel tie rods, steel plate washers, nuts, lock nuts and couplers.
- .6 Details of toe anchors.
- .7 Submit a list of equipment and access methods to be used for pile driving.
- .8 Submit full details of method and sequence of installation of piling for approval prior to start of pile installation work. Details must include templates, bracing, setting and driving sequence and number of piles in panels for driving.

- .3 Where the Contractor's supplied steel sheet piling consists of different dimensions to the design, submit a plan with details outlining the arrangement and modifications to design, such as

tie spacing. It will be the Contractor's responsibility to certify if the design is equivalent and the submission shall be sealed by a Professional Engineer.

.4 Document and submit the installation depth of all piles.

.5 Provide test results for tension and bend testing of sheet pile and tie rod materials.

1.6 STEEL CERTIFICATES

.1 At least two weeks prior to start of pile installation operation, submit mill test data and certification that all steel piling, delivered to job site, meets requirements of this section. This data shall include a tension test from each heat for quantities of finished material.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect sheet piles from nicks, scratches and blemishes.

.3 Replace defective or damaged materials with new.

.4 Use slings for lifting piling so that mass is evenly distributed and piling is not subjected to excessive bending stresses.

.5 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.

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

1.8 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Divert unused metal materials from landfill to metal recycling facility for disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel sheet piles: to CAN/CSA-G40.21, Grade 350W, and following:
- .2 Continuous interlocking Z sections:
 - .1 Common Steel Sheet Piling
 - .1 Minimum effective section modulus of $839 \times 10^3 \text{ mm}^3$ per metre of wall.
 - .2 Minimum thickness of 7.5 mm.
 - .2 Corner Pieces
 - .1 Prefabricated corner sections.
 - .2 Minimum thickness of 7.5 mm.
- .3 Layout
 - .1 Overall design layout is based on 610 mm Z-sections. Adjust plan layout to suit various supplier sections. Overall wharf length tolerance (-0.2 m, +0.6 m).
- .4 Structural steel for rolled sections including walers and waler splices: to CAN/CSA-G40.21, Grade 350W.
- .4 Structural steel for plates and miscellaneous steel: to CAN/CSA-G40.21, Grade 300W.
- .5 Tie rods:
 - .1 Material properties: ASTM A615, Grade 75, continuous threaded bar, hot rolled.
 - .2 Bars to be 32 mm diameter continuous threaded bar, with lengths to suit the drawing details.
 - .3 Sleeve nuts, couplers, connector sleeves to have 100% of the tie rod load capacity.
 - .4 Preassemble, mark and test tie rod assemblies in shop to ensure quality.
- .6 Nuts and bolts: hexagon nuts, bolts, and washers: to ASTM F3125M, Grade 830 MPa, Type 1.

2.2 SOURCE QUALITY
CONTROL: COLD
FORMED STEEL SHEET
PILING

- .7 Steel micropile tubes: to minimum 36 ksi.
- .1 Provide results of tension tests of sheet piling material to be used on project as follows:
 - .1 One tension test from each heat for quantities less than 50 tonnes.
 - .2 Two tension tests from each heat for quantities exceeding 50 tonnes.
- .2 Tension tests in accordance with CSA G40.20/G40.21.
- .3 Provide results of bend tests of sheet piling material to be used on project as follows:
 - .1 Bend tests: to ASTM A6/A6M, with amendments as follows.
 - .1 Perform S14.1 bend tests with material in condition as used in cold forming operation. 3 tests to be made from each heat and each thickness of material produced. Take bend test specimens from edge of each coil. Longitudinal axis of specimen to be transverse to coil rolling direction.
 - .2 S14.1.1 - Except as provided below, bend test specimens to have minimum width to thickness ratio of 8, with both edges parallel throughout section in which bending occurs, and is maintained.
 - .3 S14.2 - Minor surface separations less than 0.8 mm in depth related to superficial steel surface or subsurface discontinuities to not cause rejection. Surface separations in excess of 0.8 mm depth or cracks normal to metal surface are cause for rejection.

2.3 SOURCE QUALITY
CONTROL:
TIE RODS

- .1 Provide results of tension tests of tie rod material to be used on project as follows:
 - .1 One tension test from each 50 tie rods to be installed.
 - .2 Tension tests in accordance with ASTM A615/A615M-18.
- .2 Provide results of bend tests of tie rod material to be used on project as follows:
 - .1 One bend test for each 50 tie rods to be installed.

- .2 Bend tests: to ASTM A615/A615M-18, with amendments as follows.
 - .1 Perform bend tests to 30°.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 All welding shall be in accordance with CSA W59.
- .2 Do not begin pile installation until required quality control tests have been completed and test results approved by Departmental Representative.
- .3 Prior to installation, provide an underwater dive review of the sheet pile line to identify obstructions. Clear existing rock and other obstructions on the harbour bed prior to sheet piling operations.
- .4 Provide access for sheet piling operations, including by not limited to barges.
- .5 Keep interlocks free of any dirt, sand, mud or other debris.
- .6 Provide a suitable crane boom length long enough to install the piles. Normally at boom length of greater than least twice the length of the sheets being driven is required.
- .7 Select a Vibratory Driver suitable for the site and driving conditions. Upsize the equipment when required to correct drive capacity.

- .8 Steel sheet piling walls:
 - .1 Install temporary templates or bracing to hold piles in alignment during setting and driving.
 - .2 Place panel of four to eight sheet piles in templates to prevent spreading of piles in panel.
- .9 For each type of sheet pile length, install the sheet to the top of pile required.
- .10 Document the depth of all piles and notify the Departmental Representative of all piles which encounter refusal.
- .11 Prior to driving sheets, form holes for the bolting of the timber fendering system and tie locations.
- .12 Prevent the piles from becoming twisted, bent, or otherwise damaged during the pile handling and driving operation and, if applicable, during any adjacent construction work

3.3 REFUSAL

- .1 If refusal is encountered prematurely, use the following procedure:
 - .1 Leave the pile and proceed to drive remaining piles.
 - .2 Return and attempt to complete driving of obstructed pile later.
 - .3 Install toe anchors in sheet piles that cannot be fully driven to required embedment depth. See additional requirements for toe anchors in Clause 3.11.
 - .4 Cut the tops of piles to suit the arrangement. See additional requirements for cutting in Clause 3.7.
- .2 If requested by the Departmental Representative, utilize Impact equipment to further drive the pile. This will be paid for under change order.

3.4 TOLERANCES

- .1 The face of wall at top of sheet piles shall be within 50 mm of location indicated and deviation from vertical not to exceed 1 in 100.

3.5 OBSTRUCTIONS

- .1 If obstruction encountered during driving, leave obstructed pile and proceed to drive remaining piles. Return and attempt to complete driving of

obstructed pile later.

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

3.6 HOLES

- .1 Place lifting holes in the sheets as required to perform the work. Locate holes in the top 0.1 m designated for cut-off.
- .2 Drill any required holes in piling. Do not use flame cutting without permission of Departmental Representative.

