Public Works and Government Services Canada

Requisition No. EZ899-172412

MERX I.D. No. _____

SPECIFICATIONS
For
Esquimalt Graving Dock, Esquimalt, BC
South Jetty Reconstruction

Project No. R.026729.002 January 2017

APPROVED BY:

Regional Manager, A&E Services — Date 2017-04-03

Construction Safety Coordinator — Date 2017-03-27

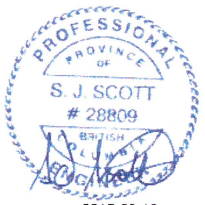
TENDER:

Project Manager — Date 2017-04-03

Real Property Services Branch, Professional and Technical Services, Pacific Region
#641 B 800 Burrard Street, Vancouver, B.C. V6Z 2V8

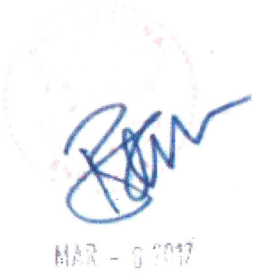
CONSULTANTS – SEAL & SIGNATURE

Prime Consultant
Discipline: STRUCTURAL/MARINE



2017-03-13

Discipline: ELECTRICAL



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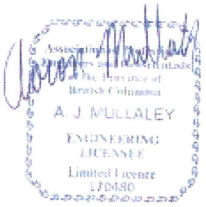
Discipline: MECHANICAL



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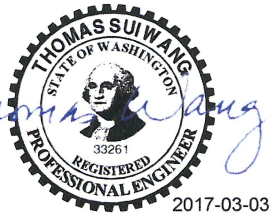
Discipline: REMEDIATION



2017-03-03

Discipline: GEOTECHNICAL

Division 1 GENERAL REQUIREMENTS

Division 2 EXISTING CONDITIONS

Division 3 CONCRETE

Division 4 MASONRY

Division 5 METALS

Division 9 FINISHES

Division 22 PLUMBING

Division 26 ELECTRICAL

Division 31 EARTHWORK

Division 32 EXTERIOR IMPROVEMENTS

Division 33 UTILITIES

Division 35 WATERWAY AND MARINE CONSTRUCTION

APPENDIX A - PRELIMINARY HAZARD ASSESSMENT FORM

A1 EGD Preliminary Hazard Assessment Form

APPENDIX B - EGD REFERENCE DOCUMENTS AND GUIDELINES

B1 EGD Environmental Policy, PWGSC, Environmental Services, August 2013.

B2 EGD Hot Work Application Form, PWGSC, Environmental Services, (2008).

B3 EGD Sample Booking Sheets (Sample – For Reference Only), PWGSC, Environmental Services, October 2012.

B4a Esquimalt Harbour – Practices and Procedures Pursuant to the Canadian Marine Act (2016).
B4b Esquimalt Harbour Controlled Access Map.

B5 EGD Tariff Sheet. PWGSC, Effective April 1, 2015.

B6 EGD Asbestos Management Plan (parts 1 and 2), April 2012

Note that the following EGD Reference Documents are presented in the Environmental Management Plan in Appendix C2, **and are not repeated in this appendix**:

EGD Reference Documents in Appendix C2:
- Sub-Appendix C - EGD Environmental Best Management Practices
- Sub-Appendix D - Pile Driving Best Management Practices
- Sub-Appendix E - Fire Prevention Best Management Practices
- Sub-Appendix F - Example Reporting Templates
- Sub-Appendix G - EGD Spill Contingency Plan
  - Appendix I - Responding to a Spill on Land
  - Appendix II - Responding to a Spill on Water
  - Appendix III - Environmental Spill or Incident Flow Chart
  - Appendix IV - Site and Location Map
- Sub-Appendix H - Fuelling and Oil Transfer Policy
- Sub-Appendix I - Township of Esquimalt Truck Routes

APPENDIX C - ENVIRONMENTAL REQUIREMENTS

C1 Environmental Effects Evaluation - Esquimalt Graving Dock - South Jetty Reconstruction Project - Esquimalt, BC, Prepared by: Keystone Environmental Ltd Project No. 13024 - September 2016 - 78 pages

This report includes sub-appendix:
Appendix A4 - Marine Mammal Exclusion Zone map

C2 Environmental Management Plan (EMP), Esquimalt Graving Dock, South Jetty Reconstruction Project, Esquimalt, BC, Prepared by Keystone Environmental Ltd - Project No. 13024 - September 2016 - 199 pages

This report includes sub-appendices:

Sub-Appendix A - Figures - site plan, site boundaries, Marine Mammal Exclusion Zone
Sub-Appendix B - Permits and Approvals - DFO permit to perform works
Sub-Appendix C - EGD Environmental Best Management Practices - Colour document by EGD covering 18 BMP's for working at the EGD.
Sub-Appendix D - Pile Driving Best Management Practices - Standard Pile Driving BMP document
Sub-Appendix E - EGD Fire Prevention Best Management Practices
Sub-Appendix F - Environmental Reporting templates - Example Reporting Templates
Sub-Appendix G - EGD Spill Contingency Plan with sub appendices:
Appendix I - Responding to a Spill on Land
Appendix II - Responding to a Spill on Water
Appendix III - Environmental Spill or Incident Flow Chart
Appendix IV - Site and Location Map
Sub-Appendix H - Fuelling and Oil Transfer Policy
Sub-Appendix I - Township of Esquimalt Truck Routes
Sub-Appendix C - Regulatory Correspondence

C3: EGD Decision Letter - DFO (2014)

APPENDIX D - DATA REPORTS AND MISCELLANEOUS REPORTS

(Note: These Reference Drawings are for reference purposes only. Contractor shall verify actual conditions at the EGD Work Site.)

D1 EGD - Timber Crib Details at Landing Wharf (sheets 29, 32, 33). Department of Public Works Canada, General Plans Esquimalt Graving Dock, ca 1926.

D2 P.W.C. New Esquimalt Dry Dock (sheets 1-9), Final Plan As Constructed, P. Lyall & Sons, 1928.

D3 EGD Improvements to Graving Dock Steel-Piled Deck - Ker Priestman Assoc (1985)

D4a EGD Load Rating Layout - KM Engineering (2005)

D4b EGD Load Rating Report - KM Engineering (2005)

D5 EGD Electrical Master Drawing South Sub Station - Genivar (2011)

D6a EGD South Jetty Cathodic Protection System Wiring Details - PWGSC (2014)

D6b EGD South Jetty Modifications to Cathodic Protection - KCB (2014)

D6c EGD Cathodic Protection Maintenance Survey - Corrosion Services (2014)

D6d EGD Cathodic Protection Study Rev 1 - Corrosion Services (2016)

D7 EGD - Supplementary Test Hole Investigation For Remedial Action Plan/Risk Management Plan (Holes GBH09-01 to GBH 09-24) - Golder Associates (March 3, 2010)

D8 EGD - Waterlot Remediation Project: Borehole Investigation - Timber Portion Of South Jetty (Hole BH11-01) Golder Associates (September 2011)

D9 EGD - South Jetty Wharf Development Project – Geotechnical Data Report (Holes DH09-01 to DH09-05) - Klohn Crippen Berger (March 23, 2010).

D10 EGD Pile Design (Holes TH83-12-1 to TH83-12-6) - Amec (1984)

D11 EGD Memo - Geotechnical Design Validation - KCB (2016)

D12 EGD South Jetty Design Criteria - KCB (2010)

D13 EGD Under Pier Remediation Geotechnical Design Input - Golder (2014)

D14 EGD - Pre-Construction Condition Survey - WSP (2015)

D15 EGD Liquefaction Assessment - KCB (2002)

D16 Pile Driving Through a Cap Associated Impacts and Concerns - Anchor QEA (2002)

APPENDIX E – INDEMNIFICATION FORMS

E1 EGD - Indemnification Form

E2 EGD - Schedule 1 - Application For The Use Of Esquimalt Graving Dock, Public Works And Government Services Canada, Victoria, British Columbia

APPENDIX F – REFERENCE DOCUMENTS

F1 EGD - South Jetty Existing Pile Condition - Assessment - Herold Engineering Ltd, July 2016

F2 EGD Sheet Pile Driving Records - VPD (Nov 2015 to March 2016)

F3 EGD Temporary Capping Eastern Portion (2016)

F4 EGD Navigation Marker Monopile design - Allspan (2016)

F5 EGD Navigation Dolphin Layout - VPD (2016)

F6 EDG, South Jetty Sediment Remediation - As-Built Seabed Bathymetry

F7 Sample Electrical Cx Forms for Spec

F8 EGD Standards for Survey

F9 South Jetty Under Pier Sediment Remediation Reference Drawings

F10 Pre-Construction Condition Survey – WSP (Jan 2016)

APPENDIX G – TECHNICAL MEMORANDUM

G1 Golder Technical Memorandum (March 2017)

G2 Golder Technical Memorandum Stability Assessment of Capping Material - East Slope

APPENDIX H – CHEMICAL TEST RESULTS OF SEDIMENTS

H1 Sub-Surface Probing and Dive Surveys - Golder (Nov 2012)

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G 02	Region Plan, Area Plans, & Contractors Work Site
G 03	West Jetty General Plan
G 04	South Jetty General Plan
G 05	Jetty Slab and Precast Deck Panel General Arrangement Plans
G 06	Jetty Pile and Precast Pile Caps General Arrangement Plans
G 07	West and South Jetty General Arrangement Sections
G 08	West Jetty General Arrangement Sections
G 09	South Jetty General Arrangement Sections
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G 11 - 19	NOT USED
G 20	Existing Bathymetry With Armoured Cap Showing Proposed Pile Locations for Reference

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D 02	South Jetty Demolition Plan East
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S 23	West Jetty Typical Reinforcement at Cleat
S 24	West Jetty Sections
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S 29	West Jetty Deck 37.5 Tonne Cleat
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S 42	West and south Jetty Utility Trench Access Cover and Fire Boat Connection Cover
S 43	West and South Jetty Deck Sections and Details
S 44	Utility Support Below Existing Structure
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S 46	West and South Jetty Chain Ladder
S 47	West and South Jetty Deck Fendering
S 48	West Jetty Oil Water Separator OI-1 Support Details
S 49	South Jetty Oil Water Separators OI-2 & OI-3 C.I.P. Beam
S 50	Tug Boat Float Plan and Section
S 51	Tug Boat Float

S 52	Tug Boat Float Gangway
S 53	Tug Boat Float Connections
S 54	Tug Boat Float Apron Details
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S 60	East Approach Retaining Wall on Piles
S 61	East Approach Retaining Wall

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S PCD1	Precast D.C. Pile-Caps
S PC1	Precast Pile Cap
S PC2	Precast Pile Cap
S PC3	Precast Pile Cap
S PC4	Precast Pile Cap
S PC5	Precast Pile Cap
S PC6	Precast Pile Cap
S PC7	Precast Pile Cap
S PC8	Precast Pile Cap
S PC9	Precast Pile Cap
S PC10	Precast Pile Cap
S PC11	Precast Pile Cap

S PC12	Precast Pile Cap
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S FS1.1	Precast Fender Supports
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S BG7	Precast Box Girder

S BG8	Precast Box Girder
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S DP3	Precast Deck Panel
S DP4	Precast Deck Panel
S DP5-7	Precast Deck Panel
S UT1	Precast Utility Trench
S UT2	Precast Utility Trench
S UT3	Precast Utility Trench
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S UT6	Precast Utility Trench
S SD1	Precast Storm Drain
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S FP1-6	Precast Flat Panel
S OW1	Precast Oil Water Separation Platform
S PC-DL	Precast Design Loads Spreadsheet

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M 02	Water / Fire and Compressed Air New Work and Kiosk Details

M 03	Sanitary and Storm New Work
M 04	West Jetty – Water, Compressed Air, Sanitary and Storm New Work
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E 03	Existing SSSR Basement Plans and Elevations
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E 06	South Jetty Low Voltage Risers and Connection Details
E 07	Fire Alarm, Communication and Scada System Details and Risers
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E 09	EGD Duct Bank Naming Convention
E 10	Jetty Duct Bank Sections 1 of 7
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E 12	Jetty Duct Bank Sections 3 of 7
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E 17	West End of Service Tunnel Details and Existing Conditions
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E 23	South Jetty Manhole and Pull Pit Details 4 of 7
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E 27	SSSR and South Jetty Lighting Control
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E 29	South Jetty Pullbox Bonding Typical Detail
E 30	Jetty Mount #1 & #2 Refurbishment Details 1 of 2
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E 32	Jetty Mounts #3 and #5 Refurbishment Details 1 of 2

E 33	Jetty Mounts #3 and #5 Refurbishment Details 1 of 2
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E 36	Existing South Jetty Regulated Service Control and Protection
E 37	Jetty Mount #4 Regulated Service control and Protection
E 38	SSSR Duct Bank to South Jetty Service Raceway Deflection Joint
E 39	Deflection Coupling Assembly Details and Dimensions (Typical)
E 40	South Jetty West End Deflection Joints
E 41	South Jetty West End Deflection Joints
E 42	New Tug Wharf Services and Details
E 43	New Tug Wharf Services and Details
E 44	Navigational Light, Caisson Plug and Fire/Emergency Alarm Pull Station

C SET:EAST END SLOPE EXCAVATION AND ENGINEERIED CAP DRAWINGS

C 01	East End Slope Excavation And Engineered Capping Plan
C 02	Engineered Capping Cross Sections – Sheet 1
C 03	Engineered Capping Cross Sections – Sheet 2
C 04	Engineered Capping Details

Part 1 General

1.1 DESCRIPTION OF WORK

.1 Public Works and Government Services Canada (PWGSC) requires the reconstruction of the previously demolished South Jetty at the Esquimalt Graving Dock (EGD) facility located in Constance Cove of Esquimalt Harbour on Vancouver Island, British Columbia.

.2 Re-suspension of any capped contaminated seabed sediments during construction activities that may result in re-contamination of any area within the Contractor's Work Site or within the EGD Waterlot, or areas outside the EGD Waterlot, that remediation has been completed as part of previous work, is of concern to the Crown. Contractor shall conduct its work in a manner to prevent re-suspension and redistribution of contaminated sediment, and shall comply with all environmental protection requirements as described within the Contract Documents, with all Permit conditions, and with all relevant Acts and Regulations.

.3 The EGD facility is actively used for ship repair and maintenance. Numerous vessels of varying sizes will call at the EGD facility throughout this Contract. EGD Operations maintains a vessel booking list that will be made available to Contractor following Notice of Award. The vessel booking list is an active working document, and is subject to change on a daily basis. Contractor shall closely coordinate with the Departmental Representative to understand the EGD facility usage and frequency of vessel calls, and to coordinate its work with EGD operations.

.4 Contractor shall provide all supervision, labour, materials, supplies, tools, equipment, hoisting, transportation, receiving, handling, storage, quality control, environmental protection, and all other services necessary for the proper execution of the work.

.5 Work to be performed under this Contract includes, but is not limited to, the following summary of principal items covered further in the Contract documents. This list of principal items is presented for Contractor convenience only, and does not represent the full list of work required, nor the required sequence of work:

.1 Assume responsibility as Prime Contractor on the Contractor's Work Site.

.2 Environmental protection responsibilities provided in Sections 01 35 43 (Environmental Procedures and Sustainability), 01 35 13.43 (Special Procedures for Contaminated Sites), and other Sections of the Specification. Environmental protection responsibilities also include compliance with all Environmental Management Plan (EMP) requirements, EGD environmental best management practices (EBMPs), EGD Environmental Policy, and other environmental protection requirements to comply with Project Permit conditions.

.3 Complying with all submissions and documentation requirements.

.4 Coordination with Departmental Representative (and designated alternates) in performance of all work.

.5 Remove the existing impressed current cathodic protection system (ICCP) from under the existing dock.

.6 Design and install a new corrosion protection system, to protect the existing sheet piled walls, the existing steel pipe pilings and the new steel pipe pilings from corrosion.

.7 Removal and/or reinstatement of miscellaneous items related to the work (e.g. safety ladders, bollards, cleats and kiosks).

.8 Extraction and removal of existing steel navigation piles, and reinstatement of Engineered Cap in these areas. Remove navigation lights from piles and deliver to EGD Operations. The extracted steel navigation piles become the property of the Contractor.

.9 Removal of asphalt and concrete pavement, and disposal off-site. Excavation of fill or overburden materials, and stockpile at designated site on EGD facility.

.10 Demolish existing concrete retaining walls and footings as shown on drawings. Dispose of debris off site.

.11 Construction of temporary shoring for excavations.

.12 Removal and stockpiling on site at a designated area, any contaminated material, as directed by Departmental Representative.

.13 Protection of the Engineered Capping of seabed from damage due to Contractor activities. Engineered Capping consists of armour rock, over filter material, over sand. This capping covers contaminated materials that were not able to be completely removed during the Environmental Remediation of the South Jetty. Location and details of the Engineered Capping is shown in drawings C28, C29, C30, C32 and C33 in the Appendices.

.14 Place armour rock capping in east end of east jetty, as shown on drawings, and reinstatement of Engineered Cap material in areas that have been disturbed by the Contractors works, e.g. around Displacement Piles, at the East Approach Retaining Wall and anywhere that the Engineered Capping has been disturbed by the Contractor.

.15 Supply and install new floats, piles and gangway, for Tug Boats, as per the drawings.

.16 Construction of a cast-in-place concrete retaining wall, complete with slope protection rock.

.17 Construction of new concrete jetties, including steel piling, precast concrete structures and cast-in-place concrete structures.

.18 Construction of storm water sewer system, including oil/water separators, catch basins and manholes.

.19 Backfilling and asphalt paving.

.20 Construction of buried PVC fire water main.

.21 Construction of exposed steel fire water main in the jetty.

.22 Construction of sanitary line in the jetty.

.23 Construction of steel compressed air line in the jetty.

.24 Construction of electrical duct banks.

.25 Supply, installation and testing of electrical cables ranging from 120 V to 600 V in the jetty and associated equipment.

.26 Supply, installation and testing of lighting.

.27 Supply, installation and testing of communications cables including telephone and SCADA.

.28 Restoration, decommissioning of temporary facilities, clean-up and demobilization from Contractor's Work Site.

.6 Contractor becomes the owner of, and is responsible for disposing off-site, any demolished concrete including reinforcing steel or timber. Excavated material, soil or sediment will be transported to a designated stockpile on the EGD facility.

.7 The Coasting Trade Act shall apply to all vessels utilized by the Contractor for the work.

.8 Contractor shall comply with “Sustainable” requirements provided in Section 01 35 43 (Environmental Procedures and Sustainability). The list of principal sustainable requirement items presented here is for Contractor convenience only, as these items must be included as a section of the Contractor’s Environmental Protection Plan (EPP), and is not intended to provide detailed requirements:

.1 Management of energy and air emissions.

.2 Water management approach.

.3 Waste management plan including material consumption, waste generation, waste reduction, and disposal procedures. This shall consider both Contractor and project-generated waste.

.4 Consideration of ecological impacts (including on-site traffic pattern and speed control management).

.5 Post-construction documentation.

.9 The work will require a planned, careful, and flexible approach by an experienced Contractor to ensure that structures are constructed carefully, contaminated sediment or contaminated excavated materials are trucked to a designated stockpile site within the EGD facility, existing structures to remain are not disturbed, and that in-water placement of materials is performed according to the methods described in the Contract Documents in order to maintain environmental quality throughout completion of the work.

.10 The Work to be performed by Contractor shall include all of the requirements specified in the Contract Documents unless otherwise expressly stated to be

performed by PWGSC, Departmental Representative, or other named entities. To fully comprehend the work, the Specification and Appendices shall be read in conjunction with the Drawings, the Unit Price Table included in the Tender documents, the EMP, site information (including Reference Drawings, documents, surveys, and other data), and other Contract documents.

1.2 CODES

.1 Perform work to current Codes, Construction Standards, Standards and Bylaws.

1.3 RELATED SECTIONS

.1 All Sections of the Specification shall be read together. The Sections listed below are specifically referenced from this Section.

.2 Section 01 32 16.06 (Construction Progress Schedule - Critical Path Method)

.3 Section 01 33 00 (Submittal Procedures)

.4 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.5 Section 01 35 43 (Environmental Procedures and Sustainability)

.6 Section 01 78 00 (Closeout Submittals)

.7 Section 02 41 16.01 (Structure Demolition)

.8 Section 31 61 13 (Pile Foundations General Requirements)

.9 Section 35 37 10 (Engineered Capping)

1.4 CONTRACT DOCUMENTS

.1 The Contract documents, Drawings, and Specifications are intended to complement each other, and to provide for and include all elements necessary for the completion of the work.

.2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

1.5 DEFINITIONS

.1 Cap Type (or Engineered Cap Type): Specified areas require placement of Engineered Cap materials. The engineered capping design is separated into several Cap Types as described and shown on the Drawings.

.2 Chart Datum: Permanently established plane from which soundings or tide heights are typically referenced for marine construction works, as shown on the Drawings.

.3 Construction Quality Control Plan: The Construction Quality Control Plan describes Contractor’s means and methods by which construction activities will be monitored for technical compliance with the Contract.

.4 Coordinates:

.1 U.T.M.: Universal Transverse Mercator projection.

.2 U.T.M. Coordinates: Plane rectangular coordinates used in grid system in which grid network is applied to U.T.M. projection. Horizontal control information as indicated.

.5 Daily Construction Report: The Daily Construction Report will be submitted by Contractor to Departmental Representative on a daily basis and will document all activities associated with the work that are completed each day. Specific submittal requirements for the Daily Construction Report are described in the individual Sections of the Specification.

.6 Deleterious Substance: A Deleterious Substance is as defined by the Fisheries Act. Generally, it is a substance that if added to water, makes the water deleterious to fish or fish habitat or any water containing a substance in such quantity or concentration or has been changed by heat or other means, that if added to water makes that water deleterious to fish or fish habitat.

.7 Demolition Debris: Demolition Debris shall be defined as incidental material arising as a result of selective site demolition or structure demolition activities, as described in Section 02 41 16.01 (Structure Demolition). All costs associated with removal and disposal of Demolition Debris shall be included within the unit rate for Structure Demolition.

.8 Directed Move: A Directed Move is when an emergency vessel access, or unforeseen or planned vessel access need occurs and Departmental Representative advises Contractor to stop work and move Contractor's equipment to another location to provide vessel access. Directed Moves are solely at the discretion of Departmental Representative and do not include regular Contractor operational moves, planned moves, or when Contractor is given notice at least eight (8) hours in advance of the need to provide vessel access.

.9 Disposal Facility: An existing facility located in Canada where waste is placed in or on land and that is designed, constructed, and operated to prevent any pollution from being caused by the facility outside the area of the facility. The facility must hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of soil or other material that is not suitable for industrial, commercial, urban park, residential, agricultural, wildlands, or any other land use specified in the BC Contaminated Sites Regulation. The facility must comply with federal, provincial, municipal, local, or other legislation, regulations, codes, by-laws, zoning, or other requirements.

.10 Drawings: Where the term is capitalized, Drawings are defined as the Contract Drawings for the work. Elsewhere, the term refers to other drawings (e.g. shop drawings).

.11 Contractors Work Site: The Contractors Work Site is defined as the boundaries within which work will be completed under this Contract and as the boundaries by which the Contractor shall assume responsibilities as Prime Contractor. The

Contractor's on-site equipment, materials and facilities shall be located within the Contractor's Work Site as shown on the drawings and described herein.

.12 EGD Facility: The EGD Facility is defined as the legal boundaries of lands and waterlot owned and administered by PWGSC inclusive of the Contractor's Work Area.

.13 Engineered Capping: Engineered Capping (also referred to as Capping or Engineered Cap) is the controlled, accurate placement of clean isolating material or materials to cover or isolate contaminated material from the aquatic environment. Engineered Cap composition and thickness can consist of a single layer of material, or multiple layers of different material types. An Engineered Cap can serve any or all of three primary functions:

.1 Physical isolation of the contaminated material from the benthic environment.

.2 Physical containment of the underlying contaminated material, preventing re-suspension and transport to other sites.

.3 Reduction of the flux of dissolved contaminants into the Engineered Cap and overlying water column

.4 Contractor shall be responsible for reinstatement of any damage to the Engineered Cap.

.14 Environmental Management Plan (EMP): The EMP identifies components of the work that could present a hazard to the environment and, therefore, require environmental management and monitoring. The overall objective of the EMP is to provide a framework through which potential environmental risks will be managed during implementation of the construction activities. The EMP provides guidance and generally accepted best management practices (BMPs) and mitigation measures, to assist the Contractor in preparation of the EPP. Because water quality management is a significant environmental protection component of the project, a Water Quality Monitoring Plan has been prepared and is included as part of the EMP. The Contractor shall adhere to the EMP and Departmental Representative-accepted EPP. In the event of a discrepancy between the EMP and provisions of federal, provincial, municipal legislation, regulations or by-laws, the more stringent provisions resulting in the higher protection of the environment and lower discharge of contaminants will prevail. Although provincial laws and municipal by-laws generally do not apply on federal lands, the Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site.

.15 Environmental Pollution and Damage: Environmental Pollution and Damage includes the presence of chemical, physical, or biological elements or agents that substantially alter or impair 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.

.16 Environmental Protection: Prevention and control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, air, and biological and cultural resources; it also includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; and radiant energy, as well as other pollutants.

.17 Environmental Protection Plan (EPP): The EPP identifies Contractor's means and methods for complying with the environmental protection requirements of the Specification, the performance standards and other requirements of the EMP, the requirements of the project Fisheries Act Authorization, and any other environmental requirements under federal, provincial, municipal, local, or other legislation, regulations, codes, or by-laws. The EPP also identifies the procedures by which Contractor will establish and maintain quality control for environmental protection of all items of the work. Although provincial laws and municipal by-laws generally do not apply on federal lands, the Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site. This plan shall address all construction activities.

.18 Hazardous Waste Quality Sediment: All sediment demonstrated to meet the definition of Hazardous Waste in the Hazardous Waste Regulations.

.19 Hazardous Waste Management Facility: An existing facility located in Canada where Hazardous Waste Quality Sediment is placed in or on land and that is designed, constructed, and operated to prevent any pollution from being caused by the facility outside the area of the facility. The facility must hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of Hazardous Waste Quality Sediment that is not suitable for industrial, commercial, urban park, residential, agricultural, wild-lands, or any other land use specified in the BC CSR.

.20 Health and Safety Plan: the site-specific and Contract-specific Health and Safety plan, prepared by the Contractor, as fully described in Section 01 35 33 Health and Safety Requirements.

.21 Horizontal Datum: Universal Transverse Mercator (UTM) North American Datum (NAD) 83, in metres (m).

.22 IL+: IL+ refers to soil classification for material containing concentrations greater than the British Columbia Contaminated Sites Regulation Industrial Land Use standards but does not meet the criteria for Hazardous Waste in the Hazardous Waste Regulations.

.23 Indicator Pile(s): As described in Section 31 61 13 (Pile Foundations General Requirements).

.24 Materials Source Separation Program (MSSP): Consists of a series of ongoing activities to separate re- usable and recyclable waste material into material categories from other types of waste at the point of generation.

.25 Mooring Device: Each mooring device shall comprise a cast steel twin horn/post mooring bollard/cleat, anchor bolts, nuts, washers and anchor plate, all as shown on the Drawings. Reinforcing bars required for anchorage are not considered part of the mooring device.

.26 Obstruction(s): Rock pieces, wood, concrete, metal items, chains, wire ropes, drill rods and other non- soil materials which are encountered fully embedded within the soils below seabed and which are demonstrated to Departmental Representative's satisfaction to materially affect pile driving. Bedrock or dense granular or till-like soils encountered during installation of the jetty piles are not to be considered as Obstructions.

.27 Stockpile Area: The Stockpile Area is defined as the area, located within the EGD site

.28 Lay-Down Area: The Lay-Down Area is located on the South Jetty, as shown on the Drawings, and may be used for on-site offices and staging of equipment, but shall not be used for stockpiling of soil materials and debris.

.29 Pre-Construction Meeting: The Pre-Construction Meeting is defined as the coordination meeting between Departmental Representative and Contractor, prior to the start of work. Departmental Representative will schedule the Pre-Construction Meeting following award of Contract.

.30 Pre-Construction Survey : The Pre-Construction Survey will be completed by Contractor to document the conditions of all existing infrastructure within the work area, complete with photographic record of any existing damage. Any damage not documented and photographed will be considered the Contractors responsibility to repair. A survey of the completed Engineered Capping in the area of the new works shall be carried out by the Contractor prior to start of any new works. The survey of the Engineered Capping shall consist of a dive survey with video records. The video recordings will be made available to the Departmental Representative upon request.

.31 Progress Meeting: Progress Meeting is defined as a meeting between Departmental Representative and Contractor that will occur on a weekly basis throughout the duration of the work, except where alternate timing arrangements are made by mutual agreement. The Contractor is responsible for scheduling Progress Meetings with Departmental Representative. Superintendent shall attend weekly meetings.

.32 Progress Surveys: Progress Surveys will be completed by Contractor on a daily basis to document progress of construction activities completed as part of the Contract. Progress Surveys will be used for progress payment to Contractor

.33 Project Permits: Project Permits are the permits, licenses, certificates, authorizations, or any other form of approval required by, or provided by municipal, provincial, federal, regulatory, permitting, or other agencies and authorities or commercial facilities, that provide the permissions to complete the work as described in the Contract Documents and to address Contractor's means

and methods in carrying out that work. Copies of key Project Permits that have been obtained by Canada are provided in the appendices to the Specification. All other Project Permits are the sole responsibility of Contractor, and must be obtained by Contractor prior to the start of the work to which the Permit applies, unless otherwise allowed by the permitting authority and accepted by Departmental Representative.

.34 Record Drawings: Record Drawings are defined as completion records that document conditions by which construction activities are completed at the Contractor's Work Site. Record Drawings will serve as the final record of conditions at completion of the work.

.35 Stand-by Time:

.1 Stand-by Time is defined as the time during which Contractor is unable to perform work identified on Contractor's progress schedule due to unanticipated conditions associated with operational needs or activities of the EGD facility, and that has been approved as such by Departmental Representative.

.2 Contractor shall be compensated for approved Stand-by Time, under the Tender Item identified as STAND-BY TIME in the Unit Price Table. Stand-by Time will not be approved or paid for under the following conditions:

.1 If adverse weather conditions, equipment breakdown or damage, or other unforeseen causes of delay (except for operational needs or activities of the EGD facility) are encountered during the work.

.2 If Contractor's approved progress schedule does not show work to be performed during the period affected by the change in vessel arrival or departure times.

.3 If Contractor does not have the claimed crews and equipment on site ready to work, unless Contractor has received prior approval from Departmental Representative to send the crews home early or bring them in late due to the schedule impact.

.4 If Contractor is given a minimum of eight (8) hours advanced notice of a change in vessel arrival or departure time that may affect Contractor's work schedule.

.5 If Contractor does not immediately notify Departmental Representative in writing of an unanticipated operational event that is preventing scheduled work from being completed, and the number of hours of delay.

.6 If Contractor could continue working at another area of the Contractor's Work Site that is not affected by the unanticipated condition. In this case, payment for a Directed Move may apply.

.7 If Contractor cannot adjust its work activities with eight (8) hours advance notice to accommodate the vessel arrival or departure,

Contractor shall substantiate this in writing to the satisfaction of Departmental Representative. Contractor's justification for Stand-by Time must be approved by Departmental Representative in order to be considered as payable Stand-by Time.

.8 If the request for compensation for Stand-by Time has not received the pre-approval of Departmental Representative.

.3 Notification: Notify Departmental Representative in writing immediately in advance of all conditions for which Contractor may request payment for Stand-by Time. Immediately following the impact event, Contractor shall provide Departmental Representative with the number of hours of delay. If the time is approved by Departmental Representative, then Departmental Representative will notify Contractor of approval for payment under Stand-by Time. Departmental Representative has sole discretion as to whether a Stand-by Time event is approved or not, to the extent allowed by the Specification.

.36 Tailgate Meeting: Tailgate Meeting is defined as a meeting between the Contractor and the Contractor's crew (including subcontractors) that will occur on a daily basis throughout the duration of the work, and will focus on daily Health and Safety considerations associated with planned construction activities. The Contractor is responsible for scheduling daily Tailgate Meetings.

.37 Tender Item: Tender Item is defined as a measure of work presented on the Unit Price Table by which the Contractor shall provide cost to complete the work as part of the tender process.

.38 Tremie (and Tremie Concrete): Concrete that is placed underwater through a tube called a Tremie pipe. The Tremie pipe has a hopper at its upper end and may be open-ended or may have a foot valve, plug or travelling plug to control flow of concrete. Concrete is placed in the hopper and sufficient head of concrete is maintained in the Tremie pipe to provide the desired rate of flow for concrete placement in the work. Alternately, the pumped concrete method of placing concrete underwater utilizes a concrete pump with discharge line in similar manner to a Tremie pipe.

.39 Vertical Datum: Vertical datum for this work shall be Chart Datum, as shown on the Drawings.

.40 Waste Audit (WA): Relates to projected waste generation, and involves controlled separation of waste.

.41 Waste Reduction Work Plan (WRWP): A written report that addresses opportunities for reduction, re-use, or recycling of materials.

.42 Waste Quality: Waste Quality shall be defined as contaminated sediment and debris or other material that is not suitable for industrial, commercial, urban park, residential, agricultural, wild-lands, or other land use specified in the BC CSR.

.43 Wastewater Treatment and Disposal Facility: A facility designed, constructed, and operated for the primary purpose of treating and disposing of wastewater. The facility must be permitted under provincial law for the operation of the facility, treatment, and disposal of the treated wastewater.

.44 Weekly Construction Report: The Weekly Construction Report is to be submitted by Contractor to Departmental Representative each week and shall provide a summary of the week's construction activities that were completed under the Contract. Specific submittal requirements for the Weekly Construction Report are described in the individual Sections of the Specification.

.45 Working Day Durations (working days) : Working Day Durations refer to Monday through Friday, not including statutory holidays. The project working days are defined for submittal timeline purposes and do not preclude Contractor from performing work on other days provided the schedule meets the requirements of the Specification.

1.6 ADDITIONAL DEFINITIONS

.1 Some Sections of the Specification contain additional definitions (of capitalized terms) that are directly related to the scope of that Section. An example is the list of additional definitions contained in Section 01 32 16.06 (Construction Progress Schedule – Critical Path Method).

1.7 PUBLIC NOTIFICATION

.1 Prepare a public notification plan as part of the Construction Work Plan that provides all construction details pertinent to the public (or First Nations) interest and the methods to be used to provide this information to the public. Initial public notifications shall be executed by the Contractor prior to the start of work on site, and shall continue on a regular basis as necessary throughout the Project. Separate notifications shall be issued for different locations and activities, to properly target the information, and to provide adequate advance notice prior to the start of each activity in each location.

.2 Public notification is required for all work under the Contract pertinent to the public (or First Nations) interest, including: Contractor's Work Site work hours; Contractor's Work Site noise and dust control measures; off-site offload facility; off-site staging and stockpile area; off-site material source locations/facilities; in-water transportation timing, methods and routing; upland transportation timing, methods and routing; treatment; disposal; and notifications required by regulations/permits.

.3 Submit proposed notifications and communication materials to Departmental Representative for approval prior to issuance or use. Communications materials shall include a list of typical questions and answers that may be used in responding to the public and media.

.4 Have suitable trained staff available to respond to public communications / inquiries or media inquiries related to Contractor's operations.

.5 Notify Departmental Representative of any public / media inquiries or communications received, and provide documentation of every such communication, including Contractor's response.

.6 Any communications / inquiries received related to the project, any specifics of the project, or to EGD operations, shall be promptly forwarded to the Departmental Representative for response.

.7 Maintain a log of all public/media communications sent and received by Contractor, and the updated log shall be submitted to the Departmental Representative on a monthly basis.

.8 Acceptable notification methods may include: attendance and presentations at Municipal / Local council meetings; newspaper advertisements; door to door distribution of notices; and Project specific public / town hall meetings or open houses organized by Contractor, including poster presentations.

1.8 OTHER CONTRACTS

.1 Other contractors operate at the EGD facility.

.2 General contractors may include:

.1 Victoria Ship Yards Co. Ltd. (Seaspan Marine Corporation);

.2 Esquimalt Drydock Company;

.3 Other ship repair / maintenance contractors; and,

.3 Further Contracts may be awarded while this contract is in progress.

.4 Coordinate with other contractors in carrying out their respective works and comply with instructions from Departmental Representative.

1.9 ESQUIMALT GRAVING DOCK OPERATIONS

.1 The Esquimalt Graving Dock shall remain fully operational for the duration of the Contract..

.1 An example representation of vessel calls at the EGD facility can be found at: https://cse-egd.tpsgc-pwgsc.gc.ca/reserve-book-eng.cfm.

.2 An example of vessel calls at the EGD facility is also provided in the appendices to the Specification.

.3 Information found on the website and in the Specification appendices will vary from actual booking list conditions at the time of the work in this Contract, and is intended only to provide a general representation of vessel calls at the EGD facility.

.4 Contractor shall not use these reference sources as the basis for Tender. A booking list of planned vessels that will call at the EGD facility will be provided to Contractor following award of Contract. Changes to the booking list will occur and shall not be considered as a basis for any claim under the Contract.

.2 Ship repair contracts, tenant operations and EGD operations and other on-going contracts shall take priority over Contractor's Work. Contractor shall conduct its operations in a manner that will minimize interference with commercial vessel activities. In the event that Contractor's marine construction equipment obstructs the navigable waterway or berthing areas so as to hinder movement of commercial vessels or hinder EGD facility operations, the equipment shall immediately be moved, at Contractor's own expense to facilitate the operational activity.

.3 Contractor shall coordinate construction planning and sequencing of work with Departmental Representative. The Construction Work Plan shall provide a schedule and sequence for all construction activities associated with this work, based on the access requirements to maintain facility operations. Access requirements are described in the Specification.

.4 The EGD facility provides emergency vessel repair services and Contractor shall be prepared to relocate any construction equipment hindering access to the EGD facility within four (4) hours of notification provided by the facility through Departmental Representative.

.5 Contractor shall make allowance in its construction schedule for delays or interruptions due to vessel movement in the EGD Waterlot, specifically if Contractor equipment is blocking navigation lane in or out of the Graving Dock.

.6 Any damage to Contractor's equipment in navigation lanes due to Contractor's failure to remove when required shall be at Contractor's sole risk and expense.

.7 Contractor shall provide updates in its Weekly Construction Reports regarding planned locations for marine construction activities, and marine transportation activities within the subsequent reporting period.

.8 Any damage to Contractor's equipment due to Contractor's failure to move when required shall be at Contractor's sole risk and expense.

.9 Contractor shall complete all construction activities in a manner to minimize disruption to EGD operations.

.10 Contractor shall provide, as part of the Construction Work Plan, planned locations of floating equipment for all construction activities for times when in-water and marine construction activities will be occurring.

.11 Contractor shall accommodate planned / scheduled vessels that will be entering or exiting the EGD facility, with a minimum of four (4) hours notice.

.12 Contractor shall be compensated for Directed Moves when advised to move construction equipment by Departmental Representative to accommodate facility emergency or operational needs. Directed Moves only apply when Departmental Representative gives less than eight (8) hours advanced notice.

.13 Departmental Representative shall notify Contractor when a Directed Move is required to accommodate EGD facility emergency or routine vessel call

operations. Payment for Directed Move(s) will be made as indicated on the Unit Price Table.

1.10 DIVISION OF SPECIFICATIONS

.1 The Specification is subdivided into Divisions (e.g. Division 01, 02, 03 etc) and Sections (e.g. this Section 01 11 55) in accordance with the current 6-digit National Master Specifications System.

.2 A Division or Section may consist of the work of more than one (1) subcontractor or trade. Responsibility for determining which subcontractor or trade provides the labour, material, equipment, and services required to complete the work rests solely with the Contractor.

.3 In the event of discrepancies or conflicts when interpreting the Drawings and Specification, the Specification governs.

1.11 TIME OF COMPLETION AND CONSTRUCTION WINDOWS

.1 The following schedule conditions are fundamental to the Contract:

.1 Complete the work of this Contract (Esquimalt Graving Dock South Jetty Reconstruction) ready for use within **twenty (20) months**

.2 The marine fisheries timing windows when in-water construction is permitted are as follows:

.1 July 1st through September 30th (in the same year); December 1st through February 15th (of the following year).

.2 In accordance with the Fisheries Act Authorization, which includes the EMP, in-water works may also be undertaken in some areas during the following two periods:

.1 February 15th up to, and including, March 31st (in the same year);

.2 October 1st through to December 1st (in the same year).

.3 Bidders shall not contact Fisheries and Oceans Canada about any aspect of this project during the tender period.

.3 The abovementioned schedule conditions have been made with the EGD facility. Contractor is expected to complete all activities as described in the Contract documents within these dates.

1.12 HOURS OF WORK

.1 Restrictive as follows:

.1 Normal work hours are between 07:00 to 23:00 Monday through Friday (i.e. working days for submittal purposes) and Saturday, not including statutory holidays.

.2 Contractor may request to work outside the above-mentioned normal work hours. Submit written request to Departmental Representative to work outside of the normal work hours a minimum of forty-eight (48) hours in advance of all requested after-hours work, including Sundays and statutory holidays.

1.13 CONSTRUCTION WORK SCHEDULE AND PROGRESS DOCUMENTATION

.1 Prepare, update and submit a construction Detail Schedule, Master Plan, "month-by-month" cash flow estimate, and associated documents per the requirements of Section 01 32 16.06 (Construction Progress Schedule – Critical Path Method). The construction work schedule format shall be a network analysis of the critical path method.

.2 The updated construction Detail Schedules and "month-by-month" cash flow estimates shall identify the work clearly, showing the detailed items of work.

.3 Additional definitions and requirements related to scheduling activities are provided within Section 01 32 16.06 (Construction Progress Schedule – Critical Path Method).

1.14 MEASUREMENT AND PAYMENT

.1 Before submitting the first progress claim, submit a breakdown of the Contract unit rates and lump sum prices in detail as requested by Departmental Representative, aggregating to the Contract price.

.2 Measurement and payment for work completed to Departmental Representative's satisfaction will be made as stipulated in the relevant technical Section of the Specification for that work item and the Unit Price Table.

.3 Measurement for Departmental Representative-advised Directed Moves shall be through formal documented communications (i.e., letters or emails) with Contractor.

.4 Measurement for approved Stand-by Time shall be through formal documented communications (i.e., letters or emails) with Contractor.

.5 Payment for Departmental Representative-advised Directed Moves shall be made by each required Directed Move event under the Tender Item for DIRECTED MOVE, as described in the Unit Price Table.

.6 Payment for approved Stand-by Time shall be made on a per hour basis under the Tender Item for STAND-BY TIME, as described in the Unit Price Table.

.7 Payment for the pre-construction survey including underwater inspection and video recording shall be made under the tender item for PRE-CONSTRUCTION SURVEY.

1.15 CODES, BYLAWS AND STANDARDS

.1 Perform work in accordance with indicated codes and regulations, construction standards, and/or any other code or Bylaw of local application.

.2 Comply with local bylaws, and all Esquimalt Graving Dock rules, and regulations enforced at the location concerned.

.3 Meet or exceed requirements of the Contract Documents, specified standards, codes, and referenced documents.

.4 In any case of conflict or discrepancy, the most stringent requirements shall apply.

1.16 DOCUMENTS REQUIRED

.1 Maintain one (1) copy of each of the following documents and any other applicable documents at the Contractor's Work Site:

.1 Contract Drawings.

.2 Contract Specification and Appendices.

.3 Addenda to Contract documents (as applicable).

.4 Copy of accepted work schedule and most recent version of construction work schedule.

.5 Health and Safety Plan and other safety related documents.

.6 Notice of Project (NOP).

.7 Copies of Contractor bid bonds.

.8 Required pre-construction submittals that have been reviewed and accepted by the Departmental Representative.

.9 EMP.

.10 Permits and acceptances.

.11 Required construction submittals (e.g., shop drawings, materials data, product data, samples, MSDS data sheets, Contractor’s daily and weekly construction reports).

.12 Change orders.

.13 Other modifications to the Contract.

.14 Quality control test reports.

.15 Manufacturers’ installation and application instructions.

.16 One set of Drawings and Specifications marked-up for “as-built purposes.”

.17 Current construction standards of workmanship listed in each Section of the Specification (these can be in electronic format).

1.17 REGULATORY REQUIREMENTS

.1 Contractor is responsible for all Project Permits, with the exception of those provided as part of the Tender package.

.2 Obtain and pay for any additional permits (including Building Permit), certificates, licenses and other approvals that have not been provided by Departmental Representative and that are required by regulatory, municipal, provincial, or federal authorities, and commercial facilities to be used to complete the work.

.3 Obtain and pay for any additional permits, certificates, licenses and other approvals that have not been provided by Departmental Representative and that are required by Contractor to suit Contractor's means and methods to complete the work.

.4 The transportation of materials and equipment by barge requires Contractor to coordinate with the Queens Harbour Master (QHM) pursuant to the Canada Marine Act.