3.7 CUTTING

- .1 The top 0.1 m (nominal) is designated for removal. Set a straight line to suit the elevations provided in the Contract Documents prior to cutting.
- .2 When flame cutting tops of piles, and flame cutting holes in piles is approved by Departmental Representative, use following procedure:
 - .1 When air temperature is above 0 degrees Celsius, no pre-heat is necessary.
 - .2 When air temperature is below 0 degrees Celsius, pre-heat until steel 25 mm on each side of line of cut has reached a temperature very warm to hand (approximately 35 degrees Celsius). Temperature indicating crayon marks may be used to measure temperature.
 - .3 Use torch guiding device to ensure smooth round holes or straight edges.
 - .4 Make cut smooth and free from notches throughout thickness. If grinding is employed to remove notch or crack, finished radius to be minimum 5 mm.

3.8 SPLICING

- .1 Use full length piles with no splicing.

3.9 WALES

- .1 Fabricate and erect steel in accordance with CSA Standard S16.1. Fabricate horizontal members with weep holes for drainage where required.
- .2 Fit joints and intersecting members accurately. Make Work in true planes with adequate fastenings. Build and erect Work perfectly rigid, plumb or true to slope, square, straight, level and accurate to sizes detailed, free from distortion or defects

detrimental to appearance or performance.

- .3 Set and secure framing brackets, hangers, anchors, inserts or similar supports for proper erection.
- .4 Bolt, splice and field weld members as detailed on the Contract Drawings.
- .5 Install tapered plates and tapered washers where required to suit skewed tie rods. Provide a minimum thickness of 16 mm on tapered plates.

3.10 TIE ROD ANCHORAGE SYSTEM

- .1 Do not place backfill behind anchored bulkhead until piles have been completely driven, adjusted and secured in final position by anchorage system.
- .2 Support tie rods at intervals along their length as indicated.
- .3 Fit and adjust tie rod systems so that connections at waling and anchor end of tie rods are tight and no slack remains before backfilling.
- .4 Saw cut tie-rods to required lengths. Do not flame cut.
- .5 At splices, butt the two ends of the tie-rods together. Locate the couplers such that they are centred over the joint. Tighten the locking nuts onto the couplers to create a rigid assembly.
- .6 Place granular sub-base material around tie-rods as indicated. Pack granular sub-base material below tie-rods to provide continuous supports.
- .7 Ensure that tie-rods are not disturbed when backfill is placed.

3.11 TOE ANCHORS

- .1 Contractor to select sheet pile toe anchor detail Type 'A' or Type 'B', as indicated on drawings.
- .2 Install toe anchors in sheet piles as indicated on drawings. Additional toe anchors may be required in sheet piles that cannot be fully driven to required embedment depth. Do not place backfill behind piles until toe anchors have been completely installed.
- .3 Employ divers during the duration of work to complete the work.
- .4 Mark all locations of toe anchors above the water

line for the review of the Departmental Representative.

- .5 Sheet Pile Toe Anchor Type 'A'
 - .1 Core holes into the bedrock and drive pipe through the fill overburden such that it projects above the harbour bottom. Excavate fill materials and debris.
 - .2 Install and support the W200 toe in a vertical alignment, close to the sheet pile wall.
 - .3 Install tremie-concrete (conforming to Section 03 33 00) and fill the steel form and core hole completely to the harbour bottom.
- .6 Sheet Pile Toe Anchor Type 'B'
 - .1 Core holes into the bedrock and install micropile pipe through the fill overburden such that it projects a minimum 300mm above the water line. Excavate fill materials and debris.
 - .2 Micropile pipe is to be welded to the sheet pile for a length of 300mm above water line.
 - .3 Install tremie-concrete (conforming to Section 03 33 00) and fill the micropile pipe completely to the bottom of the core hole.

3.12 ANCHOR BLOCKS

- .1 Excavate fills to 0.3 m below the wale location.
- .2 Carefully align and place steel sheet anchor anchors as indicated on the drawings.
- .3 Provide temporary support for the anchor blocks in order to prevent movement and/or displacement.
- .4 After plate washers, nuts, and locking nuts are installed, and after prestressing, place granular sub-base material evenly around the anchor blocks as indicated.

3.13 Backfilling

- .1 Backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling and as indicated.
- .2 Do not commence backfilling until tie-rods and anchor blocks have been installed.
- .3 Ensure that the steel sheet piling, tie-rods and anchoring systems, are not damaged when backfill material is placed.

PART 1 - GENERAL

1.1 RELATED WORK

- .1 Section 01 35 43 - Environmental Procedures.
- .2 Section 01 74 21 - Construction/Demolition
Waste Management and Disposal.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM D4491-99a(2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .3 ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
 - .4 ASTM D4716-08, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .5 ASTM D4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-4.2, Textile Test Methods.
 - .1 CAN/CGSB-148.1, Methods of Testing Geosynthetics.
 - .1 No.2-M85, Mass per Unit Area.
 - .2 No.3-M85, Thickness of Geotextiles.
 - .3 No.6.1-93, Bursting Strength of Geotextiles Under No Compressive Load.
 - .4 No.7.3-92, Grab Tensile Test for Geotextiles.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-G40.20-04 (R2009)/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel.
- .4 Ontario Provincial Standard Drawings (OPSD)
 - .1 OPSD 219.260 November 2015, Turbidity Curtain.
 - .2 OPSD 219.261 November 2015, Turbidity Curtain, Seam Detail.
- .5 Ontario Provincial Standard Specification (OPSS)
 - .1 OPSS 805, Construction Specification for Temporary Erosion and Sediment Control Measures.

1.3 SUBMITTALS

- .1 Submit details of the temporary silt curtain system to the Departmental representative prior to the start of the Work.
- .2 Submit to Departmental representative details of geotextile material and seam at least 2 weeks prior to commencing work.

1.4 DELIVERY AND STORAGE

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.
- .2 A minimum 100 metre long spare length of turbidity curtain shall be stored onsite so as to minimize any delays in the event causing damage to the installed curtain.

1.5 MEASUREMENT PROCEDURES

- .1 Supply and installation of silt curtain for environmental protection for all in-water work, maintenance of turbidity curtain during work, and removal of turbidity curtain after all in-water work is completed will be considered as part of the lump sum arrangement and shall include all labour, materials and equipment to do the work.

PART 2 - PRODUCTS

2.1 MATERIAL

- .1 Geotextile: woven synthetic fibre fabric, supplied in rolls.
 - .1 Composed of: minimum 85% by mass of polypropylene polyester with inhibitors added to base plastic to resist deterioration by ultraviolet and heat exposure for a minimum of 60 days.
- .2 Physical properties:
 - .1 Thickness: to CAN/CGSB-148.1, No. 3, minimum 0.8 mm.
 - .2 Mass per unit area: to CAN/CGSB-148.1, No.2, minimum 220 g/m2.
 - .3 Tensile strength and elongation (in any principal direction): to ASTM D4595.
 - .1 Tensile strength: minimum 1350 N, wet condition.
 - .2 Elongation at break: minimum maximum 25%.
 - .3 Seam strength: minimum 1350 N equal to or greater than tensile strength of fabric.
 - .4 Mullen burst strength: to CAN/CGSB-4.2, method 11.2, minimum 4000 N, equal to or greater than tensile strength of fabric.
- .3 Hydraulic properties:
 - .1 Apparent opening size (AOS): to ASTM D4751.

- .4 Securing pins and washers: to CAN/CSA-G40.20/
G40.21, Grade 300W, minimum 30% recycled content,
hot-dipped galvanized with minimum zinc coating of
600 g/m2 to ASTM A123M Coating Grade 85.
- .5 Seams: sewn in accordance with manufacturer's
recommendations.
- .6 Thread for sewn seams: equal or better resistance
to chemical and biological degradation than
geotextile.
- .7 Curtain height: to suit water depth and be bottom-
weighted to maintain its vertical position.

PART 3 - EXECUTION

3.1 GENERAL

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

3.2 INSTALLATION

- .1 Turbidity curtains shall consist of turbidity
curtain geosynthetic, load line, flotation,
ballast, anchors, mooring buoys, mooring lines,
adjustment lines, and tie-downs.
- .2 Design to conform to Ontario Provincial Standard
Specification, OPSS 805 and Ontario Provincial
Standard Drawings: OPSD 219.260 and OPSD 219.261 as
a minimum.
- .3 Turbidity curtains shall be constructed as follows:
 - .1 The floatation shall provide support along
the length of the turbidity curtain.
 - .2 A sleeve shall be formed and heat-sealed or
sewn along the entire bottom edge of the turbidity
curtain geosynthetic, to contain the ballast in the
sleeve. Breaks may be made in the sleeve to
facilitate pulling, provided they are a minimum 100
mm in size and spaced at minimum 3 m intervals.
 - .3 Where turbidity curtain geosynthetic is
joined to provide a continuous run, the sections
shall be connected to provide a continuous seal and
prevent the escape of turbid water between the
sections.
 - .4 The turbidity curtain, as prepared for
installation, shall be of sufficient width to
account for water depth and wave action.
 - .5 Adjustment lines shall be placed at maximum

intervals of 10 m, and are to encircle the turbidity curtain from top to bottom.

.6 The turbidity curtain shall be prepared for installation by furling and tying with furling ties every 1.5 m for the entire length of the curtain.

.7 Turbidity curtain shall be of sufficient length to permit work inside the area enclosed by the curtain without restricting equipment operations, and personnel from working.

.8 Anchor locations shall be established as is necessary to maintain the turbidity curtain in place and functioning.

3.1 OPERATION AND MAINTENANCE

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

PART 1 - GENERAL

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| <u>1.1 RELATED SECTIONS</u> | .1 | Section 35 59 14 - Miscellaneous Metals. |
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| <u>1.2 REFERENCES</u> | .1 | Canadian Standards Association (CSA International) |
| | .1 | CSA O141 - Softwood Lumber. |
| | .2 | CSA B111 - Wire Nails, Spikes, and Staples. |
| | .3 | CSA O80 - Wood preservative |
| | .2 | National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber (2017). |
| | .3 | American Society for Testing and Materials International, (ASTM). |
| | .1 | ASTM A307-14 Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod |
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| <u>1.3 MEASUREMENT PROCEDURES</u> | .1 | Measure timber fenders by units supplied and incorporated into work including connections. |
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| <u>1.4 SUBMITTALS</u> | .1 | Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Shop drawings: |
| | .1 | At least two weeks prior to finalizing timber order, submit shop drawings, clearly indicating installation details. |
| | .2 | Indicate items as follows: |
| | .1 | General arrangement of fender units. |
| | .2 | Location and size of anchor bolts. |
| | .3 | Supporting system and connection to steel piles. |
-
- | | | |
|--|----|--|
| <u>1.5 WASTE MANAGEMENT AND DISPOSAL</u> | .1 | Legally dispose all waste materials off the site, according to Section 01 74 21. |
|--|----|--|
-
- | | | |
|---|----|---|
| <u>1.6 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle materials in accordance with manufacturer's written instructions. |
|---|----|---|

HANDLING

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Timber:
 - .1 Commercially available lumber such as Eastern Hemlock, Western Hemlock or Douglas Fir Species, construction grade.
 - .2 Standard pressure treatment, non-incised, alkaline copper quaternary (ACQ) or copper azole.
- .2 Hardware:
 - .1 Structural steel for plates and miscellaneous steel to be in accordance with Section 35 59 14 - Miscellaneous Metals.
 - .2 Machine bolts, lag bolts, drift bolts, anchor bolts, nuts, round plate washers to ASTM A307.
 - .3 Spikes: to CSA B111
 - .4 Hot dip galvanized all hardware, bolts, nuts, washers and spikes to CSA G164, with minimum zinc coating of 450 g/m², unless otherwise shown on plans.
- .3 Welding materials: to CSA W48.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Supply and install dimension timbers to details shown on drawings or as specified. Treated timber to be supplied in pre-cut lengths to suit.
- .2 Field apply wood preservative to all field sawn or drilled holes, cuts and damaged components.
- .3 Protect all timber 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.

- .4 Ensure 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.

3.2 CLEANING

- .1 During and after construction, all remaining scraps, cuttings, wood chips and sawdust must be collected efficiently and in a timely manner. All wood waste must be collected and disposed of in accordance with local and provincial regulations.

PART 1 - GENERAL

1.1 SCOPE

- .1 This Section covers Work related to miscellaneous metal fabrications such as safety ladders, pile caps, and bollards.

1.2 MEASUREMENT
PROCEDURES

- .1 Safety ladders will be measured by the number of units installed.
- .1 Anchors, connections, field welding and finishing shall be considered included in the unit price of ladders and will not be measured separately for payment.
- .2 Pile caps will be measured by the length, in linear metres of cap installed, as calculated from neat dimensions measured on-site along the centerline of the cap.
- .1 Splices, support plates, anchors, field welding and finishing shall be considered included in the unit price of caps and will not be measured separately for payment.
- .3 Mooring bollards will be measured by the number of units supplied and installed.
- .1 Anchors, connections, concrete, reinforcing steel and finishing shall be considered included in the unit price of bollards and will not be measured separately for payment.
- .4 Removal, refinishing and re-instatement of traffic bollards, including anchors, connections, concrete, reinforcing steel and finishing will be considered as part of the lump sum arrangement and will not be measured separately for payment.
- .5 Supply and installation of mooring rings and eye bolts, including steel plates, connections and welding will be considered as part of the lump sum arrangement and will not be measured separately for payment.
- .6 Payment at the Contract price of unit rate tender items shall be full compensation for all labour, equipment and material to do the work.
- .7 Cleaning, shop painting and field painting of steel will not be measured separately for payment but shall be considered included in the measurement for

payment of each item.

1.3 RELATED REQUIREMENTS

- .1 Section 02 41 16 - Structure Demolition.
- .2 Section 03 30 00 - Cast-In-Place Concrete.
- .3 Section 31 62 16.13 - Steel Sheet Piles.

1.4 REFERENCES

- .1 Canadian Standards Association
 - .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA Standard S16.1-14.
 - .3 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures
 - .4 CSA W59-2018, Welded Steel Construction (Metal Arc Welding)
- .2 The Society for Protective Coatings (SSPC)
 - .1 SSPC-SP 2-82(R2004), Hand Tool Cleaning.
 - .2 SSPC-SP 6/NACE No. 3-07, Commercial Blast Cleaning.
 - .3 SSPC-Vis-1-89, Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs) Editorial Changes September 1, 2000 (Steel Structures Painting Manual, Chapter 2 - Surface Preparation Spec.).
 - .4 SSPC-PA 2-04, Measurement of Dry Coat Thickness with Magnetic Gauges.
 - .5 SSPC Good Painting Practices, Volume 1, 4th Edition.