.5 Mark floating equipment with lights, buoys, or other acceptable markings in accordance with regulations for the prevention of collisions, requirements, and directives of EGD facility, and QHM.

.6 If any portion of off-site work is conducted on federal lands not administered by PWGSC, Contractor is required, as part of its operations, to contract the federal custodian to confirm the applicable regulatory or other requirements, that may apply to Contractor's operations.

.7 Provide inspection authorities with plans and information required for issue of acceptance certificates.

.8 Furnish inspection certificates in evidence that the work installed conforms to the requirements of the authority having jurisdiction.

1.18 CONTRACTOR'S USE OF SITE

.1 The Esquimalt Graving Dock shall be assumed to be operational for the duration of the Contract.

.2 The Contractor's Work Site is indicated on the Drawings.

.3 Contractor shall provide the Departmental Representative a duly completed Indemnification Form and a Schedule 1 Form in order to gain waterborne access to the EGD facility and the Contractor's Work Site (i.e. access by Contractor's marine derricks, barges, tugboats, survey boats and other watercraft). These forms are attached in an Appendix to the Specification.

.4 Contractor is designated as Prime Contractor on the Contractor's Work Site and assumes all responsibilities of Prime Contractor as per relevant acts and regulations. Contractor shall be responsible for all work conducted by Contractor and Contractor's subcontractors on the Contractor's Work Site.

.5 Use of Contractor's Work Site:

.1 The Contractor's Work Site will be made available completely and exclusively to Contractor for execution of the work, (except where

indicated otherwise on the Drawings) to suite the timing for the work as shown on Contractor's construction work schedule that has been accepted by the Departmental Representative.

.2 Assume responsibility for assigned premises for performance of the work.

.3 Coordinate with Departmental Representative all work activities associated with this Contract.

.4 Provide security of Contractor's Work Site and all Contractor's and subcontractors' equipment and material. Secure Contractor's Work Site at the end of each work day.

.6 Perform work in accordance with Contract documents

.7 Do not unreasonably encumber the Contractor's Work Site with material and equipment.

.8 Any area in the EGD property to which access is restricted by signage is a secured or restricted area and shall not be entered, unless otherwise approved by Departmental Representative.

.9 Do not obstruct access to the EGD facility outside of the Contractor's Work Site. Maintain overhead clearances, keep roadways and walkways clear, maintain vessel navigation as described in the Specification, and maintain routes for emergency response vehicles.

.10 The Contractor shall comply with all loading limitations in force at EGD facility.

1.19 EXAMINATION

.1 Examine the Contractor's Work Site and be familiar and conversant with existing conditions likely to affect the work.

.2 Provide photographs of surrounding properties, objects, and structures liable to be damaged or be the subject of subsequent claims.

1.20 EXISTING SERVICES

.1 Where work involves breaking into, disconnecting, or connecting into existing services, carry out work at time as advised by Departmental Representative and as stipulated in the Specification.

.2 Except where connection into (or other similar disturbance of) utilities is required for the work, do no damage to existing utilities at the EGD facility. If any damage to EGD utilities occurs, and is attributable to Contractor's actions, immediately repair any such damage to satisfaction of Departmental Representative.

1.21 LOCATION OF EQUIPEMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain Departmental Representative's acceptance for actual locations if different from locations shown on the Drawings.

.4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by Departmental Representative.

1.22 SETTING OUT OF WORK

.1 Assume full responsibility for, and execute complete layout of, work to locations, lines, and elevations indicated.

.2 Provide all equipment, devices, materials, labour, and supplies needed to layout and construct the work.

.3 Facilitate the Departmental Representative's inspection of the work.

1.23 ACCEPTANCE OF SUBSTRATES

.1 Contractor shall examine existing surfaces, surfaces prepared by other contractors, and job conditions that may affect the work, and shall report defects to Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.24 QUALITY OF WORK

.1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.

.2 Workmanship, accuracy, erection methods and procedures shall meet minimum standards set out in the applicable codes and standards for that part of the work.

.3 In cases of dispute, decisions as to standard, accuracy or quality of work rest solely with Departmental Representative, whose decision is final.

1.25 WORKS COORDINATION

.1 Coordinate work of sub-trades.

.1 Designate one person to be responsible for review of Contract documents and shop drawings and managing coordination of work.

.2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.

.1 Provide each subcontractor with a complete set of the Drawings and Specification for the Contract, to assist them in planning and carrying out their respective work.

.2 Develop coordination drawings when required to facilitate the work, illustrating potential interference between the work of various trades, and distribute to affected parties.

.1 Pay particular close attention to overhead work and work within or near to structural elements.

.2 Identify on coordination drawings the structural elements, service lines, and location of external tie-in to existing EGD services.

.3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.

.4 Plan and coordinate work in such a way to construct the work as shown on the Drawings, with minimum number of service line offsets and bends.

.5 Submit copy of coordination drawings to Departmental Representative for information purposes.

.6 Submit shop drawings and product data only after coordination meeting for such items has taken place and coordination drawings have been prepared and issued to Departmental Representative.

.3 Work coordination:

.1 Ensure cooperation between trades in order to facilitate general progress of work and avoid situations of spatial interference.

.2 Ensure that each trade provides all other trades reasonable opportunity for completion of work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.

.3 Ensure disputes between subcontractors are resolved.

.4 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate work among trades and subcontractors.

1.26 SUBMITTALS

.1 In accordance with Section 01 33 00 (Submittal Procedures), submit the requested shop drawings, materials data, product data, MSDS sheets and samples indicated in each Section of the Specification.

.2 Allow sufficient time for the following:

.1 Review of shop drawings.

.2 Review of material / product data and MSDS sheets and samples.

.3 Review of re-submissions as necessary for acceptance by Departmental Representative.

.4 Ordering of accepted materials and/or products.

.3 Refer to Section 01 33 00 (Submittal Procedures) for review periods and other requirements for submittals.

1.27 RELICS AND ANTIQUITIES

.1 Relics and antiquities may be encountered during the work under the Contract. Contractor shall protect such articles and notify Departmental Representative immediately if they are encountered, as described in Section 01 35 43 (Environmental Procedures and Sustainability).

.2 Relics and antiquities and items of historical or scientific interest shall remain property of the Crown. Protect such articles and request course of action from Departmental Representative.

.3 Give immediate notice to Departmental Representative if evidence of archeological finds are encountered during dredging or excavation, and await Departmental Representative's written instructions before proceeding with work in this area.

1.28 PRODUCTS SUPPLIED BY DEPARTMENTAL REPRESENTATIVE

.1 No products will be supplied by Departmental Representative, other than items to be re-used in the work, and are as indicated on the Drawings and in relevant Sections of the Specification, such as ladders and kiosks.

1.29 EGD SITE ACCESS AND SECURITY

.1 Contractor's personnel (and his subcontractors' personnel) employed on this project will be subject to security check at entry into, and exit from, the EGD Facility. Obtain requisite clearances, as instructed, for each individual required to enter the EGD facility.

.2 Personnel will be checked provided with a pass that must be worn at all times.

.3 Contractor shall secure Contractor's equipment and staging areas and its contents throughout the construction period.

1.30 TESTING AND INSPECTION

.1 Requirements for testing and inspection to be carried out by Contractor's Quality Control testing service or laboratory accepted by Departmental Representative are specified in the Contract documents.

.2 Contractor shall appoint and pay for the services of a Quality Control testing agency or testing laboratory to perform Quality Control testing as required in each Section of the Specification, and also where required for the following:

.1 Inspection and testing required by laws, ordinances, rules, regulations, or orders of public authorities.

.2 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.

.3 Inspection and testing performed exclusively for Contractor's convenience.

.3 Where tests or inspections by Contractor's Quality Control testing agency or testing laboratory reveals that work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as Departmental Representative may require to verify acceptability of corrected work.

.4 Notify the Departmental Representative in advance of planned tests or inspections.

.5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.6 Pay costs for uncovering and make good work that is covered before required inspection or testing is completed and accepted by Departmental Representative.

.7 Provide Departmental Representative with Quality Control reports from testing agency or laboratory as soon as they are available.

.8 Departmental Representative may require, and pay for, additional inspection and testing services beyond those specified or otherwise required.

1.31 SURVEYING AND RECORDING CHANGES IN THE WORK

.1 Within ten (10) working days after Notice of Award, submit to Departmental Representative the name of the licensed surveyor (member of the Association of British Columbia Land Surveyors, ABCLS) or Professional Engineer registered to practice in the Province of British Columbia, who is employed by the Contractor, who will be responsible for the preparation and submittal of the hardcopy Record Documents (for "as-built" purposes) for the constructed works, as appropriate to the portion of the work under consideration.

.2 Record Documents, describing the final accurate "as-built" condition of the constructed works, prepared by the Contractor's licensed surveyor or Professional Engineer as appropriate to the portion of the work under consideration, shall be submitted to Departmental Representative as required by Section 01 78 00 (Closeout Submittals).

1.32 RECORD DOCUMENTS (FOR "AS-BUILT PURPOSES")

.1 The Departmental Representative will provide two (2) sets of hardcopy Contract Drawings and two (2) sets of hardcopy Specifications, for Contractor to annotate for Record Document purposes.

.2 The Departmental Representative will provide one (1) set of the original AutoCAD files of the Contract Drawings, for Contractor's general use during construction at his own risk. No representation is made as to the correctness or completeness of these AutoCAD Drawings. These AutoCad drawings are provided for informational purposes only, and do not replace or supersede the Contract Drawings.

.3 As work progresses, maintain accurate records to show all deviations from the Contract documents. Annotate the Specifications, Contract Drawings and shop drawings as changes occur. Record changes in red ink.

.4 Review all annotations (draft Record Document information) with Departmental Representative during every project progress meeting to ensure up-to-date documentation at the completion of project.

.5 Refer to Section 01 78 00 (Closeout Submittals) for submittal of Record Documents.

.6 Contractor to submit AutoCAD versions of all record drawings.

1.33 ADDITIONAL DRAWINGS

.1 Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with the Contract Drawings.

.2 Upon request, Departmental Representative may furnish up to a maximum of ten sets of Contract documents for use by Contractor at no additional cost. Of these ten (10) sets, only two (2) sets will include full-size prints of the Drawings, the remainder being half-size prints. Should more than ten (10) sets of documents be required, Departmental Representative will provide them at additional cost.

1.34 CLEANING

.1 Conduct cleaning and disposal operations daily. Comply with local ordinances and anti-pollution laws.

.2 Ensure cleanup of the work areas each day after completion of work.

1.35 MAINTENANCE MATERIALS, SPECAL TOOLS AND SPARE PARTS

.1 Specific requirements for maintenance materials, tools, and spare parts are specified in individual Sections of the Specifications.

1.36 BUILDING SMOKING ENVIRONMENT

.1 Smoking within any building is not permitted.

.2 Comply with EGD Smoking Policy and smoke only at designated smoking areas.

1.37 SYSTEM OF MEASUREMENT

.1 The metric system of measurement (SI) will be employed on this Contract.

1.38 FAMILIARIZATION OF CONTRACTOR'S WORK SITE

.1 Before submitting tender, attend tender site meeting as indicated in the Tender documents and become familiar with all conditions likely to affect the cost of the Work. Access to the EGD facility will be made available only during the Tender site meeting and not at the Contractor's discretion.

.2 No claims or change orders will be entertained by PWGSC in regard to existing conditions due to lack of familiarity with the Contractor's Work Site.

1.39 SUBMISSION OF TENDER

.1 Submission of a Tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Meetings shall be required throughout the duration of the work as described in the Specification.

.2 Contractor shall attend all required meetings and provide required preparation and follow-up materials.

1.2 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for effort associated with project meetings.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to the Contract.

1.5 SUBMITTALS

.1 Contractor shall provide pre-construction, progress, and post-construction submittals in accordance with the requirements of Section 01 33 00 (Submittal Procedures).

1.6 REFERENCES

.1 NOT USED

1.7 ADMINISTRATIVE

.1 Contractor shall complete the following activities regarding administration of meetings throughout the progress of the work:

.1 Schedule and administer Progress Meetings and Tailgate Meetings as required, or at the request of Departmental Representative.

.2 Prepare agendas for Progress Meetings.

.3 Distribute written notice of each Progress Meeting two (2) working days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for Progress Meetings and Tailgate Meetings.

.5 Preside at Progress Meetings and Tailgate Meetings.

.2 Contractor will record the Progress Meeting minutes, including significant proceedings and decisions, and identify actions by parties.

.1 Contractor will reproduce and distribute copies of Progress Meeting minutes within three (3) working days after meetings and transmit to the meeting participants. Departmental Representative will review meeting minutes and request changes as applicable. Contractor shall provide a final copy of meeting minutes within three (3) days after receipt of comments from Departmental Representative.

.3 Representatives of Contractor, subcontractors, and suppliers attending Progress Meetings shall be qualified and authorized to act on behalf of the party each represents.

1.8 PRECONSTRUCTION MEETING

.1 Within ten (10) working days after award of Contract, Departmental Representative will request a meeting of parties involved in the Contract to discuss and resolve administrative procedures and responsibilities.

.2 PWGSC and its project team, Departmental Representative, Contractor, and major subcontractors will be in attendance.

.3 Departmental Representative will incorporate mutually agreed variations to Contract documents into agreement, prior to signing.

.4 Contractor shall be prepared to discuss and/or provide, at a minimum, the following information at the Pre-Construction Meeting:

.1 Appointment of official representative of participants in the work.

.2 Contractor Health and Safety.

.3 Construction Work Schedule.

.4 Construction Work Plan (in outline only).

.5 Environmental Management.

.6 Schedule of submissions, including but not limited to, Construction Work Plan, Health and Safety Plan, Quality Control Plan, and Environmental Protection Plan.

.7 WorkSafe BC Notice of Project.

.8 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, and fences.

.9 Daily Tailgate Meeting.

.10 Progress Meetings.

.11 EGD Work Site security.

.12 Project administration, including:

.1 Proposed changes, change orders, procedures, acceptances required, time extensions, and administrative requirements.

.2 Monthly progress claims, administrative procedures, photographs, and hold backs.

.3 Appointment of inspection and testing agencies or firms.

.4 Insurances and transcripts of policies.

1.9 PROGRESS MEETINGS

.1 During the course of the work, Contractor shall schedule Progress Meetings at least once per week.

.2 Contractor, major Subcontractors involved in the work, PWGSC and its project team, and the Departmental Representative are to be in attendance.

.3 Contractor shall notify parties a minimum of two (2) working days prior to Progress Meetings.

.4 Contractor will reproduce and distribute copies of Progress Meeting minutes within three (3) working days after meetings and transmit to the meeting participants. Departmental Representative will review Progress Meeting minutes and request changes as applicable. Contractor shall provide a final copy of Progress Meeting minutes within three (3) days after receipt of comments from Departmental Representative.

.5 Progress Meeting agendas shall include, at a minimum, the following:

.1 Review and acceptance of minutes from previous meeting.

.2 Health and Safety considerations.

.3 Review of work progress since previous meeting.

.4 Field observations, problems, or conflicts.

.5 Environmental Management.

.6 Problems that impede the construction schedule.

.7 Corrective measures (action items) and procedures to regain the projected schedule.

.8 Revisions to the Construction Work Schedule.

.9 Progress schedule, during succeeding work period.

.10 Review submittal schedules: expedite as required.

.11 Maintenance of quality standards.

.12 Review proposed changes for effect on construction schedule and on completion date.

.13 Current or Potential Change Order discussion.

.14 Other business.

.6 Departmental Representative may schedule additional project meetings as necessary.

1.10 TAILGATE MEETINGS

.1 During the course of the work, Contractor shall hold daily Tailgate Meetings to occur at the start of each work shift. Multiple Tailgate Meetings shall be held if Contractor intends to work multiple shifts within a 24-hour period.

.2 Tailgate Meeting agenda shall include, at a minimum, the following:

.1 Sign-in of all attendees.

.2 Planned work activities and environmental considerations for that shift.

.3 Hazards associated with these work activities, including environmental hazards (e.g., potential for hypothermia, heat exhaustion, or heat stroke).

.4 Appropriate job-specific safe work procedures.

.5 Required personal protective equipment (PPE).

.6 Appropriate emergency procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes general requirements and procedures for preparation of the Contractor's construction Master Plan, construction Detail Schedule (CPM logic diagram), cash flow estimates, and associated documents. Additional requirements are provided for ongoing progress monitoring and reporting throughout the project.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 11 55 (General Instructions)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All costs for execution, preparation, reproduction, submittal and re-submittal (as stipulated by the Specification) of schedule submittals are deemed incidental to the work.

1.4 REFERENCES

.1 Not used

1.5 DEFINITIONS

.1 Activity: Element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Actual Finish Date (AF): Point in time that Work actually ended on activity.

.3 Actual Start Date (AS): Point in time that Work actually started on activity.

.4 Bar Chart (Gantt chart): Graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars.

.5 Baseline: Original approved plan (for Project, work package, or activity), plus or minus approved scope changes.

.6 Completion Milestones: Completion of major components of work, Substantial Completion and Total Completion.

.7 Constraint: Applicable restriction that will affect performance of Project. Factors that affect activities can be scheduled.

.8 Control: Process of comparing actual performance with planned performance, analyzing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.

.9 Critical Activity: Any activity on a critical path; most commonly determined by using critical path method.

.10 Critical Path : Series of activities that determines duration of Project. In deterministic model, critical path is usually defined as those activities with float less than or equal to specified value, often zero. It is longest path through Project.

.11 Critical Path Method (CPM): Network analysis technique used to predict Project duration by analyzing which sequence of activities (which path) has least amount of scheduling flexibility (least amount of Float).

.12 Data Date (DD): Date at which, or up to which, Project's reporting system has provided actual status and accomplishments.

.13 Detail Schedule: The detailed CPM logic diagram describing the work, as explained elsewhere in this Section of the Specification.

.14 Duration: Number of work periods (not including holidays or other non-working periods) required to complete activity or other Project element; usually expressed as workdays or work weeks.

.15 Early Finish Date (EF): In critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can finish, based on network logic and schedule constraints. Early finish dates can change as Project progresses and changes are made to Project plan.

.16 Early Start Date (ES): In critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can start, based on network logic and schedule constraints. Early start dates can change as Project progresses and changes are made to Project Plan.

.17 Finish Date: Point in time associated with activity's completion. This is usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.

.18 Float: Amount of time that activity may be delayed from its early start without delaying Project finish date. Float is mathematical calculation, and can change as Project progresses and changes are made to Project plan.

.19 Lag: Modification of logical relationship that directs delay in successor task.

.20 Late Finish Date (LF): In critical path method, latest possible point in time that activity may be completed without delaying specified milestone (usually Project finish date).

.21 Late Start Date (LS): In critical path method, latest possible point in time that activity may begin without delaying specified milestone (usually Project finish date).

.22 Lead: Modification of logical relationship that allows acceleration of successor task.

.23 Logic Diagram: See definition of Project Network Diagram.

.24 Master Plan: Summary-level schedule that identifies major activities and key Milestones.

.25 Milestone: Significant event in Project, usually completion of major deliverable.

.26 Monitoring: Capture, analysis, and reporting of Project performance, usually as compared to plan.

.27 Near-Critical Activity: Activity that has low total float.

.28 Non-Critical Activities: Activities which when delayed, do not affect specified Contract duration.

.29 Project Control System: Fully computerized system, utilizing Microsoft Project software package, showing specific tasks, dates, critical path of anticipated stages of work, and final completion of the work within the time period required by the Contract documents.

.30 Project Network Diagram: Schematic display of logical relationships of Project activities. Always drawn from left to right to reflect Project chronology.

.31 Project Plan: Formal, approved document used to guide both Project execution and Project control. Primary uses of Project plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines. Project plan may be summary or detailed.

.32 Project Planning: Development and maintenance of Project Plan.

.33 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of Project Work in relation to established milestones.

.34 Project Schedule: Planned dates for performing activities and planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be

accomplished to satisfy project objectives. Monitoring and control process involves using project schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.35 Quantified Days Duration: Working days based on 5 day work week, discounting statutory holidays.

.36 Risk: Uncertain event or condition that, if it occurs, has positive or negative effect on Project's objectives.

.37 Scheduled Finish Date (SF): Point in time that work was scheduled to finish on activity. Scheduled finish date is normally within range of dates delimited by early finish date and late finish date.

.38 Scheduled Start Date (SS): Point in time that work was scheduled to start on activity. Scheduled start date is normally within range of dates delimited by early start date and late start date.

.39 Start Date: Point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.

.40 Work Breakdown Structure (WBS): Deliverable-oriented grouping of project elements that organizes and defines total work scope of Project. Each descending level represents increasingly detailed definition of Project work.

1.6 SYSTEM DESCRIPTION

.1 Construction progress schedule: Describes processes required to ensure timely completion of Project. These processes ensure that various elements of Project are properly coordinated. It consists of planning, time estimating, scheduling, progress monitoring and control.

.2 Planning: This is most basic function of management, that of determining presentation of action and is essential.

.1 It involves focusing on objective consideration of future, and integrating forward thinking with analysis; therefore, in planning, implicit assumptions are made about future so that action can be taken today.

.2 Planning and scheduling facilitates accomplishment of objectives and should be considered continuous interactive process involving planning, review, scheduling, analysis, monitoring and reporting.

.3 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made. This implies progressively more reliability of scheduling data. The construction Detail Schedule is used for analysis and progress monitoring.

.4 Ensure project schedule efficiencies through monitoring.

.1 When activities begin on time and are performed according to estimated durations without interruptions, original Critical Path will remain accurate. Changes and delays will however, create an essential need for continual monitoring of Project activities.

.2 Monitor progress of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.

.5 Monitoring should be done sufficiently often so that causes of delays are immediately identified and removed if possible.

.6 Project monitoring and reporting: As Project progresses, keep team aware of changes to schedule, and possible consequences. In addition to Bar Charts and CPM networks, use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.

.1 Narrative reporting begins with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.

1.7 CPM REQUIREMENTS

.1 Ensure Master Plan and construction Detail Schedule are practical and remain within specified Contract duration.

.2 Master Plan and construction Detail Schedule deemed impractical by Departmental Representative are to be revised and re-submitted for review and acceptance by Departmental Representative.

.3 Acceptance of Master Plan and construction Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract. Duration of Contract may only be changed through bilateral Agreement.

.4 Consider Master Plan and construction Detail Schedule deemed practical by Departmental Representative, showing Work completed in less than specified Contract duration, to have float.

.5 First Milestone on Master Plan and construction Detail Schedule will identify start Milestone with an “ES” constraint date equal to Award of Contract date.

.6 Calculate dates for completion milestones from Plan and Schedule using specified time periods for Contract.

.7 Substantial Completion and Total Completion with “LF” constraint equal to calculated date.

.8 Delays to non-critical activities, those with float may not be basis for time extension.

.9 Do not use float suppression techniques such as software constraints, preferential sequencing, special lead/lag logic restraints, extended activity times or imposed dates other than required by Contract.

.10 Allow for and show Master Plan and construction Detail Schedule adverse weather conditions normally anticipated. Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.

.11 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration. Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.

.12 Arrange participation on and off site of subcontractors and suppliers, as required by Departmental Representative, for purpose of network planning, scheduling, updating and progress monitoring. Approvals by Departmental Representative of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.

.13 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, and Final Certificate as defined times of completion are of essence to this contract.

1.8 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit to Departmental Representative the Contractor's Project Control System for planning, scheduling, monitoring and reporting of project progress.

.3 Submit letter confirming that schedule has been prepared in co-ordination with major sub-contractors.

.4 Submit Project planning, monitoring and control system data as part of initial schedule submission and status reporting as required by Departmental Representative in following form:

.1 CD files in original scheduling software (Microsoft Project) containing schedule and cash flow information, labelled with data date, specific update, and person responsible for update.

.2 Master Plan Bar Chart.

.3 Construction Detail Schedule Bar Chart.

.4 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.

.5 Criticality report listing activities and milestones with negative, zero and up to five (5) days total float used as first sort for ready identification of critical or near critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.

.6 Progress report in early start sequence, listing for each trade, activities due to start, underway, or finished within two (2) months from update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

.7 Initial "month-by-month" cash flow estimate for all construction works, as outlined elsewhere in this Section of the Specification.

.5 Submit construction Detail Schedule updates (and companion schedules) and monthly cash flow estimates as outlined elsewhere in this Section of the Specification.

1.9 QUALITY ASSURANCE

.1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including Commissioning.

1.10 PROJECT MEETING

.1 Meet with Departmental Representative during Pre-Construction Meeting, to establish work requirements and approach to project construction operations.

1.11 WORK BREAKDOWN STRUCTURE

.1 Prepare construction Work Breakdown Structure (WBS) within twenty-one (21) calendar days of Award of Contract date. The breakdown of work shall, at a minimum, show all of the items identified in the Unit Price Table and significant design, manufacturing, construction, and installation activities.

1.12 CASH FLOW ESTIMATES

.1 Prepare and submit an initial "month-by-month" cash flow estimate for all construction works within twenty-one (21) calendar days of Award of Contract date. The breakdown of work shall, at a minimum, show all of the items identified in the Unit Price Table and significant design, manufacturing, construction, and installation activities. Detailed format for cash flow estimates shall be determined by Departmental Representative, in consultation with Contractor.

.2 Prepare and submit with each monthly progress draw an updated "month-by-month" cash flow estimate for all construction works. The month-by-month cash flow estimates shall:

.1 Be based on the contract Unit Price Table, and the current approved Contractor's construction schedule.

.2 Be consistent with progress payment claims submitted to date.

.3 Include most up to date confirmed, actual quantities, as well as most up to date and accurate estimate of remaining quantities.

.4 Include Change Orders for additional cost items that have been incorporated into the Contract.

.5 If work is conducted in more than one fiscal year (i.e. April 1st to March 31st), include a separate sub-total for each fiscal year.

.6 Provide an updated total estimated final Contract value, excluding and including applicable taxes.

1.13 MASTER PLAN

.1 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.

.2 Prepare comprehensive construction Master Plan (CPM logic diagram) and dependent Cash Flow Projection within twenty-one (21) calendar days of Award of Contract date to confirm validity or alternates of identified milestones. Master Plan will be used as baseline.

.1 Revise baseline as conditions dictate and as required by Departmental Representative.

.2 Departmental Representative will review and return revised baseline within seven (7) calendar days.

.3 Reconcile revisions to Master Plan and Cash Flow Projections with previous baseline to provide continuous audit trail.

.4 Initial and subsequent Master Plans will include:

.1 CD containing schedule and cash flow information, clearly labelled with data date, specific update, and person responsible for update.

.2 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.

.3 Network diagram showing coding, activity sequencing (logic), total float, early / late dates, current status and durations.

.4 Actual / projected monthly cash flow: expressed monthly and shown in both graphical and numerical form.

1.14 CONSTRUCTION DETAIL SCHEDULE

.1 Provide construction Detail Schedule (CPM logic diagram) within twenty-one calendar days of Award of Contract date showing activity sequencing, dates, interdependencies, equipment resourcing and assumed working hours / shifts / days. Include listed activities as follows:

.1 Submission of shop drawings, materials data, product data, MSDS data sheets and samples.

.2 Approvals.

.3 Procurement (including off-site prefabrication activities, and items with long lead time).

.4 Construction.

.5 Installation.

.6 Site works.

.7 Commencement and completion of work.

.8 Allowable in-water construction time periods and indicate on construction work schedule when in-water work cannot be performed.

.9 Other specified scheduling constraints.

.10 Final completion date within the time period required by the Contract documents.

.11 Commissioning and acceptance.

.2 Detail CPM schedule to cover in detail complete project life cycle beginning from Award of Contract to completion of the work.

.1 Detail activities completely and comprehensively throughout duration of project.

.3 Relate construction Detail Schedule activities to basic activities and milestones developed and approved in Master Plan.

.4 Clearly show sequence and interdependence of construction activities and indicate:

.1 Start and completion of all items of the work, their major components, and interim milestone completion dates.

.2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:

.1 Time for submittals, resubmittals and review.

.2 Time for fabrication and delivery of manufactured products for the work.

.3 Interdependence of procurement and construction activities.

.3 Include sufficient detail to assure adequate planning and execution of the work. Activities should generally range in duration from three (3) to fifteen (15) workdays each.

.5 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.

.6 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.

.7 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Departmental Representative for review effects created by insertion of new Change Order.

.8 The construction Detail Schedule shall include sufficient time for Departmental Representative review and acceptance of all work, Contractor corrective work if determined necessary by Departmental Representative, and cleaning / equipment decontamination, where required, prior to the designated substantial completion date.

1.15 REVIEW OF THE CONSTRUCTION DETAIL SCHEDULE

.1 Allow seven (7) calendar days for review by Departmental Representative of proposed construction Detail Schedule.

.2 Upon receipt of reviewed Detail Schedule make necessary revisions and resubmit within seven (7) calendar days to Departmental Representative for review and acceptance.

.3 Promptly provide additional information to validate practicability of construction Detail Schedule as required by Departmental Representative.

.4 Submittal of construction Detail Schedule indicates that it meets Contract requirements and will be executed generally in sequence.

.5 The construction Detail Schedule, as reviewed and accepted by Departmental Representative, will be an integral part of the Contract and will establish interim completion dates for the various activities under the Contract.

1.16 COMPLIANCE WITH (AND ADJUSTMENT OF) CONSTRUCTION DETAIL SCHEDULE

.1 Comply with the reviewed construction Detail Schedule.

.2 Proceed with significant changes and deviations from scheduled sequence of activities that cause delay, only after written receipt of approval by Departmental Representative.

.3 Identify activities that are behind schedule and causing delay. Should any activity not be completed by the stated scheduled date, Departmental Representative will have the right to require Contractor to expedite completion of the activity by whatever means appropriate and necessary, without additional compensation to Contractor. Corrective measures may include:

.1 Increase of personnel on site for effected activities or work package.

.2 Increase in materials and equipment.

.3 Overtime work / additional work shifts.

.4 Submit to Departmental Representative, justification, project schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. The construction Detail Schedule shall be used to justify time extension days requested by Contractor. Include as part of supporting evidence:

.1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved contract schedule.

.2 Prepared schedule indicating how change will be incorporated into the overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.

.3 Other supporting evidence requested by Departmental Representative.

.4 Do not assume approval of Contract extension prior to receipt of written approval from Departmental Representative.

.5 In event of Contract extension, display in the construction Detail Schedule that scheduled float time available for work involved has been used in full without jeopardizing earned float.

.1 Departmental Representative will determine and advise Contractor number of allowable days for extension of Contract based on project schedule updates for period in question, and other factual information.

.2 Construction delays affecting project schedule will not constitute justification for extension of contract completion date.

1.17 PROGRESS MONITORING AND REPORTING

.1 Requirements for progress monitoring and reporting are basis for progress payment request.

.2 On an ongoing basis, the construction Detail Schedule must show “Progress to Date”.

.3 Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring.

.4 Inspect Work with Departmental Representative at least once (1) monthly to establish progress on each current activity shown on applicable networks.

.5 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.

.6 Review, update and submit the construction Detail Schedule to Departmental Representative **at or just before each weekly construction progress meeting.** The updated construction Detail Schedule shall reflect activities completed to

date, activities in progress, logic and duration changes. The weekly update of the construction Detail Schedule shall be submitted in paper and electronic formats (source file and PDF formats).

.7 Upon Departmental Representative's request, issue a companion schedule (in source file and PDF formats) showing all sequencing logic, dependencies, equipment resourcing and assumed working hours / shifts / days.

.8 Provide a short-term "4-week look ahead schedule" based on the updated construction Detail Schedule at two-weekly intervals. The short-term "4-week look ahead schedule" shall be submitted in paper and electronic formats (source file and PDF formats).

.9 All changes to the construction Detail Schedule of more than three (3) working days shall be documented on the updated schedule and shall be submitted both in writing and electronic format (e-mailed) to Departmental Representative.

.10 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.

.11 Interim reviews of work progress based on the construction Detail Schedule will be conducted as decided by Departmental Representative, and the schedule shall be updated by Contractor in conjunction with, and to the acceptance of Departmental Representative.

.12 Submit monthly written report based on construction Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:

.1 Description of progress made.

.2 Pending items and status of: permits, shop drawings, Change Orders and possible time extensions.

.3 Status of Contract completion date and milestones.

.4 Current and anticipated problem areas, potential delays and corrective measures.

.5 Review of progress and status of Critical Path activities.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes general requirements and procedures for Contractor's submissions of all required submittals following award of the Contract (including the Construction Work Plan, other plans, construction schedule, cash flow estimate, shop drawings, product samples, and product testing data) to Departmental Representative for review.

.2 Contractor is to provide submittals to Departmental Representative in advance of, and throughout the duration of the work.

.3 Detailed requirements for each submittal are stipulated in the related Sections of the Specification.

1.2 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for required submittals or for re-submittals, as described in this Section, except as described in Clauses 1.2.3 and 1.2.4 of this Section.

.2 Pre-construction and post-construction submittals will not be measured for payment.

.3 Pre-construction submittals and re-submittals will be paid for at the Lump Sum price tendered for PRE-CONSTRUCTION SUBMITTALS. Payment shall include for all costs in connection with pre-construction submittals and re-submittals. The Lump Sum tendered for pre-construction submittals will be paid on completion of all applicable items listed in this Section to the satisfaction of Departmental Representative.

.4 Post-construction submittals and re-submittals will be paid for at the Lump Sum price tendered for POST-CONSTRUCTION SUBMITTALS. Payment shall include for all costs in connection with post-construction submittals and re-submittals. The Lump Sum tendered for post-construction submittals shall be paid on completion of all applicable items listed in this Section to the satisfaction of Departmental Representative.

.5 Construction submittals and re-submittals shall be considered as incidental to the work.

1.3 RELATED SECTIONS

.1 All Sections of the Contract documents shall apply to requirements for submittals associated with the work. The Contractor shall review and be familiar with the structure and contents of all required submittals.

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to the work.

1.5 SUBMITTALS

.1 This summary list (**Tables 1, 2 and 3**) is presented for the Contractor's convenience only, and no warranty is given to its accuracy or completeness. In the event of any discrepancies with individual Sections of the Specification, the requirements of the individual Section of the Specification apply.

SUMMARY LIST OF SUBMITTALS

Table 1 – Pre-Construction Submittals

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
1	01 11 55	1.18.3	Indemnification Form and Schedule 1 Form	Per the Specifications
2	01 11 55	1.31.1	Name of Licensed Surveyor or Professional Engineer	Within Ten (10) Working Days After Notice of Award
3	01 11 55 01 32 16.06 01 32 16.06 01 32 16.06	1.13.1 1.8.5 1.17.6 1.14.1	Construction Detail Schedule	Within Twenty-One (21) Calendar Days of Award of Contract
4	01 32 16.06	1.15.2	Resubmit of Reviewed Construction Detail Schedule	Within Seven (7) Calendar Days of Receiving Review
5	01 32 16.06	1.11.1	Work Breakdown Structure (WBS)	Within Twenty-One (21) Calendar Days of Award of Contract Date
6	01 11 55 01 32 16.06 01 32 16.06	1.13.1 1.7.2 1.13.2	Master Plan	Within Twenty-One (21) Calendar Days of Award of Contract
7	01 11 55 01 32 16.06 01 32 16.06	1.13.1 1.12.1 1.12.2	Initial Cash-Flow Estimate	Within Twenty-One (21) Calendar Days of Award of Contract

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
8	01 11 55	1.14.1	Contract Unit Rates and Lump Sum Prices	Prior to Submitting the First Progress Claim
9	01 32 16.06 01 32 16.06	1.8.2 1.8.4	Project Control System	Per the Specifications
10	01 32 16.06	1.8.3	Project Control System Letter Confirming Sub-Contractors	Per the Specifications
11	01 33 00	1.10.1	Workers' Compensation Board Status	Immediately After Award of Contract
12	01 33 00	1.10.2	Transcription of Insurance	Immediately After Award of Contract
13	01 35 13.43 01 35 43	1.5.1 1.5.2	Environmental Protection Plan (EPP)	Within Twenty-Eight (28) Calendar Days Following Contract Award
14	01 35 13.43 01 35 43	1.5.1.1 1.5.6.6	Wastewater Management and Disposal Plan (WWMDP)	As Part of the Environmental Protection Plan (EPP)
15	01 35 13.43 01 35 43	1.5.1.2 1.5.6.5	Pollution Control Plan (PCP)	As Part of the Environmental Protection Plan (EPP)
16	01 35 13.43 01 35 13.43 01 35 43	1.5.1.3 1.18.2 1.5.6.7	Stormwater Pollution Prevention Plan (SWPPP)	As Part of the Environmental Protection Plan (EPP)
17	01 35 13.43 01 35 13.43	1.5.1.4 1.19.1	Temporary Erosion and Sedimentation Control Plan (TESCP)	As Part of the Environmental Protection Plan (EPP)
	01 35 13.43	1.5.1.5	Aquatic Water Quality Control Plan (AWQCP)	As Part of the Environmental Protection Plan (EPP)
18	35 13 43.01	1.4.1	Silt Curtain Control Plan	As Part of the Environmental Protection Plan (EPP)
19	01 35 13.43	1.17.5	Wastewater Treatment and Disposal Facility Permit	When required
20	01 74 21 02 41 16.01 31 23 33.01	1.5.1 1.6.4 1.6.2	Waste Reduction Work Plan (WRWP)	As Part of the Environmental Protection Plan (EPP)

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
21	01 74 21	1.5.2	Materials Source Separation Program (MSSP) Plan	As Part of the Environmental Protection Plan (EPP)
22	01 74 21	1.5.3	Waste Audit (WA)	Upon Request
23	01 35 13.43 01 51 01 01 51 01	1.5.2 1.5.1 1.8.1	Site Layout Drawings	As Part of the Environmental Protection Plan (EPP)
24	01 35 43	1.19	Sustainable Remediation Strategies	As Part of the Environmental Protection Plan (EPP)
25	01 35 33	1.13.1	Notice of Project	Prior to Mobilization
26	01 35 33 01 35 33	1.5.3.1 1.14	Health and Safety Plan	Within Fifteen (15) Working Days Following Contract Award
27	01 35 33	1.5.3.1	Company Safety Manual	Prior to Mobilization
28	01 35 33	1.5.3.2	Copies of Reports or Directions Issued by Federal and Provincial Health and Safety Inspectors	Prior to Mobilization
29	01 35 33	1.5.3.4	Complete Set of Material Safety Data Sheets (MSDS), and All Other Documentation Required by Workplace Hazardous Materials Information System (WHMIS) Requirements	Prior to Mobilization
30	01 35 33 01 35 33	1.5.3.5 1.15	Emergency Procedures	Prior to Mobilization
31	01 35 33	1.5.5	Medical Surveillance for Site Personnel	Prior to Mobilization
32	01 45 00	1.5.1	Construction Quality Control (CQC) Plan	Within Ten (10) Working Days Following Notice of Award
33	01 45 00	1.5.1.1	Reporting and Document Control Plan	As part of the Construction Quality Control (CQC) Plan

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
	02 21 13	1.5.1	Survey Positioning Control Plan	As part of the Construction Quality Control (CQC) Plan
	02 21 13	3.1.2	Alternative Survey Positioning Method	Per the Specifications
	02 41 16.01	1.6.2	Method of Pile Extraction	Per the Specifications
	03 10 00	1.5.2	Formwork and Falsework Shop Drawings	Per the Specifications
34	03 20 00	1.6.1	Concrete Reinforcing Shop Drawings	Per the Specifications
35	03 20 00	2.3.2	Reinforcing Steel Quality control Mill Test Report	Upon Request
	03 20 00	3.4.5	Deviation From Reinforcing Placement	A Minimum of Fourteen (14) Days Prior to Construction
36	03 30 00 03 37 26 03 39 00 03 39 00 03 39 00 03 41 00 03 41 00	1.6 1.6 1.7 1.8.4 3.6 1.7.2 1.8.1	Concrete Submittals	Per the Specifications
37	03 39 00	3.14.2.8	Comprehensive Concrete Quality Control Report	Weekly
38	03 41 00	1.9.1	Precast Structural Concrete Quality Control Plan	Per the Specifications
39	03 41 00	2.3.3	Steel Reinforcement Quality Control Mill Reports	Upon Request
	03 52 16	1.5	Light Weight Concrete Submittals	Per the Specifications

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
	03 52 16	1.6.1	Light Weight Concrete Quality Control Plan	As part of the Construction Quality Control (CQC) Plan
40	04 05 12	1.5	Grout Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
41	05 50 00 31 62 16.20 31 62 16.20	1.6.1 1.6.1 2.3.5	Metal Fabrication Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Fabrication
42	05 50 00	1.7.1	Metal Fabrication Quality Control Mill Reports	Upon Request
43	09 97 19 31 61 13	1.6.1 3.5.14	Coating Submittals	A Minimum of Twenty-Eight (28) Days Prior to Application
44	35 59 13.19	1.8	Floating Fenders and Rubbing Strip Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Fabrication
45	35 59 13.19	1.9	Floating Fenders and Rubbing Strip Certification	Per the Specifications
46	35 59 29	1.8	Mooring Devices Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Fabrication
47	35 59 29	1.9	Mooring Devices Certification	Per the Specifications
48	26 05 00 26 05 00 26 05 00 26 05 00 26 05 01 26 05 05	1.4 2.2.2 3.7.1.3 3.7.5.1 3.1.1 1.3.2	Electrical Submittals	Per the Specifications
	26 05 30	1.2.1	Seismic Restraints Product Data and Shop Drawings	Per the Specifications

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
49	26 05 30	1.3.1	Electrical Seismic Restraints	Upon Request
50	26 05 31	1.2	Splitters, Junction Boxes, Pullboxes and Cabinets Product Data and Shop Drawings	Per the Specifications
51	26 05 36	1.3	Cable Trays for Electrical Systems Product Data and Shop Drawings	Per the Specifications
52	26 05 37	1.3.1	Wireways and Auxiliary Gutters Product Data	Per the Specifications
53	26 05 43.01	1.3	Cables in Trenches and Ducts Product Data	Per the Specifications
	26 12 14	1.1.1	Voltage Regulator Shop Drawings	Per the Specifications
54	26 24 16 26 24 16	1.3 2.1.12	Panelboard Product Data and Shop Drawings	Per the Specifications
	26 27 18	1.4	Electrical Structures Shop Drawings	Per the Specifications
55	26 27 26	1.2	Wiring Devices Product Data and Shop Drawings	Per the Specifications
	26 28 16	1.3	Air Circuit Breakers Shop Drawings	Per the Specifications
56	26 28 21	1.4	Moulded Base Circuit Breaker Product Data	Per the Specifications
57	26 29 23.01	1.3	Digital Metering Product Data and Shop Drawings	Per the Specifications

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
58	26 29 23.02 26 29 23.02	1.3 3.1.1.2	Power System SCADA Product Data and Shop Drawings	Per the Specifications
59	26 50 00	1.3	Lighting Product Data, Shop Drawings and Laboratory Tests	Per the Specifications
60	27 05 15	1.6	Fibre Optic System Product Data and Shop Drawings	Per the Specifications
	27 05 15	1.7	Fibre Optic System Maintenance Data	Per the Specifications
61	28 31 00	1.6	Fire Detection and Alarm Shop Drawings	Per the Specifications
62	31 23 33.01	1.6.1	Soil Management Plan	A Minimum of Twenty-Eight (28) Days Prior to Commencing Upland Bulk Excavation Work
63	31 24 15 31 24 15 31 24 15 31 24 15 31 24 15	2.1.2 2.1.4 2.2.3 2.2.5 3.3.1	General Fill Source and Quality Control Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Placement of General Fill Material
64	32 11 16.01 32 11 16.01	2.1.3 2.1.5	Granular Sub-Base Source and Quality Control Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Placement of Granular Sub-Base
65	32 11 23	2.1.3 2.1.5	Aggregate Base Courses Source and Quality Control Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Placement of Granular Base
66	32 12 13.16	1.6	Asphalt Tack Coat Samples	A Minimum of Fourteen (14) Days Prior to Commencing Work
67	32 12 13.16	1.6.4	Asphalt Tack Coat Test Data and Certification	Upon Request