1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Prior to fabrication, submit fabrication shop drawings with general layout, detailed dimensions, welding details, fastener details and all other relevant information necessary for fabrication.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for paint, MSDS sheets, surface preparation requirements, application temperature / conditions, finish and limitations.
 - .3 Submit manufacturer's instructions and

- product data sheets for dowels into concrete, including required equipment list.
- .4 Submit finishing system including detailed product data sheet, manufacturer's recommendations for surface preparation and other relevant data for each component.
- .3 Provide a detailed schedule for fabrication and coating work.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Structural steel for rolled sections: to CSA-G40.21, Grade 350W.
- .2 Structural steel for plates and miscellaneous steel: to CAN/CSA-G40.21, Grade 300W.
- .3 Hot dipped galvanizing for steel components shall be according to ASTM A123.
- .4 Paint for general steel components meeting the following requirements.
 - .1 Marine grade, ultra-durable, solvent-free, epoxy based coating with solids content of $98\% \pm 2\%$. Where colour is unavailable in epoxy based systems, a polyurethane top coat may be substituted. Dry Film Thickness: 2 coats x 2-3 mils each. Finish colour shall be dark grey for bollards and yellow for ladders.
 - .2 For pile caps, shop prime and field top coat top and side exposed surfaces, after installation, with polyurethane top coat. Dry Film Thickness: 2-3 mils. Finish colour shall be yellow.
 - .3 Surface profile for shop coating abrasive blasting to SSPC-SP10 with 3 to 4 mils surface profile.
- .5 Zinc-Rich Touch-up coating shall be brush, roller or spray applied.
 - .1 Percent solids: greater than 85% by weight.
 - .2 Zinc content: greater than 88% by weight in dry film.
 - .3 Applied in 2 coats with 1.5 mil dry film thickness.
- .6 Where specified, hot dipped galvanizing shall be according to ASTM A123.
- .7 For drilled in anchors and cast anchorage into

concrete, see Section 03 33 00.

PART 3 - EXECUTION

3.1 STEEL FABRICATION

- .1 Fabricate steel components as detailed on drawings and weld according to CSA W59.
- .2 All flame cut edges shall be as smooth and regular as those produced by edge planing and shall be free of slag.
- .3 Surfaces to be welded shall be smooth, uniform and free from birs, fins and other defects which would adversely affect the quality and uniformity of the weld.
- .4 Notify Departmental Representative of fabrication and coating schedules. Allow sufficient time for the Departmental Representative to inspect the fabricated components prior to coating work.

3.2 SAFETY LADDERS

- .1 Fabricate as detailed on drawings and shop apply the paint coating. Chain ladder shall be hot dipped galvanized. The top grab bar shall be painted similar to the pile caps.
- .2 Provide access and install ladders.
- .3 Field weld ladder to the sheet pile and grind all field welds smooth.
- .4 Apply touch-up paint and zinc-rich touch-up coating to ladder components damaged by handling and installation.

3.3 PILE CAPS

- .1 Fabricate as detailed on drawings and shop apply coatings.
- .2 Install steel pile caps and field weld to sheet piling as indicated on the drawings. Where the cap is not fully supported on the sheet piles due low cutoff elevations, weld angles for support and connection to sheeting.
- .3 Touch up coating on pile caps damaged by handling and installation.

3.4 BOLLARDS

- .1 Remove and salvage existing traffic bollards (2 total) for reuse. Transport bollards to the shop for modifications and coating.
- .2 Fabricate new bollards as detailed on drawings.
- .3 Hot dip galvanize (exterior and interior surfaces). Coordinate and place openings in the bollard for galvanizing in locations which will not impact the aesthetics or durability of the bollard.
- .4 Mooring bollards and traffic bollards shall be installed in the concrete deck, as detailed on drawings.
- .5 Touch up coating on bollards damaged by handling and installation.

3.5 PAINTING PREPARATION

- .1 Clean surfaces of metal to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and foreign substances in accordance with SSPC-SP10 Near-White Metal Blast Cleaning.
- .2 Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, by blowing with clean dry compressed air, or by vacuum cleaning.

3.6 PAINTING APPLICATION

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Paint shall be applied by spray, brush, or roller. All paint work shall be completed in the shop (not field).
- .3 Apply each coat of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .4 Allow 28 days for coating curing or according to the Manufacturer's recommendations if greater.
- .5 Handling painted metal:
 - .1 Handle painted metal after paint has dried, or when necessary for handling for painting or stacking for drying.
 - .2 Scrape off and touch up paint which is damaged in handling, with same number of coats and kinds of paint as were previously applied to metal.

APPENDIX A

GEOTECHNICAL INVESTIGATION



February 2018

GEOTECHNICAL EXPLORATION

Small Craft Harbours Howdenvale Pier Howdenvale, Ontario

Submitted to:

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AECOM Canada Ltd.
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REPORT



Report Number: 1787472-1000-R01

Distribution:

1 E-Copy - AECOM Canada Ltd.
1 E-Copy - Golder Associates Ltd.





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Important Information and Limitations of This Report

Method of Soil Classification

Abbreviations and Terms Used on Records of Boreholes and Test Pits

List of Symbols

Records of Boreholes

FIGURES

Figure 1: Location Plan

Figure 2: Grain Size Distribution – Sand

Figure 3: Grain Size Distribution - Silt

APPENDICES

APPENDIX A

Photographs



1.0 INTRODUCTION

This report presents the results of the geotechnical exploration and testing carried out for the design of the proposed Howdenvale pier reconstruction located at the end of Dock Road in Howdenvale, Municipality of South Bruce Peninsula, Ontario. The location of the site, as shown on the Key Plan, Figure 1, is on the west side of the Bruce Peninsula about 40 kilometres north of Port Elgin. The purpose of the work was to explore the subsurface soil and groundwater conditions at the site and provide geotechnical engineering recommendations for the design of the pier reconstruction. Authorization to proceed with the exploration and testing program, in accordance with our proposal letter P1787472, dated September 15, 2017, was provided by Mr. John Pucchio, P.Eng. of AECOM Canada Ltd. (AECOM).

Based on the information provided to Golder Associates Ltd. (Golder), the proposed reconstruction will consist of installing new steel sheet piling around the existing pier at the site.

This report should be read in conjunction with the attached document “Important Information and Limitations of This Report”, which comprises an integral component hereof. The reader’s attention is specifically drawn to this material, as it is essential for proper use and interpretation of the information presented and discussed herein.

2.0 SITE DESCRIPTION AND PHYSIOGRAPHY

The site is currently a wooden pier structure extending into Lake Huron in Howdenvale, Ontario. The pier is located at the end of Dock Road and is used by fishing vessels for docking. The Lake Huron water level was at about elevation 176.6 metres during drilling on November 1, 2017. Photographs of the site are provided in Appendix A.

The site is located in the physiographic region of southwestern Ontario known as the Huron Fringe.¹ Geotechnical and geological information indicate that the predominant soil type in the area are gravel bars and sand dunes. The bedrock at the site consists of grey dolostone of the Amabel Formation of Middle and Lower Silurian age.

3.0 FIELD PROCEDURES

The field work for the exploration was carried out on November 1, 2017 during which time four boreholes, labelled BH-101 to BH-104, were drilled at the approximate locations shown on the Location Plan, Figure 1. Members of our engineering staff designated the borehole locations in the field, obtained underground utility clearances, monitored the drilling, logged the boreholes, and cared for the samples obtained. The water surface elevations at the borehole locations are referenced to the top of the concrete pier abutment at the shoreline with an elevation of 177.70 metres, assumed to be referenced to geodetic datum.

The boreholes were drilled using a track-mounted drill rig supplied and operated by a specialist drilling contractor under the direction of a member of our engineering staff. The subsurface conditions encountered in the boreholes are shown in detail on the attached Record of Borehole sheets.

¹ The Physiography of Southern Ontario; Ontario Geological Survey, Special Volume 2. By Chapman and Putnam, 1984.



Standard penetration testing and sampling was carried out in the boreholes at suitable intervals of depth using 35-millimetre inside diameter split spoon sampling equipment, in accordance with ASTM D1586 “Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils”. The bedrock in BH-103 was cored using NQ-sized rock coring equipment. All of the samples obtained during the exploration were transported to our laboratory for further examination and testing. The soil stratigraphy and rock lithology encountered in the boreholes and the results of the field and laboratory testing are shown on the Record of Borehole sheets and Figures 2 and 3. Upon completion of drilling and sampling, the boreholes were backfilled in accordance with Ontario Regulation (O.Reg.) 903, as amended.

4.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered in the boreholes drilled at the site are shown in detail on the attached Record of Borehole sheets. The following discussion has been simplified in terms of major soil and rock strata for the purposes of geotechnical design. The soil and rock boundaries indicated are inferred from non-continuous samples and observations of drilling resistance and typically represent transitions from one soil or rock type to another rather than exact planes of geological change. Further, subsurface conditions may vary significantly between and beyond the borehole locations.

The subsurface conditions encountered in the boreholes generally consisted of the surficial sands overlying interlayered deposits of silty clay and silts with thin granular layers, which were underlain by dolostone bedrock.

4.1 Summary of Subsurface Conditions

Granular deposits, consisting of sand and gravelly sand, were encountered at the surface of the lake bottom in all boreholes. The granular layers were about 0.4 to 1.8 metres thick. The granular deposits had N^2 values of 1 to 13 blows per 0.3 metres and water contents of about 4 to 39 per cent. The surficial sands contained varying amounts of organics which contribute to the high water content values. A grain size distribution curve for a sample of the sand is provided on Figure 2.

Layers of silty clay and silt were encountered beneath the surficial sands in all boreholes. The interlayered soils ranged from about 1.4 to 2.6 metres in thickness. The silty clay and silt strata had N values ranging from 2 to 46 blows per 0.3 metres with water contents of about 9 to 28 per cent. Grain size distribution curves for two samples of the silt are provided on Figure 3.

Bedrock was encountered in all boreholes (proven by coring or inferred by split spoon sampler refusal) between elevations 169.6 and 172.1 metres. Following split spoon refusal in BH-103, the underlying bedrock was cored for about 2.8 metres to an elevation of 168.3 metres before termination. The bedrock consisted of medium crystalline grey dolostone. The Rock Quality Designation (RQD), Total Core Recovery (TCR), and Solid Core Recovery (SCR) for each rock core run are provided on the Record of Borehole Sheet. The cored bedrock was

² The SPT N value is defined as the number of blows required by a 63.5-kilogram hammer dropped from a height of 760 millimetres to drive a split spoon sampler a distance of 300 millimetres into the soil after having first penetrated 150 millimetres.



generally fresh to slightly weathered; based on the RQD values, the encountered dolostone would be classified as good to excellent-quality, strong to very strong rock. A photograph of the rock core is provided in Appendix A.

The Lake Huron water level was at about elevation 176.6 metres during drilling on November 1, 2017. Lake water levels at the site should be expected to fluctuate seasonally and in response to significant precipitation events and prevailing wind direction.

5.0 DISCUSSION

This section of the report provides our recommendations related to the geotechnical aspects of design of the proposed works. It should be noted that the interpretation and recommendations provided are intended for use only by the design engineer. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project. Those requiring information on construction should make their own interpretation of the factual information provided as it may affect equipment selection, proposed construction means and methods, scheduling, and the like.

Based on the information provided to Golder, the wooden pier is proposed to be reconstructed using sheet piling. No detailed design information was available at the time of preparing this report. This report should be revisited and revised, if necessary, upon receipt of a more detailed design package.

5.1 Lateral Earth Pressures

Steel sheet piles should be designed to terminate on the bedrock. The steel sheet piles should have sufficient strength to resist damage during installation in the dense silt encountered below elevation 171.6 metres in BH-101 and BH-102. The bedrock surface slopes downward from west to east, or from the shoreline into the lake, from elevation 172.1 metres in BH-104 to elevation 169.6 metres in BH-101. The unfactored triangular earth pressure distributions acting on the interior and exterior faces of the sheet piles (p in kN/m^2 ; increasing with depth), can be calculated as follows:

$$p = K(\gamma H + q)$$

where H = the height of the sheet pile in metres
 K = coefficient of lateral earth pressure
 γ = soil unit weight
 q = surcharge for other loading

For active or at-rest pressures acting on the interior face of the sheet pile, 'H' is the full height of the sheet pile. For passive pressures acting on the exterior face of the sheet pile, 'H' is the embedment depth of the pile below the mud line minus an allowance for scour.



GEOTECHNICAL EXPLORATION SMALL CRAFT HARBOURS- HOWDENVALE PIER

The design pressures may be calculated using the following parameters:

Soil Type	Coefficient of Lateral Earth Pressure			Angle of Internal Friction (degrees)	Bulk Unit Weight (kN/m ³)	Buoyant Unit Weight (kN/m ³)
	Active, K _a	At Rest, K _o	Passive, K _p			
Sand	0.31	0.47	3.3	32	18.0	10.0
Gravelly Sand	0.28	0.44	3.5	34	20.0	12.0
Silty Clay	0.33	0.50	3.0	30	19.0	9.0
Sandy Silt	0.31	0.47	3.3	32	19.5	10.0
Silt	0.31	0.47	3.3	32	19.5	10.0
Granular B Backfill	0.31	0.47	3.3	32	22	13

The earth pressure coefficients noted above are based on a horizontal soil surface adjacent to the sheet piles. The bulk unit weights should be used for soil above the water line, and the buoyant unit weights should be used for submerged soils. The upper 1 metre of soil below the mud line should be neglected in the calculation of passive pressures acting against the exterior faces of the sheet piles to account for scour and periodic loosening due to wave action. If cross bracing or a reinforced slab are used to effectively connect the sheet piles on either side of the pier such that rotational movement or deflections are restricted, pressures acting on the interior faces of the sheet piles should be calculated using the at-rest coefficient of lateral earth pressure. Pressure arising from compaction equipment and construction procedures must be considered. A compaction surcharge equal to 12 kPa should be included in the interior lateral earth pressures for the structural design of the walls.

When more details are known regarding the proposed reconstruction of the pier, this section of the report can be revisited and revised as required.

5.2 Seismic Site Classification and Hazard Values

Based on the results of the exploration and our experience in the area of the site, a Site Class D designation is appropriate for design in accordance with Section 4 of the National Building Code of Canada (NBCC).