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
68	32 12 13.23	1.6	Asphalt Prime Coat Samples	A Minimum of Fourteen (14) Days Prior to Commencing Work
69	32 12 13.23	1.6.4	Asphalt Prime Coat Test Data and Certification	Upon Request
70	32 12 16 32 12 16	1.6 3.1.2.9	Asphalt Paving Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
	32 17 23	1.4	Pavement Markings Submittals	Per the Specifications
	35 20 23	1.5	East End Slope Excavation Submittals	Per the Specifications
	35 20 23.01	1.5	East End Slope Excavation Upland Trasnportation and Disposal Submittals	Per the Specifications
71	22 05 00 22 05 01 22 15 00	Part 6 Part 9 1.B	Plumbing Submittals	Per the Specifications
72	22 10 10	2.2	Plumbing Pumps Product Data	Per the Specifications
73	22 13 18	1.6.1	Drainage Waste Test Data and Material Certification	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
74	22 13 18	1.7.1	Drainage Waste Piping Shop Drawings	Per the Specifications
75	22 15 00	1.E.7	Compressed Air System Quality Assurance Program	Within Twenty-One (21) Days of Notice of Award
76	22 15 00	1.F.1	Compressed Air System Trade Qualifications	Within twenty-one (21) days of Notice of Award
77	33 05 13 33 05 13	1.6 2.1.9	Manholes and Catchbasins Material Certification	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
78	33 11 16	1.7	Water Utility Distribution Pipe Material Certification	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
79	33 11 16	1.6	Water Utility Distribution Piping Shop Drawings and Product Data	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
80	33 41 00	1.7	Storm Utility Drainage Pipe Material Certification	A Minimum of Fourteen (14) Days Prior to Commencing Work
81	33 41 00	1.8	Storm Utility Drainage Pipe Shop Drawings and Details	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Construction of Any Permanent Stormwater Drainage Facilities
82	33 65 73	1.6	Duct Bank Details and Shop Drawings	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Construction of Any Concrete Duct Banks
83	31 61 13 31 61 13 31 61 13 31 61 13 31 61 13 31 62 16.20 31 62 16.20 31 63 19.13	1.6 3.2.6 3.2.7 3.4.5 3.5.14 1.6 2.3.5 1.6	Pile Submittals	Per the Specifications
84	31 63 19.13	3.6.3	Pile Socketing Records	Per the Specifications
85	31 61 13 31 61 13	3.14.2 3.14.3	Pile Driving Records	Per the Specifications
86	02 41 16.01 31 61 13	1.6.1 3.4.6	Alternative Pile Extraction Method	Per the Specifications

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
87	35 37 10 02 41 16.01	1.5.1 1.6.3	Engineered Capping Repair Methodology	For Approval Prior to the Start of Engineered Capping Activities
88	35 37 10 35 37 10.01	1.5.2 1.5.2	Engineered Capping Sand Samples	A Minimum of Two (2) Weeks in Advance of use
89	35 37 10 35 37 10.01	1.5.3 1.5.3	Engineered Capping Laboratory Test Reports	A Minimum of Two (2) Weeks Prior to the Start of Engineered Capping Activities
90	35 37 10 35 37 10.01	2.5.4 2.4.4	Engineered Capping Laboratory Accreditation	For Approval Prior to the Start of Engineered Capping Activities
	35 37 10.01	1.5.1	Slope Capping Activities Approach	After Review and Acceptance of the Construction Work Plan by Departmental Representative
	35 59 13.19	1.7.12	Alternative Floating Fender Design	Per the Specifications
	35 59 29	1.6.6	Alternative Mooring Device Design	Per the Specifications
	35 90 00	1.6.1	Corrosion Protection Submittals	Per the Specifications
	Package ‘B’	1.6	Protective Wrap Submittals	Prior to Mobilization

Table 2 – Progress Submittals

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
1	01 31 19	1.7.1.3	Notice of Progress Meetings	A Minimum of Two (2) Working Days in Advance
2	01 31 19	1.7.2.1	Progress Meetings Minutes	Within Three (3) Working Days of Meeting
3	01 32 16.06 01 32 16.06	1.8.5 1.17.6	Construction Detail Schedule Updates	At or Just Before Each weekly Construction Progress Meeting
4	01 32 16.06	1.17.12	Monthly Written Report on Construction Detail Schedule	Monthly
5	01 32 16.06	1.17.8	4-Week Look Ahead Schedule	At Two (2) Week Intervals
6	01 32 16.06	1.16.4	Written Submission for Contract Extension	When Required
7	01 32 16.06	1.17.5	Work Breakdown Structure (WBS) Update and Reissue	When Required
8	01 32 16.06	1.12.2	Monthly Cash-Flow Estimate	Monthly
	01 33 00	1.9.1	Photographic Documentation	Monthly
9	01 11 55	1.5.5	Daily Construction Report	Daily
10	01 11 55	1.5.43	Weekly Construction Report	Weekly
11	01 11 55	1.12.2	Notice of After Hours Work (Includes Sundays and Statutory Holidays)	Minimum of 48 hours
12	01 11 55	1.7.3	Proposed Public Notifications and Communication Materials	For Approval prior to Issuance or Use
13	01 11 55	1.7.7	Log of Public/Media Communications Sent and Received by Contractor	Monthly
14	01 11 55	1.21.4	Location of Various Services and Equipment: Field Drawings or Shop Drawings	When Required

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
15	01 11 55 01 11 55	1.25.2.2.5 1.25.2.2.6	Works Coordination: Coordination Drawings, Shop Drawings, Product Data	After Coordination Meeting
	03 30 00	3.2.1.3	Cast-in-Place Temperature Differentials	Every Twenty-Four (24) Hours Within the Monitoring Period
	03 41 00	2.3.1	Precast Quality Control Tests	For Review and Approval Prior to Placement of Subject Material in the Work
	22 13 18	1.8.2	Notice of Planned/Accidental Sanitary Piping Interruptions	Fourteen (14) Days Prior to Planned Interruption/Immediately After Accidental Interruption
16	26 05 00 26 05 00	1.4.6 3.7.5.1	Electrical Quality Control Field Report	Within 3 Days of Field Review
	26 05 30	3.1.2	Anchorage/Attachment Inspection Reports	Per the Specification
	26 05 43.01	3.4.6	Installation of Cables Quality Control Test Results	Per the Specifications
17	26 29 23.02	1.5	Power System SCADA Closeout Submittals	Per the Specifications
18	27 05 15	3.1.2	Fibre Optic System OTDR Test Results	Prior to proceeding with use
19	28 31 00	1.9.1	Fire Detection and Alarm Inspection Reports	Per the Specifications
20	31 23 33.01	2.1.3	Backfilling Quality Control Test Reports	Prior to Placement of Subject Material in the Work
	31 61 13	1.8.3	Notice of Piling Work	A Minimum of Five (5) Days Prior to Commencing Piling Work
	31 61 13	1.9.6	Notice of Differing Subsoil Conditions	When Required

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
	31 61 13	3.5.14	Pile Coating Accommodation Strategy	Per the Specifications
	33 11 16	1.8.3	Notice of Planned/Accidental Water Supply Interruptions	Fourteen (14) Days Prior to Planned Interruption/Immediately After Accidental Interruption
	33 11 16 33 41 00	2.8.2 2.3.4	Notice of Proposed Material Source	A Minimum of Twenty-Eight (28) Days Prior to Material Placement
	33 11 16	3.8.2	Notice of Hydrostatic and Leakage Testing	A Minimum of Twenty-Four (24) Hours Before Testing
	35 20 23	1.10.1	Floating Equipment Certificate of Qualification	Within Ten (10) Working Days After Notice of Award (If Required)
21	22 05 00 22 05 01	Part 10.1.1 6.1	Plumbing Quality Control Field Report	Per the Specifications
22	22 11 00	4.3.3	System Flush Sample	Per the Specifications
23	33 11 16	2.8.4	Water Utility Distribution Piping Bedding Compaction Quality Control Tests	For Review and Approval Prior to Placement of Subject Material in the Work
24	33 11 16	3.12.4	Field Megohmmeter Test Reports	Per the Specifications
25	01 35 13.43	1.17.5	Wastewater Treatment and Disposal Test Results	When required
26	33 41 00	2.3.6	Storm Utility Distribution Piping Bedding Compaction Quality Control Tests	For Review and Approval Prior to Placement of Subject Material in the Work
27	33 65 73	2.1.4	Duct Bank Bedding Compaction Quality Control Tests	For Review and Approval Prior to Placement of Subject Material in the Work
28	01 35 33	1.5.3.3	Copies of Incident and Accident Reports	When required

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
29	01 45 00	1.5.2	Inspection and Laboratory Test Reports	Within Two (2) Days of Receipt
30	01 45 00	1.11.2	Submit Samples or Materials Required for Testing	Per the Specifications

Table 3 – Post-Construction Submittals

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
1	26 29 23.01	1.5	Digital Metering Closeout Submittals	Per the Specifications
2	28 31 00	1.7	Fire Detection and Alarm Closeout Submittals	Per the Specifications
3	01 11 55 01 78 00 01 78 00 33 11 16 22 05 00	1.31.2 1.8.3 1.11 1.9 5.5	Record Drawings	Two (2) Weeks Before Substantial Performance
4	01 78 00	1.11.4.1	Pre-Construction Survey	Per the Specifications
5	01 78 00	1.11.4.2	Post- Construction Surveys	Per the Specifications
6	01 78 00 01 78 00 01 78 00	1.12 1.14.5 1.15.5	Receipt of Delivered Products	Per the Specifications
7	01 78 00	1.14.4	Inventory Listing of Spare Parts	Per the Specifications
8	01 78 00	1.15.4	Inventory Listing of Maintenance Materials	Per the Specifications
9	01 78 00	1.16.4	Inventory Listing of Special Tools	Per the Specifications
10	01 78 00	1.18.1	Certificate of Completion	Per the Specifications
11	01 91 13	1.7.2.4	Start-Up Documentation	Prior to Start of Cx

ITEM #	SPEC ID	Clause	Submittal	Submittal Schedule
12	01 91 13	1.9.1.1	Cx Procedures	Submit and Obtain Written Approval at Least Four (4) Weeks Prior to Start of Cx
13	01 78 00 33 11 16 33 41 00 26 05 00 26 29 23.01 26 29 23.02 28 31 00 22 05 00 22 13 18	1.8.3 3.13 3.10 3.7.5.2 1.5.2 1.5.2 1.7.1 5.3.2 4.5.1	Operations and Maintenance Manuals	Per the Specifications

1.6 SHOP DRAWINGS AND PRODUCT DATA

.1 [Refer to CCDC 2 GC 3.11].

.2 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.

.3 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia.

.4 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.

.5 Allow 7 days for Departmental Representative's review of each submission.

.6 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.

.7 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.

.8 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.

.9 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.

.10 After Departmental Representative's review, distribute copies.

.11 Submit one electronic copy plus 6 prints of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.12 Submit one 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.

.13 Submit one 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.

.14 Submit one 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.

.15 Submit one electronic copy of manufacturers 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.

.16 Submit one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.18 Submit one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.19 Delete information not applicable to project.

.20 Supplement standard information to provide details applicable to project.

.21 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, [transparency] [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.

.22 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that PWGSC 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.

1.7 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's site office.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples 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 samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.8 MOCK-UPS

.1 Erect mock-ups in accordance with [01 45 00 - Quality Control].

1.9 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copies of colour digital photography in jpg format, standard resolution monthly with progress statement to Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints: 2 locations.

.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: monthly.

.1 Upon completion of: excavation, and other work as directed by Departmental Representative.

1.10 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Work Safe BC status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes special procedures that are applicable for work performed at contaminated sites, such as the Contractor's Work Site. The soils at Esquimalt Graving Dock are known potentially to contain contaminants – hydrocarbons and metals. Contractor shall be responsible for adhering to these special procedures while completing all work under this Contract.

.2 Other Sections of the Specification, the Environmental Management Plan (EMP), and Project Permits (including the Fisheries Act Authorization) may also contain specific requirements for environmental protection. These documents are to be reviewed and complied with by Contractor. Those specific requirements are in addition to the requirements in this section. In the event of a perceived difference or discrepancy between the EMP, Contract Specifications, Fisheries Act Authorization, and the provisions of any applicable legislation, regulations, or municipal bylaws, the more stringent provisions resulting in the higher degree of environmental protection and safety, and the lower discharge of contaminants, will prevail. The control of environmental pollution requires consideration of noise levels, air, water, and land.

.3 Contractor shall review and understand, and abide by, the EGD Environmental Best Management Practices (EBMPs) and the EGD Environmental Policy during completion of the work. The EGD EBMPs and Environmental Policy are included as reference documents to these Specifications.

.4 All work shall comply with applicable local, Municipal, Provincial and Federal Acts, Laws and Regulations. In the case of conflict or discrepancy, the most stringent shall apply.

.5 Contractor shall comply with the conditions of all permits issued for completion of this project.

.6 Contractor is responsible for environmental protection during all construction activities at all locations where it performs work. Work locations include, but are not limited to, the Contractor's Work Site. This Section primarily addresses work conducted at the Contractor's Work Site, but Contractor is responsible for complying with federal, provincial, or municipal and local legislation environmental laws, regulations, and permits at all locations that are used.

.7 Contractor is responsible for its actions if they result in recontamination of areas within the Contractor's Work Site or within the EGD Waterlot, or areas outside the EGD Waterlot, that remediation has been completed as part of previous work. Contingency action to clean up uncontaminated areas that are contaminated as a result of Contractor operations will be the responsibility of Contractor at Contractor’s own cost.

1.2 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

.3 Section 01 35 43 (Environmental Procedures and Sustainability)

.4 Section 01 74 11 (Cleaning)

.5 Section 02 55 10 (Dust Control)

.6 Section 35 37 10 (Engineered Capping)

1.3 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for Special Procedures for Contaminated Sites.

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for definitions.

1.5 SUBMITTALS

.1 Submit, within twenty-eight (28) calendar days following Contract award, an Environmental Protection Plan (EPP) for Departmental Representative review and acceptance; see Section 01 35 43 (Environmental Procedures and Sustainability) and further requirements elsewhere in this Section of the Specification for required submittal information.

.1 Wastewater Management and Disposal Plan (WWMDP). Submit a WWMDP as a section of the EPP.

.2 Pollution Control Plan (PCP). Submit a PCP as a section of the EPP.

.3 Stormwater Pollution Prevention Plan (SWPPP). Submit a SWPPP as a section of the EPP.

.4 Temporary Erosion and Sedimentation Control Plan (TESCP). Submit a TESCP as a section of the EPP.

.5 Aquatic Water Quality Control Plan (AWQCP). Submit the AWQCP as a section of the EPP.

.2 Site Layouts: Prior to mobilization to Contractor's Work Site, and as part of the EPP; submit site layout drawings for the Contractor's Work Site, showing existing conditions and facilities, construction temporary facilities, and temporary controls provided by Contractor including the following:

.1 Means of ingress, egress, and temporary traffic control facilities.

.2 Equipment staging areas.

.3 Exclusion zones, and other zones specified in Contractor’s site-specific Health and Safety Plan.

.4 Grading, including contours, required to construct temporary facilities.

.5 Wastewater collection areas or facilities as necessary.

.6 Wastewater Treatment and Disposal Facilities as necessary.

.7 Wastewater storage areas as necessary.

1.6 SEQUENCING AND SCHEDULING

.1 Do not commence work involving contact with potentially contaminated or hazardous materials until all environmental are operational and accepted by Departmental Representative.

1.7 WASTEWATER MANAGEMENT AND DISPOSAL

.1 Describe Contractor’s approach, equipment, and methods to manage and properly discharge and/or dispose of wastewater generated during construction activities in a WWMDP as part of the EPP.

.2 Wastewater management and disposal requirements provided in this section apply to management of wastewater generated at the Contractor's Work Site.

.3 Provide, operate, and maintain wastewater storage tanks to store wastewaters.

.4 Wastewater includes handbasin and shower wastewaters from personnel hygiene; water collected from dewatering operations; and water collected from equipment decontamination.

.5 There shall be no discharges of any kind within the EGD Facility without the expressed written approval by the Departmental Representative

.1 Do not discharge wastewater from personnel hygiene or toilet facilities on site. Dispose of these wastewaters off site at a permitted Wastewater Treatment and Disposal Facility.

.2 Barge dewatering and discharge at the Contractor's Work Site, where allowed, shall comply with the EMP and Project Permits.

.3 Equipment decontamination wastewater should be contained, treated, and tested prior to discharging it at the Contractor's Work Site, provided it meets water quality performance objectives per the EMP and Fisheries Act Authorization.

.4 Wastewater generated as part of these activities that cannot meet these requirements shall be disposed of at a Wastewater Treatment and Disposal Facility.

.6 Provide pumps and piping to convey collected wastewaters to designated wastewater storage tanks; provide wastewater storage tanks with minimum total live capacity such that effluent quality can be analyzed and accepted prior to discharge.

.7 Install wastewater storage tanks in locations determined by Contractor and accepted by Departmental Representative.

.8 Support tank(s) on temporary aboveground foundation(s).

.9 Connect pumps, piping, valves, miscellaneous items, and necessary utilities as required for operation of facilities; and protect tanks, valves, pumps, piping, and miscellaneous items from freezing.

.10 Do not operate wastewater storage tanks until inspected and accepted by Departmental Representative.

.11 Transport and dispose of wastewaters that cannot be discharged at the Contractor's Work Site (e.g., personnel hygiene, toilet facilities, wastewaters that do not comply with water quality criteria) to a Wastewater Treatment and Disposal Facility, as identified by Contractor for review by Departmental Representative.

.12 Wastewater sample and analysis: Contractor shall perform sampling and analysis of stored wastewater for disposal purposes prior to removal from the Contractor's Work Site and transport to a Wastewater Treatment and Disposal Facility. Contractor shall determine appropriate methods of disposal based on results of the analyses. Upon receipt of analytical results, transfer tank contents, without spills or release, to off-site permitted Disposal Facility. Following completion of tank emptying, decontaminate tank interior with steam or high- pressure water wash supplemented by detergent. Dispose of tank decontamination water with tank contents.

.1 Sanitary wastewater and decontamination wastewater, and potentially other wastewater streams that do not meet water quality criteria shall be disposed of off-site at a Wastewater Treatment and Disposal Facility.

.2 Wastewater designated for disposal at a Wastewater Treatment and Disposal Facility must be transported from the Contractor's Work Site on water; truck transport of wastewater from the Contractor's Work Site is not allowed.

.3 Contractor shall identify a Wastewater Disposal Facility in the EPP for other wastewater streams, per results of wastewater testing, and in accordance with the requirements defined in the Specification.

1.8 VEHICULAR ACCESS

.1 Maintenance and use at Contractor's Work Site and Contractor Off-Site Offload Facility:

.1 Prevent contamination of access roads. Immediately scrape up debris or material on access roads that is suspected to be contaminated as determined by Departmental Representative; transport and place into designated area accepted by Departmental Representative. Clean access roads at least once per shift.

1.9 DUST AND PARTICULATE CONTROL

.1 Complete dust control activities according to means and methods presented in Section 02 55 10 (Dust Control).

1.10 POLLUTION CONTROL

.1 Describe Contractor’s approach, equipment, and methods to control pollution during construction activities in a PCP as part of the EPP.

.2 Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by construction operations.

.3 Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on site.

.4 Promptly report spills and releases potentially causing damage to environment, as specified by the EMP. Contractor shall review and understand, and abide by, the EGD EBMPs for spill response during completion of the work.

.5 Contractor shall make available the Material Safety Data Sheets (MSDS) at the Contractor's Work Site for the list of known pollutants that are being used at the Contractor's Work Site as part of the work. Contact manufacturer of pollutant if known and ascertain hazards involved, precautions required, and measures used in cleanup or mitigating action.

.6 Take immediate action using the necessary resources to contain and mitigate effects on environment and persons from spill or release. In addition, comply with EGD Spill Contingency Plan for work at the Contractor's Work Site.

.7 Provide spill response materials including containers, adsorbent, shovels, and personal protective equipment (PPE). Make spill response materials available at all times in which hazardous materials or wastes are being handled or transported.

1.11 STOCKPILING AND TRANSPORTATION OF CONTAMINATED MATERIALS FROM CONTRACTOR'S WORK SITE

.1 All excavated materials will be stockpiled as directed by the Departmental Representative.

.2 Provide, maintain, and operate storage/stockpiling facilities as required. Stockpiling location will be located in Lot 203 in the north west area of the EGD Facility as shown on drawings. The exact location within Lot 203 to be determined by Departmental Representative.

.3 Install 6-mil polyethylene liner below proposed stockpile locations to prevent contact between stockpile material and ground.

.4 Equip facility with tarps capable of covering all stockpiled material.

.5 Contractor will ensure that stockpiled material not being actively added to is covered with tarps and these are secured so they do not blow off. Any stockpiles not fully covered by tarps must be fixed immediately.

.6 The Departmental Representative will be responsible for testing of stockpiled suspected contaminated soils.

1.12 PROGRESS CLEANING

.1 Maintain cleanliness of work and surrounding the Contractor's Work Site to comply with federal, provincial, and local fire and safety laws, ordinances, codes, and regulations. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site.

.2 Coordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials.

1.13 FINAL DECONTAMINATION

.1 Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from the Contractor's Work Site.

.2 Perform decontamination as specified to satisfaction of Departmental Representative. Departmental Representative will inform Contractor to perform additional decontamination if required at Contractor’s own cost.

1.14 REMOVAL AND DISPOSAL

.1 Remove surplus materials and temporary facilities from the Contractor's Work Site.

.2 Dispose of non-contaminated waste materials, litter, debris, and rubbish off site.

.3 Do not burn or bury rubbish and waste materials at the Contractor's Work Site.

.4 Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

.5 Do not discharge wastes into streams or waterways.

.6 Dispose of following materials at appropriate permitted Disposal Facility, Hazardous Waste Management Facility, or Wastewater Treatment and Disposal Facility identified by Contractor and in accordance with the content of these Specifications:

.1 Debris including excess construction material.

.2 Non-contaminated litter and rubbish.

.3 Disposable PPE worn during final cleaning.

.4 Wastewater removed from wastewater storage tank.

.5 Wastewater generated from final decontamination operations including wastewater storage tank cleaning.

.7 Minimize generation of Hazardous Waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

1.15 RECORD KEEPING

.1 Maintain bills of ladings and waste manifests for minimum of 365 days (one year) from date of shipment or longer period required by applicable law or regulation. These documents should also be provided to Departmental Representative.

1.16 ENVIRONMENTAL MANAGEMENT PLAN

.1 An EMP has been prepared for this Contract and is provided in an Appendix to the Specification. Specific clauses related to Contractor completion of activities associated with this project are cited in this Section of the Specification. Contractor shall also be responsible for reviewing and understanding the EMP, and conducting all construction activities in accordance with the requirements of the EMP, Project Permits, and the Specification. Contractor shall use the EMP as a reference during development of the EPP.

1.17 WASTEWATER TREATMENT AND DISPOSAL

.1 Describe Contractor’s approach, equipment, and methods to install, maintain, and operate the Wastewater Treatment and Disposal Facility in the WWMDP as part of the EPP.

.2 Design and Operating Criteria: Design water filtering plant capable of filtering waste water generated from upland dewatering, sanitary wastewater, and equipment decontamination activities to meet discharge requirements of authority having jurisdiction; capable of removing oil, suspended solids, particulates, and asbestos fibers, and filtering water through particulate filter prior to discharge.

.1 Ensure that discharges from the Contractor's Work Site meet the water quality performance objectives of the EMP and Project Permits.

.2 Design water filtering operations capable of receiving liquid/solid mixtures and not causing delay to operations.

.3 Piping: Suitable material type, of sufficient diameter and structural thickness for purpose intended; satisfactorily tested for leaks with potable water in presence of Departmental Representative before handling wastewater.

.4 Installation: Provide labour, materials, and equipment and do work required for setup and construction of water filtering plant.

.5 Initial Testing (if applicable): Performance of Wastewater Treatment and Disposal Facility provided by Contractor may be inspected by Departmental Representative. Contractor shall submit treatment test results to Departmental Representative and other permitting authorities as applicable for review and the

Contractor shall submit the facility's permit to treat and dispose or discharge treated wastewater. The Contractor may use a new Wastewater Treatment and Disposal Facility that is constructed for project purposes or an existing permitted Wastewater Treatment and Disposal Facility.

.6 Operation:

.1 On basis of analytical results reviewed by Departmental Representative, make system modifications required for effluent to satisfy effluent criteria, or continue with normal dewatering operations.

.2 Operate Wastewater Treatment and Disposal Facility by experienced, qualified personnel in accordance with manufacturer's instructions and procedures submitted by Contractor and reviewed by Departmental Representative.

.7 Decommissioning/dismantling:

.1 Decontaminate and remove salvageable components of water filtering plant including water filtering system, pumps, piping, and electrical equipment.

.2 Dispose of non-salvageable equipment and materials at the permitted Disposal Facility.

1.18 UPLAND WATER CONTROL AT CONTRACTOR'S WORK SITE

.1 This section applies to over-land water control (i.e. stormwater and surface water control) for management of construction water at the Contractor's Work Site.

.2 Contractor shall prepare and submit a SWPPP and submit to Departmental Representative as part of the EPP. The SWPPP shall describe the following:

.1 Protect the Contractor's Work Site from puddling or running water. Grade areas to drain. Provide water barriers as necessary to protect the areas from soil erosion.

.2 Prevent surface water runoff from leaving work areas.

.3 Do not discharge decontaminated water, or surface water runoff, or groundwater that may have come in contact with potentially contaminated material, off site or to municipal sewers.

.4 Direct surface waters that have not contacted potentially contaminated materials to existing surface drainage systems.

.5 Control surface drainage including ensuring that gutters are kept open, water is not directed across or over pavements or sidewalks except through accepted pipes or properly constructed troughs, and runoff from unstabilized areas is intercepted and diverted to suitable outlet.

.6 Dispose of water in manner not injurious to public health or safety, to the environment, or to any part of work completed or under construction.

.7 Provide, operate, and maintain necessary equipment appropriately sized to keep excavations, staging pads, and other work areas free from water.

.8 Contain water from decontamination facilities. Transfer potentially contaminated decontamination waters to wastewater storage tanks separate from wastewater from personnel hygiene/decontamination facility.

.9 Have on hand sufficient pumping equipment, machinery, and tankage in good working condition for ordinary emergencies, including power outage, and competent workers for operation of pumping equipment.

.10 Contain and collect wastewaters and transfer such collected wastewaters to Contractor-supplied drums, wastewater storage tanks, or Contractor's Work Site treatment facility.

1.19 TEMPORARY EROSION AND SEDIMENT CONTROL AT THE CONTRACTOR'S WORK SITE

.1 Contractor shall prepare and submit a TESCP and submit to Departmental Representative as part of the EPP. The TESCP shall address potential erosion and sediment control measures if required for construction activities at the Contractor's Work Site, and discuss the following as applicable:

.1 Plan to execute construction by methods to control surface drainage from cuts and fills, borrow and waste disposal areas, stockpiles, staging areas, and other work areas. Prevent erosion and sedimentation.

.2 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical. Strip vegetation, regrade, or otherwise develop to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and water courses, and repair damage caused by soil erosion and sedimentation as directed by Departmental Representative.

.3 Provide and maintain temporary measures which may include, concrete blocks, silt fences, hay or straw bales, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, dikes, and other construction required to prevent erosion and migration of silt, mud, sediment, and other debris off site or to other areas of site where damage might result, or that might otherwise be required by laws and regulations. Make sediment control measures available during construction.

.4 Hay or Straw Bale: Wire-bound or string-tied; securely anchored by at least two (2) stakes or rebars driven through bale 300 mm to 450 mm into ground; chinked (filled by wedging) with hay or straw to prevent water from escaping between bales; and entrenched minimum of 100 mm into ground.

.5 Silt Fence: Assembled, ready to install unit consisting of geotextile attached to drivable posts. See Section 35 13.43.01 SILT CURTAIN for more details.

.6 Geotextile: Uniform in texture and appearance, having no defects, flaws, or tears that would affect its physical properties; and containing sufficient ultraviolet ray inhibitor and stabilizers to provide minimum 2-year service life from outdoor exposure.

.7 Net Backing: Industrial polypropylene mesh joined to geotextile at both top and bottom with double stitching of heavy-duty cord, with minimum width of 750 mm.

.8 Posts: Sharpened wood, approximately 50 mm square, protruding below bottom of geotextile to allow minimum 450 mm embedment; post spacing 2.4 m maximum. Securely fasten each post to geotextile and net backing using suitable staples.

.9 Plan construction procedures to avoid damage to work or equipment encroachment onto water bodies or drainage ditch banks. In event of damage, promptly take action to mitigate effects. Restore affected bank or water body to existing condition.

.10 Installation:

.1 Construct temporary erosion control items as indicated. Actual alignment and/or location of various items as directed by Departmental Representative.

.2 Check erosion and sediment control measures daily after each rainfall.

.3 Whenever sedimentation is caused by stripping vegetation, regrading, or other development, remove it from adjoining surfaces, drainage systems, and watercourses, and repair damage as quickly as possible.

.4 Prior to or during construction, Departmental Representative may require installation or construction of improvements to prevent or correct temporary conditions on site. Temporary improvements must remain in place and in operation as necessary or until otherwise directed by Departmental Representative.

.5 Repair or replace damaged bales, end runs, and undercutting beneath bales.

.6 Unless otherwise directed by Departmental Representative, remove temporary erosion and sediment control devices upon completion of work. Spread accumulated sediments to form a suitable surface for seeding or dispose of, and shape area to permit natural drainage to satisfaction of Departmental Representative. Materials once removed become property of Contractor.

.11 Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

.12 Do not disturb existing embankments or embankment protection.

.13 Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

.14 If soil and debris from site accumulate in low areas, storm sewers, roadways, gutters, ditches, or other areas where, in Departmental Representative's determination, it is undesirable, remove accumulation and restore area to original condition.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOTIFICATION OF NON COMPLIANCE

.1 Departmental Representative will notify Contractor, in writing, of observed noncompliance with federal, provincial, or municipal and local environmental laws or regulations, permits, and other elements of Contractor's EPP. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site.

.2 Any regulatory fees or penalties that result from non-compliance with these regulations shall be the sole responsibility of Contractor to pay.

.3 Notwithstanding this notification process, Contractor shall be responsible for conducting all construction activities in a manner compliant with these regulations.

.4 Contractor shall inform Departmental Representative of proposed corrective action after receipt of such notice, and take such action for approval by Departmental Representative.

.5 Departmental Representative will issue a stop work order until satisfactory corrective action has been taken.

.6 No time extensions shall be granted or equitable adjustments allowed to Contractor for such suspensions.

3.2 IMPLEMENTATION

.1 At the Pre-Construction Meeting, Departmental Representative and Contractor shall discuss Contractor's operations to develop mutual understandings relative to the administration of the environmental protection program.

.2 Supervision:

.1 During the work, all activities, including those of subcontractors, shall be supervised by Contractor to assure compliance with the intent and details of the EPP.

.2 Contractor shall discuss environmental compliance at daily tailgate meetings and Weekly Progress Meeting for itself and its subcontractors to assure that all personnel working at the Contractor's Work Site are familiar with the environmental protection provisions.

.3 All equipment and materials for environmental protection shall be inspected every week, at a minimum, to ensure that they are in proper order, being applied correctly, and have not deteriorated.

.4 Contractor shall provide to Departmental Representative a written inspection report as part of the weekly construction report documenting the condition of the equipment and materials.

3.3 PROTECTION OF FISH AND WILDLIFE

.1 All work shall comply with the work window timing requirements described in Section 01 11 55 (General Instructions), the Fisheries Act Authorization, and the EMP.

.2 All work shall be performed and all steps taken to prevent interference or disturbance to fish and wildlife.

.3 Water flows or habitat outside the Contractor's Work Site that are critical to fish or wildlife shall not be altered or disturbed.

.4 Contractor shall immediately cease dredging or other in-water operations if fish kill or distressed fish are observed, and immediately notify Departmental Representative.

3.4 DUST CONTROL

.1 Dust control shall be performed as the work proceeds, whenever a dust nuisance or hazard occurs.

3.5 MAINTENANCE OF POLLUTION CONTROL FACILITIES

.1 Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the Contract or for that length of time construction activities create the particular pollutant.

3.6 TRAINING OF CONTRACTOR PERSONNEL

.1 Contractor personnel shall be trained in environmental protection and pollution control as required by applicable federal, provincial, and local requirements. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site.

.2 Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel.

.3 The training and meeting agenda shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and maintenance of facilities and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control. Anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants, shall also be discussed.

END OF SECTION

PSPC Update on Asbestos Use

Effective April 1, 2016, all Public Service and Procurement Canada (PSPC) contracts for new construction and major rehabilitation will prohibit the use of asbestos-containing materials. Further information can be found at http://www.tpsgc-pwgsc.gc.ca/comm/vedette-features/2016-04-19-00-eng.html

Part 1 General

1.1 REFERENCES

.1 Government of Canada:

- .1 Canada Labour Code – Part II
- .2 Canada Occupational Health and Safety Regulations.

.2 National Building Code of Canada (NBC):

- .1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 The Canadian Electric Code (as amended)

.4 Canadian Standards Association (CSA):

- .1 CSA Z797-2009, Code of Practice for Access Scaffold.
- .2 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
- .3 CSA S350-M1980 (R2003), Code of Practice for safety in Demolition of Structures.
- .4 CSA Z1006-10 Management of Work in Confined Spaces.
- .5 CSA Z462- Workplace Electrical Safety Standard

.5 National Fire Code of Canada 2010 (as amended)

- .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.

.6 American National Standards Institute (ANSI):

- .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.7 Province of British Columbia:

- .1 Workers Compensation Act Part 3 Occupational Health and Safety.
- .2 Occupational Health and Safety Regulation.

.8 Departmental:

- .1 Preliminary Job Hazard Analysis Check List.

1.2 RELATED SECTIONS

.1 Refer to the following Sections as required:

- .1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 51 01 (Temporary Facilities)

.3 Section 02 41 13 (Selective Site Demolition)

.4 Section 02 41 16.01 (Structure Demolition)

1.3 WORKERS COMPENSATION BOARD COVERAGE

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

.1 PSPC may terminate the Contract without liability to PSPC where Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Work effected by submittal shall not proceed until review is complete.

.3 Submit the following:

.1 Company Safety Manual and site-specific project Health and Safety Plan.

.2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.3 Copies of incident and accident reports.

.4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.

.5 Emergency procedures.

.4 Prior to the start of the work, Departmental Representative will review Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to Contractor within five (5) working days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

.5 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.

.6 Submission of the Site Specific Health and Safety Plan, and any revised version, to Departmental Representative is for information and reference purposes only. It shall not:

.1 Be construed to imply approval by Departmental Representative.

.2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.

.3 Relieve Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

.1 Assume responsibility as the Prime Contractor for work under this Contract.

.2 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 the work.

.3 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.

1.7 HEALTH AND SAFETY COORDINATOR

.1 Contractor shall designate a Health and Safety Coordinator (and designee) in its Health and Safety Plan. The Health and Safety Coordinator must:

.1 Be responsible for completing all Contractor and subcontractor(s) workers' health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

.2 Be responsible for implementing, daily enforcing, and monitoring Contractor's compliance with the site-specific project Health and Safety Plan.

.3 Be on site during execution of work. If Contractor's work hours and schedule necessitate use of additional personnel to support the Health and Safety Coordinator, identify those personnel in the Health and Safety Plan.

1.8 GENERAL CONDITIONS

.1 Provide safety barricades and lights around the Contractor's Work Site (as necessary) to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the Contractor's Work Site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

.2 Secure site(s) at night time as deemed necessary to protect site against entry.

.3 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect other dock users.

.4 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, pipe piles, open stair wells, and open edges of floors and roofs. Provide as required by governing authorities.

.5 Erect temporary enclosure around Contractor's Work Site (as shown on the Drawings) using 1.8 m fencing. Provide access gates as required. Maintain fence in good repair.

.6 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

.7 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.9 PROJECT / SITE CONDITIONS

.1 The Esquimalt Graving Dock is a dry dock and ship repair facility. It is an industrial site wherein industrial, manufacturing, fabrication, heavy construction, and like works are conducted by a variety of contractors and sub-trades for a variety of owners and sub-trades for a variety of owners and/or PWGSC.

.2 Work at site will involve a number of hazards known to PSPC as noted in the Preliminary Hazard Assessment Form. This site may involve contact with hazardous and/or toxic materials and substances such as, but not limited to:

.1 Waste sandblast grit.

.2 Paint spray, including solvents and mineral spirits.

.3 Waste water.

.4 Contaminated soils and debris.

.5 Polychlorinated biphenyl (PCB).

.6 Creosote and creosote materials.

.7 Asbestos.

.8 Lead paints and other paints containing toxic substances such as arsenic and carcinogens.

.3 Other safety hazards or risks which may be encountered include, but are not limited to:

.1 Contact with traveling and mobile cranes, forklifts, manlifts and other motorized vehicles.

.2 Overhead hazards such as that created by material transported by cranes.

.3 Fall hazards.

.4 Drowning hazards.

.5 Confined space hazards.

.6 Electrical hazards.

.7 Contact with operating mechanical, electrical, electronic, pneumatic, thermal, and hydraulic machinery and equipment.

.8 Fire hazards.

1.10 UTILITY CLEARANCES

.1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work.

.2 The Contractor will not rely solely upon the Reference Drawings or other information provided for utility locations.

1.11 REGULATORY REQUIREMENTS

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at the Contractor's Work Site.

.2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.

1.12 WORK PERMITS

.1 Obtain specialty trade permit(s) related to project before start of work.

1.13 FILING NOTICE

.1 Contractor is to complete and submit a Notice of Project before work commences.

.2 Provide copies of all notices to Departmental Representative.

1.14 HEALTH AND SAFETY PLAN

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:

.1 Primary requirements:

.1 Contractor’s safety policy.

.2 Health and safety requirements of the EGD facility.

.3 Identification of applicable compliance obligations.

.4 Definition of responsibilities for project safety / organization chart for project.

.5 General safety rules for project.

.6 Job-specific safe work procedures.

.7 Inspection policy and procedures.

.8 Incident reporting and investigation policy and procedures.

.9 Occupational Health and Safety Committee / Representative procedures.

.10 Occupational Health and Safety meetings.

.11 Occupational Health and Safety communications and record-keeping procedures.

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.

.3 List hazardous materials to be brought on site as required by work.

.4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.

.5 Identify personal protective equipment (PPE) to be issued to and used by workers.

.6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work / activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Health and Safety Plan shall not relieve Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.15 EMERGENCY PROCEDURES

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:

.1 Designated personnel from own company.

.2 Regulatory agencies applicable to work and as per legislated regulations.

.3 Local emergency resources.

.4 Departmental Representative and other PWGSC staff as required.

.2 Include the following provisions in the emergency procedures:

.1 Notify workers and the first-aid attendant of the nature and location of the emergency.

.2 Evacuate all workers safely.

.3 Check and confirm the safe evacuation of all workers.

.4 Notify the fire department or other emergency responders.

.5 Notify adjacent workplaces or residences that may be affected if the risk extends beyond the workplace.

.6 Notify Departmental Representative and site staff.

.3 Provide written rescue / evacuation procedures as required for, but not limited to:

.1 Work at high angles.

.2 Work in confined spaces or where there is a risk of entrapment.

.3 Work with hazardous substances.

.4 Underground work or under-pier work.

.5 Demolition of structures.

.6 Work on, over, under and adjacent to water.

.7 Workplaces where there are persons who require physical assistance to be moved.

.4 Designate and mark emergency exit routes to provide quick and unimpeded exit. Follow and comply with emergency exit routes at the EGD Facility.

1.16 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to Departmental Representative and in accordance with the Canada Labour Code.

.2 Where use of hazardous and toxic products cannot be avoided:

.1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00 (Submittal Procedures).

.2 In conjunction with Departmental Representative, schedule to carry out work during “off hours” when there are fewer dock users.

.3 Provide adequate means of ventilation as required.

.4 Contractor shall ensure product is applied as per manufacturer’s recommendations.

.5 The Contractor shall ensure that only pre-approved products are brought onto the work site in an adequate quantity to complete the work.

1.17 ASBESTOS HAZARD

.1 Carry out any activities involving asbestos in accordance with applicable Provincial Regulations.

.2 Remove, handle, transport and dispose of asbestos containing materials in accordance with applicable provincial regulations.

1.18 PCB REMOVALS

.1 Mercury-containing fluorescent tubes and ballasts, which contain polychlorinated biphenyls (PCBs), are classified as hazardous waste.

.2 Remove, handle, transport and dispose of in accordance with applicable provincial regulations.

1.19 REMOVAL OF LEAD-CONTAINING PAINTS

.1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.

.2 Carry out demolition activities involving lead-containing paints in accordance with applicable provincial regulations.

1.20 ELECTRICAL SAFETY REQUIREMENTS

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

.1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.

.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.21 ELECTRICAL LOCKOUT

.1 Coordinate with Departmental Representative to develop, implement and enforce procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request authorization form. Have procedures available for review upon request by Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a logbook for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.22 OVERLOADING

.1 Ensure no part of work is subjected to a load that will endanger its safety or will cause permanent deformation.

1.23 FALSEWORK

.1 Design and construct falsework in accordance with CSA S269.1 (R2003) (Falsework for Construction Purposes).

1.24 SCAFFOLDING

.1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797- 2009 (Code of Practice for Access Scaffold) and B.C. Occupational Health and Safety Regulations.

1.25 CONFINED SPACE AND RESTRICTED ACCESS SPACE

.1 Carry out work in confined spaces in accordance with provincial regulations.

1.26 POWDER-ACCUATED DEVICES

.1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from Departmental Representative.

1.27 FIRE SAFETY AND HOT WORK

.1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.

.2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.28 FIRE SAFETY REQUIREMENTS

.1 Store oily / paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

.3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the Departmental Representative is required prior to any gas or diesel tank being brought onto the work site.

1.29 FIRE PROTECTION AND ALARM SYSTEM

.1 Fire protection and alarm systems shall not be:

.1 Obstructed.

.2 Shut off.

.3 Left inactive at the end of a working day or shift.

.2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.

.3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.30 UNFORSEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard or condition (including identification of unexploded ordinance) become evident during performance of the work, immediately stop work and advise Departmental Representative verbally and in writing.

1.31 POSTED DOCUMENTS

.1 Post legible versions of the following documents on site:

.1 Site-specific project Health and Safety Plan.

.2 Sequence of work.

.3 Emergency procedures.

.4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.

.5 Notice of Project, per WorkSafeBC requirements.

.6 Floor plans or site plans.

.7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

.8 Workplace Hazardous Materials Information System (WHMIS) documents.

.9 Material Safety Data Sheets (MSDS).

.10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by Departmental Representative.

1.32 MEETINGS

.1 Attend Health and Safety Pre-Construction Meeting and all subsequent meetings called by Departmental Representative.

.2 All personnel employed by Contractor and his subcontractors shall attend the mandatory EGD Safety Orientation presentation prior to starting work at the Contractor's Work Site.

1.33 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.

.3 Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. Contractor and his subcontractor(s) will be responsible for any costs arising from such a "stop work order".

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes environmental procedures that are required for the Contract. Contractor shall be responsible for adhering to these special procedures while completing all work under this Contract.

.2 Contractor shall review, understand and abide by the Environmental Management Plan (EMP) and the Project Permits prior to submission of Tender. The EMP is included as an Appendix of the Specification.

.3 Contractor shall review, understand and abide by the EGD Environmental Best Management Practices (EBMPs) and the EGD Environmental Policy throughout the work. The EGD EBMPs and Environmental Policy are included as reference documents to the Specification.

.4 Environmental degradation arising from construction activities shall be prevented, abated, controlled, and minimized by complying with all applicable federal, provincial, and local laws and regulations concerning environmental pollution control and abatement, as well as the specific requirements in the Project Permits. Contractor shall comply with all permit conditions. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the EGD Work Site.

.5 Contractor is responsible for environmental protection during all construction activities at all locations it performs work. Work locations include, but are not limited to, the EGD Work Site, and during barge transport over water and land-based transportation of dredged material. This section primarily addresses work conducted at the EGD Work Site, but Contractor is responsible for complying with environmental protection regulations at all locations that are used.

1.2 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for work associated with environmental procedures and sustainability. Activities associated with environmental procedures and sustainability shall be considered incidental to the work.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to the Contract.

1.5 SUBMITTALS

.1 Submittals shall be in accordance with Section 01 33 00 (Submittal Procedures).

.2 Contractor shall submit an Environmental Protection Plan (EPP) for review and acceptance by Departmental Representative within twenty-eight (28) calendar days following Contract award. The EPP shall present the procedures by which Contractor shall establish and maintain quality control for environmental protection of all items of the work, and the means and methods that Contractor will use to comply with the Specification, the EMP, and all required Project Permit conditions. This plan shall address all construction activities. The EPP shall present a comprehensive overview of known or potential environmental issues.

.3 Address topics at a level of detail commensurate with environmental issues and required construction tasks.

.4 Address all topics that the Specification and EMP requires Contractor to discuss in the EPP.

.5 See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for additional information and requirements to be included in the EPP.

.6 At a minimum, the EPP shall contain the following information:

.1 Organization chart and names of persons responsible for EPP compliance.

.2 Names and qualifications of persons responsible for manifesting waste to be removed from site.

.3 Upland Work: See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for upland work submittal requirements as part of the EPP.

.4 In-Water Work:

.1 Describe methods, procedures, and best management practices to comply with water quality performance criteria objectives per the EMP and Section 01 35 13.43 (Special Procedures for Contaminated Sites), these specifications and all conditions of Project Permits, and contingency measures that Contractor will take to meet requirements if exceedances occur.

.5 Pollution Control Plan:

.1 Submit a Pollution Control Plan as a section of the EPP.

.2 Procedures, response actions, and reports to be used in the event of an unforeseen spill of regulated substance. Spill response procedures shall be completed in accordance with the EGD Spill Contingency Plan.

.3 In-water refueling of marine equipment within the EGD Work Site and within Esquimalt Harbour will not be allowed. Contractor to submit to the Departmental Representative for approval, plans for

refuelling of marine equipment, and BMP's for refuelling of marine equipment.

.4 The name of the individual who will be responsible for implementing and supervising the spill containment and cleanup.

.5 Training requirements for Contractor's personnel and methods of accomplishing the training.

.6 Non-hazardous and hazardous solid waste disposal plan, in compliance with the EMP, identifying methods and locations for solid waste disposal including structure demolition debris and other debris generated during dredging activities.

.7 Identification of potentially hazardous substances to be used on the job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with federal, provincial, and municipal laws and regulations for storage and handling of these materials. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the EGD Work Site.

.6 Wastewater Management and Disposal Plan (WWMDP)

.1 Submit a WWMDP as a section of the EPP.

.2 Identify methods and procedures for management and/or discharge of waste waters that are generated from other construction activities, such as cleanup water, decontamination water, personnel and equipment decontamination facilities, and water used in flushing of lines.

.3 See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for additional requirements regarding wastewater management and disposal.

.7 Stormwater Pollution Prevention Plan (SWPPP):

.1 Submit a SWPPP as a section of the EPP.

.2 See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for additional requirements regarding the SWPPP.

1.6 ENVIRONMENTAL RESPONSIBILITY

.1 Contractor shall demonstrate in the performance of the work that it is environmentally responsible by complying with environmental legislation, regulations, and authorizations; following all Departmental Representative instructions and policies, practices, and procedures established by Departmental Representative with respect to the environment that are communicated by Departmental Representative to Contractor from time to time; being observant for, and immediately notifying Departmental Representative of, any environmental problems that develop at the EGD Work Site; and taking all

reasonable and necessary measures in the performance of the work to avoid causing negative impacts to the environment. Where negative impacts occur, Contractor shall immediately advise Departmental Representative and shall be solely liable to undertake all reasonable and necessary measures to minimize the effect of such negative impacts and restoring the site to pre-impact conditions.

.2 Maintain key pollution control systems in working condition throughout the project and undertake all works such that there are no unauthorized discharges of liquids or solids to the marine environment, or of gas to the atmosphere.

.3 Maintain a neat work area free of unnecessary debris, tools, equipment, or materials; dispose of sewage, refuse, and chemical wastes in compliance with the EGD EBMPs and applicable federal, provincial, and municipal or local legislation, regulations, or laws; and remove all tools, equipment, supplies, and wastes from the site upon completion of the work.

.4 Maintain all equipment and machinery in good working order and free of leaks or excess oil, grease, and debris. Ensure that appropriately equipped spill kits are available on all equipment at the EGD Work Site, and ensure that workers and supervisory staff are knowledgeable with the provisions of the EPP and EMP and are adequately trained to implement the measures contained therein.

1.7 FIRES

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

1.8 DISPOSAL OF NON-SEDIMANT WASTE

.1 Do not bury rubbish and waste materials on the EGD Work Site.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil, or paint thinner into waterways, storm sewers, or sanitary sewers.

.3 Do not discharge wastes into streams or waterways.

.4 Contractor is responsible for storing, separating, handling, transporting, and disposing of all waste materials in accordance with provincial, federal, and local and municipal regulations and requirements, and at appropriate Disposal Facilities or transfer stations.

.5 Disposal/recycling of other waste generated during the project shall be done in compliance with federal, provincial, and municipal, or local legislation, regulations, and laws, as applicable and the facilities used will need to be reviewed by Departmental Representative.

1.9 VEHICULAR ASSESS AND PARKING

.1 Maintenance and use:

.1 Prevent contamination of access roads. Immediately scrape up debris or material on access roads that is suspected to be contaminated from

Contractor activities as determined by Departmental Representative; transport and place into a designated area approved by Departmental Representative. Clean access roads at least once per shift.

.2 Departmental Representative, at Departmental Representative's sole discretion, may collect soil samples for chemical analyses from traveling surfaces of constructed and existing access routes prior to, during, and upon completion of the work. Excavate and dispose of soil contaminated by Contractor's activities at Contractor's own cost.

.2 Vehicles/equipment shall be in good working order and not be leaking any fuel or fluids.

.3 Traffic management measures (such as 'flag person') shall be implemented if required at site access points to direct traffic.

1.10 UPLAND DRAINAGE

.1 Comply with the Temporary Erosion and Sedimentation Control (TESC) Plan, as prepared for and provided in the EPP and described in Section 01 35 13.43 (Special Procedures for Contaminated Sites), for work to be completed at the EGD Work Site. Implement monitoring and reporting requirements to ensure that control measures are in compliance with the TESC Plan and federal, provincial, and municipal laws and regulations. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the EGD Work Site.

1.11 SURFACE WATER QUALITY

.1 Materials and equipment shall be regularly inspected, maintained, operated, and stored in a manner that prevents deleterious substances (e.g. petroleum products, silt, etc.) from entering the watercourse.

1.12 WORK ADJACENT TO WATERWAYS

.1 Applies to work to be performed at the EGD Work Site:

.1 Do not use waterway beds for borrow material.

.2 Do not dump excavated fill, waste material, or debris in waterways.

.3 Special care shall be exercised while working near water's edge including implementation of site-specific erosion and sediment control measures. Silt fences shall be used to minimize soil or intertidal sediment transport into the waterway.

1.13 POLLUTION CONTROL

.1 See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for requirements regarding pollution control.

1.14 SPILL OR RELEASE OF DILETERIOUS SUBSTANCES

.1 Contractor shall immediately contain and assess the spill, provide appropriate notifications, and take the necessary steps to prevent further discharge. Contractor is responsible for immediate cleanup of the spill and restoration of the area to the satisfaction of Departmental Representative and other regulatory agencies, where involved.

.2 Contractor shall follow the procedures for spill reporting as outlined in its Pollution Control Plan included in the EPP.

.3 All workers shall be fully aware of the spill prevention and response procedures including notification of Departmental Representative.

.4 Report all spills in accordance with the British Columbia Spill Reporting Regulations, EBMPs, EGD Spill Contingency Plan, Fisheries Act, and EMP.

.5 Departmental Representative shall be immediately informed of all spills that occur at the EGD Work Site.

.6 Further information on dangerous goods emergency cleanup and precautions including a list of companies performing this work can be obtained from the Transport Canada 24-hour number (613) 996-6666 collect.

.7 Spill kits will be kept at the EGD Work Site at all times.

.8 Contractor shall take due care to ensure no deleterious materials, including sediment-laden runoff, leave the EGD Work Site or enter any surface water or stormwater at or near the EGD Work Site.

.9 If Contractor is planning to discharge any deleterious materials, including water discharge (effluent) or sediment-laden runoff (including concrete, runoff coming in contact with uncured concrete, and any other sediment-laden runoff), leaving the EGD Work Site, Contractor is responsible for ensuring that appropriate permits are in place and that the discharge meets the permit requirements.

.10 Equipment fuelling or lubricating shall occur at the EGD Work Site in accordance with EBMPs.

.11 The use of any paints, corrosion protective coatings, wood preservatives, or any other potentially deleterious substances that may be applied to surfaces that will have contact with the marine environment, shall be in accordance with the EMP, EBMPs, environmental protection measures outlined in the EPP, as well as applicable legislation, guidance documents or industry standards pertaining to the activity. The application of paints, corrosion protective coatings, wood preservatives or any other potentially deleterious substance should occur away from water wherever possible to ensure no accidental release of deleterious chemicals by runoff or overspray.

.12 Any equipment remaining on site overnight shall have appropriately placed drip pans or other spill/leak containment measures.

.13 Measurements for the containment of potentially harmful toxic substances due to the rinse, cleaning water, or solvents for glues, wood preservatives, and other potentially harmful or toxic substances shall be identified and implemented by Contractor to prevent leakage, loss, or discharge into the storm drain system or into the marine environment.

.14 Prevent discharges containing asphalt, grout, concrete, or other waste materials from reaching storm drains or the marine environment. This includes, but is not limited to the following:

.1 Minimizing the washing of sand or gravel from new asphalt, debris from drilling or cutting, or other materials into storm drains and the marine environment by sweeping.

.2 Application of fog seals, tack coats, or other coatings, if required, during periods when rainfall is unlikely to occur during application.

.3 Cleaning equipment off site.

.4 Protection of drainage structures with filter fences if required.

.15 During the purging of tanks and associated lines, procedures must prevent the release of any fuels to the surface, surface water, catch basins, or soils within or surrounding the EGD Work Site.

.16 During installation of in -water piles and/or the filling of piles with concrete, Contractor shall prevent the discharge of any deleterious materials, including water discharge (effluent), sediment or any other materials generated from installation. Where potentially deleterious materials are generated they must be removed and/or treated. Contractor shall complete construction activities in accordance with the EMP, EBMPs, environmental protection measures outlined in the EPP, as well as applicable legislation, guidance documents or industry standards pertaining to the installation of in-water piles.

1.15 NOISE AND LIGHT CONTROL

.1 Contractor shall comply with EBMPs regarding noise control while conducting activities at the EGD Work Site and identify measures for noise control in the EPP, as per the EMP.

.2 Although municipal bylaws are not applicable to federal sites, the EGD Environmental Policy states that the EGD will "*meet or exceed applicable federal, provincial and municipal legislation and regulations...related to [their] identified environmental aspects*"; therefore, Contractor is to adhere to Township of Esquimalt and City of Colwood noise bylaws at the EGD Work Site boundary and respect an 85 dBA limit for the construction zone. Contractor shall undertake noisier activities during daytime hours whenever possible and may be required to modify activities/schedules based on noise monitoring and resident feedback. Site-specific noise legislation for the project are provided in the table below and

included in the EMP.

Table 01 35 43-1

Legislation	Application to the Project
Township of Esquimalt "Noise Control Bylaw, 2007, No. 2677"	The Bylaw permits Noise Source Zones denoted "Activity" (applicable to the EGD) the following equivalent sound level limits in Noise Receiver Zones denoted "Quiet" (applicable to the residential areas immediately adjacent to the EGD): 60 dBA (decibels, A-weighted) during the day (from 7:00 a.m. to 10:00 p.m. on a week day or Saturday and from 10:00 a.m. to 10:00 p.m. on a Sunday or holiday). 55 dBA during night time hours.
City of Colwood Bylaw No. 38	The Bylaw to Regulate Noise within the City of Colwood prohibits the disturbance of the quiet, peace, rest, enjoyment, comfort or convenience of the neighbourhood or of persons in the vicinity, and stipulates the following construction hours: 07:00 to 19:00 h Monday to Saturday 08:00 to 17:00 h on Sundays and statutory holidays

.3 All construction equipment shall be operated with exhaust systems in good repair to minimize noise.

.4 Ensure that noise control devices (i.e. mufflers and silencers) on construction equipment are properly maintained.

.5 Contractor shall implement use of lighting shrouds for work to be completed during night-time hours to minimize lighting disruptions to local residents.

1.16 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 EPP or the EMP. Notwithstanding this notification process, Contractor shall be responsible for conducting all construction activities in a manner compliant with these regulations. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the EGD Work Site.

.2 Contractor shall inform Departmental Representative of proposed corrective action after receipt of such notice, and take such action for approval by Departmental Representative.

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

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

1.17 SPECIES AT RISK AND MARINE WILDLIFE

.1 Refer to the Canadian Environmental Assessment Act (CEAA) Screening Environmental Assessment Report and its addendum "Phase 2 Environmental Effects Evaluations" for information on Species at Risk (SAR) that have a potential to occur within or adjacent to the EGD Work Site.

.2 Marine mammal monitoring will be implemented by the PWGSC Environmental Monitor during construction activities, with a process in place to temporarily stop works if marine mammals are observed, as per the EMP.

.1 If any marine mammal enters the marine mammal safety perimeter during in-water activities, Contractor shall immediately notify Departmental Representative. The marine mammal safety perimeter is defined as 500 m from active operations for cetaceans and 25 m from active operations for pinnipeds. Departmental Representative will assess active operations and determine if work delay or shut-down is necessary until the marine mammal(s) vacate the marine mammal safety perimeter.

.2 Marine mammals which could potentially enter the EGD Work Site include the stellar sea lion, harbour porpoise, and killer whale. Additional information for these mammals with potential to occur in the EGD Work Site is provided in the EMP. Under no circumstances will any Contractor or Environmental Monitor attempt to capture or molest any marine mammal.

.3 Should a SAR be encountered, measures are to be implemented to avoid destruction, injury, or interference with the species, its residence, and/or its habitat (e.g., through siting, timing, or design changes). If the foregoing cannot be avoided, Contractor shall cease work and contact Departmental Representative for advice regarding mitigation measures.

.4 In the event that it is determined by Departmental Representative that the project likely may have unexpected adverse effects on a SAR, Contractor will cease work and contact Departmental Representative for advice regarding mitigation measures.

1.18 MIGRATORY BIRDS/WILDLFE HABITAT

.1 Ensure that all works are in compliance with the Migratory Birds Convention Act. If Contractor, in the course of its work, identifies nesting birds within the EGD Work Site, notify Departmental Representative immediately.

.2 Restrict vehicle movements to construction areas and access roads and avoid harassment of animals.

1.19 SUSTAINABLE REMEDIATION

.1 A sustainable remediation section shall be submitted by Contractor as a subsection of the EPP. The sustainable remediation section shall describe the sustainable remediation strategies and/or technologies used during completion of this work. It shall include a description of all of the sustainable remediation elements incorporated into Contractor's approach, whether required by the Contract documents or independently proposed by Contractor, including, but not limited to, energy use reduction controls and tracking measures; transportation minimization and sustainable transportation evaluation; emission reduction controls and policies; recycling, reuse, and waste minimization; use of local materials, facilities, and work force; and/or justification for any proposed approach that does not meet the minimum sustainable remediation requirements and/or preferences included in the Contract documents.

.2 The sustainable remediation section of the EPP will be reviewed by Departmental Representative as part of the pre-construction submittal requirements of the Specification. Final acceptance of the EPP by Departmental Representative will constitute acceptance of the sustainable remediation requirements.

.3 Contractor must include the following as a part of its sustainable remediation section within the EPP:

.1 Management of energy and air emissions.

.2 Water management approach.

.3 Waste management plan including material consumption, waste generation, waste reduction, and disposal procedures. This shall consider both Contractor and project-generated waste.

.4 Consideration of ecological impacts (including on-site traffic pattern and speed control management).

.5 Post-work documentation.

.4 Energy and Air Emissions Management:

.1 Contractor shall provide documentation that supports good vessel and engine / equipment maintenance and properly train operators to run equipment efficiently.

.2 Contractor shall provide a list of equipment to be used, including expected fuel usage and hours of operation, as well as a list of fuels and hydraulic oils that will be used in equipment.

.3 Fuel and hydraulic oil requirements include, but are not limited to, the following:

.1 Ensure hydraulic machinery, if required, uses environmentally-sensitive hydraulic fluids that are non-toxic to aquatic life and that are readily or inherently biodegradable.

.4 All personal vehicles should be turned off when not in use or when the driver leaves the unit for any length of time, except:

.1 In the event of the use of a power tailgate when the electrical system alone would not support its operation; such as in cold weather or low electrical supply conditions.

.2 In extreme winter weather situations where a vehicle not idling would create an operational safety problem (e.g., severe fogging or icing of windshield).

.5 Car share and carpool programs are strongly encouraged.

.6 Contractor shall minimize idling to control air pollution due to exhaust emissions and reduce fuel usage.

.1 When the equipment is forced to remain motionless due to traffic conditions or mechanical difficulties outside of the operator's control.

.2 When it is necessary to ensure the safe operation of the machine or to verify that the machine is in good working order or complies with other conditions specified by the machine manufacturer's manual or other technical document prescribed for that machine.

.3 When testing, servicing, repairing, or for diagnostic purposes, including regeneration of a diesel particulate filter.

.4 When necessary to serve the purpose of the machine in the course of its operation, including during the operation of a crane, cement mixer, cherry picker, boom lift, or similar machine.

.5 In the performance of emergency work or for public safety purposes; or in accordance with an approved written anti-idling procedure.

.6 Idling limits will be enforced by Departmental Representative.

.7 Turning off diesel combustion engines on construction equipment not in active use, and on trucks that are idling while waiting to load or unload material for five (5) minutes or more.

.8 Contractor shall place diesel equipment away from the general public and sensitive receptors.

.9 Contractor shall use, to the extent practicable, machines with automatic idle-shutdown devices and auxiliary power systems that meet California Air Resources Board (CARB) equipment specifications to power cab heating and air conditioning when equipment is unengaged.

.10 Contractor shall retrofit machinery and heavy equipment for diesel-engine emission control and exhaust treatment technologies such as particulate filters and oxidation catalysts.

.11 Contractor shall use cleaner engines, cleaner or alternative fuels, and cleaner diesel control technology on diesel-powered equipment with engines greater than 50 horsepower whether the equipment is owned or rented.

.12 Contractor will be encouraged to use cleaner engines, cleaner or alternative fuels, and cleaner diesel control technology on vessels and vehicles.

.13 Contractor shall limit EGD Work Site vehicle speeds to posted EGD facility speed limits.

.14 Contractor shall use rail, when feasible and cost effective, for the transportation of materials to minimize greenhouse gas emissions.

.5 Water Management:

.1 Contractor shall minimize fresh water and potable water consumption and maximize use of non-potable water and water reuse during daily operations and treatment processes.

.2 Contractor shall explore the utilization of rumble grates with a closed-loop greywater washing system (or an advanced, self-contained wheel washing system) to minimize vehicle tracking of sediment and soil across non-work areas or off site.

.6 Material Consumption and Waste Generation and Disposal Management:

.1 Contractor shall maximize diverting the total project waste, in order of preference by: 1) weight; and 2) volume, whichever is most feasible to measure, by seeking opportunities to reduce, reuse, and/or recycle demolition materials that are not considered contaminated or hazardous substances. Contractor shall dispose of uncontaminated recyclable or salvable demolition materials by a combination of salvage, reuse, or recycling at a Disposal Facility, approved by Departmental Representative. Other innovative approaches to achieve the minimum diversion rate are encouraged and should be specified and described in the sustainable remediation section of the EPP.

.2 Waste material management hierarchy can be viewed as: reuse on-site, recycle on-site, reuse off-site, and recycle off-site.

.3 Minimum diversion rate may be achieved by recovering and recycling the following materials, components, and fixtures:

.1 Concrete and concrete blocks.

.2 Ferrous metal.

.3 Non-ferrous metals: Copper, aluminum, etc.

.4 Untreated lumber.

.5 Plywood and particle board.

.6 Paper and cardboard.

.7 Non-contaminated soil and topsoil.

.7 Ecological Impacts Management:

.1 Contractor shall clean all equipment prior to each arrival at the EGD Work Site to ensure that no invasive vegetative species are present on the equipment during the performance of the work.

.2 Contractor shall establish minimally-intrusive and well-designed traffic patterns for on-site activities and plans to minimize on-site impacts and reduce off-site traffic congestion.

.8 Following completion of the work, Contractor shall submit all relevant documentation regarding completion of sustainable remediation requirements including, but not limited to, the following:

.1 Records of equipment maintenance throughout completion of the work, including documentation of types of oils used.

.2 Documentation of carpool/rideshare programs use, as applicable.

.3 Description of equipment retrofit activities completed for this Contract.

.4 Documentation of rail transportation use for transportation of materials, as applicable.

.5 Estimate of water volume captured and/or recycled during completion of the work.

.6 Documentation of material volumes/tonnages brought to recycling facilities or treatment facilities for disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes Contractor requirements for quality control, including coordination with material suppliers, testing agencies, and other entities that may be employed by PWGSC or Departmental Representative during completion of the work. The intent of this Section is to require Contractor to establish a necessary level of quality control that will:

.1 Provide sufficient information to assure both Contractor and Departmental Representative that the Specification requirements are and have been met.

.2 Contractor shall establish, provide, and maintain a Construction Quality Control (CQC) Plan as specified herein, detailing the methods and procedures that will be taken to assure that all materials and completed construction elements conform to the Drawings, the Specification, and other requirements. Although guidelines are established and certain minimum requirements are specified herein and elsewhere in the Specification, it is the responsibility of Contractor to ensure that construction and construction quality control are accomplished in accordance with the stated purpose and in accordance with the Specification as described herein.

.3 Contractor shall be prepared to discuss and present, at the Pre-Construction Meeting, its understanding of the quality control requirements. Contractor shall not begin any construction until the CQC Plan has been reviewed and accepted by Departmental Representative.

1.2 MEASUREMENT AND PAYMENT

.1 Quality control is considered incidental to the work and will not be measured separately. No separate payment will be made under this Section.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.3 Section 01 35 43 (Environmental Procedures and Sustainability)

.4 Section 35 37 10 (Engineered Capping)

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 Within ten (10) working days following Notice of Award, submit the CQC Plan for review and acceptance by Departmental Representative. Contractor's CQC Plan shall include:

.1 Reporting and Document Control Plan describing procedures for communicating progress testing, and other data with Departmental Representative.

.2 Personnel, procedures, methods, instructions, records, and forms to be used to control the work and verify that the work conforms to the Contract documents.

.3 Description of the CQC organization, including an organization chart showing the various CQC team members, along with their designated responsibilities and lines of authority. At a minimum, identify the Project Manager, Site Supervisor(s), CQC Supervisor, Surveyor, or Engineer, and Health and Safety Coordinator.

.4 Acknowledgement that the CQC staff will conduct inspections for all aspects of the work specified, and shall report to the CQC Supervisor, or someone of higher authority in Contractor's organization.

.5 The name, qualifications, duties, responsibilities, and authorities of each person assigned a primary CQC function.

.6 Testing methods, schedules, and procedures used to report CQC information to Departmental Representative, including samples of the various reporting forms.

.2 Submit four (4) copies of all inspection and laboratory test reports to Departmental Representative within two (2) days following completion of inspection or receipt of analytical data from a testing laboratory.

.3 Provide copies to subcontractor of work being inspected or tested.

1.6 REFERENCES

.1 NOT USED

1.7 QUALITY CONTROL ORGANIZATION

.1 CQC Supervisor: As part of the CQC Plan, Contractor shall identify an individual within its organization, located at the EGD Work Site, who shall be responsible for overall management of the CQC as part of the Contract, and have the authority to act in all CQC matters for the Contractor.

.2 Personnel: A staff shall be maintained under the direction of the CQC Supervisor to perform all CQC activities. The actual number of staff during any specific work period may vary to cover shift needs, and rates of performance. The personnel of this staff shall be fully qualified by experience and technical training to perform their assigned responsibilities and shall be directly hired for the work by Contractor.

1.8 INSPECTION

.1 Contractor will allow Departmental Representative access to the work. If part of the work is in preparation at locations other than the EGD Work Site (i.e.

Contractor Off-Site Offload Facility), Contractor shall allow access to such work whenever and wherever it is in progress.

.2 Give timely notice requesting inspection if work is designated for special tests, inspections, or reviews by Departmental Representative instructions, or law of the EGD Work Site or Contractor Off-Site Offload Facility.

.3 If Contractor covers, or permits to be covered, work that has been designated for special tests, inspections, or reviews before such is made, uncover such work, have inspections or tests satisfactorily completed, and make good such work.

1.9 INDEPENDANT INSPECTION AGENCIES

.1 Independent inspection/testing agencies will be engaged by the Contractor for purpose of inspecting or testing portions of work, as applicable, with the exception of the hiring of the Pile Driving Analyzer (PDA) testing firm, which the Departmental Representative will hire. Cost of PDA services will be borne by PWGSC.

.2 Employment of inspection/testing agencies does not relax responsibility to perform work in accordance with Contract documents.

.3 If defects are revealed during inspection or testing, additional inspection or testing will be required to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to PWGSC. Contractor shall pay costs for re-testing and re-inspection as necessary.

1.10 ACCESS TO WORK

.1 Allow inspection / testing firms access to EGD Work Site.

.2 Contractor shall make accessible to Departmental Representative all construction equipment that is employed for completion of the work.

.3 Contractor shall cooperate to provide reasonable facilities for such access.

1.11 PROCEDURES

.1 Notify appropriate entity and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples or materials required for testing, as requested in the Specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in work.

.3 Provide labour and facilities to obtain and handle samples and materials at the EGD Work Site. Provide sufficient space to store samples as necessary.

.4 Complete required materials testing as described in the Specifications for which the work applies. Results of laboratory testing shall be reviewed by Departmental Representative to determine compliance with the requirements of the work.

1.12 REJECTED WORK

.1 Remove defective work, whether result of poor workmanship, use of defective products, or damage, and whether incorporated in work or not, which has been rejected by Departmental Representative as failing to conform to Contract documents. Replace or re-execute in accordance with Contract documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If, in the opinion of Departmental Representative, it is not expedient to correct defective work or work not performed in accordance with the Contract documents, PWGSC will deduct from the Tender Price the difference in value between work performed and that called for by Contract documents, the amount of which will be determined by Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers mobilization and demobilization for the work.

.2 Mobilization shall include the following activities:

- .1 All pre-construction submittals;
- .2 Establishment of necessary site offices;
- .3 Site preparation for working and lay down areas, including site perimeter fencing;
- .4 Workshops and other temporary facilities (as covered by Section 01 51 01 Temporary Facilities), including utility connections;
- .5 Set up of site survey control monuments;
- .6 Development and implementation of all environmental protection measures;
- .7 All work required to prepare and move to the Work Site the Contractor's plant and equipment, pile-driving derricks and equipment to be used for repairing or replacing removed Engineered Capping materials;
- .8 Moving all other major equipment required for the work to the EGD Work Site;
- .9 Preparation of formwork for precast concrete components;
- .10 Making ready for work; and,
- .11 The cost of maintaining bonds and insurance as required.

.3 Demobilization shall include the following activities:

- .1 Project closeout and required closeout submittals;
- .2 All things necessary to remove all construction equipment, plant and excess materials from the EGD Work Site;
- .3 Dismantling and removal of all temporary facilities; and,
- .4 Clean up of the EGD Work Site to a condition satisfactory to Departmental Representative at completion of the work.

.4 Items which are not to be included in mobilization / demobilization are any portion of the work covered by a specific Tender item or other incidental work which is specified as being included in a Tender item.

1.2 RELATED SECTIONS

.1 Section 01 51 01 (Temporary Facilities)

1.3 MEASUREMENT AND PAYMENT

.1 Mobilization and demobilization will not be measured for payment.

.2 Mobilization will be paid for at the Lump Sum price tendered for MOBILIZATION. Payment shall include for all costs in connection with mobilization as described in Clause 1.1.2 of this Section. The Lump Sum tendered for Mobilization shall be paid on completion of all applicable items listed in Clause 1.1.2 to the satisfaction of Departmental Representative.

.3 Supply and set up of plant and equipment not specifically noted in Clause 1.1.2 of this Section shall be deemed to be incidental to the work and shall not be covered by the Lump Sum tendered for Mobilization.

.4 Demobilization will be paid for at the Lump Sum price tendered for DEMOBILIZATION. Payment shall include for all costs in connection with demobilization as described in Clause 1.1.3 of this Section. The Lump Sum tendered for Demobilization shall be paid on completion of all applicable items listed in Clause 1.1.3 to the satisfaction of Departmental Representative.

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section presents requirements for the establishment of temporary facilities as part of the Work including Contractor access to the EGD Facility and Contractor's Work Site, locations for material delivery, Contractor's Lay-Down Area, requirements for office space, and availability of site services.

.2 Contractor's Work Site is delineated on the drawings and will be made available for the duration of the Contract. All materials delivery, on-site staging, storage, and placement of temporary facilities must take place within these boundaries.

.1 The Contractor's Work Site is limited and constricted. The Contractor shall determine distribution of required facilities, storage, staging, etc within the Contractor's Work Site. Access for Contractor's Staff, Consultant Team and the Departmental Representative will be maintained for the duration of the Contract.

.3 Install, maintain, and operate all temporary facilities and controls as required for safe and proper completion of the Work for the duration of the Contract.

.4 The Contractor' Work Site will be made available to Contractor at the time of Notice of Award. **This is contingent upon Contractor's submittal, and Departmental Representative's acceptance, of pre-construction submittals.**

1.2 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. Include all costs for temporary facilities in the tendered price for MOBILIZATION, as described in Section 01 50 00 (Mobilization and Demobilization).

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.3 Section 01 50 00 (Mobilization and Demobilization)

.4 Section 01 74 11 (Cleaning)

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions associated with this Contract.

1.5 SUBMITTALS

.1 Contractor shall submit layout drawings for the Contractor's Work Site to Departmental Representative in accordance with schedule requirements presented in Section 01 35 13.43 (Special Procedures for Contaminated Sites) as part of the Environmental Protection Plan.

1.6 REFERENCES

.1 NOT USED

1.7 ACCESS AND DELIVERY

.1 The Esquimalt Graving Dock Facility shall be assumed to be fully operational for the duration of the Contract.

.2 The Contractor's primary access to the EGD Facility will be via the Main Entrance off Admirals Road and via water.

.1 The designated entry and exit of Contractor's vehicles to the Contractor's Work Site will be via the EGD Main Entrance on Admirals Road, along the South Jetty Access Road, and along the deck of the South Jetty, as shown on the Drawings. Access alongside the Graving Dock will only be by special permission from Departmental Representative.

.1 Repair damage resulting from Contractor's use.

.3 Secondary access to the EGD Facility will be via the EGD Rear Entrance off Maplebank Road with 48 hour prior written request for approval. This route may also be used during an emergency.

.1 When utilized, the secondary access route will be via the EGD Rear Entrance off Maplebank Road, along the Main Road to the South Jetty Access Road. Access around the head of the drydock is not permitted.

.4 Vehicular movement in and out of the EGD Facility will pass through check points and be monitored by EGD security. All Contractor's and subcontractor's staff must carry current photo identification or a valid EGD Contractor Access Pass. All Contractor's and subcontractor's staff that do not have a valid EGD Contractor Access Pass are subject to a sign-in process as administered by EGD Facility security.

.1 No parking is allowed outside of the Contractor's Work Area. Unauthorized vehicles will be towed at the Contractor's expense.

.5 Individual safety and security requirements are in place:

.1 All persons will be subject to security check prior to entering the EGD Facility and must obtain security clearance.

.1 All un-cleared personnel require escort at all times while at the EGD Facility.

.2 All persons performing work must complete EGD Safety Orientation prior to performance of any work at the EGD Facility.

.6 For all land access, Contractor is required to use only the designated entrance to the EGD Facility as shown on the Drawings and as described herein.

.7 For all water access, Contractor must abide by all federal, provincial, and local regulations applicable to transportation by water. Vessel movement outside of the work area must be communicated to the QHM using Channel 10. Similarly, vessels approaching the Esquimalt Harbour Control Zone must communicate with the QHM using Channel 10 prior to entry.

.1 Vessels moored or berthed at the site for any reason must remain entirely within the Contractor's Work Site.

.8 Delivery of materials may take place via land or via water. For water based deliveries, no special restrictions will be in place beyond requirements described within the specifications. For land based deliveries, the following shall apply:

.1 For infrequent delivery by single-unit vehicles (i.e. Vehicles without a hitched trailer unit), no additional restrictions shall apply;

.2 Deliveries exceeding a frequency of four per hour, or any deliveries by multi-unit vehicles (i.e. Vehicles with a trailer) will be considered limited access. Limited access additional restrictions are as follows:

.1 Contractor must provide written request a minimum 48 hours of delivery requirement, and provide 24 hour advanced written confirmation of any planned limited access deliveries.

.2 Limited access deliveries may be subject to 24 hour delay from requested time of delivery subject to other operations taking place within the EGD Facility. This delay, if applicable, will be confirmed by the Departmental Representative at the time of the Contractor's 48 hour advance request, except in the case of Emergency Dockings as described in Section 00 11 55 of the specifications.

.3 A looped route for arrival, delivery, and exit may be available to limited access vehicles via the driving path along the south edge of the Graving Dock. The availability of this route will be dependent on other operations within the EGD Facility and must be coordinated with the Departmental Representative at the time of the written 48 hour advance request for access.

.1 Access along the south edge of the drydock will be restricted as follows:

.1 Cannot impede access for emergency vehicles

.2 Cannot impact ongoing tenant operations or ongoing ship repair activities

.3 Cannot impact other contracts or contractors

.4 Cannot impact crane services

.9 Provide and maintain access roads, sidewalk crossing ramps, and construction runways as may be required for access to the work. All roadways and walkways outside of the Project Site and Work Area shall be kept clear of materials and equipment at all times.

.1 Along the South Jetty Access Road, single lane traffic must be maintained at a minimum at all times including use of flaggers to ensure safe vehicle and pedestrian movement.

.2 Burma Road must remain open at all times.

.10 No vehicles shall be parked or left unattended beyond the limits of the Project Site and Work Area.

.11 No materials shall be stored outside of the Contractor's Work Site.

.12 No vessels or other floating equipment shall be berthed or moored outside of the Contractor's Work Area.

.13 No vessels or other floating equipment shall be berthed or moored in any manner that impedes entry to the drydock without 48 hour advance written approval by the Departmental Representative.

.1 The Contractor shall remain on site with personnel readily available to relocate such vessels immediately upon request from the Departmental Representative while the vessels are in a position that impedes access into the Graving Dock or berthing at the North Landing Wharf."

.14 Provide and maintain competent flag operators, traffic signals, barricades and flares, lights, or lanterns as may be required to perform work and to protect other users of the EGD Facility.

1.8 CONTRACROR'S LAY-DOWN AREA AND DEPARTMENTAL REPRESENTATIVE'S OFFICE SPACE

.1 The Contractor's Work Site and Lay-Down Area is shown on the Drawings. The Contractor shall place temporary fencing where shown in accordance with requirements provided in Section 01 35 33 (Health and Safety Requirements). The location of the temporary fencing shall not exceed the Contractor's Work Site and at no time shall the temporary fencing be installed into the designated Fire Lane on Burma Road. The Contractor shall submit layout drawings for the Contractor's Work Site prior to mobilization, clearly showing location of the temporary fencing, for review by the Departmental Representative. Temporary fencing shall not be installed prior to acceptance of layout by the Departmental Representative. Provide means of access to the Departmental Representative for emergency use.

.2 Provide space nearby to the Contractor's Office Area for the Office of the Departmental Representative's consultant team. The consultant team's temporary office will be provided and maintained by the Contractor for the duration of the Contract. The Office of the Departmental Representative's consultant team shall include the following, all provided by the Contractor:

.1 1200 sq ft of office space for exclusive use of Departmental Representative's consultant team and other personnel as determined by the Departmental Representative. Office space may be one or more buildings containing a minimum of 4 separate 80 sq ft offices, one meeting room and 1 unisex washroom with flush-toilet. The offices shall be equipped with internet access, and a printer capable of connectivity with each office space shall be provided. Power, water, heating and maintenance of the buildings are Contractor's responsibility.

1.9 ACCESS TO WATERBORNE EQUIPMENT

.1 Provide access to waterborne equipment (e.g. marine derricks, barges and tugboats) from the upland portion of the Contractor's Work Site. Contractor shall assess conditions of the Contractor's Work Site to determine method of access to waterborne equipment. Methods of access to waterborne equipment may include ladders, ramps, gangways, temporary floats, or other marine vessels.

1.10 POWER

.1 Electrical power and lighting may be available at the EGD Facility. Ship repair activities take priority over the work included in this Contract. If available, electrical power may be used for construction purposes at no extra cost to the Contract.

.2 Conveyance from existing power sources to desired location of use is the responsibility of the Contractor, and shall not be placed in a way that could interfere with other operations within the EGD Facility. To access available power, Contractor must take out an electrical permit, use a licensed electrical contractor to make connections, and provide CSA approved equipment, panel(s), cable, etc.

.3 Contractor to submit written request to the Departmental Representative for use of site services minimum 48 hours in advance of requirement for use.

.4 Availability of site services is at the sole discretion of the Departmental Representative and at no time does the unavailability of site services result in delay by the Crown.

1.11 COMPRESSED AIR

.1 Compressed air service may be available at the EGD Facility. Ship repair activities take priority over the work included in this Contract. If available, compressed air may be used for construction purposes at no extra cost to the Contract. Conveyance from existing connection points to desired location of use is the responsibility of the Contractor, and shall not be placed in a way that could interfere with other operations within the EGD Facility. Conveyance equipment shall include isolation shut-offs.

.2 Contractor to submit written request to the Departmental Representative for use of site services minimum 48 hours in advance of requirement for use.

.3 Availability of site services is at the sole discretion of the Departmental Representative and at no time does the unavailability of site services result in delay by the Crown.

1.12 WATER SUPPLY

.1 Non-potable water supply may be available at the EGD Facility. Ship repair activities take priority over the work included in this Contract. If available, water may be used for construction purposes at no cost to the Contract. Conveyance from existing connection points to desired location of use is the responsibility of the Contractor, and shall not be placed in a way that could interfere with other operations within the EGD Facility. Conveyance equipment shall include isolation shut-offs.

.2 Contractor to submit written request to the Departmental Representative for use of site services minimum 48 hours in advance of requirement for use.

.3 Availability of site services is at the sole discretion of the Departmental Representative and at no time does the unavailability of site services result in delay by the Crown.

1.13 CRANE SERVICES

.1 Crane services may be available at the EGD Facility. Ship repair activities take priority over the work included in this Contract. If available, contractor will follow established procedures for requisition of crane services. Contractor will supply all equipment below the hook necessary for safe lifting of load, including certified rigger(s).

.2 Contractor to submit written request to the Departmental Representative for use of site services minimum 48 hours in advance of requirement for use.

.3 Availability of site services is at the sole discretion of the Departmental Representative and at no time does the unavailability of site services result in delay by the Crown.

1.14 SANITARY FACILITIES

.1 Contractor is responsible for providing its own washroom facilities for the duration of the Contract. Contractor's washrooms shall be located within the Project Site and Work Area.

1.15 SCAFFOLDING

.1 Construct and maintain scaffolding in a rigid, secure, and safe manner.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required.

1.16 REMOVAL OF TEMOPRARY FACILITIES

.1 Remove temporary facilities from the Contractor's Work Site when directed by Departmental Representative.

.2 Clean and repair damage caused by installation or use of temporary facilities.

1.17 CLEAN-UP

.1 Conduct all project clean-up activities in accordance with Section 01 74 11 (Cleaning).

.2 Remove construction debris, waste materials, and packaging material from the Contractor's Work Site daily.

.3 Clean dirt or mud tracked onto paved or surfaced roadways.

.4 Store materials resulting from work activities that are salvageable.

1.18 SIGNS AND NOTICES

.1 Signs and notices for safety and instruction shall be in both official languages or graphic symbols conforming to CAN/CSA-Z321.

.2 Maintain signs and notices in good condition for duration of project, and dispose of off-site on completion of project or when directed by Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PRODUCTS, MATERIALS AND EQUIPMENT

.1 Use new products, materials and equipment unless otherwise specified. The term "products" is referred to throughout the Specification.

.2 Use products of one manufacturer for material and equipment of the same type or classification unless otherwise specified.

.3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

.5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.

.1 Prevent electrolytic action between dissimilar metals.

.2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.

.6 Fastenings which cause spalling or cracking are not acceptable.

.7 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.8 Use heavy hexagon heads, semi-finished unless otherwise specified.

.9 Bolts may not project more than one (1) diameter beyond nuts.

.10 Types of washers as follows:

.1 Plain type washers: Use on equipment and sheet metal.

.2 Soft gasket lock type washers: Use where vibrations occur.

.3 Resilient washers: Use with stainless steel.

.11 Deliver, store, and maintain packaged material and equipment with manufacturer's seals and labels intact.

.12 Prevent damage, adulteration, and soiling of products during delivery, handling, and storage. Immediately remove rejected products from site.

.13 Store products in accordance with suppliers' instructions.

.14 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction:

.1 Use primer or enamel to match original.

.2 Do not paint over nameplates.

1.2 QUALITY OF PRODUCTS

.1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.

.2 Defective products will be rejected regardless of previous inspections.

.1 Inspection does not relieve responsibility, but is precaution against oversight or error.

.2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by Departmental Representative.

.4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with Departmental Representative based upon the requirements of the Contract documents.

.5 Unless otherwise indicated in the Specification, maintain uniformity of manufacture for any particular or like item throughout the project.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY OF PRODUCTS

.1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply lead times for any items.

.2 If delays in supply of products are foreseeable, notify Departmental Representative of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the work.

.3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

1.4 MANUFACTURERS INSTRUCTIONS

.1 Unless otherwise indicated in the specifications, install or erect products in accordance with the manufacturer’s instructions.

.1 Do not rely on labels or enclosures provided with products.

.2 Obtain written instructions directly from the manufacturer.

.2 Notify Departmental Representative in writing of conflicts between the Specification and the manufacturer's instructions so that Departmental Representative may establish the course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in either the Contract price or the Contract time.

1.5 CONTRACTOR'S OPTIONS FOR SELECTION OF PRODUCTS FOR TENDERING

.1 Products specified by "Prescriptive" specifications: select any product meeting or exceeding the Specification.

.2 Products specified under "Acceptable Products" (used for complex mechanical or electrical systems, for example): Select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specification and indicated Products.

.3 Products specified by performance and referenced standard: Select any product meeting or exceeding the referenced standard.

.4 Products specified as "Approved Products" to meet particular design requirements or to match existing materials: Use only the specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Special Instructions to Tenderers".

.5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.

1.6 SUBSTITUTION AFTER CONTRACT AWARD

.1 No substitutions are permitted without prior written acceptance of Departmental Representative.

.2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.

.3 Proposals will be considered by Departmental Representative if:

.1 Products selected by Tenderer from those specified are not available;

.2 Delivery date of products selected from those specified would unduly delay completion of Contract, or

.3 Alternative product to that specified, which is brought to the attention of considered by Departmental Representative, and which is considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.

.4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.

.5 Amounts of all credits arising from approval of the substitutions will be determined by Departmental Representative, and the Contract price will be reduced accordingly.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section provides general requirements for maintaining project cleanliness during completion of the work and requirements for final cleaning prior to project closeout and demobilization from the EGD Work Site.

1.2 MEASUREMENT AND PAYMENT

.1 Cleaning is considered incidental to the work and will not be measured separately. No measurement or payment will be made under this Section.

1.3 RELATED SECTIONS

.1 NOT USED

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

1.7 PROJECT CLEANLINESS

.1 Maintain work in tidy condition, free from accumulation of waste products and debris, including that caused by the EGD facility or other Contractors.

.2 Remove waste materials from EGD Work Site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials.

.3 Make arrangements with, and obtain permits from, authorities having jurisdiction for disposal of waste and debris.

.4 Provide containers at the EGD Work Site for collection of waste materials and debris.

.5 Dispose of waste materials and debris off site in accordance with these Specifications.

.6 Clean interior areas prior to finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.7 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.8 Schedule cleaning operations so that resulting dust, debris, and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems, nearby structures and equipment, and adjacent water bodies.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section describes waste management and disposal procedures for structures demolition work.

1.2 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for work associated with waste management and disposal. Activities associated with waste management and disposal shall be considered incidental to the work.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 02 41 16.01 (Structure Demolition)

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to this Contract.

1.5 SUBMITTALS

.1 Prepare a Waste Reduction Work Plan (WRWP), to be submitted as part of the EPP, and that includes a written report describing opportunities for reduction, re-use, or recycling of materials.

.2 Prepare a Materials Source Separation Program (MSSP) Plan, to be submitted as part of the EPP, and which consists of a series of ongoing activities to separate re-usable and recyclable waste material into material categories from other types of waste at the point of generation.

.3 Upon request by Departmental Representative, prepare and submit a Waste Audit (WA), which relates to projected waste generation and involves controlled separation of waste

1.6 MATERIALS SOURCE SEPERATION

.1 Before project start-up, prepare Materials Source Separation Program. Provide separate containers for re-usable and/or recyclable materials of the following:

.1 Metals.

.2 Wood.

.3 Plastics

.4 Other materials as indicated in technical sections.

.2 Implement Materials Source Separation Program for waste generated on project in compliance with approved methods and as accepted by Departmental Representative.

.3 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.4 Locate separated materials in areas which minimize material damage.

1.7 DIVERSION OF MATERIAL

.1 Create a list of materials to be separated from the general waste stream and stockpiled in separate containers, to the acceptance of Departmental Representative and consistent with fire regulations.

.1 Mark containers.

.2 Provide instruction on disposal practices.

1.8 STORAGE, HANDLING AND APPLICATION

.1 Do work in compliance with Waste Reduction Work Plan.

.2 Handle waste materials not re-used, salvaged, or recycled in accordance with appropriate regulations and codes.

.3 Materials in separated condition: Collect, handle, store on site, and transport off-site to an approved and authorized recycling facility.

.4 Materials must be immediately separated into required categories for re-use or recycling.

.5 Unless specified otherwise, materials for removal become Contractor’s property.

.6 On-site sale of salvaged / recyclable material is not permitted.

.7 Provide Departmental Representative with receipts indicating quantity and type of materials delivered to landfill.

.8 Provide Departmental Representative with receipts indicating quantity and type of materials sent for recycling.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section provides project closeout requirements for post-construction submittals that Contractor is required to submit to Departmental Representative following completion of the work.

.2 This Section also presents process and requirements for inspection and declaration that the work has been completed as required by the Contract documents. Upon formal review and acceptance of the work by Departmental Representative, the work will be determined to be complete and Contractor shall then demobilize from the EGD Work Site.