Mean seismic hazard values were determined for a 2 per cent in 50-year (0.000404 per annum) probability of exceedance for the standard base condition assuming "firm ground" (NBCC 2015 Soil Class C, average Vs30 shear wave velocity 450 m/s). The 5 per cent damped spectral acceleration (S_a) values for the location of the site (as multiples of gravitational acceleration, or 9.81 m/s²) are: $S_a(0.2) = 0.08$; $S_a(0.5) = 0.06$; $S_a(1.0) = 0.04$; and $S_a(2) = 0.02$. The peak ground acceleration (PGA) value for the site is 0.43 m/s², with a peak ground velocity (PGV) of 0.05 m/s. Acceleration-based (F_a) and velocity-based (F_v) site coefficients of 1.3 and 1.4, respectively, should be applied to account for the Site Class D designation.



5.3 Erosion and Scour Protection

Consideration should be given to providing scour and erosion protection along the front of the sheet pile wall exposed to wave action. The requirements for and design of erosion protection should be assessed by the hydraulics design engineer.

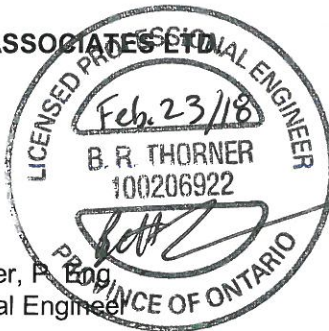
6.0 GEOTECHNICAL INSPECTIONS AND TESTING

A regular program of geotechnical inspections should be carried out during construction to confirm that the conditions encountered are consistent with the results of the boreholes, to determine that the intent of the design recommendations provided is being met and that the various project and material specifications are consistently achieved.

The factual data, interpretation and recommendations in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within twelve months of the date of the report, Golder Associates Ltd. should be given an opportunity to confirm that the recommendations are still valid. The subject geotechnical exploration and this report address only the geotechnical aspects of the proposed project; potential environmental impacts or related issues are beyond the defined scope of this work and have not been addressed.

We trust that this report provides sufficient information for your present requirements. Should any point require clarification, please contact this office.

GOLDER ASSOCIATES LTD.



Brett Thorner, P.Eng.
Geotechnical Engineer

Mark A. Swallow, P.E., P.Eng.
Principal and Senior Practice Leader

BT/MAS/cr

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IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.



IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

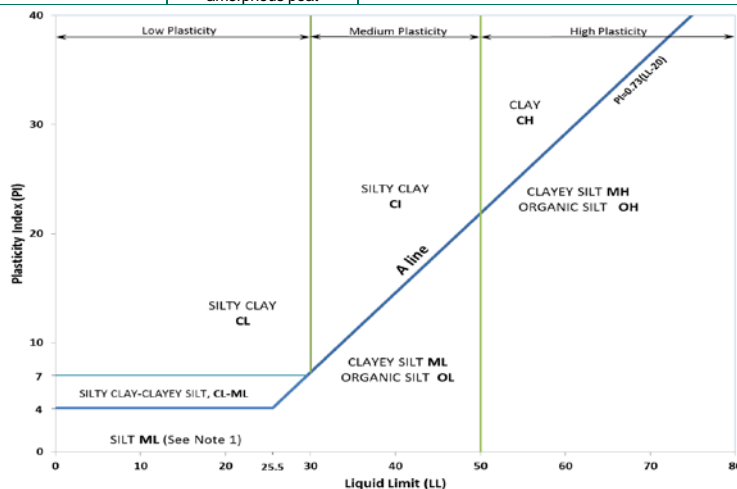
Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$		$Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$			Organic Content	USCS Group Symbol	Group Name			
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4		≤1 or ≥3			≤30%	GP	GRAVEL			
				Well Graded	≥4		1 to 3				GW	GRAVEL			
			Gravels with >12% fines (by mass)	Below A Line	n/a						GM	SILTY GRAVEL			
				Above A Line	n/a						GC	CLAYEY GRAVEL			
		SANDS (≤50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3			SP		SAND				
				Well Graded	≥6	1 to 3			SW		SAND				
			Sands with >12% fines (by mass)	Below A Line	n/a						SM	SILTY SAND			
				Above A Line	n/a						SC	CLAYEY SAND			
			Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name	
							Dilatancy	Dry Strength	Shine Test		Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT				
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT				
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT				
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT				
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT				
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30%	CL	SILTY CLAY				
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium	(see Note 2)	CI	SILTY CLAY				
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY				
		HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT		
				Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT		



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.

Note 2 – For soils with <5% organic content, include the descriptor “trace organics” for soils with between 5% and 30% organic content include the prefix “organic” before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.

For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between “clean” and “dirty” sand or gravel.

For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.

A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BORHEOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (i.e., SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.).

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
FS	Foil sample
GS	Grab Sample
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size
TP	Thin-walled, piston – note size
WS	Wash sample

SOIL TESTS

w	water content
PL, w _p	plastic limit
LL, w _L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D _R	relative density (specific gravity, G _s)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness²

Term	SPT 'N' (blows/0.3m) ¹
Very Loose	0 - 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

- SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects.
- Definition of compactness terms are based on SPT-'N' ranges as provided in Terzaghi, Peck and Mesri (1996) and correspond to typical average N₆₀ values. Many factors affect the recorded SPT-'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), groundwater conditions, and grain size. As such, the recorded SPT-'N' value(s) should be considered only an approximate guide to the compactness term. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N' ^{1,2} (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

- SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
- SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
$\ln x$	natural logarithm of x
\log_{10}	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index $= (w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index $= (w - w_p) / I_p$
I_C	consistency index $= (w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index $= (e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
C_v	coefficient of consolidation (vertical direction)
C_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio $= \sigma'_p / \sigma'_{vo}$

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction $= \tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

Notes: 1
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$

PROJECT: 1787472

RECORD OF BOREHOLE BH-101

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: November 1, 2017

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DRILLING CONTRACTOR: London Soil Test Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m					HYDRAULIC CONDUCTIVITY, k, cm/s					ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m													
									SHEAR STRENGTH Cu, kPa	nat V. rem V.	+ ⊕	Q - U -	● ○	WATER CONTENT PERCENT Wp — W — WI						
									20	40	60	80		10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³			
									20	40	60	80		10	20	30	40			
	POWER AUGER 210mm ID HOLLOW STEM	WATER LEVEL		176.64 0.00				177												
		WATER						176												
									175											
	POWER AUGER UNCASED	(SM) SAND, some silt, with organics; grey		174.20 2.44				174												
		(CL) SILTY CLAY, some sand; grey; firm to stiff		173.83 2.81	1	SS	5	173												
		(ML) SILT, some sand, some clay; grey; compact to dense		172.77 3.87	2	SS	12	172												
						3	SS	21	171											
						4	SS	35	170											
						5	SS	43												
					6	SS	46													
				7	SS	46														
		END OF BOREHOLE		169.63 7.01				169												
		Spoon refusal at elev. 169.6m																		

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DEPTH SCALE

1 : 50



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PROJECT: 1787472

RECORD OF BOREHOLE BH-102

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: November 1, 2017

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DRILLING CONTRACTOR: London Soil Test Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m					HYDRAULIC CONDUCTIVITY, k, cm/s					ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m		SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT							
									20	40	60	80	nat V. rem V.	+ ⊕	Q - U -	● ○	10 ⁻⁶	10 ⁻⁵		
									20	40	60	80		10	20	30	40			
	POWER AUGER 210mm ID HOLLOW STEM	WATER LEVEL		176.64 0.00				177												
0																				
1	POWER AUGER UNCASED	WATER						176												
2				174.87 1.77				175												
					1	SS	1													
3			(SP) SAND, some silt, with organics; very loose to compact		2	SS	11	174												
4				173.07 3.57				173												
			(ML) SANDY SILT, some clay; grey; loose to compact		4	SS	21													
5				172.25 4.39				172												
			(SP) gravelly SAND, some silt; grey; compact		5	SS	28													
6			171.58 5.06				171													
		(ML) SILT, some sand, some clay; grey; compact to dense		6	SS	14														
7			170.52 6.16				170													
		(SP) SAND, some gravel; grey; very dense																		
8		END OF BOREHOLE																		
9		Spoon refusal at elev. 170.5m																		

DEPTH SCALE

1 : 50



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PROJECT: 1787472

RECORD OF BOREHOLE BH-103

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: November 1, 2017

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DRILLING CONTRACTOR: London Soil Test Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m					HYDRAULIC CONDUCTIVITY, k, cm/s					ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m		SHEAR STRENGTH Cu, kPa		nat V. rem V. + Q - U -			WATER CONTENT PERCENT						
									20	40	60	80	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³	Wp	W		
									20	40	60	80		10	20	30	40			
0	POWER AUGER 210mm ID HOLLOW STEM	WATER LEVEL		176.62 0.00				177												
1		WATER						176												
2	POWER AUGER UNCASED			175.03 1.59				175												
		(SM) SAND, some silt, with organics; grey; very loose			1	SS	2													
				174.12 2.50				174												
		(SP) gravelly SAND, some silt; grey; compact		173.82 2.80	2	SS	13													
		(CL) SILTY CLAY, some sand; grey; stiff		173.51 3.11																
					3	SS	7													
4					4	SS	5	173											MH	
5		(ML) SILT, some sand, some clay, trace gravel			5	SS	2	172												
6					6	SS	15													
7	WASH BORING HQ CASING	Spoon refusal at elev. 171.1m		171.10 5.52				171												
8																				
9																				
10		END OF BOREHOLE		168.32 8.30				168												

DEPTH SCALE

1 : 50



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PROJECT: 1787472

RECORD OF BOREHOLE BH-104

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: November 1, 2017

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DRILLING CONTRACTOR: London Soil Test Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m					HYDRAULIC CONDUCTIVITY, k, cm/s					ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m		SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT							
									20	40	60	80	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³				
0	POWER AUGER 210mm ID HOLLOW STEM	WATER LEVEL		176.58 0.00				177												
1		WATER						176												
2	POWER AUGER UNCASED	(SP) SAND, some silt, with organics; grey; very loose to loose		174.99 1.59				175												
3				1	SS	2														
4		2	SS	8																
5		3	SS	4																
6		4	SS	3																
7		(ML) SILT, some sand, some clay, trace gravel; grey; very dense END OF BOREHOLE		172.25 4.33 172.07 4.51	5	SS	50/50mm	172												
8		Spoon refusal at about elev. 172.1m																		
9																				

DEPTH SCALE

1 : 50

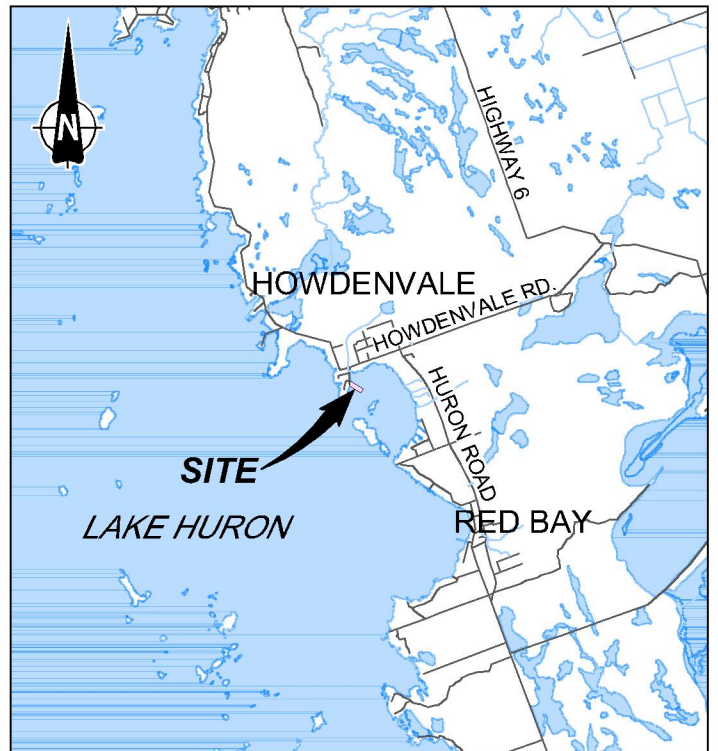


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KEY PLAN

LEGEND

● BOREHOLE


REFERENCE

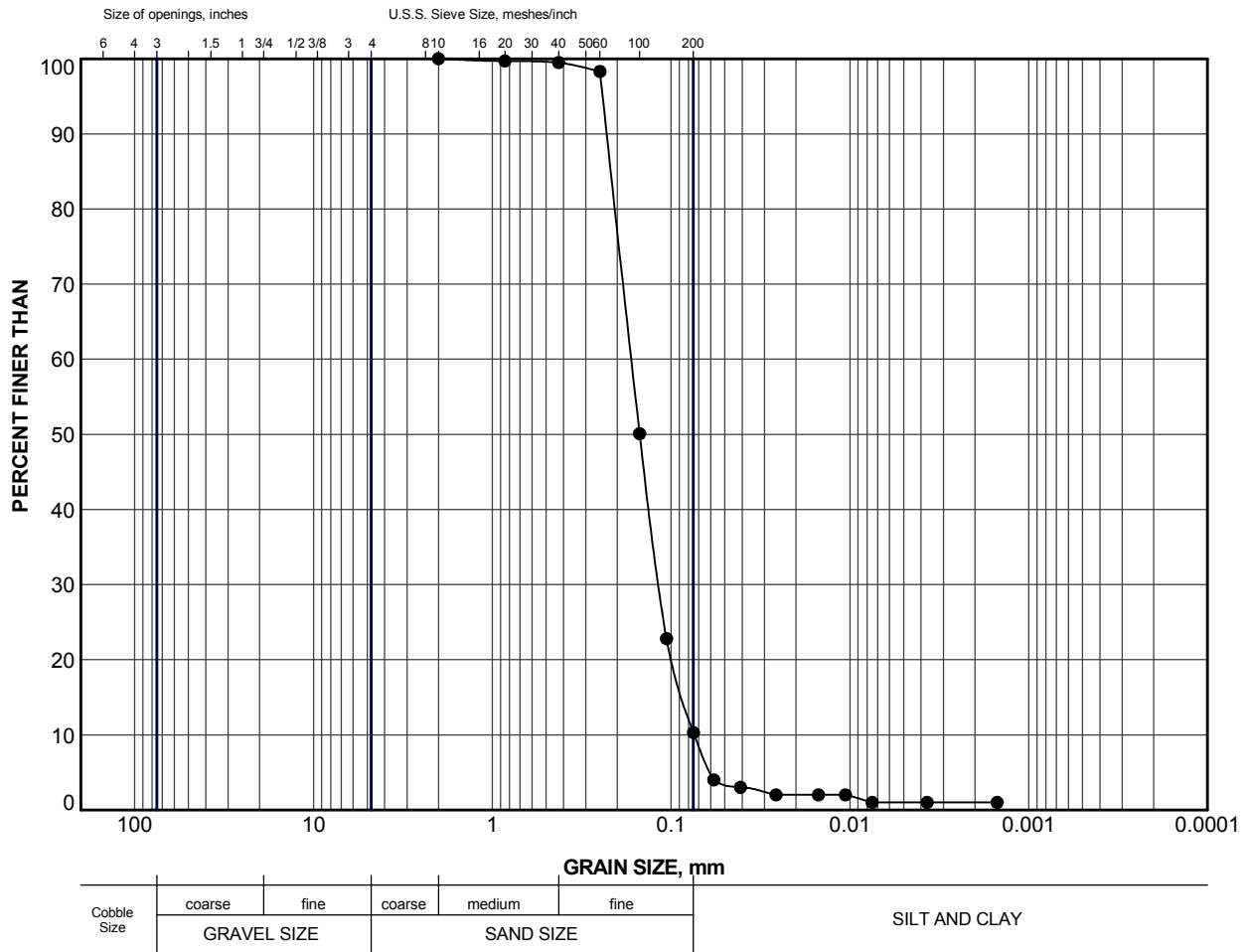
DRAWING BASED ON PLAN PROVIDED BY AECOM,
HOWDENVALE_AERIAL - 2015 UPDATE.DWG,
OCTOBER 26, 2017;
2015 AERIAL IMAGE FROM THE COUNTY OF BRUCE
INTERACTIVE WEB MAPPING SITE, BY PERMISSION;
AND CANMAP STREETFILES V.2008.