1.2 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. Include all costs for closeout submittals in the tendered price for DEMOBILIZATION, as described in Section 01 50 00 (Mobilization and Demobilization).

1.3 RELATED SECTIONS

.1 Section 01 50 00 (Mobilization and Demobilization)

.2 Section 01 11 55 (General Instructions)

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

1.7 INSPECTION AND DECLARATION

.1 Inspection by Contractor: Contractor shall conduct inspection of work, identify deficiencies and defects, and repair as required to conform to requirements of the Contract documents.

.2 Notify Departmental Representative, in writing, of satisfactory completion of Contractor inspection and that corrections have been made.

.3 Request inspection by Departmental Representative.

.4 Inspection by Departmental Representative: Departmental Representative, accompanied by Contractor, will inspect the work to identify defects or

deficiencies in the work and then compile a deficiency list describing all noted defects and deficiencies.

.5 Contractor shall correct work accordingly, as advised by Departmental Representative, at no cost to PWGSC.

.6 Final Inspection: When items noted above are completed, request Final Inspection of work by Departmental Representative, accompanied by Contractor. If work is still deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection. Repeat this process until the work is complete to Departmental Representative's satisfaction.

1.8 SUBMISSION

.1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.

.2 Revise content of documents as required before final submittal.

.3 Two (2) weeks before substantial performance of the work, submit to Departmental Representative four (4) final copies of all Record Drawings and other required post-construction documentation (e.g. operation and maintenance manuals).

.4 Ensure spare parts, maintenance materials and special tools provided are new, neither damaged nor defective, and of same quality and manufacture as products provided in work.

.5 If requested, furnish evidence as to type, source and quality of products provided.

.6 Defective products will be rejected, regardless of previous inspections. Replace products at Contractor's expense.

1.9 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: Vinyl, hard covered, three (3) "D" ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 Cover: Identify each binder with typed or printed title "Project Record Documents"; list title of project and identify subject matter of contents.

.4 Arrange content by systems under section numbers and sequence of table of contents.

.5 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.6 Text: Manufacturer's printed data, or typewritten data.

.7 Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.10 CONTENTS, EACH VOLUME

.1 Table of contents – provide the following:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.4 Schedule of products and systems, indexed to content of volume.

.2 For each product or system, list the names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product data: Mark each sheet to clearly identify products and component parts, and data applicable to installation. Delete inapplicable information.

.4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

1.11 RECORD DOCUMENTS (FOR "AS BUILT" PURPOSES)

.1 Contract Drawings and shop drawings: Legibly mark each item to record actual construction, including:

.1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.2 Field changes of dimension and detail.

.3 Changes made by change orders.

.4 Details not on original Contract drawings.

.5 References to related shop drawings and modifications.

.2 Contract Specifications: Legibly mark each item to record actual construction, including;

.1 Manufacturer, trade name, and catalogue number of each “Product / Material” actually installed, particularly optional items and substitute items.

.2 Changes made by change orders.

.3 Record of “as-built” Information:

.1 Record changes in red ink. Refer also to Section 01 11 55 (General Instructions) for preparation of record documents.

.2 Before final inspection at completion of the project, using the hardcopy set of Contract Drawings, Specification and shop drawings that have been marked-up by Contractor with “as-built” information throughout the project, neatly transfer all annotations to the second set of Contract Drawings, Specifications and shop drawings (as preparation for the record documents).

.4 Submit "Record" information for all elements of the work as required by the Specification. Record information shall include, but not be limited to, the following:

.1 Pre-Construction Survey for the entire EGD Work Site.

.2 Post- Construction Surveys for completion of work elements. Surveys shall be those used for the basis of measurement and payment of the work.

.3 Any additional "Record" information provided as part of Daily and Weekly Construction Reports.

.4 Record Drawings as described elsewhere in this Section.

.5 Submit the record documents (the complete record of "as-built" information) for review and approval of Departmental Representative. If corrections are required, make such corrections to Departmental Representative's satisfaction, and re-submit for review and approval of Departmental Representative.

.6 Contractor is required to submit AutoCAD versions of all record drawings.

1.12 EQUIPEMENT AND SYSTEMS

.1 Operating procedures – include the following:

.1 Start-up, break-in, and routine normal operating instructions and sequences.

.2 Regulation, control, stopping, shutdown, and emergency instructions.

.3 Summer, winter, and any special operating instructions.

.2 Maintenance requirements – list routine procedures.

.3 Provide servicing and lubrication schedule, and list of lubricants required.

.4 Include manufacturer's printed operation and maintenance instructions.

.5 Include sequence of operation by controls manufacturer.

.6 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.7 Provide installed control diagrams by controls manufacturer.

.8 Provide Contractor's coordination drawings with installed colour coded piping diagrams.

.9 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.10 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.11 Additional requirements: as specified in individual specification Sections.

1.13 MANUFACTURERS DOCUMENTATION REPORTS

.1 When specified in individual Sections of the Specification, require manufacturer to provide authorized representative to demonstrate operation of equipment and system, instruct Departmental Representative's indicated facility's personnel, and provide detailed written report that demonstration and instructions have been completed.

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.14 SPARE PARTS

.1 Provide spare parts in quantities specified in individual Sections of the Specification.

.2 Provide items of same manufacture and quality as items in work.

.3 Deliver to on-site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in maintenance manual.

.5 Obtain receipt for delivered products and submit to Departmental Representative.

1.15 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials in quantities specified in individual Sections of the Specification.

.2 Provide items of same manufacture and quality as items in work.

.3 Deliver to on-site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in maintenance manual.

.5 Obtain receipt for delivered products and submit to Departmental Representative.

1.16 SPECIAL TOOLS

.1 Provide special tools in quantities specified in individual Sections of the Specification.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to location as directed; place and store.

.4 4 Receive and catalogue all items:

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in maintenance manual.

1.17 WARRANTIES, BONDS, TEST REPORTS, INSPECTION REPORTS

.1 Separate each document with index tab sheets keyed to table of contents listing.

.2 List subcontractor, supplier and manufacturer with name, address, and telephone number of responsible principal.

.3 Obtain warranties, bonds, test results, inspection reports executed in duplicate by subcontractors, suppliers, manufacturers, and inspection agencies within ten (10) days after completion of the applicable item of work.

.4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the date of substantial performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

1.18 COMPLETION

.1 Submit a written certificate that the following actions have been performed:

.1 Work has been completed and inspected for compliance with the Contract documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced, and are fully operational.

.4 Certificates required by the PWGSC Fire Protection Engineering Services and utility companies have been submitted.

.5 Operation of systems has been demonstrated to the EGD personnel indicated by Departmental Representative.

.6 Work is complete and ready for final inspection.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers general requirements relating to commissioning of project's components and systems, specifying general requirements for Performance Verification (PV) of components, equipment, sub-systems, systems, and integrated systems.

1.2 MEASUREMENT AND PAYMENT

.1 Payment for commissioning shall be at the Lump Sum price tendered for COMMISSIONING, which shall cover the work activities listed in this Section. Payment shall include for all costs in connection with commissioning.

1.3 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

1.4 ACRONYMS

.1 AFD - Alternate Forms of Delivery, service provider.

.2 BMM - Building Management Manual.

.3 Cx - Commissioning.

.4 EMCS - Energy Monitoring and Control Systems.

.5 O&M - Operation and Maintenance.

.6 PI - Product Information.

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

1.5 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's PV responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Effectively train O&M staff.

.3 Contractor to assist in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

1.6 NON-CONFORMANCE WITH PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Departmental Representative to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor.

1.7 PRE Cx REVIEW

.1 During Construction: Co-ordinate provision, location and installation of provisions for Cx.

.2 Before start of Cx:

.1 Ensure installation of related components, equipment, sub-systems, systems is complete.

.2 Fully understand Cx requirements and procedures.

.3 Understand completely design criteria and intent and special features.

.4 Submit complete start-up documentation to Departmental Representative.

.5 Ensure systems have been cleaned thoroughly.

.6 Ensure “As-Built” system schematics are available.

.3 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.8 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.9 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 (Submittal Procedures).

.1 Submit proposed Cx procedures to Departmental Representative and obtain written approval at least four (4) weeks prior to start of Cx.

.2 Documentation to be provided for all electrical and mechanical systems.

1.10 COMMISSIONING DOCUMENTATION

.1 Departmental Representative to review and approve Cx documentation.

.2 Provide completed and approved Cx documentation to Departmental Representative.

1.11 COMMISSIONING SCHEDULE

.1 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, re-testing, re-commissioning, re-verification.

.4 Training.

1.12 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections, including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.13 MANUFACTURERS INVOLVEMENT

.1 Obtain manufacturer's installation, start -up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

1.15 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 Operate and maintain systems for length of time required for commissioning to be completed.

.3 After completion of commissioning, operate and maintain systems until substantial completion.

1.16 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.17 START OF COMMISSIONING

.1 Notify Departmental Representative at least fourteen (14) days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.18 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx under actual operating conditions, over entire operating range, in all modes.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.19 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.20 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed only with written approval from Departmental Representative.

1.21 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx, leave systems in normal operating mode.

.2 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.22 MAINTENANCE, MATERIALS, SPARE PARTS AND SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.23 OCCUPANCY

.1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

END OF SECTION

1. PART 1 – GENERAL

1.1 Description

.1 Local survey control and upland benchmark locations are shown on the Drawings. Contractor shall refer to provided benchmark location information to help establish survey control, and positioning control, for the Contract work.

.2 The Drawings represent conditions existing on the date of the surveys shown on the Drawings and are for information purposes only. The Drawings serve as the basis for the estimated quantities of materials as described in the Tender documents.

.3 Contractor may complete Progress Surveys using in-house survey resources. Contractor shall employ a third-party (i.e., do not use Contractor's own survey crew to manage survey work) licensed professional surveyor, member of the Association of British Columbia Land Surveyors (ABCLS), or professional engineer employed by Contractor that is licensed to perform bathymetric and topographic surveys in British Columbia to conduct Pre-Construction and Post-Construction Surveys.

.4 Methods and procedures for hydrographic surveys shall be in accordance with or exceed the accuracy requirements of "Navigation and Dredging Support Surveys" per the Hydrographic Surveying Engineering and Design Manual (EM 1110-2-1003) as prepared by U.S. Army Corps of Engineers (USACE), dated January 1, 2002. Should there be discrepancies between the Hydrographic Surveying Engineering and Design Manual and these Specifications, the more strict survey requirements shall take precedence unless Contractor obtains clarification from the Departmental Representative otherwise.

.1 A copy of the Engineering and Design – Hydrographic Surveying Manual (EM 1110-2-1003) can be viewed and downloaded from: http://publications.usace.army.mil/publications/eng-manuals/EM_1110-2-1003_pfl/toc.htm

.5 Methods and procedures for topographic surveys shall be in accordance with or exceed the accuracy requirements of the Engineering and Design – Control and Topographic Surveying Manual (EM 1110-1-1005) as prepared by USACE, dated January 1, 2007. Should there be discrepancies between the Engineering and Design – Control and Topographic Surveying and these Specifications, the more strict survey requirements shall take precedence unless Contractor obtains clarification from Departmental Representative otherwise.

.1 A copy of the Engineering and Design – Control and Topographic Surveying Manual (EM 1110-1-1005) can be viewed and downloaded from: http://publications.usace.army.mil/publications/eng-manuals/EM_1110-1-1005_sec/toc.htm

.6 Contractor shall perform the Pre-Construction Survey prior to conducting any dredging or debris removal work or pile installation.

.7 Contractor shall perform Post-Construction (final) Surveys following Departmental Representative acceptance of the work, based on Progress Survey results. Final measurement and payment for the work will be determined using Contractor's survey results.

.8 Departmental Representative may conduct its own Pre-Construction Survey to compare against the Contractor's Pre-Construction Survey for quality assurance. If there are discrepancies between the two Pre-Construction Surveys, Contractor's surveyor shall coordinate with the Departmental Representative's surveyor to determine which survey is inaccurate, and if Departmental Representative determines that Contractor's survey means and methods are inaccurate, Contractor shall adjust and correct its surveying means and methods at Contractor's own cost.

.9 Departmental Representative may review Contractor's survey work or conduct additional surveys throughout the construction work as a quality assurance check of the Contractor's Progress Survey and Post-Construction Survey work.

.10 Contractor shall establish its survey and positioning control to provide an accurate method of horizontal and vertical control before any in-water work starts.

.11 Contractor shall provide daily progress surveying and positioning control, as described further in this section, to provide quality control of the work and to calculate or verify volumes, areas, limits, positions, and other aspects of the work.

.12 Progress Survey data collected by Contractor shall be used for work progress tracking and reporting in the Daily Construction Report and Weekly Construction Report.

.13 Contractor shall conduct Post-Construction Surveys for each Contractor-defined dredging or capping subarea after Contractor has completed work in a subarea and the Post-Construction Surveys will be used as the basis for measurement and payment and acceptance of the work.

.14 Contractor shall calculate completed in-situ quantities for dredging and capping placement, based on survey results, for progress reporting and measurement and payment purposes.

.15 This work includes furnishing all labour, materials, tools, equipment, and incidentals required for surveying in support of the overall project as described in the Contract documents and in the Specification.

1.2 Measurement and Payment Procedures

.1 Surveying will not be measured individually.

.2 Surveying will be paid for at the unit price, per each day of surveying, tendered for SURVEYS. Each day of surveying may consist of multiple surveys as determined by Contractor's construction schedule. Payment shall include all costs in connection with collection, processing, and reporting of all survey data (pre-construction, progress, and post-construction) that shall be used to calculate or verify progress and measurement and payment volumes, areas, limits,

positions, and other aspects of the work, and calculating quantities for progress reporting and measurement and payment purposes, as described in these Specifications.

1.3 Related Sections

.1 Section 01 11 55 (General Instructions)

.2 Section 35 20 23 (Dredging, Barge Dewatering and In-Water Transportation)

.3 Section 35 37 10 (Engineered Capping)

.4 Section 35 37 10.01 (Residuals Management Cover Placement)

1.4 Definitions

.1 See Section 01 11 55 (General Instructions) for all definitions related to the Contract documents.

1.5 Submittals

.1 As part of the Quality Control Plan, in accordance with Section 01 33 00 (Submittal Procedures), Contractor shall prepare a Survey and Positioning Control Plan that describes the means and methods that will be implemented for all surveying activities required for the work. In-water construction activities shall not begin until: 1) the Quality Control Plan has been reviewed and accepted by Departmental Representative. At a minimum, the Survey and Positioning Control Plan shall contain the following information:

.1 Description of the approach that will be utilized for completion of all project surveys and positioning control activities (i.e. on-site base stations or CanNet technologies). Contractor shall maintain consistent approach for completion of all surveys and positioning control activities unless otherwise approved by Departmental Representative.

.2 Description of survey equipment proposed for use in collection of all survey data for the work.

.3 Process for completion of all Pre-Construction, Progress, and Post-Construction Surveys as required by and described within the Specification.

.4 Process for inclusion of daily Progress Survey data, including all electronic information and data from survey instruments, as part of Daily and Weekly Construction Report submittal requirements as described in the Specification.

.5 Procedures and quantity calculation methods for calculating Progress Surveys and Post-Construction Survey.

.2 Pre-Construction, Progress, and Post-Construction Surveys.

.1 Surveys shall be completed using the project horizontal (Universal Transverse Mercator) and vertical (Chart Datum) datums.

.2 Contractor's licensed professional surveyor shall stamp all Departmental Representative-accepted Pre-Construction and Post-Construction Surveys. The licensed surveyor does not need to stamp the Progress Surveys.

.3 Submit all surveys in hard copy drawing format and electronic drawing format as described below to Departmental Representative.

.4 Submit Pre-Construction Survey and calculated quantities to Departmental Representative at least ten (10) working days prior to start of in-water construction activities.

.5 Submit daily Progress Surveys and calculated quantities to Departmental Representative as part of Contractor's Daily Construction Report.

.6 Submit Post-Construction Surveys and calculated quantities to Departmental Representative within seventy-two (72) hours after completing the Post-Construction Survey, and as part of Contractor's Weekly Construction Report or Contractor request for information (RFI) submittal.

.3 Hard Copy Drawing Requirements:

.1 Provide plan view contour drawing, using 0.2-metre contour intervals (using even number intervals).

.2 Provide plan view spot elevation drawing.

.3 Provide cross sections through the area where work was completed at no greater than 10-metre spacing between cross sections unless otherwise accepted by Departmental Representative. Cross section information shall show the pre-construction elevations, progress or post-construction elevations, and the design template (elevations and grades).

.4 Indicate on drawing, at a minimum, the date of survey, datums, extent of survey coverage, elevation markings (for spot elevations and contour lines), location of cross sections, scale bar, and licensed professional surveyor stamp (for Pre-Construction and Post-Construction Surveys).

.4 Electronic Drawing Requirements:

.1 Submit all survey data in AutoCAD Civil3D 2012 format or older format if acceptable to Departmental Representative. All AutoCAD drawings submitted by Contractor shall be in conformance to PWGSC National Computer Aided Design and Drafting (CADD) Standard.

.2 Submit all survey data in a separate ASCII text file with XYZ spot elevation data.

.3 Departmental Representative will provide Contractor with the EGD Work Site basemap file in *.dwg format for Contractor use.

.5 Quantity Calculations:

.1 Contractor shall submit its quantity (volume) calculations to Departmental Representative for review and acceptance. Contractor shall also submit supporting information to help Departmental Representative verify that Contractor's calculated quantities are accurate. Supporting information may include, but is not limited to, certified weight tickets, barge tonnage estimates (based on barge displacement measurements), and other field inspection information that Contractor may elect to use for quality control purposes.

.2 Quantities shall be computed to the nearest in situ cubic metre based on comparison to Contractor's Pre-Construction Survey or relevant Progress Surveys. Quantities shall be broken down by each bid item listed in the Unit Price Table. Each quantity shall also be broken down into payable quantities, and Excessive Overdredging or Excessive Over-Placement quantities.

.3 Quantities shall be computed using Triangulated Irregular Network (TIN) or similar three-dimensional calculation methods using generated surfaces from the survey data. Contractor shall describe its quantity calculation method(s) in the Survey and Positioning Control Plan. Double end area method will not be an acceptable quantity calculation method.

.4 Quantities calculations shall be submitted on a daily and weekly basis as part of the Daily Construction Report and Weekly Construction Report.

2. PART 2 – PRODUCTS – NOT USED

3. PART 3 – EXECUTION

3.1 Survey Equipment

.1 Contractor's third party licensed surveyor shall use multi-beam survey equipment for the Pre-Construction and Post-Construction Surveys. If multi-beam survey equipment is considered by Contractor to not be feasible for use at the site due to site bathymetry, obstructions, or access, Contractor shall notify Departmental Representative during the bidding period before final questions are due, and propose an alternate surveying method as part of its question to Departmental Representative. Departmental Representative will review any concerns raised about surveying method and will issue a clarification or addendum to either keep this requirement or modify the survey equipment requirement.

.2 Contractor shall employ an accepted method to locate and control horizontal position that can include: Real Time Kinematic Global Positioning System (RTK-GPS) or Differential Global Positioning System (DGPS). If Contractor proposes to use an alternative positioning method, that method must be submitted to Departmental Representative and accepted prior to start of work.

.3 Bed elevations, converted to the project vertical datum, shall be determined using spot elevation measurements and survey control points.

.4 Accuracy for measured elevations shall be +/- 0.1 metres; accuracy of horizontal position shall be +/- 1 metres at the 95% confidence interval.

3.2 Ranges and Tide Gauges

.1 Contractor shall furnish, set, and maintain in good order, all ranges, buoys, tide gauges, tide board, and other markers necessary to define the work and to facilitate inspection. Contractor shall establish and maintain a tide gauge or board in a location where it may be clearly seen during in-water construction operations and inspections. Contractor shall also install an automatic recording tide gauge with water level sensor. The tide gauge shall provide a continuous recording of tidal change for every 15-minute interval or each 0.03 metre change, whichever occurs first. Tidal changes shall be recorded in Chart Datum, with these changes visually provided to the dredging and material placement equipment operator at all times during the construction activities to allow proper adjustment of dredge and placement elevations.

3.3 Conduct of Work

.1 Layout of Work:

.1 Contractor shall establish an accurate method of horizontal and vertical control before the work begins. Survey control points shown on the Drawings are provided for reference purposes only to assist Contractor in establishing horizontal and vertical control.

.2 The proposed method and maintenance of the horizontal control system shall be subject to the acceptance of Departmental Representative and if, at any time, the method fails to provide accurate location of the work, Contractor may be required to suspend its operations until such time that accurate control is established.

.3 Contractor shall lay out its work using control points established by Contractor as part of the work and shall be responsible for all measurements taken to establish these points.

.4 Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, range markers, transponder stations, and labour as may be required to lay out the work shown on the Drawings.

.5 It shall be the responsibility of Contractor to maintain all points established for the work until authorized to remove them. If such points are destroyed by Contractor or disturbed through its negligence prior to an authorized removal, they shall be replaced by Contractor, at Contractor's own cost.

.2 Positioning Methods:

.1 Observation data will be recorded electronically or in standard surveying field book format.

.2 Observed ranges shall be corrected for scale, calibration, and automatic variations when present.

.3 Accuracy of horizontal position shall be within +/- 1 metre.

.4 Accuracy for vertical positioning shall be +/- 0.1 metre.

.5 Contractor shall provide verification of positioning accuracy throughout completion of in-water construction activities, and submit documentation as part of the Weekly Construction Report.

3.4 Pre-Construction, Progress, and Post-Construction Surveys

.1 Pre-Construction Survey:

.1 Contractor shall conduct a pre-construction multi-beam bathymetric survey and supplemental surveys as necessary to fully identify pre-construction elevations and grades throughout the under-pier area of the EGD Work Site. Bathymetric survey equipment may not be suitable for surveying the upper slope areas, and Contractor may have to conduct a supplemental topographic survey. This Pre-Construction Survey shall be completed and submitted to Departmental Representative at least ten (10) working days prior to the start of dredging activities, and will be used as the basis for measurement and payment purposes.

.2 The Pre-Construction Survey shall cover all areas of work as shown on the Drawings.

.3 If vessels or other obstructions prevent Contractor from being able to fully survey all of the under-pier area of the EGD Work Site, coordinate with Departmental Representative to determine whether to rely upon the Contract Drawings in those areas or to rely upon initial Progress Survey in those areas to supplement the Pre-Construction Survey.

.2 Progress Surveys:

.1 Contractor shall provide daily (or less frequent only if accepted by Departmental Representative) measurements of the previous day's work, using multi-beam survey equipment. The survey's spot elevation spacing shall be determined by Contractor and shall provide sufficient density of spot elevation data to provide adequate information for Contractor to provide quality control of its work. Departmental Representative shall be satisfied as to the survey's data density, and if not satisfied may advise Contractor to increase the survey data density at Contractor's own cost.

.2 The survey data will accompany Contractor's Daily Construction Report submitted to Departmental Representative, including all electronic information and data from survey instruments.

.3 Survey results may be used to adjust construction procedures to ensure that the configuration of the work conforms to the Drawings and permit requirements. Contractor may be required to adjust its construction

procedures to ensure compliance with the Drawings and permit requirements, at Contractor's own cost.

.4 Dredging Progress Surveys:

.1 Contractor shall complete Progress Surveys on a daily basis to document daily progress for completion of dredging activities. Results of daily Progress Surveys should accurately depict the daily progress of the dredging work and shall be submitted as part of Contractor's Daily and Weekly Construction Reports.

.2 When dredging is determined to be completed by Contractor within each Contractor-defined dredging subarea, Contractor will conduct its Progress Survey over that entire dredging subarea to document that that dredging subarea is completed and submit to Departmental Representative to review.

.3 If all of the required dredging within a dredging subarea has not been satisfactorily completed, as determined by Departmental Representative, Contractor shall correct the deficiencies indicated in the survey, re-survey the subarea, and Departmental Representative will review the re-survey to confirm that dredging within that dredging subarea has been satisfactorily completed. The cost for Contractor re-survey will not be cause for additional compensation to Contractor.

.4 Contractor's Progress Surveys will be used to determine post-dredge elevations and for computing progress dredge volumes that are reported in the Daily Construction Report and Weekly Construction Report.

.5 Departmental Representative reserves the right to conduct its own surveys during construction to verify Contractor's survey work. In the event of a discrepancy, Departmental Representative may choose to retain another surveyor mutually acceptable to both Contractor and Departmental Representative to resolve the discrepancy.

.5 Capping Progress Surveys:

.1 Following completion of all dredging activities within each dredging subarea and acceptance of the work by Departmental Representative, Departmental Representative will advise Contractor to place capping materials in that subarea.

.2 Contractor shall complete Capping Progress Surveys on a daily basis to document daily progress for completion of material placement activities. Results of Capping Progress Surveys should accurately depict the daily progress of the material placement work and shall be submitted as part of Contractor's Daily and Weekly Construction Reports.

.3 Contractor and Departmental Representative shall follow the same procedures regarding acceptance of the work as described above for Dredging Progress Surveys.

.6 Residuals Management Cover Progress Surveys:

.1 Following collection of confirmational sediment samples in areas outside of the project boundary, but within the EGD Work Site, the Departmental Representative may advise Contractor to place Residuals Management Cover Materials in designated areas where recontamination has occurred.

.2 Contractor shall complete Residuals Management Cover Progress Surveys on a daily basis to document daily progress for completion of material placement activities. Results of Residuals Management Cover Progress Surveys should accurately depict the daily progress of the material placement work and shall be submitted as part of Contractor's Daily and Weekly Construction Reports.

.3 Contractor and Departmental Representative shall follow the same procedures regarding acceptance of the work as described above for Dredging and Capping Progress Surveys.

.3 Post-Construction Surveys:

.1 Dredging Post-Construction Surveys:

.1 Following completion of Required Dredging work, and Contingency Re-Dredging work (as necessary), within each Contractor defined dredging subarea and Departmental Representative acceptance of the work completion, based upon review of the Progress Surveys in that dredging subarea, Contractor shall conduct a Post-Construction Survey (for Required Dredging, and where designated by Departmental Representative for Contingency Re-Dredging, as appropriate) of the dredging subarea that will be used for final measurement and payment for required dredging work.

.2 Results of this survey will be compared to the monthly progress reports provided by Contractor.

.3 This Post-Construction Survey will be used as the Pre-Construction Survey for capping material placement activities.

.4 Departmental Representative reserves the right to conduct its own Post-Construction Survey during construction to verify Contractor's survey work. In the event of a discrepancy, Departmental Representative may choose to retain another surveyor mutually acceptable to both Contractor and Departmental Representative to resolve the discrepancy.

.2 Capping Post-Construction Surveys:

.1 Following completion of each capping layer (sand, filter material and armour rock material placement) within each Contractor-defined subarea and Departmental Representative acceptance of the work completion, based upon review of Progress Surveys in that subarea, Contractor shall conduct a Post-Construction Survey of the capping work that will be used for final measurement and payment purposes.

.2 Results of these surveys will be compared with the monthly progress reports provided by Contractor.

.3 Contractor and Departmental Representative shall follow the same procedures regarding acceptance of the work as described above for Dredging Post-Construction Surveys.

.3 Residuals Management Cover Post-Construction Surveys:

.1 Following placement of Residuals Management Cover Material in areas outside of the project boundary, but within the EGD Work Site, Contractor shall conduct a Residuals Management Cover Post-Construction Survey of the material placement work that will be used for final measurement and payment purposes.

.2 Results of these surveys will be compared to the monthly progress reports provided by Contractor.

.3 Contractor and Departmental Representative shall follow the same procedures regarding acceptance of the work as described above for Dredging and Capping Construction Surveys.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the breakup and removal of existing asphalt apron pavement immediately adjacent to the west jetty, south jetty and east approach structure, as shown on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 74 21 (Waste Management and Disposal)

.2 Section 02 41 16.01 (Structure Demolition)

.3 Section 02 55 10 (Dust Control)

1.3 MEASUREMENT AND PAYMENT

.1 Removal of existing asphalt pavement will be measured in cubic metres of asphalt material actually removed, regardless of depth or thickness removed or number of operations required.

.2 Payment for removal of existing asphalt shall be at the unit price tendered for ASPHALT PAVING REMOVAL. Payment shall include all costs in connection with breakup, sorting, removing, hauling, stockpiling and disposal of existing asphalt pavement to the limits shown on the Drawings.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Contractor is responsible for the disposal of asphalt materials.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 NOT USED

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PREPARATION

.1 Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed.

.2 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.

3.2 PROTECTION

.1 Protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Departmental Representative at no additional cost.

3.3 REMOVAL

.1 Remove existing asphalt pavement to lines and grades as shown on the Drawings, except as otherwise established by Departmental Representative in the field.

.2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement or granular materials that are to remain in place.

.3 Prevent contamination with base course aggregates, soil or other materials when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.

.4 Provide for suppression of dust generated by removal process in accordance with Section 02 55 10 (Dust Control).

3.4 STOCKPILING MATERIAL

.1 Dispose of removed asphalt pavement by stockpiling in locations designated by Departmental Representative.

.2 Removed asphalt pavement which is to be recycled in hot mix asphalt concrete under this Contract may be stockpiled at designated asphalt plant site.

3.5 SWEEPING

.1 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooms as required.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers:

.1 Demolition of reinforced concrete structures.

.2 Disposal of debris arising from such demolition.

.3 Dismantling, extraction and off-site disposal of timber and steel bolting materials, miscellaneous steel materials and attachments in the edge of the existing concrete deck.

.2 Existing concrete structures to be demolished, or partially demolished, include: parapet wall at timber crib near dry dock entrance, miscellaneous pavement slabs, manholes, vaults and duct banks, all as shown on the Drawings and as found in the field.

.3 This Section also covers the extraction and off-site disposal of temporary steel piles, as shown on the Drawings and as found in the field. The navigation lights are to be returned to PWGSC EGD Electrical Department. The steel piles will become the property of the contractor.

.4 Demolition and disposal of asphalt pavement is covered under Section 02 41 13.14 (Asphalt Paving Removal).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.3 Section 01 35 33 (Health and Safety Requirements)

.4 Section 01 35 43 (Environmental Procedures and Sustainability)

.5 Section 01 74 21 (Waste Management and Disposal)

.6 Section 02 41 13.14 (Asphalt Paving Removal)

.7 Section 02 55 10 (Dust Control)

.8 Section 05 50 00 (Metal Fabrications)

1.3 MEASUREMENT AND PAYMENT

.1 Dismantling, extraction, and off-site disposal of temporary steel piles, regardless of the method of extraction, will not be measured individually. Dismantling, extraction, and off-site disposal of navigation piles at the South Jetty will be paid for at the Lump Sum prices tendered STRUCTURE DEMOLITION: NAVIGATION PILES. Payment shall be full compensation for dismantling, controlled extraction from driven condition in seabed, transportation and removal off-site. Once removed, the steel piles become the property of the contractor.

Included in the cost of removal of the piles is the cost of filling holes with sand, filter material and rock armouring and all work incidental thereto as specified and as shown on the Drawings.

.2 Contractor to use methods of extraction of piles to minimize sediment being pulled up through the cap and spreading onto the rock armouring.

.3 No separate measurement or payment will be made for incidental materials (such as bolts, steel brackets, connectors, etc) that are recovered during structure demolition.

.4 Measurement for demolition of existing unreinforced and reinforced concrete structures will be calculated in cubic metres of concrete demolished, computed from field surveys of existing concrete surface (before demolition) and final concrete/substrate surface (after demolition), to demolition lines shown on the Drawings or as directed by Departmental Representative.

.5 Demolition of existing unreinforced and reinforced concrete structures, as described in this Section, and regardless of the method of demolition, will be paid for at the unit price tendered for:

.1 STRUCTURE DEMOLITION: CONCRETE DEMOLITION AT SIESMIC JOINT

.2 STRUCTURE DEMOLITION: CONCRETE BASE UNDER ASPHLAT PAVING

.3 STRUCTURE DEMOLITION: CONCRETE PARAPET WALL

.4 STRUCTURE DEMOLITION: CONCRETE RETAINING WALL

.6 Payment shall include for all costs in connection with demolition, controlled breakup, sorting, transport and disposal of the concrete structures and reinforcing steel, as specified and as shown on the Drawings.

.7 Demolition, dismantling, extraction, sorting, transport and off-site disposal of the steel bolting materials, reinforcing bars, screws, nails, tie-rods, through-bolts, threaded rod, anchor bolts and other miscellaneous materials within and attached to the existing timber or concrete structures to be demolished will not be paid for separately, but shall be included in the relevant prices of the work covered by this Section.

1.4 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CAN/CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

.2 National Building Code of Canada (NBCC), Part 8 - Safety Measures at Construction and Demolition Sites.

.3 WorkSafeBC, Occupational Health & Safety Regulations.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 If the proposed method to extract existing temporary steel piles from seabed does not utilize vibratory piling hammer, then submit alternative equivalent method for review by Departmental Representative.

.2 Submit methodology for extraction of piles indicating how to prevent contaminated materials from below the Engineered Capping being brought to the surface of the seabed during pile extraction.

.3 Contractor to submit methodology for repair of Engineered Cap,

.4 At least twenty-eight (28) days prior to start of structure demolition work, submit detailed Waste Reduction Work Plan in accordance with Section 01 74 21 (Waste Management and Disposal) and indicate:

.1 Descriptions of types and anticipated quantities of materials to be salvaged, re-used, recycled and land-filled.

.2 Schedule of concrete demolition.

.3 Number and location of dumpsters.

.4 Anticipated frequency of tippage.

.5 Names and addresses of hauliers, waste facilities and waste receiving organizations.

1.7 SITE CONDITIONS

.1 Review environmental site information and the Environmental Management Plan and take precautions to protect environment.

.2 For geotechnical investigation reports and other background data, refer to the Data Reports listed in the Specification Index. Review all Data Reports for information regarding composition and condition of structures to be demolished, and geotechnical conditions.

.3 Contractor shall inspect the work site to thoroughly familiarize himself with site conditions before starting structure demolition work.

.4 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received from Departmental Representative.

.5 Notify Departmental Representative before disrupting Esquimalt Graving Dock access or services.

.6 The Engineered Capping covers contaminated sediments. The removal of the temporary steel piles shall be done in such a way to prevent to the extent

practicable, the amount of contaminated sediments being brought up to the surface of the seabed during pile extraction.

Part 2 Products

2.1 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Demonstrate that tools and machinery are being used in manner which allows for salvage of materials in best condition possible.

Part 3 Execution

3.1 PREPARATION AND PROTECTION

.1 Do work in accordance with Section 01 35 33 (Health and Safety Requirements).

.2 Protection:

.1 Support affected structures and prevent movement, settlement, or damage to adjacent structures, utilities and portions of structures to remain in place. Provide bracing, shoring and underpinning as required.

.2 If safety of structure being disassembled or demolished (or adjacent structures and services) appears to be endangered, take preventative measures, cease operations and immediately notify Departmental Representative.

.3 Prevent debris from blocking surface drainage system, mechanical and electrical systems.

.4 Keep noise, dust, and inconvenience to occupants to a minimum and in accordance with Section 02 55 10 (Dust Control).

.5 Protect dry dock cranes, caisson gates, electrical systems, services and equipment.

.6 Install and maintain temporary structural safety barricades and work site procedures throughout the demolition work, in accordance with WorkSafeBC requirements.

.7 Provide temporary dust screens, covers, railings, supports and other protection as required.

.3 Locate and protect utility lines. Do not disrupt active or energized utilities designated to remain undisturbed.

.4 Disconnect electrical, fibre optic, telephone and communication service lines entering areas designated for demolition as shown on the Drawings.

.5 Post warning signs on electrical lines and equipment which must remain energized to serve other dock equipment and services during period of demolition.

.6 Disconnect, cap and re-route designated mechanical services, as shown on the Drawings.

.7 During all in-water and above-water demolition and pile extraction work, Environmental Protection shall comply with the requirements of Section 01 35 43 (Environmental Procedures and Sustainability) and the EMP.

.8 Employ structural demolition methods that minimize or eliminate deposition of cementitious material, concrete debris or concrete dust into the marine environment.

.9 Do not allow buoyant items that have been demolished or detached from their original position (i.e. floating debris) to float beyond the work site. Do not allow such floating debris to cause any hindrance or obstacle to marine traffic and EGD dry dock operations. Identify and collect such floating debris, and dispose in accordance with the Specification.

3.2 DEMOLITION, SALVAGE AND DISPOSAL

.1 Demolish and remove existing timber, steel and concrete structures, portions of existing structures, attachments and utilities as shown on the Drawings, to permit new construction.

.2 Except where an equivalent alternative method has been submitted and accepted by Departmental Representative, use vibratory piling to extract temporary piles from the seabed.

.3 Prevent debris, dust, and any sediment laden waters from entering any drainage system, water course or marine environment in line with EGD Environmental Best Management Practices (EBMPs), specifically EBMP #17 and EBMP #18.

.4 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.5 Do not dispose of waste or volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.

.6 Sort materials into appropriate piles for re-use and/or recycling.

.7 Blasting methods shall not be used to assist in demolition of concrete structures.

.8 During concrete demolition work, recover and dispose of miscellaneous reinforcing bars, formwork ties, tie-rods, through-bolts, threaded rod, anchor bolts, and miscellaneous materials within the existing concrete structures.

3.3 DISASSEMBLY, AND DEMOLITION PROCEDURES

.1 Materials removed from jetty structures, and from items designated for structural demolition and disposal off-site, are property of Contractor, except where salvage and re-use is specified.

.2 Throughout course of disassembly and demolition pay close attention to connections and material assemblies. Employ workmanship procedures which minimize damage to materials and equipment.

.3 Ensure workers and subcontractors are trained to carry out work in accordance with appropriate demolition techniques.

.4 Project supervisor with previous demolition experience must be present on site throughout demolition work.

.5 Carry out demolition in accordance with CAN/CSA S350 and other applicable safety standards.

.6 Workers must utilize adequate fall protection as required by WorkSafeBC.

.7 Remove and store materials to be salvaged, in manner to prevent damage.

.8 Store and protect in accordance with requirements for maximum preservation of material.

.9 Handle salvaged materials as new materials.

.10 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt.

.11 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

.12 Where existing materials are to be re-used in the work, use special care in removal, handling, storage and re-installation to assure proper function in completed work.

.13 Trim faces and edges of partially demolished structural elements to tolerances shown on the Drawings.

.14 Waste Management and Disposal:

.1 Separate waste materials for reuse and/or recycling, in accordance with Section 01 74 21 (Waste Management and Disposal).

.2 Dispose of removed materials, to appropriate recycling or re-use facilities except where specified otherwise, in accordance with authority having jurisdiction.

.3 Dispose of creosoted or treated timber components in accordance with Provincial regulations.

3.4 PROCESSING

.1 Designate location for processing of materials which eliminates double handling (except where specified otherwise) and provides adequate space to maintain efficient material flow.

.2 De-nail, strip and separate materials to ensure best possible condition of salvaged materials.

.3 Keep processing area clean and free of excess debris.

.4 Supply separate, marked disposal bins for categories of waste material.

.5 Separate processed materials into organized piles for stockpiling. Provide collection area for materials processed designated for alternate disposal. Pile materials on pallets to facilitate transport off-site.

3.5 STOCKPILING

.1 Label stockpiles, indicating material type and quantity.

.2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.

.3 For salvaged attachments and utilities that are to be re-used in the work, locate stockpiled materials convenient for use in new construction. Eliminate double-handling wherever possible.

.4 Stockpile materials that are designated for alternate disposal in a location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

.5 Stockpile materials shall be contained and filtered to limit particle transfer into the marine environment.

3.6 REMOVAL FROM SITE AND DISPOSAL

.1 Remove materials that cannot be salvaged for re-use or recycling, and dispose of in accordance with applicable codes at licensed facilities.

.2 Transport material designated for alternate disposal by approved haulers to receiving organizations listed in Waste Reduction Work Plan and in accordance with regulations. Do not deviate from haulers and receiving organizations listed in Waste Reduction Work Plan without prior written authorization from Departmental Representative.

.3 Dispose of materials not designated for alternate disposal in accordance with regulations. Disposal facilities must be listed in Waste Reduction Work Plan. Do not deviate from disposal facilities listed in Waste Reduction Work Plan without prior written authorization from Departmental Representative.

3.7 REMOVAL OF TEMPORARY STEEL PILES

.1 Remove temporary steel piles in such a way to reduce the amount of sediments from rising above the Engineered Capping.

.2 Fill holes to within 450mm of seabed with Type 1 sand (see Section 35 37 10 (Engineered Capping) for sand specification.

.3 Fill 150mm with Filter Material.

.4 Fill remaining 300mm with 0.15 m armour rock as per 2.3 in Section 35 37 10 (Engineered Capping) rock armouring.

3.8 CLEANING AND RESTORATION

.1 Keep site clean and organized throughout demolition procedure.

.2 Upon completion of project, remove debris, trim surfaces and leave work site clean.

.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife or marine environment.

.4 Repair damage to adjacent structures and utilities caused by disassembly or demolition of structures in the work, as directed by Departmental Representative.

.5 Upon completion of project, reinstate adjacent jetty apron pavement areas affected by Work to condition which existed prior to beginning of Work, and match the condition of adjacent, undisturbed areas.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section specifies requirements for dust control for the duration of the project.

1.2 RELATED SECTIONS

.1 Section 02 41 13.14 (Asphalt Paving Removal)

.2 Section 02 41 16.01 (Structure Demolition)

.3 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.4 Section 31 24 15 (General Fill)

1.3 MEASUREMENT AND PAYMENT

.1 Supply and application of water for dust control is considered incidental to the work and will not be measured separately.

.2 Supply, installation, relocation as necessary, and final removal of dust screens for dust control is considered incidental to the work and will not be measured separately.

.3 No measurement or payment will be made under this Section.

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

Part 2 Products

2.1 MATERIALS

.1 Water: to Departmental Representative’s approval.

.2 Dust Screens: to Departmental Representative’s approval.

Part 3 Execution

3.1 APPLICATION

.1 Ensure that dust arising from all Contractor operations, such as barge or truck transportation, material stockpiling and demolition work, is controlled by water application and use of dust screens.

.2 Ensure that dust blown from the Work does not affect adjacent facilities.

.3 Apply water as required for dust control, and when directed by Departmental Representative. Dust control methods shall be chosen such that a minimal amount of water required.

.4 Apply water with distributors equipped with spray system to ensure uniform application and with means of shut off.

.5 Runoff from water used for dust control shall not enter the storm drains.

.6 Provide temporary dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work, and public.

.7 Maintain, relocate as necessary, and remove dust screens at completion of those portions of the work that may generate airborne dust.

.8 Secure and cover material in open trucks hauling excavated material, and re-use the covers.

.9 If Contractor's dust and particulate control is not sufficient for controlling dusts and particulates into atmosphere, stop work. Discuss, with Departmental Representative, procedures to resolve the problem. Make necessary changes to operations prior to resuming excavation, handling, processing, or other work that may cause release of dusts or particulates.

.10 Take extra precautions, when necessary, to ensure that dust control measures are adequate during hot and dry weather, if there are strong winds, or if sediment is stockpiled overnight.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers formwork for all concrete components of the work.

1.2 RELATED SECTIONS

.1 Section 03 20 00 (Concrete Reinforcing)

.2 Section 03 30 00 (Cast-in-Place Concrete)

.3 Section 03 39 00 (General Concrete Requirements)

.4 Section 03 41 00 (Precast Structural Concrete)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under sections for which concrete formwork, falsework and accessories are required.

1.4 REFERENCES

.1 ANSI/ACI-347, Concrete Formwork, Recommended Practice for.

.2 ASTM A760/A760M-01a, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.

.3 CAN/CSA G401-01, Corrugated Steel Pipe Products.

.4 CAN/CSA-A23.1-M, Concrete Materials and Methods of Concrete Construction.

.5 CAN3-O86-M, Engineering Design in Wood (Working Stress Design).

.6 CAN3-O86.1-M, Engineering Design in Wood (Limit States Design).

.7 CAN3-O86.1S1, Supplement No. 1 to CAN3-O86.1-M Engineering Design in Wood (Limit States Design).

.8 CAN3-O86 S1, Supplement No. 1 to CAN3-O86-M, Engineering Design in Wood (Working Stress Design).

.9 CSA O121-M, Douglas Fir Plywood.

.10 CSA-S269.1-1975 (R2003), Falsework for Construction Purposes.

.11 CSA-S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.

.12 CSA-S269.3-M92 (R2003), Concrete Formwork.

.13 CSA O151-M, Canadian Softwood Plywood.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings for formwork and falsework.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of BC, Canada.

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.5 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

1.6 DEFINITIONS

.1 NOT USED

Part 2 Products

2.1 MATERIALS

.1 Formwork lumber:

.1 plywood – medium density overlay Douglas Fir to CSA 0121 square edge 19mm thick, and,

.2 wood formwork materials to CAN3-O86.1, CAN3-O86.1S1.

.2 Falsework materials: to CSA S269.1.