NOTES

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH
ACCOMPANYING TEXT.


ALL LOCATIONS ARE APPROXIMATE ONLY.

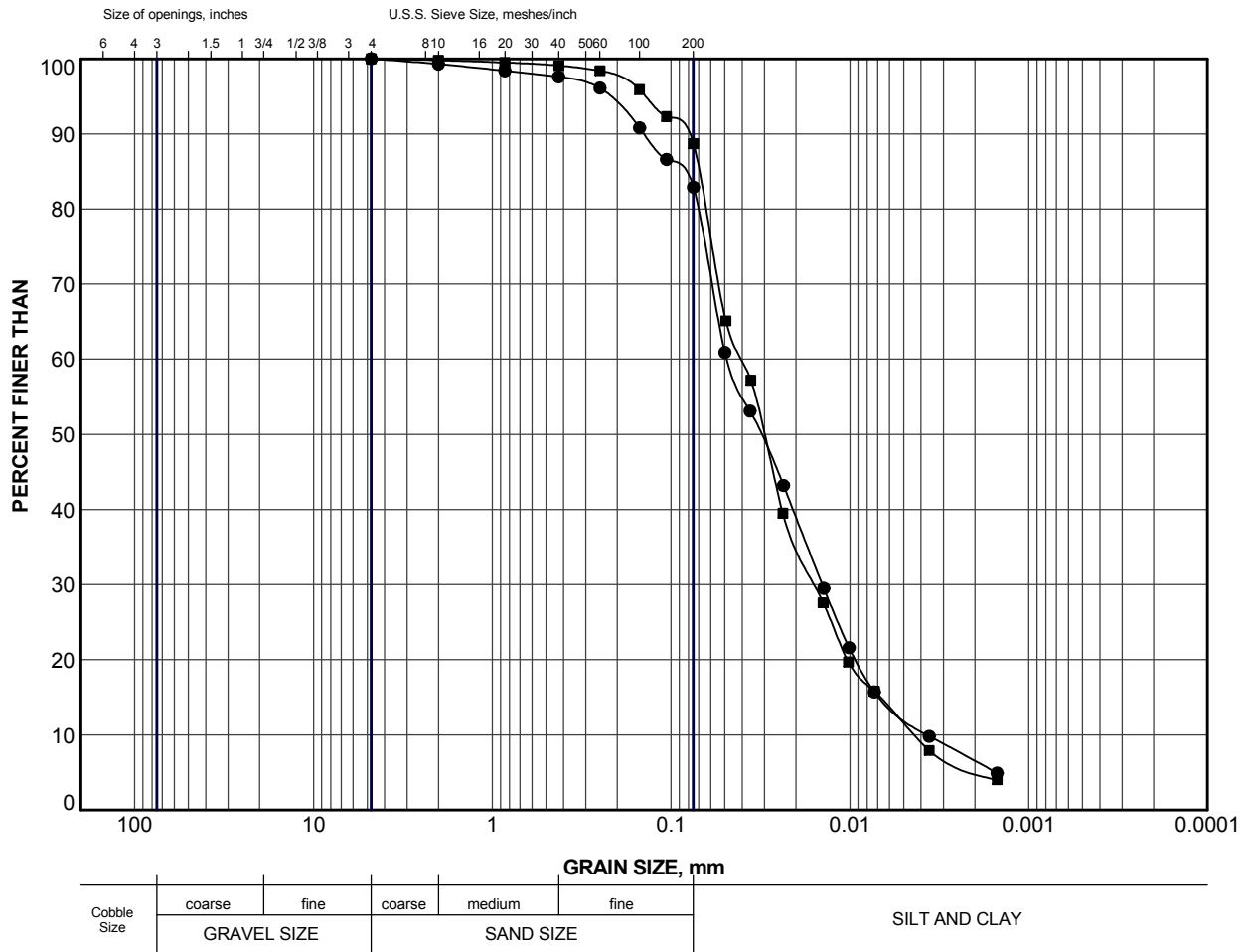
PROJECT	GEOTECHNICAL EXPLORATION SMALL CRAFT HARBOURS HOWDENVALE PIER HOWDENVALE, ONTARIO				
TITLE	LOCATION PLAN				
	PROJECT No.	1787472	FILE No.	1787472-R01001	
	CADD	LWK	Dec. 7/17	SCALE	AS SHOWN
	CHECK	BT		REV.	
FIGURE 1					



LEGEND


SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH-104	1	174.4

PROJECT		GEOTECHNICAL EXPLORATION SMALL CRAFT HARBOURS HOWDENVILLE PIER HOWDENVILLE, ONTARIO			
TITLE		GRAIN SIZE DISTRIBUTION SAND			
PROJECT No.		1787472		FILE No. 1787472-R01002	
DRAWN		LMK	Dec 7/17	SCALE	N/A
CHECK				REV.	
 Golder Associates		FIGURE 2			



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH-101	3	172.2
■	BH-103	4	172.6

PROJECT		GEOTECHNICAL EXPLORATION SMALL CRAFT HARBOURS HOWDENVILLE PIER HOWDENVILLE, ONTARIO			
TITLE		GRAIN SIZE DISTRIBUTION SILT			
PROJECT No.		1787472		FILE No. 1787472-R01003	
DRAWN		LMK	Dec 7/17	SCALE	N/A
CHECK		BT		REV.	
 Golder Associates		FIGURE 3			



APPENDIX A

Photographs



APPENDIX A

Site Photographs



Photograph 1: Looking east at BH-101 at east end of pier.



Photograph 2: Looking south at BH-101.



APPENDIX A

Site Photographs



Photograph 3: Looking east from BH-104 near shoreline.



APPENDIX A

Site Photographs



Photograph 4: Rock core from BH-103.

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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