.3 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of tie devices leaving holes larger than 25 mm dia in concrete surface. The portion which remains embedded in the concrete shall have a minimum cover of 50 mm after patching.

.4 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.

.5 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal 15 to 24 mm^2/S at 40° C, flashpoint minimum 150° C, open cup.

Part 3 Execution

3.1 ERECTION

.1 Verify lines, levels and plumb walls before proceeding with formwork and ensure dimensions agree with drawings.

.2 Obtain Departmental Representative’s approval for use of earth forms.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Construct falsework in accordance with CSA S269.1.

.5 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.

.6 Obtain Departmental Representative's permission before framing openings not indicated in concrete joists, beams or columns.

.7 Align form joints and make watertight. Keep form joints to minimum.

.8 Use 25 mm chamfer strips on external corners of beams, joints and columns, except where indicated otherwise on the Drawings.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Line forms for the following surfaces:

- .1 All faces of precast concrete elements that will not receive subsequent cast-in-place concrete;
- .2 Internal faces of access openings;
- .3 Exposed faces of jetty deck slab and bull rail;
- .4 Exposed faces of closure pours; and,
- .5 Exposed faces of retaining walls.

.11 Do not stagger joints of form lining material. Align joints to obtain uniform pattern.

.12 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

.13 Re-use of formwork and falsework is subject to requirements of CAN/CSA-A23.1.

.14 Slip-forming methods shall not be used.

.15 Formwork and falsework shall be designed and fabricated in accordance with WorkSafeBC regulations.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the provision and installation of (uncoated and stainless steel) reinforcement for all concrete components of the work.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 30 00 (Cast-in-Place Concrete)

.3 Section 03 39 00 (General Concrete Requirements)

.4 Section 03 41 00 (Precast Structural Concrete)

.5 Section 31 63 19.13 (Rock Sockets for Piles)

.6 Section 33 41 00 (Storm Utility Drainage Piping)

1.3 MEASUREMENT AND PAYMENT

.1 Except for item 1.3.2, no measurement or payment will be made under this Section. Include reinforcement costs, whether for uncoated or stainless steel, in items of concrete work in Section 03 30 00 (Cast-in-Place Concrete Structures), Section 03 41 00 (Precast Structural Concrete), Section 33 41 00 (Storm Utility Drainage Piping) as relevant to the item of concrete work.

.2 Payment for reinforcing steel in concrete filled 914mm diameter and 762mm diameter steel pipe piles, including rock sockets, will be paid per cage as detailed on the drawings.

.3 Payment for reinforcing steel (paid under the relevant concrete items per Clauses 1.3.1 and 1.3.2), whether for uncoated or stainless steel, shall include for all costs in connection with detailing, fabricating, supplying and installing reinforcing steel, including supporting materials, spacers, ties, inserts for dowels, and additional splices not shown on the Contract Drawings.

1.4 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-S6-14, Canadian Highway Bridge Design Code.

.3 CSA-G30.3, Cold Drawn Steel Tie Wire for Concrete Reinforcement.

.4 CSA-G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.

.5 CSA-G30.14, Deformed Steel Wire for Concrete Reinforcement.

.6 CSA-G30.15, Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

.7 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

.8 CAN/CSA-G40.21, Structural Quality Steels.

.9 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.10 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement (for Grade 75 Threadbar).

.2 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.

.3 ASTM A955M, Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement.

.3 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.4 American National Standards Institute/American Concrete Institute: ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Submit shop drawings, including placement of reinforcement, in accordance with Section 01 33 00 (Submittal Procedures).

.2 Shop drawings shall consist of bar bending details, bar schedules and placing drawings. Bar schedules shall detail each type of bar and provide a total weight, computed from the theoretical mass specified in CAN/CSA-G30.18.

.3 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, types of reinforcement (uncoated or stainless), locations of reinforcement and splices, and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings. Prepare reinforcement drawings in accordance with the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.4 Detail lap lengths and bar development lengths to CAN/CSA-S6-06 (Canadian Highway Bridge Design Code), unless indicated otherwise.

Part 2 Products

2.1 MATERIALS

.1 Substitution of bar sizes, spacing and splice locations may be made only if permitted in writing by Departmental Representative.

.2 Provide materials free of loose rust, mill scale or oil coating which may reduce concrete bond.

.3 Reinforcing steel: uncoated billet steel (also termed "black bar"), grade 400, deformed bars to CAN/CSA-G30.l8, unless indicated otherwise.

.4 Weldable reinforcing steel: uncoated weldable low alloy steel deformed bars to CAN/CSA-G30.18.

.5 Stainless steel reinforcing: bars to ASTM A276 and ASTM A955M. Stainless steel reinforcing bars shall be of a stainless steel type specified as follows: 316 LN, Duplex 2205 or Duplex 2304. Stainless steel reinforcing bars shall only be used at specific locations identified on the Drawings. Substitution of stainless steel reinforcing bars with epoxy coated bars, galvanized bars or bars made from proprietary materials (MMFX® or similar) will not be permitted.

.6 Plain round bars: to CAN/CSA-G40.21.

.7 Tie wires to tie uncoated reinforcing steel: cold-drawn annealed steel wire ties, 16-gauge minimum black annealed wire, to CSA-G30.3.

.8 Tie wires used to tie stainless steel reinforcing bars to other stainless steel reinforcing bars, to uncoated reinforcing steel bars or to shear studs, shall be stainless steel wire of a type listed as follows: 316 LN, Duplex 2205 or Duplex 2304. Tie wire shall be 1.6 mm in diameter.

.9 Deformed steel wire for concrete reinforcement: to CSA-G30.14.

.10 Welded steel wire fabric: to CSA-G30.5. Provide in flat sheets only.

.11 Welded deformed steel wire fabric: to CSA-G30.15. Provide in flat sheets only.

.12 Chairs, bolsters, bar supports, spacers: acceptable non-metallic material in accordance with CAN/CSA-A23.1. stainless steel reinforcing bars.

.13 Mechanical couplers for reinforcing bars: subject to approval of Departmental Representative.

2.2 DETAILING AND FABRICATION

.1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.l, ANSI/ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Reinforcement splices shall be located as detailed on the reviewed placing drawings. Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on reviewed placing drawings.

.3 Provide lap splice lengths, standard hooks and bar development lengths to CAN/CSA-S6-06 (Canadian Highway Bridge Design Code), unless indicated otherwise. All reinforcing bar embedments shall be treated as tension embedments, and all lap splices shall be treated as Class B tension lap splices to CAN/CSA-S6-06, unless indicated otherwise. The smaller bar shall govern the splice length, except for angled splices. Where a lap splice is made between a black bar and a stainless steel bar, the black bar shall govern the splice length.

.4 Mechanical couplers for reinforcing bars may be used subject to approval of Departmental Representative, and shall develop not less than 120 % of the minimum yield strength of the bar. Where mechanical couplers are to be used to couple stainless steel reinforcing bars, the mechanical coupler shall be stainless steel.

.5 Welding of reinforcement is not permitted without written approval of Departmental Representative. If welding is approved by Departmental Representative, weld reinforcement in accordance with CSA-W186.

.6 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 All steel incorporated in the work shall be identified by heat number.

.2 Provide Departmental Representative with certified copy of mill test report for each lot of reinforcing steel (including stainless steel reinforcing bars), showing physical and chemical analysis, prior to fabrication.

.3 Upon request, inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend reinforcement except where indicated or authorized in writing by Departmental Representative. When field bending is authorized, bend without heat, applying a slow and steady pressure.

.2 Do not field bend stainless steel reinforcement except where authorized in writing by Departmental Representative. Stainless steel reinforcement shall only be bent on equipment assigned solely for this purpose.

.3 Replace bars which develop cracks or splits, or exhibit excessive surface contamination.

3.2 FIELD WELDING

.1 Do not field weld reinforcement except where indicated or authorized in writing by Departmental Representative. When field welding is authorized by Departmental Representative, weld reinforcement in accordance with CSA-W186.

.2 Welding of stainless steel reinforcement is not permitted.

3.3 HANDLING AND STORAGE

.1 Reinforcing steel shall be handled and stored at all times so that damage, surface contamination and loss of identification tags are avoided.

.2 Stainless steel reinforcing bars shall be stored clear of the ground on timbers or other suitable protective cribbing spaced to prevent sags in bundles. Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles. Stainless steel reinforcing bars shall be stored separately from uncoated reinforcing steel bars with the bar tags maintained and clearly visible until ready for placing.

3.4 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.

.2 Use plain round bars, where indicated on the Drawings, as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply an even film of mineral lubricating grease. Align bars for intended movement within hardened concrete.

.3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing steel and placement.

.4 Ensure cover to reinforcement is maintained during concrete pour.

.5 Deviation from placement, such as for construction access, to be noted and submitted to Departmental Representative for review not less than fourteen (14) days prior to construction.

.6 Where reinforcing bars project temporarily from concrete structures already cast, protect the exposed bar portions from corrosion until subsequent concrete is placed.

3.5 FIELD TOUCH-UP AND REMEDIATION

.1 Prior to placing concrete, clean off loose rust, mill scale or oil coating which may reduce concrete bond.

.2 Prior to placing concrete, clean off salt deposits from surface of reinforcing bars.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes construction of the cast-in-place concrete components of the jetty structures, including deck, rock socket fill, pipe pile fill, ductbank supports, oil water separator supports, bullrails, bollard and cleat mounting, closure pours, retaining walls and other miscellaneous reinforced and unreinforced concrete structures.

.2 Concrete construction for storm sewer catch basins, duct banks, and water main thrust blocks is covered in other Sections.

.3 Concrete construction for underwater concrete is covered under Section 03 37 26 (Underwater Placed Concrete), but is measured and paid under this Section.

.4 Supply and placement of 0.15m armour rock to be installed underwater at the displacement control pile caps as a levelling course for the pre-cast pile cap to be seated upon, is covered under Section 35 37 10 (Engineered Capping).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 10 00 (Concrete Forming and Accessories)

.3 Section 03 20 00 (Concrete Reinforcing)

.4 Section 03 39 00 (General Concrete Requirements)

.5 Section 03 37 26 (Underwater Placed Concrete)

.6 Section 03 41 00 (Precast Structural Concrete)

.7 Section 04 05 12 (Grout)

.8 Section 05 50 00 (Metal Fabrications)

.9 Section 09 97 19 (Painting Exterior Metal Surfaces)

.10 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.11 Section 31 24 15 (General Fill)

.12 Section 31 63 19.13 (Rock Sockets for Piles)

.13 Section 32 11 16.01 (Granular Sub-Base)

.14 Section 32 11 23 (Aggregate Base Courses)

.15 Section 33 05 13 (Manholes and Catch Basins)

.16 Section 33 11 16 (Water Utility Distribution Piping)

.17 Section 33 41 00 (Storm Utility Drainage Piping)

.18 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 Concrete covered by this Section will be measured in cubic metres incorporated into the work, determined by the details and dimensions shown on the Drawings. Blockouts, ducts, embedded pipe or other items creating voids where the volume is greater than 0.10 m^3 shall be deducted from the measurement.

.2 Concrete covered by this Section will be paid for at the relevant unit prices tendered. Except as noted in item 1.3.3, payment for concrete shall include for all costs in connection with the concrete, as specified and as shown on the Drawings, including all reinforcing steel, formwork, falsework, accessories and temporary support structures required for the work

.3 Concrete for pipe pile infill shall include concrete infill to rock sockets. Pipe pile infill will be measured and paid for under this Section at the relevant unit prices tendered. Reinforcing for pipe piles, including reinforcing extending into rock sockets shall not be included in the unit rate for pipe pile infill and instead shall be measured and paid under Section 03 20 00 Concrete Reinforcing.

.4 Concrete for precast concrete components will be measured to Section 03 41 00 (Precast Structural Concrete). Payment shall include all costs in connection with precast concrete, including reinforcing steel.

.5 Ducts embedded in concrete structures (except duct banks) will not be measured separately, but considered incidental to the work. All costs in connection with ducts embedded in concrete structures (except duct banks) shall be included in the unit prices tendered for concrete.

.6 Concrete thrust blocks for firewater mains will not be measured separately, but considered incidental to the work. All costs in connection with thrust blocks for firewater mains shall be included in the unit prices tendered for concrete.

.7 Concrete for storm utility drainage piping system (cast-in-place and precast) will be measured to Section 33 41 00 (Storm Utility Drainage Piping). Payment shall include all costs in connection with supplying and installing the storm utility drainage system, including reinforcing steel.

.8 Expansion joints, movement joints, contraction joints and construction joints will not be measured separately, but considered incidental to the work. All costs in connection with the construction of joints, including concrete anchorages at movement joints, and waterstop where required, shall be included in the unit prices tendered for concrete.

.9 Miscellaneous metal fabrications, including metal fabrications at movement joints, will be measured to Section 05 50 00 (Metal Fabrications), and payment shall include all costs in connection with supplying and installing miscellaneous metal fabrications.

.10 Excavation for concrete structures will be measured to Section 31 23 33.01 (Excavation, Trenching and Backfilling) and payment shall include all costs in connection with excavation.

.11 Granular base and granular sub-base under cast-in-place concrete structures will be measured to Section 32 11 23 (Aggregate Base Courses) and Section 32 11 16.01 (Granular Sub-Base), and payment shall include all costs in connection with granular base and granular sub-base, respectively.

.12 General fill adjacent to or under cast-in-place concrete structures will be measured to Section 31 24 15 (General Fill), and payment shall include all costs in connection with general fill.

1.4 REFERENCES

.1 ASTM A307, Specification for Carbon Steel Externally Threaded Standard Fasteners.

.2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Submit shop drawings for Departmental Representative's review, in accordance with Section 01 33 00 (Submittal Procedures). Indicate the following items:

.1 Concrete Reinforcing, as stipulated by Section 03 20 00.

.2 Concrete Forming and Accessories, as stipulated by Section 03 10 00

.3 Precast Structural Concrete, as stipulated by Section 03 41 00.

.4 Metal Fabrications, as stipulated by Section 05 50 00.

.2 Submit the concrete pour sequence, placing procedures, formwork, insulation and checklists for all cast-in-place concrete structures, for Departmental Representative's review, in accordance with Section 01 33 00 (Submittal Procedures).

.3 Submit installation plan and details for thermocouples and monitoring instruments in jetty deck slabs, as specified in this Section and in Section 03 39 00 (General Concrete Requirements) for measurement of in-situ thermal gradients, for Departmental Representative's review, in accordance with Section 01 33 00 (Submittal Procedures).

1.7 OPERATING ENVIRONMENT

.1 Management of environmental effects on construction of cast-in-place concrete structures shall be the sole responsibility of the Contractor.

.2 The design ambient temperature range is from -5° C minimum to 23° C maximum.

Part 2 Products

2.1 MATERIALS

.1 Compacted backfill materials under concrete structures: to Section 31 24 15 (General Fill), Section 32 11 16.01 (Granular Sub-Base) or Section 32 11 23 (Aggregate Base Courses), as appropriate to the material described on the Drawings.

.2 Concrete mixes and materials: to 03 39 00 (General Concrete Requirements)

.3 Reinforcing steel: to Section 03 20 00 (Concrete Reinforcing).

.4 Joint filler, adhesive, back-up rod, sealant primer, joint sealant, bond breaker, and waterstop : to Section 03 39 00 (General Concrete Requirements).

.5 Miscellaneous metalwork: to Section 05 50 00 (Metal Fabrications).

.6 Mooring bollard anchor bolts: to Section 35 59 29 (Mooring Devices).

Part 3 Execution

3.1 GENERAL

.1 The sequencing of concrete pours shall make provision to minimize the effects of concrete shrinkage on the finished structure.

.2 Install movement joints, crack control joints and construction joints at locations shown on the Drawings, except as otherwise approved by Departmental Representative.

.3 Concrete mix design, initial concrete temperature, placing procedures, formwork and insulation shall be employed to ensure that the maximum temperature differential over the cross-section of any reinforced concrete element, does not exceed 22° C. This provision does not apply to mass concrete.

3.2 JETTY DECK SLABS

.1 Thermal monitoring and control of core temperature at Jetty Deck Slabs:

.1 Temperatures of jetty deck slab pours shall be monitored at two locations per pour at a minimum of 1.0 m from the edge of the pour. Install thermocouples and monitoring instruments at mid-depth of the cast-in-place portion of the deck slab, to measure the actual temperatures within the core of the concrete section. Thermocouple wires shall exit the concrete at a vertical face so as not to interfere with finishing of the top

surface. For maximum allowable temperature, refer to 03 39 00 (General Concrete Requirements).

.2 Protect thermocouples and monitoring instruments from damage during jetty deck construction activities.

.3 Record the temperature differentials at 12-hour intervals for at least ninety-six (96) hours after concrete placement, to determine actual cast-in-place thermal changes. Supply written record of temperatures plotted against elapsed time to Departmental Representative every twenty-four (24) hours within the monitoring period.

.4 If the change in core temperature in any pour of the jetty deck slab exceeds the allowable value as stipulated in Section 03 39 00 (General Concrete Requirements), then adjust the mix design, initial concrete temperature, placing procedures, formwork and/or insulation as required to rectify the situation to the satisfaction of the Departmental Representative, prior to the next concrete placement for the jetty deck slab.

.5 Until such time that the change in concrete core temperatures in the jetty deck slab are shown to be within the allowable value as stipulated in 03 39 00 (General Concrete Requirements), jetty deck pours shall be limited to a maximum size of 15 m by 15 m on plan. Under no circumstances shall jetty deck pours be larger in size than 25 m by 25 m on plan.

3.3 CONCRETE STRUCTURES FOUNDED ON COMPACTED FILL

.1 Remove unsuitable material at founding level to extent and depth as directed by Departmental Representative.

.2 Prepare foundations and construct miscellaneous concrete items only after completion and acceptance of sub-grade preparation and compaction.

3.4 MISCELLANEOUS EMBEDDED STEELWORK

.1 Build into the concrete structures the miscellaneous metal fabrications to details shown on the Drawings.

3.5 GALVANIZING AND PAINTING

.1 Coat all miscellaneous steel as defined by Section 09 97 19 (Painting Exterior Metal Surfaces).

3.6 ERECTION OF METAL FABRICATIONS

.1 Do not damage metal fabrications in storing, handling and erecting.

.2 Adequate provision shall be made to keep the metal fabrications plumb and in true alignment during erection.

.3 Miscellaneous metal fabrications to be embedded in concrete, or grouted, shall be accurately set and held firmly in position while concrete or grout is being placed and cured. Any embedded fabrications that are incorrectly placed or that move during embedment to an extent that will affect their proper operation shall be removed and replaced correctly or shall be corrected by other approved means.

.4 All damage to painting shall be restored by touch-up painting by Contractor to provide an unbroken paint film equal to the original coating, as specified in Section 09 97 19 (Painting Exterior Metal Surfaces).

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section specifies requirements for supply and placement of concrete underwater by Tremie concrete method.

1.2 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

.3 Section 03 10 00 (Concrete Forming and Accessories)

.4 Section 03 20 00 (Concrete Reinforcing)

.5 Section 03 30 00 (Cast-in-Place Concrete)

.6 Section 03 39 00 (General Concrete Requirements)

.7 Section 31 61 13 (Pile Foundations General Requirements)

.8 Section 31 62 16.20 (Steel Pipe Piles)

.9 Section 31 63 19.13 (Rock Sockets for Piles)

1.3 MEASUREMENT AND PAYMENT

.1 Underwater placed concrete will be paid for at the unit price tendered for UNDERWATER PLACED CONCRETE: DISPLACEMENT CONTROL PILES.

.2 Miscellaneous steelwork items embedded in underwater placed concrete will not be measured separately. All costs in connection with embedded steelwork shall be included in the prices tendered for underwater placed concrete.

.3 The cost of quality control shall be deemed to be incidental to the work and no separate payment will be made.

1.4 REFERENCES

.1 American Society for Testing and Materials, hereinafter referred to as ASTM:

.1 ASTM C260: Standard Specification for Air-Entraining Admixtures for Concrete

.2 ASTM C494/C494M: Standard Specification for Chemical Admixtures for Concrete

.3 ASTM C1017/C1017M: Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

.2 Canadian Standards Association, hereinafter referred to as CSA:

.1 CAN /CSA-A300: Cementitious Materials for use in Concrete

.2 CAN/CSA-A23.1: Concrete Materials and Methods of Concrete Construction (refer to ASTM C260 and C494 for Admixtures)

.3 CAN /CSA-A23.2: Methods of Test for Concrete

1.5 DEFINITIONS

.1 See Section 01 11 55 (General Instructions) for all definitions related to the Contract documents.

1.6 SUBMITTALS

.1 At least twenty-eight (28) days prior to placing Tremie Concrete, and in accordance with Section 01 33 00 (Submittal Procedures), submit to Departmental Representative a Method Statement for Tremie Concrete work. In the Method Statement provide details of proposed materials, additives, tremie equipment, work methods, sequencing and construction schedule as follows:

.1 Concrete materials and execution details as stipulated in 03 39 00 (General Concrete Requirements)..

.2 Methodology to control placement of Tremie Concrete, and to prevent escape of cementitious materials into the marine environment.

.3 Specific methodology for Tremie Concrete placement as pipe pile infill.

.4 Specific methodology for Tremie Concrete placement at the (timber crib) displacement control piles.

1.7 MIX DESIGN TRIALS

.1 Perform mix design trials as stipulated in Section 03 39 00 (General Concrete Requirements).

Part 2 Products

2.1 MATERIALS

.1 Portland cement: Type MS (was Type 20) to CAN/CSA-A3001. Type GU (was Type 10) cement may be used if tricalcium aluminate content is between 4.0 % and 7.5 %.

.2 Other materials: to Section 03 39 00 (General Concrete Requirements).

2.2 TREMIE CONCRETE MIX

.1 For Tremie concrete mix requirements refer to Section 03 39 00 (General Concrete Requirements), Type A concrete.

.2 Tremie concrete shall be proportioned to provide rheology suitable for concrete placement underwater, with cohesion and flow characteristics that will allow the mixture to flow and consolidate into the forms and around reinforcement, without segregation.

.3 For Tremie concreting, use anti-washout admixtures as required to eliminate segregation and to minimize environmental impact of cement washout in water.

Part 3 Execution

3.1 GENERAL

.1 Carry out Tremie concrete work in accordance with Section 03 10 00 (Concrete Forming and Accessories), Section 03 20 00 (Concrete Reinforcement), Section 03 30 00 (Cast-in-Place Concrete), 03 39 00 (General Concrete Requirements), and CAN/CSA-A23.1-09 clause 7.2.6, except as otherwise stipulated in this Section.

.2 No work shall commence until approval in writing is given by Departmental Representative for concrete materials, additives and mix design.

3.2 PREPARATION AND CONSTRUCTION JOINTS

.1 Where concrete must bond to existing surfaces, clean surfaces just prior to starting concrete placement. Use water jets, mechanical scrapers or other means. When quantities of mud or rock cuttings are present, remove by air lift.

.2 Construction joints shall be provided only at locations shown on the Drawings, unless approved otherwise by Departmental Representative.

.3 Reinforcing steel shall be continuous through construction joints.

3.3 TREMIE CONCRETE INSTALLATION

.1 Obtain Departmental Representative's approval before placing Tremie concrete. Provide twenty-four (24) hours notice prior to placing of concrete.

.2 Pumping of Tremie concrete is permitted, subject to Departmental Representative's approval of equipment and mix design. If pump placement is used, the mix design may be modified, subject to Departmental Representative's approval, to provide the desired properties at the point of discharge.

.3 The method of deposit and type of equipment used shall be of a design that will prevent segregation during discharge.

.4 Concrete deposited under water shall be discharged and spread by moving the equipment so as to maintain as nearly as practicable a uniform flow, and to prevent dropping concrete through water.

.5 Ensure reinforcement and inserts are not disturbed during Tremie concrete placement.

.6 Place Tremie concrete in one continuous operation to full depth required:

.1 Supply complete equipment for every phase of operation.

.2 Provide sufficient supply of concrete to complete pour without interruption.

.7 Provide water-tight Tremie pipe sized to allow free flow of concrete. Diameter of Tremie pipe to be minimum 200 mm and minimum eight times maximum size of coarse aggregate.

.8 Provide hopper at top of Tremie pipe and means to raise and lower the pipe.

.9 Provide plug or foot valve at bottom of Tremie pipe to permit filling pipe with concrete initially.

.10 For widespread underwater placement, provide minimum of one Tremie pipe for every 20 m² of plan area and to maximum spacing of 6 m centre to centre. Do not move Tremie pipes laterally through concrete. Interruptions to flow caused by relocation of Tremie pipe to the next location shall be minimized to avoid formation of cold joints.

.11 Contractor is responsible for taking all measures necessary to prevent an accidental release (concrete spill) to the marine environment. In the event of accidental release, the Contractor is responsible for providing an appropriate spill response to limit potential deleterious substances from entering the marine environment and to meet water quality criteria as detailed in the Water Quality Management Plan (WQMP).

.12 Start placement with Tremie pipe full of concrete. Keep bottom of pipe buried minimum 300 mm in freshly placed concrete. Control rate of flow by varying depth of pipe bottom in concrete.

.13 If seal is lost, allowing water to enter pipe, withdraw pipe immediately. Refill pipe, and continue placing as specified.

.14 Do not vibrate, disturb or puddle concrete after placement.

.15 If Tremie operation is interrupted so that a construction joint has to be made, cut surface laitance by jetting (within 24 to 36 hours) and remove loose material by pumping or air lifting before placing next lift.

.16 Pumped concrete (alternate) method:

.1 Follow procedures as for Tremie method in placing concrete using discharge line from concrete pump as Tremie pipe.

.2 Pump discharge line to have minimum diameter of 125 mm.

.17 Cold joints shall be avoided. In the event of equipment breakdown, or if for any reason continuous placing is interrupted, if concreting is not resumed within one hour, discontinue placing and do not resume until a minimum of seventy-two (72) hours has elapsed or the concrete strength has reached 10 MPa, whichever is shorter. Ensure that the inlet valves necessary for resumption of concreting are kept clean and free of concrete.

.18 Underwater inspection of concreting in progress shall be done in accordance with Contractor’s method statement, or as directed by Departmental Representative.

.19 Maintain accurate records of concrete placed underwater by Tremie method to indicate date, pour location, quality, air/water temperature, and test samples taken.

3.4 DIMENSIONAL TOLERANCE

.1 The dimensional tolerance for Tremie concrete work shall be +/- 25 mm.

3.5 PROTECTION

.1 During Tremie concrete work take every precaution to prevent escape of cementitious materials into the marine environment.

.2 Take every precaution to prevent abrasion or cement loss from the finished Tremie concrete product during the work.

.3 After completion of Tremie concrete placement, do not apply external loading until Tremie concrete has achieved its seven (7) day compressive strength.

3.6 QUALITY

.1 Quality control for Tremie concrete production and delivery shall be as stipulated in Section 03 39 00 (General Concrete Requirements).

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply of concrete for all components of the work, regardless whether they are cast at the project site or precast.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 10 00 (Concrete Forming and Accessories)

.3 Section 03 20 00 (Concrete Reinforcing)

.4 Section 03 37 26 (Underwater Placed Concrete)

.5 Section 03 30 00 (Cast-in-Place Concrete)

.6 Section 03 41 00 (Precast Structural Concrete)

.7 Section 04 05 12 (Grout)

.8 Section 05 50 00 (Metal Fabrications)

.9 Section 09 97 19 (Painting Exterior Metal Surfaces)

.10 Section 31 63 19.13 (Rock Sockets for Piles)

.11 Section 33 05 13 (Manholes and Catch Basins)

.12 Section 33 11 16 (Water Utility Distribution Piping)

.13 Section 33 41 00 (Storm Utility Drainage Piping)

.14 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. Concrete shall be measured and paid for as specified in the relevant Sections.

.2 The cost of quality control shall be deemed to be incidental to the work and no separate payment will be made.

.3 The cost of Departmental Representative's quality assurance testing will be borne by Departmental Representative.

.4 No separate measurement or payment will be made for reinforcing steel. Refer to Section 03 20 00 (Concrete Reinforcing) and Section 03 30 00 (Cast-in-Place Concrete).

.5 Movement joints and construction joints will not be measured separately, but considered incidental to the work. All costs in connection with joints, including waterstop where indicated, shall be included in the unit prices tendered for concrete covered by the relevant Sections.

.6 Miscellaneous steelwork items embedded in concrete shall be measured to Section 05 50 00 (Metal Fabrications), and payment will include all costs in connection with supplying and installing miscellaneous steelwork items.

1.4 REFERENCES

.1 American Concrete Institute, hereinafter referred to as ACI:

.1 ACI 305R Hot Weather Concreting

.2 ACI 306R Cold Weather Concreting

.2 American Society for Testing and Materials, hereinafter referred to as ASTM:

.1 ASTM C157/C157M-04: Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete

.2 ASTM C171: Sheet Materials for Curing Concrete

.3 ASTM C309: Liquid Membrane-Forming Compounds for Curing Concrete

.4 ASTM C260-01: Standard Specification for Air-Entraining Admixtures for Concrete

.5 ASTM C494/C494M-05: Standard Specification for Chemical Admixtures for Concrete

.6 ASTM C1017/C1017M-03: Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

.7 ASTM C1202-05: Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration

.8 ASTM D994: Specification for Pre-Formed Expansion Joint Filler for Concrete (Bituminous Type)

.3 Canadian Standards Association, hereinafter referred to as CSA:

.1 CAN /CSA-A3001: Portland Cement

.2 CAN/CSA-A23.1: Concrete Materials and Methods of Concrete Construction (refer to ASTM C260 and C494 for Admixtures)

.3 CAN /CSA-A23.2: Methods of Test for Concrete

.4 CAN/CSA-A3001: Supplementary Cementing Materials

.5 CAN/CSA-A300:1 Blended Hydraulic Cement

.4 Canadian General Standards Board, hereinafter referred to as CGSB:

.1 CAN/CGSB-19.24M Sealing Compound, Multi-Component, Chemical Curing

.2 CAN/CGSB-37.2M Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Damp-proofing and Waterproofing

.3 CAN/CGSB-44-GP35M Polyvinyl Chloride (PVC) Waterstop

1.5 DEFINITIONS

.1 Design Service Life: The time during which the structure performs its design function without unforeseen maintenance or repair.

1.6 CONCRETE SERVICE LIFE

.1 Notwithstanding any Design Service Life requirements specified elsewhere, the concrete incorporated in the work shall be designed for durability, for the specified exposure class, in conformance with the applicable clauses in CAN/CSA-A23.1-09 section 4.1, and for a Design Service Life of 75 years.

1.7 SUBMITTALS

.1 At least twenty-eight (28) days before the start of each type of concrete work submit, to Departmental Representative for his review, the following items in accordance with Section 01 33 00 (Submittal Procedures):

.1 Source of concrete.

.2 Source of cementitious material(s).

.3 Source of aggregate(s), including test report dated within one year demonstrating that aggregates meet the requirements of CAN/CSA-A23.1, including assessment of alkali-aggregate reactivity.

.4 Departmental Representative, at his discretion, may require samples of the proposed aggregate(s) to be supplied by Contractor, at Contractor's cost, for independent testing purposes.

.5 Proposed admixtures and method of application.

.6 Mix design for each type of concrete, indicating material content of each component per m^3.

.7 Evidence that the proposed mix design for each type of concrete will achieve the specified Design Service Life. This shall include rapid chloride permeability (ASTM C1202) and 28-day drying shrinkage (ASTM C157).

.8 Quality Control Plan, including proposed methods for early identification of trends in concrete properties and for taking corrective actions.

.9 Certification that proposed concrete materials and mix design conform to CAN/CSA-A23.1 and the requirements of this Section. Certification of aggregates shall include assessment of alkali aggregate reactivity in accordance with CAN/CSA-A23.1-09, Clause 4.2.3.5.1.

.10 Certification that proposed concrete production plant, including delivery equipment, conforms to CAN/CSA-A23.1 and the requirements of this Section.

.11 Details of proposed protective systems and procedures for placing and curing concrete, including situations when the ambient temperature is less than 5 degrees Celsius, or greater than 25 degrees Celsius.

.12 Details of proposed patching, repair and finishing procedures.

.2 Submittals required by clause 3.6 of this Section shall be provided to Departmental Representative at least twenty-four (24) hours prior to the start of concrete placement, except that the check lists specified in clause 3.6.3 shall be provided at least four (4) hours prior to the start of concrete placement.

1.8 MIX DESIGN TRIALS

.1 At least twenty-eight (28) days before the start of each type of concrete work, carry out a full-scale trial of the proposed mix design. A full-scale trial shall consist of a minimum of 5 m^3 of concrete batched at the plant designated as the source of that type of concrete.

.2 Contractor shall arrange for sampling and testing of trial concrete. Failure to achieve the specified requirements or changes in source of materials or batching plant may require further mix design trials at Departmental Representative's discretion, and at Contractor's own cost.

.3 The cost of each trial, including all sampling and testing of trial concrete, shall be borne by Contractor.

.4 For each type of concrete, a full-scale trial is not required if (instead) Contractor submits to Departmental Representative acceptable evidence of adequate performance of concrete from previous comparable mix designs with the required concrete properties. Evidence of adequate long-term performance is also required, in order to assure compliance with the Design Service Life.

Part 2 Products

2.1 MATERIALS

.1 Portland cement: Type MS (was Type 20) to CAN/CSA-A3001. Type GU (was Type 10) cement may be used if tricalcium aluminate content is between 4.0 % and 7.5 %.

.2 Supplementary Cementing Materials: Type F Fly Ash or Type CI Fly Ash and Type SF Silica Fume, to CAN/CSA-A3001.

.3 Water: to CAN/CSA-A23.1.

.4 Aggregates: to CAN/CSA-A23.1, normal density.

.5 Air entraining admixture: to CAN/CSA-A23.1 (which refers to ASTM C260).

.6 Chemical admixtures: to CAN/CSA-A23.1 (which refers to ASTM C494). Use of accelerating or set retarding admixtures during cold and hot weather placing to be subject to Departmental Representative's approval. Calcium chloride shall not be used. Chemical admixtures in all concrete shall be free of chloride ions.

.7 Superplasticizing admixtures: to CAN/CSA-A23.1 (which refers to ASTM C494 and ASTM C1017).

.8 Curing compound: to CAN/CSA-A23.1 white, or to ASTM C309, Type 1-1-chlorinated rubber Type 1-D with fugitive dye.

.9 Joint filler shall be asphalt-impregnated fibreboard to ASTM D994.

.10 Adhesive shall be a pressure sensitive adhesive compatible with the joint filler.

.11 Back-up rod shall be an extruded, closed-cell, circular polyethylene foam back-up material for use with cold applied sealants.

.12 Sealant primer shall be a single component, resin based primer specifically formulated for use with the joint sealant. An Example of an Acceptable Product is as follows:

.1 Sika Primer TPR-415.

.2 Alternative material: Approved by addendum in accordance with instructions to bidders.

.13 Joint sealant shall be gun grade, two component, polysulphide sealant, grey or bronze in colour. Examples of Acceptable Products are as follows:

.1 For horizontal applications, use Sika Duoflex S.L. conforming to CAN/CGSB-19.24, Type 1, Class B.

.2 For vertical and overhead applications, use Sika Duoflex N.S. conforming to CAN/CGSB-19.24, Type 2, Class A.

.3 Alternative material: Approved by addendum in accordance with instructions to bidders.

.14 Epoxy adhesive for drilled rebar shall be an injectable mortar designed for use with precast concrete. An example of an acceptable product is as follows:

.1 Hilti HIT-HY 200

.2 Alternative material: Approved by addendum in accordance with instructions to bidders.

.15 Bond breaker shall be asphaltic emulsion conforming to CAN/CGSB-37.2.

.16 Waterstop shall be Polyvinyl Chloride (PVC) ribbed type waterstop with centre-bulb, conforming to CAN/CGSB-44-GP35M, size as indicated on the Drawings. Swelling / bentonite type waterstop systems are not considered an equivalent alternate in this application.

2.2 CONCRETE MIXES

.1 Concrete mixes shall be proportioned to provide a workable mix suitable for the complexity of that class of work, without segregation or bleeding.

.2 Proportion normal density concrete in accordance with CAN/CSA-A23.1 Alternative 1, for the specified exposure class, to give the properties stipulated in Table 1 of this Section for each concrete type.

.3 Slump shall be measured at time and point of discharge. Slump indicated is without superplasticizer. Concrete shall be placed at the lowest possible slump

compatible with conditions of placement. Subject to approval by Departmental Representative, slump may be increased above the indicated maximum by the addition of an approved superplasticizer. The superplasticizing admixture, if used, shall not adversely influence the performance of the air-entraining admixture.

TABLE 1 – CONCRETE PROPERTIES

Concrete Type	Exposure Class	Compressive Strength (MPa) 28 days / 56 days	(1) Nominal Aggregate Size, max. (mm)	Slump, (mm)	Air Content (%)	Water / Cementing Materials Ratio, max. (by weight)	Chloride Ion Penetrability Requirements and Age of Test
A	C-1	35/NA	20	75 ± 20	5 - 8	0.40	<1500 Coulombs within 56 days
B	C-1	35/45	20	75 ± 20	5 – 8	0.35	<1000 Coulombs within 56 days
C	C-1	35/45	20	50 ± 20	5 - 8	0.35	<1000 Coulombs within 56 days
D	C-1	35/NA	20	75 ± 20	5 – 8	0.40	<1500 Coulombs within 56 days
E	C-3	30/NA	20	75 ± 20	4 - 7	0.50	-
F	C-1	NA/40	14	75 ± 20	4 - 7	0.35	<1000 Coulombs within 56 days

Note (1): See definition in CSA A23.1-09.

.4 Concrete mix types shall be used as follows:

.1 **Type A (tremie concrete)**: Rock Sockets at Piles, Pipe Pile Infill, and Displacement Control Pile Caps Infill.

.2 **Type B**: Precast Pre-tensioned Box Girders, Precast Pile Caps, Precast Fender Supports, Precast Corner Supports, Precast Utility Trench Segments, and Precast Deck Panels.

.3 **Type C**: Jetty Deck Slab.

.4 **Type D**: East Approach Retaining Wall, and other reinforced concrete structures not identified as Types A to C.

.5 **Type E**: Bedding, cradles, encasement, supports, manhole and catch basin bases, manhole benching for stormwater drains, thrust blocks and duct banks.

.6 **Type F**: Precast Concrete Tug Boat Float.

.5 Concrete Types A, B, D and F: Where mixtures for these concrete types contain more than 30% fly ash (by weight of the cementitious materials), the mixture and curing shall conform to CSA A23.1-09 Clause 8.7.

.6 The quantity of cementitious materials shall be kept to the minimum necessary to achieve the compressive strength, permeability and water/cementing materials ratio specified in Table 1 of this Section.

.7 Special requirements for concrete Type A (underwater placed concrete):

.1 Shall comply with the requirements of Section 03 37 26 (Underwater Placed Concrete), and CSA A23.1-7.2.6

.2 Shall have a minimum cementitious content of 356 kg/m^3.

.3 Shall have a fine aggregate content of 45% to 55% of the total aggregate.

.4 Shall have a slump after addition of superplasticizer of 175 ± 25 mm.

.8 Special Requirements for concrete Types B and F:

.1 Concrete types B and F shall also meet the requirements of CSA A23.4-04

.2 Mix shall contain minimum 15% Fly Ash and 5-8% Silica Fume by mass of total cementitious materials.

.9 Special requirements for concrete Type C (jetty deck slab):

.1 The mix for concrete Type C shall be proportioned to minimize drying shrinkage. Measures shall include appropriate aggregate gradation and proportioning, and appropriate use of admixtures to reduce the water content of the mix.

.2 The mix shall contain 10%-20% fly ash and 5%-8% silica fume, by mass of total cementitious materials. When ambient temperature at time of placement will drop below 10 ^{o}C, use maximum 10% fly ash.

.3 Maximum concrete temperature at time of placement shall be 20 ^{o}C.

.4 Take special care and employ appropriate measures to ensure that the temperature of the jetty deck cast-in-place concrete measured at mid-depth of cast-in-place portion of the deck slab does not change by more than 10 ^{o}C from the placement temperature within 48 hours of placement.

.10 All concrete specified for exposure class C-1 shall meet chloride ion permeability requirements listed in Table 1 of this Section.

.11 For grout, refer to Section 04 05 12 (Grout).

Part 3 Execution

3.1 GENERAL

.1 All concrete work shall be in accordance with CAN/CSA-A23.1.

.2 No work shall commence until approval in writing is given by Departmental Representative for concrete materials and mix design.

.3 Upon acceptance by Departmental Representative of a concrete mix design, including ingredients and sources of materials, changes or modifications in any manner will not be permitted without the prior approval of Departmental Representative.

3.2 MISCELLANEOUS EMBEDDED STEELWORK

.1 Contractor shall build into the concrete structures various inserts, access manholes, pits, etc. and fit same with metal covers, frames, etc. all to details shown on the Drawings.

.2 All reinforcing bar dowels and anchor bolts shall be placed before the concrete is poured, unless indicated otherwise.

.3 Contractor shall not damage metal fabrications in storing, handling, erecting and during concrete placement.

.4 Adequate provision shall be made to keep metal fabrications plumb and in true alignment during erection and throughout concrete placement. Metal fabrications to be embedded in concrete, or grouted, shall be accurately set and held firmly in position while concrete or grout is being placed and cured. Templates shall be used to ensure correct placement.

.5 Any embedded fabrications that are incorrectly placed or that move during embedment to an extent that will affect their proper operation shall be removed and replaced correctly or shall be corrected by other means, subject to Departmental Representative's approval.

.6 All damage to coatings shall be restored by Contractor in accordance with Section 09 97 19 (Painting Exterior Metal Surfaces) to provide an unbroken coating film equal to the original coating.

3.3 MOVEMENT JOINTS

.1 Movement joints (i.e. for expansion, seismic movement, or contraction) shall be provided at locations shown on the Drawings.

.2 The formed surface of the joint shall be cleaned of all accretions of concrete or foreign materials.

.3 The joint filler material shall cover the entire surface of the joint and fit around all openings and reinforcement. Exposed edges of the filler material shall be set back from the outer face as shown on the Drawings. Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. The filler shall be secured to the concrete surface by stapling, the specified adhesive or other positive fastening. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape.

All joints in the filler shall be so tight that mortar from fresh concrete cannot seep through to the opposite surface.

.4 The diameter of the back-up rod shall be from 25 to 50 percent larger than the width of the joint into which it is to be inserted. The back-up rod shall be positioned to maintain the distance, as shown on the Drawings, of the rod from the outer face of the concrete.

.5 Before application of the sealant, the sides of the joints shall be cleaned of curing compound, or other contaminants, by wire brushing. The joint shall then be blown free of all dirt and dust by oil-free compressed air. The depth to the back-up rod from outer face of concrete shall be checked and if it is more than ± 3 mm in error, it shall be corrected. The joint surface shall then be primed, after which the sealant shall be applied and the exposed outer face lightly tooled to a smooth, neat surface. The aspect ratio of the joint sealant shall be 1:1.

.6 Install PVC waterstop as indicated on the Drawings. Ensure that waterstop is properly secured against displacement by fluid forces of concrete placement by use of coated tying wire, or other approved means.

.7 Joints in PVC waterstop shall be field welded in accordance with manufacturer's instructions. Joints in waterstop material shall be as watertight as the continuous material, and shall have a permanent strength and flexibility not less than 50% of that of the continuous material.

.8 Bends and corners in PVC waterstop shall be pre-formed by the manufacturer.

3.4 CONSTRUCTION JOINTS

.1 Construction joints shall be provided only at locations shown on the Drawings, unless approved otherwise by Departmental Representative.

.2 The hardened surface of horizontal and vertical construction joints shall be roughened by mechanical means to full amplitude of 5 mm to CAN/CSA-A23.1-09 clause 7.2.2, to expose clean and sound aggregate, prior to casting the subsequent part of the structure. Roughen concrete surface by suitable methods authorized by Departmental Representative.

.3 The next layer of concrete above a horizontal construction joint shall be of the quality specified, but shall be proportioned with an excess of mortar, have a depth of approximately 150 mm, and be well-vibrated to achieve maximum bond, all as required by CAN/CSA-A23.1-09, clause 7.2.2.

.4 Reinforcing steel shall be continuous through construction joints.

.5 Where shown on the drawings, form a recess in the exposed edge(s) of construction joints and seal with back-up rod and sealant as for a movement joint.

3.5 CONCRETE SUPPLY

.1 Not less than two batch mixers shall be available at the batch plant site at all times during which concrete is being placed.

.2 The batch plant shall have an assured source of supply of cement at a temperature not exceeding 40º C.

.3 All concrete production and delivery equipment shall be capable of delivering successive batches of concrete at intervals not exceeding twenty (20) minutes. The rate of delivery shall not be greater than will allow for proper placement and consolidation of the concrete.

.4 The elapsed time from batching of concrete (measured from the time the cement is added to the aggregate) to commencement of discharge at the site shall not exceed ninety (90) minutes. The use of retarder requires the prior approval of Departmental Representative.

.5 Stationary and truck mixers with blades worn more than ten percent from original blade design profile will not be allowed. Accumulations of hardened mortar or concrete shall be completely removed or the equipment will not be allowed.

.6 All mixers and agitating equipment used in production of concrete will be subject to testing of batch uniformity for concrete by Departmental Representative.

3.6 PLACING CONCRETE

.1 Obtain Departmental Representative's approval before placing concrete. Provide twenty-four (24) hours notice prior to placing of concrete.

.2 Prior to placing of concrete, obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.

.3 Contractor is responsible for taking all measures necessary to prevent an accidental release (concrete spill) to the marine environment. In the event of accidental release, the Contractor is responsible for providing an appropriate spill response to limit potential deleterious substances from entering the marine environment and to meet water quality criteria as detailed in the Water Quality Management Plan (WQMP).

.4 Prior to placing of concrete, review all applicable drawings for formwork blockouts, sleeves, reinforcement, embedded items (including electrical and mechanical), and submit to Departmental Representative a check list covering these items. The check list shall be signed off by each trade involved in that pour.

.5 All concrete placing methods shall be in accordance with CAN/CSA-A23.1. Concrete shall not be deposited by free fall into the forms when the drop exceeds 1.5 m. A drop pipe or other approved method shall be employed in such circumstances.

.6 Pumping of concrete is permitted, subject to Departmental Representative's approval of equipment and mix design. If pump placement is used, the mix designs may be modified, subject to Departmental Representative's approval, to provide the desired properties at the point of discharge.

.7 When placing fresh concrete adjacent to hardened concrete restrained by continuous reinforcement, special consideration shall be given to the concrete

curing, placing temperature, control of heat of hydration of the mix components, or use of insulation to guard against thermal and/or shrinkage cracking.

.8 Except where proprietary self-consolidating concrete products have been approved by Departmental Representative for use in the work, all concrete shall be consolidated by internal vibration using an adequate number of immersion vibrators with the correct frequency. One spare vibrator for each 3 operating ones shall be on hand during all concrete placement operations.

.9 Ensure reinforcement and inserts are not disturbed during concrete placement for all concrete work.

.10 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.11 Do not place load upon new concrete until authorized by Departmental Representative.

3.7 CURING OF CONCRETE

.1 Concrete shall be protected and cured in accordance with the requirements of CAN/CSA-A23.1-09, section 7.4. Curing type shall meet the requirements of CAN/CSA-A23.1-09, Tables 2 and 20, for the applicable exposure class, except as noted.

.2 Notwithstanding the requirements of CAN/CSA-A23.1-09 (Tables 2 and 20), curing Type 3 (extended) shall be used for:

.1 Concrete jetty deck slab,

3.8 COLD AND HOT WEATHER PRECAUTIONS

.1 All concrete work in cold or hot weather shall be executed strictly in accordance with CAN/CSA-A23.1 and ACI 305R or ACI 306R recommendations, as applicable. Curing and protection of the fresh concrete shall conform to CAN/CSA-A23.1.

3.9 TOLERANCES

.1 The dimensional tolerances for concrete work shall be as given in CAN/CSA-A23.1-09 clause 6.4, unless noted otherwise.

3.10 FINISHING

.1 Finishing and treatment of concrete slab surfaces, and the sloping concrete fillet surface at the upper retaining wall, shall be in accordance with CAN/CSA-A23.1-09 clause 7.5 and Table 22 for Class A finish, unless noted otherwise.

.2 All exposed horizontal surfaces that are not intended to receive any additional concrete shall have a float finish as specified and shall conform accurately, within specified tolerance limits, to grades and elevations shown on the Drawings. Finished surfaces shall be free from open texturing, voids, bug holes, plucked

aggregate, and local projections. Further trowel, broom or special finishes shall be performed as specified and where shown or required.

.3 Provide broom finish for the concrete wearing surface of the Jetty Deck Slab. The broom finish shall be aligned with the slope of the finished concrete surface to facilitate water runoff. Broom finish shall mean a fine, but slip-resistant, striated surface produced by brushing the newly troweled surface with a soft bristled broom. Brooming shall be performed when the concrete has been previously float finished and troweled and is sufficiently hard to retain the texture.

.4 Formed finishes: to CSA A23.1 (smooth formed finish).

3.11 JOINT FILLERS

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.2 Locate and form movement joints as indicated. Install joint filler.

3.12 REPAIRS AND SURFACE PATCHING

.1 Immediately after removal of formwork, concrete surfaces shall be inspected for defects. Repairable defects shall be repaired as soon as practicable with patching mortar as described herein. If proper and effective repair of a defect is not feasible, or the repair work carried out is not successful, the elements affected shall be identified to Departmental Representative and shall be removed and replaced at Contractor's own cost.

.2 Immediately after removal of formwork, all bolts, ties, nails or other metal not required for further construction purposes, shall be removed or cut back to a depth of at least 50 mm from the surface of the concrete. The cut out areas and cavities shall be repaired as soon as practicable with patching mortar as described herein.

.3 Surface irregularities, such as bulges, fins, lips or plugs shall be removed by chipping or grinding, and if necessary, shall be repaired as soon as practicable with patching mortar as described herein. Grinding, when used, shall not proceed until the concrete has sufficiently hardened to prevent dislodgement of coarse aggregate particles.

.4 Materials used to repair or patch surface defects shall be made of similar constituents and of approximately the same proportions as used for the concrete being patched, except that adjustments to the aggregate size and sand content may be made if required to provide similar finish to adjacent surfaces as determined by trial repair or patch. The quantity of mixing water shall be no more than necessary to facilitate handling and placing.

.5 Proprietary bagged patching materials may be used, subject to approval by Departmental Representative.

.6 The patching mortar shall colour-match the colour of the surrounding concrete.

.7 The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

.8 Bonding grout shall be prepared using a mix of one part cement to one part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream and then well brushed into the surfaces to be repaired or patched.

.9 A pre-approved latex type bonding agent may be added to the repair or patching material. Quantity and use of admixture shall be accordance with the manufacturer's specifications.

3.13 PROTECTION

.1 Take every precaution to prevent damage, abrasions and staining of surfaces and edges of concrete during the work. Provide plywood or insulation protection and polyethylene wrappings or other means as required to concrete elements that may be damaged by subsequent construction activities. Remove protective coverings at completion of construction.

.2 Barricades shall be erected to prevent traffic on newly finished surfaces.

3.14 QUALITY

.1 Quality control for concrete production and delivery shall be the responsibility of the Contractor.

.2 A Quality Control Plan approved by Departmental Representative shall be implemented throughout concrete production in accordance with the requirements of CAN/CSA-A23.1. In addition, as part of the Contractor's Quality Control Plan, the following shall be undertaken:

.1 Obtain and retain 1 sample of each lot of cement.

.2 Obtain and retain mill certificate for each lot of cement.

.3 Obtain and retain sieve analysis of all aggregates at least once each week.

.4 Maintain a record of each batch of concrete showing measured quantities of constituents.

.5 Each delivery shall be accompanied by a delivery slip which clearly identifies the concrete by mix number and class. Obtain and retain each delivery slip, for subsequent handover to Departmental Representative's site representative.

.6 Undertake sampling and testing of concrete materials and concrete products in accordance with CAN/CSA-A23.1.

.7 Maintain a record of concrete test results. During construction, analyze results at least weekly for early identification of trends in concrete properties and for pre-emptive corrective action as required. Advise Departmental Representative of corrective actions taken.

.8 Deliver to Departmental Representative weekly comprehensive Quality Control Reports.

.3 Departmental Representative may retain at his sole discretion a testing agency to undertake confirmatory testing, as and when Departmental Representative deems necessary. This quality assurance activity shall not relieve the Contractor of his responsibility for quality control measures outlined above.

.4 At Departmental Representative's sole discretion, Departmental Representative's testing agency may perform Quality Assurance as follows:

.1 Advise Departmental Representative on the suitability of aggregates, cementitious materials, admixtures and mix design for the various Types of concrete.

.2 Evaluate the Contractor's mix designs at the trials on the basis of the Contractor's samples and tests. If trials are not required, evaluate mix designs on evidence presented for approval.

.3 Perform sampling and testing at point of concrete deposit as required by Departmental Representative for quality assurance purposes.

.4 Provide overall review of Contractor's Quality Control Plan and perform checks during the progress of the work.

.5 Provide specialist advice on concrete technology.

.5 Inspection or testing by Departmental Representative and/or his testing firm will not augment or replace Contractor Quality Control, or relieve Contractor of his contractual responsibility for quality work.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, manufacture and erection of precast concrete products of standard or special shapes that are reinforced using steel reinforcement, which may also be prestressed by pre-tensioning, and through application become an integral structural part of the project.

.2 This Section describes construction of the following precast concrete elements:

.1 Precast pre-tensioned concrete box girders as detailed and as shown on the Drawings, manufactured in a certified precast production facility.

.2 Precast fender supports, precast pile caps, precast corner supports, precast flat panels, and precast deck panels, as detailed and as shown on the Drawings, manufactured either at a certified precast production facility or by Contractor's own forces at a site of his choice.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 10 00 (Concrete Forming and Accessories)

.3 Section 03 20 00 (Concrete Reinforcing)

.4 Section 03 30 00 (Cast-in-Place Concrete)

.5 Section 03 39 00 (General Concrete Requirements)

.6 Section 04 05 12 (Grout)

.7 Section 05 50 00 (Metal Fabrications)

.8 Section 22 13 18 (Drainage Waste Piping)

.9 Section 33 41 00 (Storm Utility Drainage Piping)

.10 Section 35 59 13.19 (Marine Fenders)

1.3 MEASUREMENT AND PAYMENT

.1 Payment for SUPPLY AND FABRICATION OF PRECAST CONCRETE MEMBERS will be made by EACH of the type specified and grouped as follows. Payment will include cost of design, where indicated). Contractor is responsible for designing all protrusions, inserts, ducts, openings and penetrations in both contractor and consultant designed precast elements:

.1 Pile Caps: PC1 to PC16 (total of 76)

.2 Corner pieces: CC1 and CC2 (total of 2) (Including design)

.3 Fender Supports (wide): FS1, FS2, FS2A, B & C, and FS4.(total of 34)

.4 Fender Supports (narrow): FS3 (total of 6)

.5 Deck panels: DP1 to DP4 (total of 441) (Including design)

.6 Deck panels (triangular): DP5A, 5B, 5C, DP6A, DP6B, DP7A, DP7B (total of 7) (Including design)

.7 Utility trench UT1, UT2, UT4, UT6 and UT6A (total of 37) (Including design)

.8 Utility trench corner: UT3 and UT5 (total of 2) (Including design)

.9 Storm drains: SD1, SD1A and SD2 (total of 33) (Including design)

.10 Box girders: BG1 to BG8 (total of 40) (Including design)

.11 Flat Panels: FP1, FP2, FP3, FP3A, FP4, FP5, and FP6 (total of 11) (Including design)

.12 Displacement Control Piles: DCP A-G (total 7) (Including design)

.13 Oil Water Separator Support Beam: (total of 1)

.14 Tug Boat Float Box Girder, Including Polystyrene foam, Bullrail, Rubrail, and Pile Guides

.2 Payment for SUPPLY AND FABRICATION OF PRECAST CONCRETE MEMBERS will be made by EACH at the price bid as per the groups above. Payment shall be for design (where indicated), quality control, working drawings, supply and placing of concrete, formwork, reinforcing steel, prestressing strands and any required inserts. Payment shall also cover tensioning, curing, release, stripping of forms, patching as necessary and storage of members. The Department Representative may require an acceptable declaration from the Contractor transferring ownership of the materials to the PWGSC. Full payment for supply and fabrication of each precast element will be made when each precast element is complete and ready for shipping and is to the satisfaction of Departmental Representative.

.3 Payment for SHIPPING AND ERECTION OF PRECAST CONCRETE MEMBERS will be made by EACH at price bid as per the groups above. Payment shall be for quality control, loading, shipping, unloading and handling of members. Payment shall also cover falsework and erection of members.

.4 Voids, openings, inserts, bearing pads, grouting, temporary supports, and other miscellaneous items for precast concrete elements will not be measured separately, but considered incidental to the work.

.5 All precast elements covered by this Section will be paid for at the relevant unit prices tendered. Payment shall include all costs in connection with supply, casting, handling, delivery, storage, erection of precast elements in correct position in the work, temporary supports, including removal and patching of erection devices. Payment shall also include all costs in connection with voids, openings, inserts, bearing pads, grouting, and other miscellaneous items for precast concrete elements all as specified and as shown on the Drawings, including reinforcing steel. Full payment for shipping and erection of precast elements will be made when each precast element is installed in the work to the satisfaction of Departmental Representative.

1.4 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.2 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.3 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.

.4 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

.5 ASTM D2240, Standard Test Method for Rubber Property - Durometer Hardness.

.2 Canadian Standards Association, hereinafter referred to as CSA:

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A23.4, Precast Concrete - Materials and Construction.

.3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 CSA-A3001, Cementitious Materials for Use in Concrete.

.5 CSA B137.3-M Rigid Poly (Vinyl Chloride) (PVC) Pipe and Pressure Applications.

.6 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

.7 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.8 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.9 CAN/CSA-S6, Canadian Highway Bridge Design Code.

.10 CSA-W47.1, Certification of Companies for Fusion Welding for Steel

.11 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.12 CSA-W59, Welded Steel Construction (Metal Arc Welding) (Metric version).

.13 CSA-W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 Canadian General Standards Board, hereinafter referred to as CGSB:

.1 CAN/CGSB-1.40, Anticorrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181, Ready Mixed Organic Zinc-Rich Coating.

.3 CAN/CGSB-44-GP35M Polyvinyl Chloride Waterstop.

.4 The Master Painters Institute (MPI) - Architectural Painting Specification Manual (ASM):

.1 MPI # 18, Organic Zinc Rich Primer.

.2 MPI # 23, Oil Alkyd Primer.

.5 Underwriters' Laboratories of Canada (ULC):

.1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.5 DEFINITIONS

.1 NOT USED

1.6 DESIGN REQUIREMENTS

.1 Design precast elements to CAN/CSA-S6 for the loads specified on the drawings and to CAN/CSA-S6 and CSA-A23.4 to carry handling and installation stresses.

.2 Clear concrete cover over reinforcing bars and strands shall meet the requirements of Table 8.5 of CAN/CSA S6, Canadian Highway Bridge Design Code.

.3 Precast elements shall be formed with a positive camber, determined by the Contractor, to meet the following criteria:

.1 Camber upon release from formwork and pretension strand restraints shall not induce cracking in the top of precast members

.2 Precast members shall be designed such that the camber when in place with dead load from the cast-in-place deck topping shall be between 0 and 5mm.

1.7 PERFORMANCE REQUIREMENTS

.1 Construction tolerances for precast elements shall conform to CSA-A23.4.

.2 All precast elements shall be produced to lines and dimensions as shown on the submitted shop drawings, except where adjustments to theoretical lines and dimensions have been proposed by the Contractor and have been approved in writing by Departmental Representative to suit field measurements of other parts of the work.

1.8 SUBMITTALS

.1 Submit, to Departmental Representative for review, shop drawings including placement of reinforcement, and construction method statement in accordance with Section 01 33 00 (Submittal Procedures). This submission shall be sealed by a suitably experienced Professional Engineer licensed to practice in the Province of British Columbia. Submit shop drawings in accordance with CSA-A23.4 and include following items:

.1 Design calculations for all item noted as designed by Manufacturer on the drawings.

.2 Estimated camber.

.3 Finishing schedules as applicable.

.4 Design calculations and arrangement of additional reinforcement provided by manufacturer, if required for handling and installation purposes.

.5 Shop drawings showing details of prestressed and non-prestressed precast elements, camber, reinforcement and connections, voids, openings, inserts and sleeves for mechanical and electrical items.

.6 Method statement for casting, transporting, lifting and placing precast concrete elements in the work, including crane slinging arrangement.

.7 Location of lifting devices, openings, sleeves, inserts and related reinforcement in precast concrete elements.

.8 Age and strength of precast concrete, at time of first lift from casting bed, and at time of final installation in the work.

.9 Details of method of removal (or embedment) of lifting devices, after erection of precast elements in the work.

1.9 QUALITY CONTROL

.1 Quality Control Plan: submit written report to Departmental Representative verifying compliance that concrete provided meets performance requirements of concrete as specified in this Section.

1.10 QUALIFICATIONS

.1 Fabricate and erect precast concrete elements by manufacturing plant certified in appropriate category according to CSA-A23.4.

.2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants for structural prestressed and non-prestressed concrete elements. Manufacturer shall also be a member in good standing of the Canadian Precast/Prestressed Concrete Institute.

.3 Only precast elements fabricated in such certified plants to be acceptable to Departmental Representative and plant certification to be maintained for duration of fabrication and erection.

.4 Welding companies certified to CSA-W47.1.

1.11 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle and store precast concrete elements according to manufacturer's instructions.

.2 To prevent staining, protect corners of precast elements from contacting earth or asphalt.

1.12 OPERATING ENVIRONMENT

.1 Management of environmental effects (such as wind, tidal state and sea state) on handling and erection of precast concrete elements, shall be the sole responsibility of Contractor.

.2 The installation work covered by this Section is located above, within and below the intertidal and splash zones. The normal tidal range at Esquimalt Harbour is indicated on the Drawings. Extreme tidal elevations, including surge effects, will exceed the indicated tidal range.

.3 The design ambient temperature is from -5°C minimum to 23°C maximum.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: to Section 03 39 00 (General Concrete Requirements).

.2 Reinforcing steel: to Section 03 20 00 (Concrete Reinforcing).

.3 Welded wire fabric: to ASTM A185/A185M.

.4 Steel inserts or other steel elements: to Section 05 50 00 (Metal Fabrications).

.5 PVC pipes shall be rigid polyvinyl chloride pipe to CSA B137.3-M.

.6 Waterstop shall be Polyvinyl Chloride (PVC) ribbed type waterstop with centre-bulb, conforming to CAN/CGSB-44-GP35M, size as indicated on the Drawings. Swelling / bentonite type waterstop systems are not considered an equivalent alternate in this application.

.7 Prestressing steel tendons and bars: to CAN/CSA-S6.

.8 Hardware and miscellaneous materials: to CSA-A23.1/A23.2.

.9 Forms: to Section 03 10 00 (Concrete Forming and Accessories), and to CSA-A23.4.

.10 Anchors and supports: to CAN/CSA-G40.21 Type 300W galvanized after fabrication.

.11 Welding materials and electrodes: to CSA W48 certified by Canadian Welding Bureau.

.12 Galvanizing: hot dipped galvanizing with minimum zinc coating of 610 g/m² to CAN/CSA-G164.

.13 Steel primer: to CAN/CGSB-1.40, MPI #23.

.14 Zinc-rich primer: to CAN/CGSB-1.181, MPI #18.

.15 Elastomeric bearing pads: natural rubber, 55 +/- 5 durometer hardness to ASTM D 2240, and 17.0 MPa minimum tensile strength to ASTM D 412, moulded to size or cut from moulded sheet.

.16 Grout and grout pads: to Section 04 05 12 (Grout).

.17 Shims: non-corroding.

.18 Left-in-Place Void Former: expanded polystyrene (EPS) rigid, closed cell, plastic foam products to CAN/ULC-S701, Type 1.

.19 Deck drains: to Section 33 41 00 (Storm Utility Drainage Piping).

2.2 MANUFACTURED PRECAST ELEMENTS

.1 Manufacture precast concrete elements in accordance with CSA-A23.4.

.2 Mark each precast concrete element to correspond to identification mark on shop drawings for location with date cast on part of concrete element not be exposed.

.3 Provide hardware suitable for handling elements.

.4 Design tendons and anchorages in accordance with CAN/CSA-S6.

.5 Hot dip galvanize steel inserts after fabrication, touch up damaged areas with zinc-rich primer on anchors after welding.

2.3 SOURCE QUALITY CONTROL

.1 Provide Departmental Representative with certified copies of quality control tests related to this project as specified in CSA-A23.4 and CSA-G279.

.2 Provide records from in-house quality control program based upon plant certification requirements to Departmental Representative for inspection and review.

.3 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel supplied, showing physical and chemical analysis.

.4 Precast plants to keep complete records of supply source of concrete material, steel reinforcement, prestressing steel and provide to Departmental Representative for review upon request.

Part 3 Execution

3.1 GENERAL

.1 For all precast concrete elements, the Contractor is responsible for:

.1 Designing the precast concrete element for the final in-place load conditions specified on the drawings.

.2 The adequacy of the precast elements for all temporary loads resulting from casting, handling, storage and installation in the work.

.3 Designing and providing extra reinforcing, where required to resist temporary loads.

.4 Ensuring that adequate timber dunnage is placed under all precast elements that are stacked for storage or transportation, so that warping or other damage is avoided.

.5 Designing the lifting arrangement and installation method for the precast elements to minimize dynamic lifting stresses.

.6 Designing and providing lifting devices and attachments to suit the proposed method of installation in the work.

.2 Timber formwork shall not be left in place inside any precast element. It is acceptable to use expanded polystyrene (EPS) rigid, closed cell, plastic foam products to form internal voids, and leave them in place, subject to approval of Departmental Representative.

3.2 ERECTION

.1 Erect precast concrete components in accordance with CSA-A23.4 and CAN/CSA-S6.

.2 Do welding in accordance with CSA-W59, for welding to steel structures and CSA-W186, for welding of reinforcement.

.3 Before installing reinforcing or concrete at closure pours, clean off mill scale at exposed ends of prestressing strands at end faces of precast elements.

.4 Precast elements shall be lifted level into position in the Work and then grouted into place, using submitted and reviewed erection procedures.

.5 Erect precast elements within non-cumulative erection tolerances in accordance with CSA-A23-4.

.6 Set elevations and alignment between precast concrete elements to within allowable tolerances before connecting elements.

.7 Grout underside of precast element with shrinkage compensating grout to achieve correct alignment and elevations. Provide slight excess of grout to ensure full bearing is achieved on the hardened grout.

.8 Secure precast elements in place as indicated on reviewed shop drawings.

.9 Do not weld or secure bearing plates at sliding joints.

.10 Clean field welds with wire brush and touch-up.

.11 Ensure that concrete strength of precast elements is not less than 28-day strength at time of placing precast elements in the Work.

.12 Ensure that concrete strength of precast elements is adequate for Contractor’s lifting procedure at time of placing precast elements in the Work.

.13 Lift precast elements carefully into place without impact. Control dynamic lifting stress in concrete and reinforcement by use of appropriate slinging arrangement.

.14 Provide minimum bearing width on the supporting surfaces as indicated on the Drawings.

.15 Provide adequate temporary connection of precast elements to steel pipe piles and cap beams to safely resist self-weight, construction live loads and environmental loads, until completion of structure.

.16 Grout at bearing surfaces shall attain 28-day compressive strength prior to any live loading or environmental loading.

3.3 INSPECTION

.1 Contractor shall pay travel costs for required inspections by the Departmental Representative for manufacturing facilities located outside a 100km radius of the Esquimalt Graving Dock.

3.4 CLEANING

.1 Use cleaning methods as reviewed by Departmental Representative before cleaning soiled precast concrete surfaces.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers providing Cellular Concrete or "Foamed Concrete", a non-pervious, Low Density Cellular Concrete (LDCC) to fill the electrical utility tunnel at the location shown in the plans and in accordance with the details in the plans and these specifications.

.2 The lightweight material is formed by the injection (or blending) of a preformed stable foam into a cement based slurry. Cellular concrete typically contains no sand or aggregate.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 30 00 (Cast-in-Place Concrete)

.3 Section 03 39 00 (General Concrete Requirements)

.4 Section 04 05 12 (Grout)

1.3 MEASUREMENT AND PAYMENT

.1 Cellular concrete covered by this Section will be measured in cubic metres incorporated into the work, determined by the details and neat dimensions shown on the Drawings. Blockouts, void formers, ducts, embedded pipe or other items creating voids where the volume is greater than 0.10 m3 shall be deducted from the measurement.

1.4 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM C 495 - 07 Standard Test Method for Compressive Strength of Lightweight Insulating Concrete

.2 ASTM C 796 - 04 Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam

1.5 SUBMITTALS

.1 Mix design for LDCC, including materials to be used and their sources.

.2 Resume of contractor showing experience as specified below, including qualifications of contractor's superintendent and/or foreman.

.3 Description of equipment and placement methods to verify compliance with specifications.

1.6 QUALITY CONTROL

.1 Quality Control Plan: submit written report to Departmental Representative verifying compliance that concrete provided meets performance requirements of concrete as specified in this Section.

.2 Contractor shall have a record of experience and quality of work placing foam concrete that is satisfactory to the Departmental Representative. Including the following:

.1 Shall be capable of developing a mix design, batching, mixing, handling, and placing LDCC.

.2 Shall be regularly engaged in the production and pumping of LDCC for filling abandoned pipes or other structures.

.3 Shall have satisfactory completed at least five (5) similar LDCC projects during the last twelve (12) months.

.4 Workers included the contractor's superintendent and /or foreman, shall be fully qualified to perform the work and have had previous experience in production and pumping of LDCC under similar conditions.

1.7 OPERATING ENVIRONMENT

.1 Management of environmental effects (such as wind, tidal state and sea state) on handling and erection of precast concrete elements, shall be the sole responsibility of Contractor.

.2 The installation work covered by this Section is located above, the intertidal and splash zones. The normal tidal range at Esquimalt Harbour is indicated on the Drawings. Extreme tidal elevations, including surge effects, will exceed the indicated tidal range.

.3 The design ambient temperature is from -5°C minimum to 23°C maximum.

Part 2 Products

2.1 MATERIALS

.1 Portland cement shall comply with ASTM C150 (Type I, II or III).

.2 Fly ash shall be Class C or Class F and compatible with foaming agent.

.3 Water shall be free from deleterious substances.

.4 Foaming agent shall conform to ASTM C796.

.5 Admixtures for water reducing, retarding, accelerating, and other specific properties may be used when recommended by the manufacturer of the foaming agent.

.6 Cellular Concrete shall have the following properties:

Range of Cast Density, Kg/m^3	385 - 480

Minimum Compressive Strength (28 Days), MPa	0.27
Flow Consistency per ASTM D6107	Greater than 7”

Part 3 Execution

3.1 GENERAL

.1 Foam generating equipment shall be used to produce a predetermined quantity of pre-formed foam which shall be mixed and blended with cementitious slurry.

.2 Equipment shall be calibrated to produce consistent foam with stable, uniform cellular structure.

.3 LDCC shall be produced utilizing specialized automated proportioning, mixing, and foam producing equipment, which is capable of meeting the specified properties.

.4 Avoid excessive handling of the material.

.5 After sufficient mixing of the foam with slurry, the material shall be conveyed promptly in its final location.

.6 All equipment used must be approved by the foam manufacturer.

3.2 HEAT OF HYDRATION

.1 Contractor shall demonstrate that the rate of placement of the Cellular Concrete will not produce high heat of hydration to damage the conduits or pipe spacers used in the utility trench.

3.3 CONDUIT BUOYANCY

.1 Contractor shall take account of buoyancy of the conduits when placing the Cellular Concrete and shall ensure that these remain in place during placement of the Concrete.

3.4 CLEANING

.1 Use cleaning methods as reviewed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes the requirements for grout for the following applications, as described on the Drawings:

.1 Type 1 Grout: As a bed under precast concrete components, or as a bed under cast steel bollards, or for miscellaneous applications such as bearing pads for metal fabrications.

.2 Type 2 Grout (fiber-reinforced): As annulus infill grout at the structural connection between steel pipe piles and precast concrete fender supports, and as annulus infill grout at the structural connection between steel pipe piles and precast corner supports.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 10 00 (Concrete Forming and Accessories)

.3 Section 03 30 00 (Cast-in-Place Concrete)

.4 Section 03 39 00 (General Concrete Requirements)

.5 Section 03 41 00 (Precast Structural Concrete)

.6 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant Sections for which grout or grouting is required.

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 For each type of grout proposed for use in the work, at least twenty-eight (28) days prior to commencing work, submit the following in accordance with Section 01 33 00 (Submittal Procedures) to Departmental Representative for review:

.1 Manufacturer’s product data sheets and printed instructions;

.2 Proposed admixtures;

.3 Proposed Quality Control Plan;

.4 List of all equipment to be used for grouting;

.5 Calibration certificates for all gauges to be used for grouting; and,

.6 Certification that each type of grout will comply with the Specification.

.2 Submit grouting records, to Departmental Representative for review, in timely fashion during the work.

1.6 REFERENCES

.1 CAN/CSA-A23.1-M, Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-A23.2-M, Methods of Test for Concrete.

.3 Additional material and testing standards listed in CAN/CSA-A23.1-09 section 2.

.4 ASTM C1116 / C1116M - 10a, Standard Specification for Fiber-Reinforced Concrete.

Part 2 Products

2.1 MATERIALS

.1 Grout used as a bed under various precast concrete components, or as a bed under cast steel bollards installed at concrete structures, or for miscellaneous applications shall be non-metallic and shrinkage compensating cementitious "flowable" grout, and shall be proportioned and mixed to give the properties in Table 1, unless noted otherwise:

TABLE 1 – PROPERTIES FOR TYPE 1 GROUT (BEDDING)

Grout Property	Test Method	Limit
Plastic:		
Bleeding:	CAN/CSA-A23.2-1B	< 1.0 %
Expansion:	CAN/CSA-A23.2-1B	Range = 0.0 % to 2.0 %
Workability (flow):	CAN/CSA-A23.2-1B	Range = 20 to 30 seconds
Hardened:		
28-day Compressive Strength:	CAN/CSA-A23.2.1B	> 35 MPa

.2 Annulus infill grout at the structural connection between steel pipe piles and precast concrete fender supports (or precast concrete corner supports) shall be non-metallic and shrinkage compensating cementitious "flowable" polypropylene fiber grout, and shall be proportioned and mixed to give the properties in Table 2, unless noted otherwise:

2.2

TABLE 2 – PROPERTIES FOR TYPE 2 GROUT (STRUCTURAL CONNECTIONS)

Grout Property	Test Method	Limit
Plastic:		
Bleeding:	CAN/CSA-A23.2-1B	< 0.5 %
Expansion:	CAN/CSA-A23.2-1B	Range = 0.5 % to 3.0 %
Height Change:	ASTM C877	> 0.3 %
Workability:		
a) If no coarse aggregate is used;	CAN/CSA-A23.2-1B (flow)	± 5 sec. deviation from value in trial.
b) If 10 mm coarse aggregate is added.	CAN/CSA-A23.2-5C (slump)	± 20 mm deviation from value in trial.
Air Entrainment:	CAN/CSA-A23.2-4C	0.0 % to 3.0 % (after adding superplasticizer)
Hardened:		
Compressive Strength:	CAN/CSA-A23.2.1B	
a) 3 day		> 30 MPa
b) 28 day		> 60 MPa
Porosity, 28 days Boiled Absorption:	CAN/CSA-A23.2.1B for casting cube; and ASTM C642 for test procedure.	< 12 %
Expansion, at 56 days:	ASTM C1090, but using curing in ASTM C1107.	> 0.00 %
Aggregates:		
Fine Aggregate:	CSA/A23.1-09	Gradation limits do not apply.
Coarse Aggregate:	CSA/A23.1-09	The Contractor may add up to 50 % by volume of coarse aggregate (10 mm maximum size)

.1 Superplasticizing admixtures: CAN/CSA-A23.1, and refer to ASTM C260 and ASTM C494 for admixtures.

.2 Use of accelerating or set retarding admixtures to be subject to Departmental Representative's review.

.3 Synthetic fiber reinforcement for Type 2 grout mixture shall meet the requirements below, unless noted otherwise:

.1 Material: Fibrillated polypropylene.

.2 Conformance: ASTM C1116.

.3 Specific Gravity: 0.91

.4 Alkali Resistance: Alkali proof.

.5 Storage: Store in clean, dry area in accordance with manufacturer's instructions.

2.3 GROUTING EQUIPMENT

.1 All plant and equipment for mixing and placing grout, including head-box, any circulating hoses and fittings, shall be of a type and size and mechanical condition suitable for doing the work in an efficient and effective manner.

.2 Demonstrate to the satisfaction of Departmental Representative the ability of the grout mixing and pumping equipment to produce the specified grout mix in a pre-construction field trial.

.3 Grout mixer parameters:

.1 Provide a high speed, high shear (colloidal) mixer of sufficient capacity to provide a continuous supply of uniformly mixed, stable suspension grout. Paddle or shear vane mixers may be used, subject to Departmental Representative's review;

.2 Provide a head-box to ensure continuous grout flow; and,

.3 Mixing unit to be equipped with an accurate water metering unit for controlling the amount of mixing water used in the grout.

.4 Maintain all grouting equipment in a fully serviceable condition, capable of continuous and efficient performance during any grouting operation.

Part 3 Execution

3.1 MIXING AND PLACING GROUT

.1 Grout shall be mixed to a flowable consistency and in accordance with good practice.

.2 For Type 2 grout placed as annulus infill grout at the structural connection between steel pipe piles and precast concrete fender supports, and as annulus infill grout at the structural connection between steel pipe piles and precast corner supports, incorporate 900 g/m^3 of polypropylene fibers into the grout mix prior to placement in the work. Add synthetic fiber reinforcement to Type 2 grout mixture in accordance to manufacturer's instructions.

.3 Place grout continuously from one side (or from bottom to top in vertical spaces) to ensure that all air is expelled as the grout front advances.

.4 Ensure that grout attains 100 % contact with the contact area shown on the Drawings.

.5 Cure grout by moist cure with burlap for minimum twenty-four (24) hours

.6 Protect grout from freezing until it has attained compressive strength 20 MPa.

.7 If grout will be subject to freezing within 14 days of placement, the grout shall contain entrained air in conformance with CAN/CSA-A23.1-09 clause 6.8.4.3.

3.2 TESTING GROUT

.1 Testing of grout properties shall be to CAN/CSA A23.2.1B.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the fabrication and installation of: structural steel members, access/equipment hatches (covers, frames) at utility and mechanical trenches; covers, frames and miscellaneous metalwork for storm utility drainage manholes and catch basins; deck drains/covers and deck drain junction boxes; metal fabrications at movement joints; gangway for tug boat float, and other miscellaneous steel fabrications.

.2 Bolting material and other fabricated metal items not described elsewhere shall also be fabricated in accordance with this Section.

.3 Seismic movement joint plates and fasteners shall also be fabricated in accordance with this Section.

.4 For steel pipe piles, refer to Section 31 62 16.20 (Steel Pipe Piles).

.5 For grounding requirements for metalwork items, refer to Section 26 05 27 (Grounding).

.6 For mooring bollards and cleats, refer to Section 35 59 29 (Mooring Devices).

.7 For fender chains and brackets, refer to Section 35 59 13.19 (Marine Fenders).

.8 For cable trays, pipe supports and other electrical supports, refer to the Section relevant for each item.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 41 16.01 (Structure Demolition)

.3 Section 03 30 00 (Cast-in-Place Concrete)

.4 Section 03 39 00 (General Concrete Requirements)

.5 Section 03 41 00 (Precast Structural Concrete)

.6 Section 09 97 19 (Painting Exterior Metal Surfaces)

.7 Section 26 05 27 (Grounding)

.8 Section 31 62 16.20 (Steel Pipe Piles)

.9 Section 33 05 13 (Manholes and Catch Basins)

.10 Section 33 41 00 (Storm Utility Drainage Piping)

.11 Section 35 59 29 (Mooring Devices)

.12 Section 35 59 13.19 (Marine Fenders)

1.3 MEASUREMENT AND PAYMENT

.1 Covers, frames, ladders and metalwork for access/equipment hatches at utility and mechanical trenches, gangway for tug boat float and other miscellaneous metal items described on the Drawings except as noted in 1.3.2, will not be measured individually. All the aforementioned metal items are collectively termed miscellaneous metal fabrications, regardless of steel grade or type, and will be paid for at the Lump Sum price tendered for METAL FABRICATIONS: MISCELLANEOUS. Payment shall be full compensation for supply and installation of these metal fabrications.

.2 Seismic Movement Joint: all plates, fasteners, and studs associated with the seismic movement joint shall be paid for under this Section and measured per lineal meter of seismic movement joint installed.

.3 Anchor bolts, brackets, bearing pads and other miscellaneous steel fabrications will not be measured separately, but considered incidental to the work of this Section. All costs in connection with anchor bolts, brackets, bearing pads and other miscellaneous steel fabrications shall be included in the price tendered for the associated items of work.

.4 Covers, frames and miscellaneous metalwork for storm utility drainage manholes and catch basins, deck drains/covers/bends/tees and deck drain junction boxes, are considered incidental to the work and will be paid for within the lump sum price tendered for Storm Utility Drainage under Section 33 41 00 (Storm Utility Drainage Piping).

1.4 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 .2CAN/CSA-W47.l, Certification of Companies for Fusion Welding of Steel.

.3 CAN/CSA-W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.4 CAN/CSA-W59, Welded Steel Construction.

.5 CSA W59.2-[M1991(R2008)], Welded Aluminum Construction.

.6 CAN/CSA-W178.1, Certification of Welding Inspection Organizations.

.7 CAN/CSA-W178.2, Certification of Welding Inspectors.

.8 CAN/CSA-S16.1, Limit States Design of Steel Structures.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A27/27M, Specification for Steel Castings, Carbon, for General Applications

.2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.3 ASTM A108, Low Carbon Steel.

.4 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.5 ASTM A153/Al53M, Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware.

.6 ASTM A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.7 ASTM A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

.8 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.

.9 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.10 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).

.11 ASTM A351, Standard specification for Castings, Austenitic, Austenitic-Ferrite (Duplex), for Pressure-Containing Parts.

.12 ASTM A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

.13 ASTM A536, Standard Specification for Ductile Iron Castings.

.14 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar Type.

.15 ASTM A890 / A890M, Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application.

.16 ASTM B209M-[07], Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].

.17 ASTM B210M-[05], Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes [Metric].

.18 ASTM B211M-[03], Standard Specification for Aluminum and Aluminum Alloy Bar, Rod and Wire [Metric].

.3 Other standards:

.1 CGSB l-GP-40M, Standard for: Primer, Structural Steel, Oil Alkyd Type.

.2 American Welding Society (AWS): AWS - A5.10/A5.10M[1999(R2007)], Specification for Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Submit shop drawings, in accordance with Section 01 33 00 (Submittal Procedures), to Departmental Representative a minimum of twenty-eight (28) days prior to commencing fabrication (this also applies to adaption and re-use of salvaged steelwork items).

.2 Indicate materials, core thicknesses, finishes, connections, joints, methods of anchorage, number of anchors, supports, reinforcement, details and accessories.

.3 Review of shop drawings by Departmental Representative will not relieve Contractor of responsibilities for the accuracy of the detail dimensions, general fit-up of parts to be assembled, adequacy of connection details, nor errors or defects contained in the shop drawings.

1.7 QUALITY CONTROL SUBMITTALS

.1 If requested, submit to Departmental Representative certified copies of mill reports, analyses, and tests covering chemical and physical properties of materials used in the work.

.2 Welding of the gangway and gangway support shall be inspected and certified by an independent testing agency. These costs to be paid for by the Contractor.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.2l, Grade 350W (or Grade 300W for plates / sections not commonly available in Grade 350W, subject to Departmental Representative’s review and approval).

.2 Aluminum and Aluminum-Alloy Extruded Bar, Rods, Wire, Shapes, and Tubes: to ASTM B221M.

.3 Aluminum sheet or plate: to ASTM B209M.

.4 Aluminum drawn tubes: to ASTM B210M.

.5 Aluminum bolts and rivets: to ASTM B316M.

.6 Aluminum welding wire: to AWS - A5.10/A5.10M.

.7 Steel pipe (except where indicated otherwise): to ASTM A53/A53M, galvanized finish.

.8 For pipe pile materials, refer to Section 31 62 16.20 (Steel Pipe Piles).

.9 Deck drains/covers: stainless steel type 316L to ASTM A351.

.10 Bends and tees: stainless steel type 316L to ASTM A403M.

.11 Flanges on bends and tees: stainless steel type 316L to ASTM A182.

.12 Flange adaptors: ductile iron to ASTM A536.

.13 Junction box: stainless steel type 316L to ASTM A167.

.14 Welding materials: to CSA W59.

.15 Bolts and anchor bolts: to ASTM A325 and A307, respectively, except where noted otherwise.

.16 Concrete anchors: Approved Products are as follows:

.1 Nelson studs (where specified as uncoated) to ASTM A108.

.2 Nelson studs (where specified as stainless steel) to ASTM A276, Type 316L.

.17 Galvanizing: hot dipped galvanizing with zinc coating 6l0 g/m2 to ASTM A123/A123M or ASTM A153/Al53M as appropriate.

.18 Shop coat primer: to CGSB l-GP-40M.

.19 Stainless steel for movement joints: cover plate to ASTM A167 Type 316L, remainder to ASTM A276 Type 316L.

.20 Manhole and catch basin frames, covers and gratings to Section 33 05 13 (Manholes and Catch Basins).

Part 3 Execution

3.1 FABRICATION

.1 Fabrication, connection design and detailing of all structural steelwork shall conform to CAN/CSA-S16.1 (Limit States Design of Steel Structures).

.2 Welding of structural steelwork shall conform to CAN/CSA-W59 (Welded Steel Construction) and shall be performed by certified welders. Fabrication shops shall be approved by the Canadian Welding Bureau to CAN/CSA-W47.1.

.3 Do structural aluminum work: to CAN/CSA-S157.

.4 Do aluminum welding: to CSA W59.2.

.5 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.6 Use welded connections for exterior metalwork unless indicated otherwise, or approved otherwise by Departmental Representative.

.7 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications to provide corrosion protection in accordance with CAN/CSA-S16.l.

.8 Where possible, fit and shop assemble work, ready for erection.

.9 All Nelson Stud anchor welding to be made in accordance with recommendations of the Nelson Stud Welding Co., Lorain, Ohio.

3.2 CORROSION PROTECTION

.1 Unless otherwise noted in Section 09 97 19 (Painting Exterior Metal Surfaces), and except for stainless steel items, all steel fabrications covered by this Section shall be galvanized after fabrication.

.2 For steel fabrications specifically noted in Section 09 97 19 (Painting Exterior Metal Surfaces), surfaces shall be painted in accordance with that Section.

3.3 QUALITY ASSURANCE INSPECTION

.1 Departmental Representative, at his sole discretion, may inspect the steel prior to galvanizing for the degree of cleanliness to check for compliance with ASTM A123/A123M or ASTM A153/A153M as appropriate. In the event that Departmental Representative elects to inspect the steel prior to galvanizing, no galvanizing shall be allowed until Departmental Representative has accepted the surface preparation.

.2 Departmental Representative, at his sole discretion, may measure the dry film thickness (DFT) of the galvanizing on the steel fabrications to check for compliance with these specifications

3.4 ERECTION

.1 Erection of all structural steelwork shall conform to CAN/CSA-S16.1 (Limit States Design of Steel Structures).

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Hand items over for casting into concrete to appropriate trades together with setting templates.

.5 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection as follows:

.1 Galvanized surfaces with zinc rich primer.

.2 Coated surfaces in accordance with Section 09 97 19 (Painting Exterior Metal Surfaces).

.6 Refer to Section 26 05 27 (Grounding) for grounding requirements for metalwork items.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply of all labour, materials and equipment required to clean and coat steel pipe piles (for the length indicated on the Drawings) and other miscellaneous steel items specifically identified within this Section.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 39 00 (General Concrete Requirements)

.3 Section 05 50 00 (Metal Fabrications)

.4 Section 31 62 16.20 (Steel Pipe Piles)

.5 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant Sections for which application of coatings to metal items and field touch up is required.

1.4 REFERENCES

.1 SSPC-PS COM, Commentary on Painting and Coatings Systems.

.2 SSPC-SP COM, Surface Preparation Commentary for Steel and Concrete Structures

.3 SSPC-PA 1, Shop, Field and Maintenance Painting of Steel.

.4 SSPC-SP 1, Solvent Cleaning.

.5 SSPC-SP 10, Near White Blast Cleaning.

.6 SSPC-VIS1, Pictorial Surface Preparation Standards for Painting Steel Surfaces.

.7 SSPC-AB 1, Mineral and Slag Abrasives

.8 SSPC-AB 2, Cleanliness of Recycled Ferrous Metallic Abrasives

.9 SSPC-AB 3, Ferrous Metallic Abrasives

.10 SSPC-Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Non-porous Substrates

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Coating product literature including case histories, references and colour availability shall be submitted in accordance with Section 01 33 00 (Submittal Procedures) for Departmental Representative's approval, no less than twenty-eight (28) days prior to application.

1.7 OPERATING ENVIRONMENT

.1 The work covered by this Section is located above, within and below the intertidal and splash zones.

.2 The design ambient temperature is from -5°C minimum to 23°C maximum.

Part 2 Products

2.1 MATERIALS

.1 Abrasive blasting materials shall conform to SSPC-SP COM, SSPC-SP 10 and SSPC-AB 1 or SSPC-AB 2 and 3.

.2 The abrasive size shall be selected to achieve a profile height that satisfies the requirements of the manufacturer for the specified protective coating system.

.3 Coatings shall be a high solids, surface tolerant, abrasion resistant, low temperature cure two-component epoxy paint system which may be applied to a high film thickness, designed for immersion in saltwater with a proven history of use in marine environments under saltwater immersion conditions.

.4 Solvents and other cleaners that are used to remove oil, grease and other soluble contaminants such as salts shall be as recommended by the coating manufacturer and shall conform to SSPC-SP 1.

Part 3 Execution

3.1 SURFACE PREPERATION OF STEEL PIPES

.1 All work shall be performed in accordance with SSPC-SP COM.

.2 Any areas that are contaminated with oil and grease shall be solvent cleaned prior to abrasive blast cleaning, as per SSPC-SP1.

.3 A representative number of steel piles in each batch or shipment shall be tested for soluble salts as per SSPC-Guide 15 prior to abrasive blast cleaning to ensure that the steel piles have not been contaminated during shipment with soluble salts. The number of piles tested in each shipment shall be determined by the coating manufacturer.

.4 All steel surfaces to be painted, whether fabrication or casting, shall be abrasive blast cleaned to SSPC-SP 10 and the appearance shall approximate the visual standard SP 10 of SSPC-VIS1.

.5 The surface profile shall be as specified by the coating manufacturer.

.6 All traces of abrasive materials shall be removed from the surface by blowing clean, dry compressed air onto the surface.

.7 The compressed air shall have water/oil traps on the line to prevent contamination of the steel by oil or water.

3.2 APPLICATION OF COATING ON STEEL PIPES

.1 Paint coat steel pipe piles only to the length indicated on the Drawings. Leave remainder of length uncoated.

.2 All paint coating application shall be done in accordance with the coating manufacturers' recommendations and in conformance with SSPC-PA 1.

.3 The paint coating shall be applied to the recommended thickness of the coating manufacturer to provide a 15 year life expectancy in salt water immersion when 5 to 10 % coating breakdown occurs and active rusting of the steel substrate is present as determined by SSPC-Vis 2 Grade 4. The minimum total thickness of the coating system shall be 400 microns (16 mils).

.4 All steel must be clean and dry prior to paint coating application. Any cleaned steel not coated within eight hours shall be blast cleaned again.

.5 All paint coating material shall be delivered to the project site in the original factory-sealed containers bearing the coating manufacturer's labels identifying the product number, batch number, name, colour, instructions for use and WHMIS requirements. Material Safety Data Sheets shall accompany the material and remain on site at all times.

.6 The shelf life of all paint coating materials, as recommended by the coating manufacturer of each specific product, shall not be exceeded.

.7 All paint coating materials shall be stored in an area which shall protect the materials from weather and temperature extremes as per the coating manufacturer's recommendations.

.8 No paint coating application work shall be performed under unfavourable weather conditions unless a suitable heated enclosure is provided which shields the steel from precipitation and provides suitable application temperatures as recommended by the coating manufacturer.

.9 No paint coatings shall be applied if the conditions for relative humidity, ambient temperature and steel temperature do not satisfy the coating manufacturer's requirements.

.10 All products shall be thoroughly mixed as per the coating manufacturer's recommended procedures.

.11 Thinning shall not be allowed except as recommended by the coating manufacturer.

.12 Monitor and record the wet and dry film thickness of the coatings during application to ensure the proper thickness is attained, as recommended by the coating manufacturer's recommendations for the required service life in salt water immersion.

.13 Ensure the paint coating system is properly cured prior to handling, transporting or placing the coated items in service.

.14 When two or more repair coats are to be applied to the steel at the project site and the coatings have been contaminated with oil, grease or soluble salts, wash each repair coat with a suitable cleaner, thoroughly rinse it, dry the surface and then apply the subsequent coats by brush or roller as recommended by the coating manufacturer.

.15 Containers of the coating material shall be kept sealed when not in use. A solvent float or other method, as recommended by the coating manufacturer, shall be used to re-seal partially full containers.

3.3 MISCELLANEOUS METAL ITEMS

.1 Unless noted otherwise, all miscellaneous metals not directly referenced within this Section are to be hot dip galvanized in accordance with Section 05 50 00 (Metal Fabrications).

.2 Mooring bollards and cleats shall be cleaned and coated with the same coating system as noted in Clauses 3.1 and 3.2 of this Section.

.3 Where metal fabrications are cast within concrete, the faces cast within the concrete are not to be coated with topcoat, but are to be painted with a primer coat of epoxy as recommended by the coating manufacturer and in accordance with Clauses 3.1 and 3.2 of this Section.

.4 Mask all threaded components.

.5 Ensure all painted steel fabrications are handled by padded slings once they are coated.

.6 The painted steel fabrications shall be stored and shipped on wooden dunnage padded with carpet at contact points.

3.4 QUALITY ASSURANCE INSPECTION

.1 Departmental Representative, at his sole discretion, may inspect the steel prior to paint application for the degree of cleanliness to check for compliance with SSPC-SP10. No coating work shall be allowed until Departmental Representative has approved the surface preparation.

.2 Departmental Representative, at his sole discretion, may measure the dry film thickness (DFT) of the coatings on the painted items to check for compliance with these specifications.

3.5 FIELD REPAIRS

.1 Weld areas and areas of coating damage shall be cleaned and re-coated as recommended by the coating manufacturer in general accordance with SSPC-PA 1 and Clauses 3.1 and 3.2 of this Section to ensure that the required service life is attained as detailed in Clause 3.2.3.

.2 The coating system on painted items shall be repaired for any damage caused by Contractor's forces prior to Substantial Completion.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section describes Basic Mechanical Requirements required to provide for a complete installation of all mechanical systems for this project. This section shall apply to all other Division 22 specification sections as well as all work shown on the drawings.

.2 Note that the words "mechanical" and "plumbing" are used interchangeably throughout these specifications.

.3 The contractors and suppliers scope is tied to the terms of the General Contract. It is the responsibility of the contractor and suppliers to be familiar with the sections that relate to their specific scope of work in all sections of the specification documents.

1.2 TRADE COOPERATION

.1 The successful completion of the project scope will require coordination and cooperation between the many trades and equipment suppliers that make up this Division. This shall include scheduling and providing the labour and technical resources as required to complete the project.

.1 The Mechanical Contractor’s responsibility will be to coordinate, and schedule all work required to complete the project. It is the responsibility of the subtrades and equipment suppliers to cooperate with the mechanical contractor by supplying the necessary labour and technical resources as required in a timely manner. This will include ensuring that the required assistance will be provided by:

.1 The Testing, Balancing, and Adjusting (TAB) agency.

.2 The Plumbing Contractor.

.3 The Sheet Metal Contractor.

.4 The Fire Protection Contractor.

.5 The Equipment Suppliers.

.6 The Controls Contractor.

.7 The Electrical Contractor.

.8 The General Contractor.

.2 The Mechanical Contractor shall resolve intercontractor/supplier co-ordination issues.

.2 Where problems become apparent, work at the identification and resolution of these problems.

1.3 MEASUREMENT AND PAYMENT

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

.2 Submittals shall be considered incidental to the works.

1.4 RELATED SECTIONS

.1 The complete scope of mechanical work for this project is defined across the entire sections that make up this division of the specifications.

.2 The contractors and suppliers scope is tied to the terms of the General Contract. It is the responsibility of the contractor and suppliers to be familiar with the sections that relate to their specific scope of work in all sections of the specification documents.

1.5 SUBMITTALS

.1 Submittals shall meet the requirements of Section 01 33 00 Submittal Procedures and Section 01 78 00 Close Out Requirements.

.2 Shop Drawings

.1 Along with a transmittal letter, submit a cover sheet titled "Shop Drawing Submittal Title Sheet" that identifies:

.1 The equipment and/or service description.

.2 Identify the section of the contract specification that calls up the equipment and/or service.

.3 Identify the paragraph number of the contract specification section that calls up the equipment and/or service.

.2 Provide PDF copies of shop drawings for all equipment. Submit the information as listed below.

.3 Shop drawings shall indicate all aspects of the construction and operating performance of the product proposed and shall include:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Points of operation on performance curves.

.3 Manufacturer to certify current model production.

.4 Certification of compliance to applicable codes.

.4 Identify materials and equipment by manufacturer trade name and model number. Include copies of applicable brochure or catalog material.

.5 Clearly mark submittal material using arrows, underlining or circling to show:

.1 Specific model numbers if equipment sheets are generic.

.2 Differences from specified products, ratings or capabilities.

.3 Options being proposed.

.4 Cross out non-applicable materials.

.5 Specifically note on the submittal specified features such as special tank linings, pumps, seals, materials, or painting.

.6 Include dimensional and technical data sufficient to check if equipment meets specified requirements.

.7 Include wiring, piping, service connection data, and motor sizes.

.6 The General Contractor and Mechanical Contractor shall endorse shop drawings indicating that the shop drawings have been reviewed and submitted without qualifications.

.7 Submit shop drawings for the following equipment:

.1 Plumbing Fixtures
.2 Pumps
.3 Drains, Interceptors

.3 Close-out Submittals

.1 Permits

.1 All permits required for the project must be taken out and signed off by the approving inspection authority.

.1 Submit copies of all permits and final permit inspection clearances.

.2 Operating and Maintenance Manuals

.1 The work of this section will be performed by a Testing, Adjusting, and Balancing (TAB) Agency retained and paid by the Mechanical Contractor.

.2 Documentation will be submitted in both paper and electronic file format. The electronic file format shall be in ADOBE PDF format unless otherwise specified.

.3 The Contractor's obligation for manuals is to provide the following documentation to the TAB agency:

.3 THREE clean, paper copies and a PDF version of:

.1 A copy of all Shop Drawings. Version included is to be the version given "Reviewed" status by the Consultant.

.2 Manufacturer's equipment start-up reports for:

.1 Plumbing Piping Systems

.2 Hydrostatic tests performed on:

.1 Plumbing Piping
.2 Sanitary Sewer Piping
.3 Storm Drain Piping
.4 Compressed Air Piping

.4 Inspection certificates for:

.1 Plumbing / Water Piping
.2 Sanitary Sewer Piping
.3 Storm Drain Piping
.4 Hot Water Heater
.5 Compressed Air Piping.

.5 Certificate of Guarantee

.6 A digital copy in Microsoft Excel format of:

.1 List of equipment manufacturers and suppliers and subcontractors used on the project.

.2 A valve schedule.

.7 Approvals:

.1 Submit one (1) draft copy of the Operation and Maintenance Manual to the Consultant for approval. Submission of individual data will not be accepted.

.8 Additional data:

.1 Prepare and insert into operation and maintenance manuals additional data when need for it becomes apparent during specified demonstrations and instructions.

.1 It will be the Contractors responsibility to ensure that all updates are inserted in the manuals. The forwarding of manual updates to the Owner with the expectation to have the Owner insert them in the manuals will not be accepted.

.9 The maintenance manual shall contain as a minimum the following sections:

.1 Table of Contents

.2 PART ONE - DESCRIPTION OF SYSTEMS

.1 Title page indicating project title and the names, addresses, telephone and fax numbers of the Owner, Mechanical Engineer, General Contractor, Mechanical Contractor and the agency preparing the manuals.

.2 Description of systems, including description of system controls, and components comprising the system.

.3 Describe systems operation and sequence of control operation, including start-up, shutdown, and intended response of system components to controlling devices.

.4 Description of operation of systems at various loads together with reset schedules and seasonal variances

.5 Operation instruction for systems and component.

.6 Description of actions to be taken in event of equipment failure.

.7 Valves schedule and flow diagram.

.8 Colour coding chart

.9 System details and schematic drawing.

.3 PART TWO – MAINTENANCE AND TEST INFORMATION

.1 A list of equipment manufacturers, suppliers, and sub-contractors used. Contact information for equipment manufacturers, suppliers, and subcontractors shall include:

.1 Contact Name

.2 Contact Position

.3 Contact Email Address

.4 Contact Phone Number

.5 Company Mailing Address

.6 Company Phone Number

.7 Company Web Site

.2 Equipment performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.3 Equipment Maintenance and Test Information. This information shall include:

.1 Maintenance procedures

.2 Maintenance schedule

.3 Lubrication requirements

.4 Exploded parts list

.5 List of part numbers

.4 Copies of hydrostatic testing performed on:

.1 Plumbing Piping

.2 Sanitary Sewer Piping

.5 Storm Drain Piping Copies of Inspection Certificates for:

.1 Plumbing Piping

.2 Sanitary Sewer Piping

.3 Storm Drain Piping

.4 Water Heater

.6 Balancing reports for air and water systems provided by Testing, Adjusting and Balancing (TAB) Agency.

.7 Manufacturer equipment start-up reports. Start-up reports shall be provided for the following equipment:

.1 Water Heater

.8 A letter bearing the seal of the Engineer stating that all installed fall restraint anchors are of adequate capacity and correctly installed.

.9 Certificate of Guarantee

.4 PART THREE – SHOP DRAWINGS

.1 Include a copy of all Shop Drawings. Version included is to be the version given “Reviewed” status by the Consultant.

.2 The maintenance manuals shall be provided in PDF format.

.3 The Operating and Maintenance manuals are to be submitted hard – post/hot stamped expandable binders with the project name embossed (hot stamp cover) The front cover and spine of the binders are to bear the text “OPERATING AND MAINTENANCE MANUAL – PROJECT NAME – PROJECT DESCRIPTION”.

.10 Site Record Drawings

.1 Maintain a set of record drawings at the site. Record drawings shall be neatly maintained on a set of prints plotted by the Contractor. The Mechanical Consultant will provide a PDF copy of all plans.

.2 Drawings are to be maintained in an up to date condition at all times, recording all changes and deviations to the installation from those indicated on the construction issue drawings. The record drawings shall include, but not be limited to, the following changes and shall be recorded daily.

.1 Size, location, arrangement, route, and extent of ductwork, piping, conduit, terminal units, equipment, fixtures, cleanouts, valves, rough in, etc.

.2 Above and below grade piping inside the buildings with invert elevations and locations to be given at each cleanout, manhole and change in direction.

.3 Include all revision drawings, supplementary drawings, change orders, addenda and site revisions, etc. on the as-built drawings.

.11 As-Built Drawings

.1 Before start of Testing, Adjusting, and Balancing for HVAC, finalize production of as-built drawings.

.1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.2 Submit to Consultant, one (1) copy in ADOBE PDF format for approval and make corrections as directed.

.2 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.3 As-Built drawings are to be submitted in both hard and soft copy format.

1.6 REFERENCES

.1 Worksafe BC Occupational Health and Safety Regulation

.2 National Plumbing Code

.3 CAN/ULC

.4 British Columbia Building Code

.5 Local Municipal or City Bylaws

.6 Local Authority Having Jurisdiction

.7 NFPA 2007

Part 2 Products

2.1 CONDITIONS FOR ACCEPTANCE

.1 Base Bid means an item is specified by manufacturer and model number meets the specifications in all respects regarding performance, quality of material and workmanship and is acceptable to the Consultant without qualification.

.1 Base Bid equipment is as listed in the Specification and Mechanical Equipment Schedules and on the Drawings.

.2 Approved Equal means the Consultant has deemed the manufacturer capable of producing material, fixture, or equipment of comparable quality.

.1 Products supplied by an approved equal must match the specified product in performance, approximate dimensions, quality of material and quality of workmanship.

.2 If in the opinion of the Consultant, material submitted for review does not meet these criteria, satisfactory material from the equal manufacturer shall be provided, or the Contractor will revert to the Base Bid product.

.3 Any and all work created by the use of equal or alternate products that vary from the base bid specifications due to differences in space requirements, weight, performance or electrical requirements shall be the responsibility of the Contractor.

.1 If, in the opinion of the Consultant, such work is not carried out in a manner that will ensure satisfactory operation and performance of the equipment, then the specified manufacturer shall be used.

.4 Manufacturers of equipment, materials, and fixtures who are not listed as equal and wish to be accorded "equal" status shall make a request for review by the consultant. Such material, fixtures, and equipment shall meet the requirements for an equal as described in the Standard of Acceptance.

.1 Request for reviews shall be made at least fourteen (14) days prior to close of tender. All information required by the Consultant to evaluate proposed manufacturer shall be furnished at the time of the request. This information shall include:

.1 Technical specifications and performance data for the proposed product.

.2 A list of local references where the proposed product has been installed. The references are to include:

.1 The names and contact information of the installing contractors

.2 The name and contact information of the owners' representatives.

.5 Mechanical systems have been designed based on equipment from the Base Bid manufacturer. The onus shall be on the Mechanical Contractor, in conjunction with the suppliers of the equal or alternate equipment, to ensure that their equipment will meet the required performance, noise criteria, and electrical characteristics, as well as fit properly into allotted space. The designed allowances, the required access and service spaces shall be maintained.

.1 Any additional costs incurred due to modifications being required because of use of "equal" or "alternate" equipment shall be borne by the Mechanical Contractor.

.2 This will include all mechanical system modifications, room layout reconfiguration, or any modifications required by other trades.

.6 If shop drawings of any product submitted are rejected on technical reasons after three submissions, the Contractor, at no additional expense to the Owner, shall revert to the specified base bid product and manufacturer for this project.

2.2 PRODUCTS – BASE BID AND APPROVED EQUAL MANUFACTURERS

Backflow Preventers	Clayton, Conbraco, Singer, Watts, Wilkins
Water Heaters - Instantaneous	Rinnai, Navien
Drains- Area	Smith, Ancon, Zurn, Mifab
Flow and Pressure Switches	Potter, System Sensor
Hose Bibbs	Smith, Ancon, Zurn
Identification – Pipe and Duct	3M, SMS, Duramark, Bradley
Interceptors	Smith, Ancon, Zurn, Mifab
Pipe Couplings - Di-Electric	Watts, AG Specialties
Pipe Fittings and Flanges	Mason, Flexonics, Hyspan
Pipe Supports and Hangers	Crane, Unistrut, Myatt, Grinnell, Sarco, Hunt, Taylor
Pressure Gauges	Weiss, Ashcroft, Trerice, Marsh, Winter, Miljoco
Pressure Relief Valves	Watts, Singer, Braukmann, Conbraco, Sarco
Pumps - In-Line Circulators	Grundfos, Armstrong, Bell & Gossett
Strainers	Red & White, Sarco, Armstrong, Mueller, Watts, Conbraco
Thermometers	Weiss, Ashcroft, Trerice, Marsh, Winter, Miljoco, Weksler
Valves (Ball, Check)	Red & White/Toyo, Kitz, Milwaukee, Conbraco
Valves (Balancing)	Armstrong, DeZurik, T/A

Part 3 Execution

3.1 REGULATORY BODIES

.1 All work shall be carried out following the codes, regulations, and standards as prescribed by the following regulating bodies:

.1 Worksafe BC Occupational Health and Safety Regulation

.2 National Plumbing Code.

.3 British Columbia Electrical Code.

.4 British Columbia Building Code

.5 Local Municipal or City Bylaws

.6 CAN/ULC Standards

.7 CSA and CGA Standards

3.2 FIRE STOPPING

.1 No Fire Stopping required on this project.

3.3 SEISMIC SUPPORT

.1 This contractor shall provide all seismic restrain on piping systems as required by code, regulation, specifications, or by the Authority Having Jurisdiction.

.2 This Contractor shall retain the services of a Professional Engineer registered in the province of British Columbia to design and review the seismic support of the piping and services installed under this contract. The Professional Engineer shall provide the consultant with a Schedule S upon completion of the pipe installation.

3.4 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.5 CLEANING

.1 Clean interior and exterior of all systems including strainers.

3.6 INITIAL EQUIPMENT START-UP

.1 The Testing, Adjusting, and Balancing Agency and the Commissioning Agency are NOT responsible for the initial start-up and running of equipment. This contractor and their supplier representatives shall be responsible for all initial equipment start-up responsibilities.

.2 The initial equipment start-up shall be completed prior to involving the Testing, Adjusting or Balancing Agency and the Commissioning Agency.

.3 The equipment installation shall be checked to ensure that it meets the equipment manufacturer’s specified requirements. This shall, as required by the equipment, include:

.1 Supply of correct operating electrical voltage and phase.

.2 Operating electrical current limits.

.3 Fluid compatibility.

.4 Pressure compatibility.

.4 The initial start-up of each piece of equipment shall be documented with a startup checklist.

.1 The following data must be included in the start-up checklist:

.1 Document specified operating voltage and phase of the power feed.

.1 Specify the type of electrical feed for three phase systems (delta or wye configuration).

.2 Measured operating electrical voltages.

.1 Measure and document all phase-to-phase voltages on three phase systems.

.3 Measured operating electrical current loads

.1 Measure and document all phase-to-phase currents on three phase systems

.4 Measured operating pressures.

.1 Document suction and discharge pressures.

.5 Measured operating temperatures and the description of the media being measured.

.2 Where the equipment supplier's representative is starting up equipment, the manufacturer's checklist shall be included in addition to the above required data.

3.7 IDENTIFICATION

.1 PIPING

.1 Identify fluids in piping with markers showing name, pipe size, and service, including temperature and pressure where relevant, and with arrows to indicate flow direction.

3.8 FIELD QUALITY CONTROL

.1 MANUFACTURER'S FIELD SERVICES:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports for inclusion in the Maintenance Manuals.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.2 Schedule site visits for regular construction site meetings, to routinely review work status in the field, and coordination with other trades as required.

3.9 INSTRUCTION OF OWNER'S OPERATING STAFF

.1 The Commissioning Agency retained for the project will coordinate and run a training and instruction session for facility operating and maintenance personnel.

.2 Instruction to be during regular work hours.

.3 The following sub-Contractors are required to participate and assist with the demonstration and training session:

.1 Testing and Balancing Agency

.2 Manufacturer's representative for:

.1 Plumbing Fixtures

.2 Water Heater

.4 The Contractor shall obtain a written release from the Owner or his representative, stating:

.1 The Owner has received satisfactory instruction in operation and maintenance of all mechanical equipment and systems.

.2 The Owner has reviewed operation and maintenance manuals.

.3 Specified spare parts of components, keys, removable handles, and the like have been turned over to the Owner.

3.10 PROTECTION

.1 Store materials in a clean dry space and protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.11 LAWS, NOTICES, PERMITS AND FEES

.1 Give all necessary notices, obtain all necessary permits, and pay all fees in order that the work specified may be carried out.

.2 Furnish any certificates necessary as evidence that the work installed conforms to the law and regulations of all authorities having jurisdiction.

3.12 PROGRESS CLAIMS

.1 Submit with each progress claim a progress claim summary based on the Progress Claim Summary Form.

.1 Submit detailed price breakdowns on a photocopy of the Detailed Price Breakdown Form for each section of the fire protection work listed on the Progress Claim Summary Form and for each separate mechanical change order item.

.2 Progress claims will be reduced to allow for any necessary deficiency holdbacks on items, which do not become apparent until the systems are commissioned.

3.13 WARRANTY

.1 The entire mechanical system, including the plumbing system shall be warranted free of defects in materials and workmanship for a period of one operating year. The warranty shall include both materials and labour.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section includes the materials and installation requirements for plumbing pumps for related plumbing systems.

1.2 MEASUREMENT AND PAYMENT

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

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 23 05 00 Common Work Results For Plumbing – Submittal.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, and limitations.

Part 2 Products

2.1 GENERAL

.1 Provide all pumps as specified in the project's equipment schedules.

.2 Pump motors shall meet the motor requirement specified under Section 23 05 13 Motors Drives and Guards for Mechanical Systems.

.3 Pumps specified to be complete with adjustable speed drives or variable speed drives shall:

.1 The drive shall be shipped with correctly sized load and line reactors. Reactors shall be shipped with each drive for all supply voltages, 208 VAC 3ϕ(No exceptions). The drive shall meet the requirements specified in Section 23 05 13 Motors Drives and Guards for Mechanical Systems.

.2 The motors shall be invertor duty motors. Invertor duty winding insulation ratings shall exceed NEMA MG1- Part 31.4.4.2 standards and have a Voltage Withstand Capability of 2000 V in 0.1 μs.

.3 Refer to Section 23 05 13 Motors Drives and Guards for Mechanical Systems for detailed requirements.

2.2 DOMESTIC WATER CIRCULATION PUMPS P-1 & P-2

.1 Domestic water circulation pump to have 50mm flange connections, circulating pump complete with bronze body, self lubricated graphite bearings, ceramic thrust bearing, and suitable for domestic water use.

.2 Pumps to cycle in response to the outside air temperature controller.

.3 Install pump complete with all necessary isolating valves and check valve.

Part 3 Execution

3.1 INSTALLATION

.1 Provide drains for bases and stuffing boxes piped to and discharging into floor drains.

.2 Provide air cock and drain connection on horizontal pump casings.

.3 Provide line sized gate valve and strainer on suction and line sized soft seated check valve and memory stop balancing valve on discharge.

.4 Provide pressure monitoring as per specification.

.5 Decrease from line size, with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide support under elbows on pump suction and discharge line sizes 100 mm and over.

.6 Check and align base mounted pumps prior to start-up.

.7 Shave or replace pump impellers to meet actual operating conditions.

.8 Where remote control panels are used, this contractor shall allow for wiring from panel to pumps.

.9 Install a coated 10 GA steel drain pan under oil pumps. Drain pan shall be 100 mm deep extending 150 mm around pump. Provide support brackets.

.10 Provide spacer at inlet and outlet on vertical in-line pumps complete with screen diffuser.

.11 Supply, install, and wire all required float switches.

.12 Provide seismic restraints for pumps.

.13 Secure control panels for seismic loads.

3.2 PERFORMANCE

.1 Refer to the pump schedule.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This sections covers the plumbing and water distribution systems.

1.2 MEASUREMENT AND PAYMENT

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

1.3 REFERENCES

.1 ANSI - American National Standards Institute.

.2 AMSE - American Society of Mechanical Engineers International.

.3 ANSI/ASME B16.15 - Cast Bronze Threaded Fittings, Classes 125 and 250

.4 4 ANSI/ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ASTM – American Society for Testing and Materials International Inc.

.6 ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.7 AWWA - American Water Works Association.

.8 CSA - Canadian Standards Association.

.9 CSA B242 - Groove and Shoulder Type Mechanical Pipe Couplings.

.10 CAN/CSA-B125.3 - Plumbing Fittings.

.11 CAN/ULC S102 – Smoke and Flame Spread Classification

.12 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.13 MSS - Manufacturer's Standardization Society of the Valve and Fittings Industry.

.14 MSS SP 67 - Butterfly Valves.

.15 MSS SP 70 - Gray Iron Gate Valves, Flanged and Threaded Ends.

.16 MSS SP 71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends.

.17 MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.

.18 NRC - National Research Council

.19 NRCC 38728 - National Plumbing Code of Canada (NPC).

Part 2 Products

2.1 DOMESTIC WATER/FIRE WATER PIPING

SERVICE	MATERIALS
Domestic Water Service	Stainless Steel

.1 Pipe: ASTM A312, Type 316/316L, Schedule 10, or 40. Roll or Cut grooved as appropriate to the pipe material, wall thickness, pressure, size and method of joining. Use Victaulic RX roll sets specifically designed for grooving schedule 10 stainless steel pipe.

.2 Mechanical Couplings for Joining Stainless Steel Pipe:

.1 Stainless Steel Mechanical Couplings: Manufactured in two or more segments of cast stainless steel, conforming to ASTM A-351, A-743, and A-744. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. (Gaskets used on potable water systems shall be UL classified in accordance with ANSI/NSF-61 for potable water service.) Mechanical coupling bolts shall be stainless steel, type 316, meeting the physical properties of ASTM A-193, grade B8M, Class2.

.2 Rigid Type: Cast with key designed to clamp the bottom of the groove to provide an essentially rigid joint. Victaulic Series 489.

.3 Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Series 77S. Note: Provide at least two flexible type fittings in every straight pipe run. For longer pipe runs, provide at least two fittings per 50 meters of straight pipe run. Attach fittings at opposite ends of a common pipe.

.3 Flange Adapters:

.1 For use with grooved end pipe and fittings, for mating to ANSI Class 125 flanged components. Victaulic Style 441.

.4 Grooved End Fittings:

.1 Fittings shall be manufactured of stainless steel conforming to ASTM A-403, WPW, WPW/S9, or CR/S9, or shall be fabricated from stainless steel pipe conforming to ASTM A312, with factory grooved ends. Fittings shall be type 316/316L stainless steel.

.5 Grooved End Valves:

.1 Butterfly Valves: Grade CF8M stainless steel body and disc, 316 stainless steel stem, PTFE impregnated glass fabric bearings with 316 stainless steel backing, with synthetic rubber seal. (Grade to suit the intended service.) Valve stem shall be offset from the disc centerline to provide full 360-degree circumferential seating. Bubble-tight, dead-end or bi-directional service to 300 psi (2065 kPa) CWP. Victaulic Series 461.

.6 Ball Valves:

.1 Grade CF8M stainless steel body, 316 stainless steel ball and stem, TFE seats, fluoroelastomer seals, standard port, two-piece valve. Victaulic Series 726S.

.7 Swing Check Valves:

.1 National pipe size 2 1/2 and over, flanged:

.1 To MSS SP 71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap

Part 3 Execution

3.1 INSTALATION

.1 Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

.2 The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.

.3 See the latest copy of the manufacturer's Field Assembly and Installation Instructions.

.4 Provide Pressure Gauges at each Kiosk.

.5 Individual take-off lines to be from the top of the compressed air main.

.6 Mechanical drains installed at valve locations. Pipe drains to below deck.

.7 Install shut off ball valves at all outlets and on all major branch lines.

.8 Provide unions to permit removal and replacement of equipment.

.9 Following installation blow out all piping to ensure interior is thoroughly cleaned of all oil and debris

3.2 TRAINING

.1 A factory trained field representative (direct employee) shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. The factory trained field representative shall provide confirmation of the on-site training completion date via e-mail to the Departmental Representative within 5 business days of training completion.

3.3 APPLICATION

.1 Use grooved couplings and fittings on applicable systems in accordance with manufacturer's recommendations.

.2 Unions are not required in installations using grooved mechanical couplings. (The couplings shall serve as unions).

.3 Grooved joint products may be installed in all locations as permitted by the engineer and local code.

.4 Use grooved end valves where possible. Install grooved joint flange adapters where flanged or lug type valves are necessary.

.5 The coupling manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

3.4 PIPE HANGARS

.1 The use of perforated band iron is not permitted on this project.

.2 Install hangers for steel pipe with a maximum separation as indicated in manufacturers literature. 3.0 m maximum hanger spacing.

.3 Provide galvanized steel, continuous threaded hanger rods. Provide dielectric tape to protect pipe at all hanger locations.

.4 Inserts:

.1 Insert shall be malleable iron case or galvanized steel shell with expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

.3 Cast-in-place concrete insert shall be galvanized malleable iron or steel Grinnell Fig 281 or Fig 282 or Unistrut.

.4 All inserts shall be ICBO approved. Use only ICBO design load ratings.

3.5 QUALITY OF WORK

.1 All piping shall be completed in conformance with:

.1 ANSI/ASME B31.

.2 Special procedures specified elsewhere in specifications.

.3 Applicable requirements of provincial authority having jurisdiction.

3.6 INSTALLATION REQUIREMENTS

.1 Inspection and Tests - General Requirements

.1 Tests on compressed air systems shall consist of a hydraulic test of 1050 kPa (150 PSIG) for 8 hours with no loss of pressure, with all outlet valves closed and the piping isolated from the compressor.

3.7 DOMESTIC WATER PIPING

.1 Application

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Installation

.1 Install in accordance with British Columbia Plumbing Code and the local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ANSI standards.

.3 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated

3.8 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion

3.9 PRESSURE TESTS

.1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.10 FLUSHING AND CLEANING

.1 Flush entire system for 8 h.

.2 Ensure outlets flushed for 2 hours.

.3 Let stand for 24 hours, then draw one (1) sample off longest run.

.1 Submit to testing laboratory to verify that system is clean to Provincial and local health authority potable water guidelines.

.2 Let system flush for additional 2 hours, then draw off another sample for testing.

3.11 PRE-START-UP INSPECTIONS

.1 The systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.12 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.

.2 Upon completion, provide laboratory test reports on water quality for Consultant approval.

3.13 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.4 Check control, limit, and safety devices for normal and safe operation.

.5 Rectify start-up deficiencies.

3.14 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

.3 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.15 PERFORMANCE VERIFICATION

.1 Domestic Water Piping

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 TAB HWC in accordance with specifications withdrawal is maximum and inlet pressure is minimum.

.3 Verify performance of temperature controls.

.4 Verify compliance with safety and health requirements.

.5 Check for proper operation of water hammer arrestors. Run one (1) outlet for 10 seconds then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.6 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 In accordance with Section 22 05 00

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and installation of drainage waste piping for sanitary sewer, as shown on the Drawings.

1.2 MEASUREMENT AND PAYMENT

.1 Drainage waste piping will not be measured individually. Drainage waste piping will be paid for at the Lump Sum price tendered for DRAINAGE WASTE PIPING. Payment shall be full compensation for laying, jointing, installation, flushing, testing, supply and delivery of materials including pipe, fittings, valves, hangers, supports, thrust blocks and all work necessary or incidental thereto for which separate measurement is not provided elsewhere.

1.3 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 00 (Closeout Submittals)

.3 Section 03 41 00 (Precast Structural Concrete)

1.4 DEFINITIONS

.1 NOT USED

1.5 REFERENCES

.1 ASTM International Inc.

.1 ASTM D 1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.

.2 ASTM D 1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

.3 ASTM D 2466, Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

.4 ASTM D 2564, Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-B137 Series-05, Thermoplastic Pressure Pipe Compendium.

.3 Green Seal Environmental Standards (GSES)

.1 Standard GS-36, Commercial Adhesives.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

1.6 MATERIAL CERTIFICATION

.1 At least twenty-eight (28) days prior to commencing work, submit manufacturer's test data and certification that pipe materials meet the requirements of this Section. Include manufacturer's drawings, information and shop drawings where pertinent.

1.7 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 (Submittal Procedures).

1.8 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Notify Departmental Representative a minimum of fourteen (14) days prior to any planned interruption service. Notify Departmental Representative immediately of any accidental interruption of sanitary sewer force main.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

.1 For buried and above ground sanitary waste piping to:

.1 CAN/CSA B137.

.2 ASTM D 1785

.3 ASTM D 2466

.2 Joints: Solvent weld for PVC to ASTM D 2564.

.3 Movement joints, required at locations indicated on the Drawings, are to accommodate 51 mm of relative movement (measured from the installed position).

2.2 HANGARS AND SUPPORTS

.1 Pipe hangers and supports as shown on the Drawings.

.2 Permanent pipe hangers and supports: hot dipped galvanized after manufacture.

.3 Pipe hangers and support to manufacturer's standard production components, parts and assemblies.

.4 The use of perforated band iron is not permitted on this project.

.5 Install hangers for steel pipe with a maximum separation as indicated in manufacturers literature. 3.0 m maximum hanger spacing.

.6 Provide galvanized steel, continuous threaded hanger rods. Provide dielectric tape to protect pipe at all hanger locations.

2.3 DRAINAGE WASTE AND VENT PIPING

SERVICE	MATERIAL
Sanitary and Vent	ABS Type DWV

Storm Drain Below Deck	PVC, ABS Type DWV

.1 Plastic Pipe Adhesives and Sealants:

.1 The maximum VOC limit shall be 50 g/L to GSES GS-36.

.2 Fittings

SERVICE	**MATERIAL**	**JOINT**
Sanitary Drainage and Vent Below deck	ABS Type DWV	Solvent Weld
Storm Drainage (Buried)	PVC	Solvent Weld
Footing Drainage	PVC	Solvent Weld

.3 Plastic Pipe and Fittings

.1 ABS Type DWV

.1 Pipe and fittings shall be manufactured from ABS compound for pipe and fittings as per ASTM D3965 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS).

.2 All systems components shall be certified by NSF International for use in corrosive waste drainage systems as a Special Engineered (SE) product and bear the NSF mark.

.2 PVC SDR

.1 All PVC SDR Series pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound per ASTM D1784.

.2 The pipe shall be manufactured in strict compliance to ASTM D2241, consistently meeting and/or exceeding the Quality Assurance test requirements of this standard with regard to pressure rating, material, workmanship, burst pressure, flattening, impact resistance, and extrusion quality.

.3 Standard lengths of pipe sizes 10" and larger shall be beveled each end by the pipe manufacturer.

.4 This pipe shall carry the National Sanitation Foundation (NSF) seal of approval for potable water applications.

.4 Plastic Pipe Joints

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 PIPE INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Install in accordance with BC Plumbing Code and local authority having jurisdiction.

.3 Pipe penetrations in precast segments, as required for sanitary sewer installation, shall be made in accordance Section 03 41 00 (Precast Structural Concrete). Caulk all such pipe penetrations in accordance with that Section.

.4 Align pipes carefully before jointing.

.5 Complete each joint before laying next length of pipe.

.6 Minimize deflection after joint has been made.

.7 Cleanouts:

- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify cleanout rods can probe as far as the next cleanout, at least.

.8 Test to ensure traps are fully and permanently primed.

.9 Ensure fixtures are properly anchored, connected to system and effectively vented.

.10 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.3 HANGAR INSTALLATION

.1 Install hangers to manufacturer's recommendations.

.2 Install hanger so that rod is vertical under operating conditions.

.3 Adjust hangers to equalize load.

3.4 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.5 OPERATION AND MAINTENANCE MANUALS

.1 Provide operation and maintenance manuals, as stipulated in Section 01 78 00 (Closeout Submittals) for new valves or other equipment items installed in the work, if any.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Materials:

- .1 Pipe
- .2 Couplings
- .3 Pressure Ratings
- .4 Fittings
- .5 Valves
- .6 Execution

1.2 SCOPE OF WORK

.1 Provide all materials, labour, and equipment required to complete a general service compressed air system as specified.

.2 All work shall be completed to comply with and conform to the above referenced codes, regulations, and standards.

.3 All work carried out under this contract shall be performed by qualified tradesmen, qualified and licensed by the Provincial Authorities.

.4 Should the contractor opt to use apprentices on the project a minimum Journeyman to a maximum Apprentice ratio must be 1:2. There must be a minimum of one journeyman for a maximum of every two Apprentices.

.5 The Journeyman must be on site at all times. The Apprentices must not work without the direct supervision of a Journeyman.

.6 All installations shall be performed in accordance with the specification, to the satisfaction of the Architect, Consultant and Owner.

.7 The Contractor shall submit a quality assurance program within 21 days of contract award. The Consultant shall review the program. Upon acceptance, the program shall be implemented for the duration of the contract.

1.3 MEASUREMENT AND PAYMENT

.1 Compressed air piping will not be measured individually. Compressed air piping will be paid for at the Lump Sum price tendered for COMPRESSED AIR PIPING. Payment shall be full compensation for laying, jointing, installation, flushing, testing, supply and delivery of materials including pipe, fittings, valves, hangers, supports, thrust blocks and all work necessary or incidental thereto for which separate measurement is not provided elsewhere.

1.4 SUBMITTALS

.1 Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable style or series designation.

1.5 REFERENCES

.1 1. American Society for Testing and Materials (ASTM)

.1 ASTM A193 - Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications

.2 ASTM A312 – Seamless and Welded Austenitic Stainless Steel Pipe

.3 ASTM A351 – Castings, Austenitic, Austenitic-Ferritic (Duplex), for pressure Containing Parts

.4 ASTM A536 – Ductile Iron Castings

.5 ASTM A743 – Castings, Iron-Chromium Nickel, Corrosion Resistant, for General Applications

.6 ASTM A744 – Castings, Iron-Chromium Nickel, Corrosion Resistant,

.2 Provincial and Local Environmental Codes and Standards

.3 WorkSafe BC standards

1.6 QUALITY ASSURANCE

.1 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1.7 TRADE QUALIFICATIONS

.1 The Contractor shall submit names and qualifications of all personal (including sub-trades) intended for this project within twenty-one (21) days of contract award. The Owner reserves the right to accept or reject any individual proposed for the project, based on qualifications.

1.8 HEALTH AND SAFETY

.1 Complete the work following all occupational health and safety requirements in accordance the regulations.

1.9 DELIVERY, STOREAGE AND HANDLING

.1 Pacing, shipping, handling and unloading: 1. Deliver, store and handle in accordance with manufacturer's written instructions.

Part 2 Products

2.1 Pipe:

.1 ASTM A312, Type 304/304L or 316/316L, Schedule 10, or 40. Roll or Cut grooved as appropriate to the pipe material, wall thickness, pressure, size and method of joining. Use sets specifically designed for grooving schedule 10 stainless steel pipe.

2.2 Mechanical Couplings for Joining Stainless Steel Pipe:

.1 Stainless Steel Mechanical Couplings: Manufactured in two or more segments of cast stainless steel, conforming to ASTM A-351, A-743, and A-744. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Gaskets shall be Grade "T" Nitrile Gaskets. Mechanical coupling bolts shall be stainless steel, type 316, meeting the physical properties of ASTM A-193, grade B8M, Class2.

.1 Rigid Type: Cast with key designed to clamp the bottom of the groove to provide an essentially rigid joint.

.2 Flexible Type: Use in locations where vibration attenuation and stress relief are required. Note: Provide at least two flexible type fittings in every straight pipe run. For longer pipe runs, provide at least two fittings per 50 meters of straight pipe run. Attach fittings at opposite ends of a common pipe.

.2 Flange Adapters: For use with grooved end pipe and fittings, for mating to ANSI Class 125 flanged components.

2.3 Grooved End Fittings:

.1 Fittings shall be manufactured of stainless steel conforming to ASTM A-403, WPW, WPW/S9, or CR/S9, or shall be fabricated from stainless steel pipe conforming to ASTM A312, with factory grooved ends. Fittings shall be type 304/304L or 316/316L stainless steel.

2.4 Grooved End Valves:

.1 Butterfly Valves: Grade CF8M stainless steel body and disc, 316 stainless steel stem, PTFE impregnated glass fabric bearings with 316 stainless steel backing, with synthetic rubber seal. (Grade to suit the intended service.) Valve stem shall be offset from the disc centerline to provide full 360-degree circumferential seating. Bubble-tight, dead-end or bi-directional service to 300 psi (2065 kPa) CWP.

.2 Ball Valves: Grade CF8M stainless steel body, 316 stainless steel ball and stem, TFE seats, fluoroelastomer seals, standard port, two-piece valve

Part 3 Execution

3.1 INSTALLATION

.1 General

.1 Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

.2 The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.

.3 See the latest copy of the manufacturer's Field Assembly and Installation Instructions

.4 Provide Pressure Gauges at each Kiosk.

.5 Individual take-off lines to be from the top of the compressed air main.

.6 Mechanical drains installed at valve locations. Pipe drains to below deck.

.7 Install shut off ball valves at all outlets and on all major branch lines

.8 Provide unions to permit removal and replacement of equipment.

.9 Following installation blow out all piping to ensure interior is thoroughly cleaned of all oil and debris.

.2 Training

.1 A factory trained field representative (direct employee) shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products.

.2 The factory trained field representative shall provide confirmation of the on-site training completion date via e-mail to the Departmental Representative within 5 business days of training completion.

.3 Application:

.1 Use grooved couplings and fittings on applicable systems in accordance with manufacturer's recommendations.

.2 Unions are not required in installations using grooved mechanical couplings. (The couplings shall serve as unions.)

.3 Grooved joint products may be installed in all locations as permitted by the engineer and local code.

.4 Use grooved end valves where possible. Install grooved joint flange adapters where flanged or lug type valves are necessary.

.5 The coupling manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

.4 Pipe Hangers

.1 The use of perforated band iron is not permitted on this project.

.2 Install hangers for steel pipe with a maximum separation as indicated in manufacturers literature. 3.0 m maximum hanger spacing.

.3 Provide galvanized steel, continuous threaded hanger rods. Provide dielectric tape to protect pipe at all hanger locations.

.4 Inserts:

.1 Insert shall be malleable iron case or galvanized steel shell with expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

.3 Cast-in-place concrete insert shall be galvanized malleable iron or steel Grinnell Fig 281 or Fig 282 or Unistrut.

.4 All inserts shall be ICBO approved. Use only ICBO design load ratings.

3.2 QUALITY OF WORK

.1 All piping shall be completed in conformance with:

.1 ANSI/ASME B31.

.2 ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX

.3 Special procedures specified elsewhere in specifications

.4 Applicable requirements of provincial authority having jurisdiction.

3.3 INSTALLATION REQUIREMENTS

.1 Inspection And Tests - General Requirements

.1 Tests on compressed air systems shall consist of a hydraulic test of 1050 kPa (150 PSIG) for 8 hours with no loss of pressure, with all outlet valves closed and the piping isolated from the compressor.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 This sections covers specialty items related to the plumbing and water distribution systems.

1.2 MEASUREMENT AND PAYMENT

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

Part 2 Products

2.1 GENERAL

.1 Products shall be complete with accessories, and mounting hardware.

2.2 TEMPERATURE & PRESSURE RELIEF VALVES

.1 Model - Watts ASME rated.

.2 Pipe T & P valves with a pipe of full outlet size to below deck

2.3 DOUBLE CHECK VALVE ASSEMBLIES

.1 304 Stainless Steel

.2 Grooved Fittings

.3 Replaceable Check disc rubber

.4 Access port, four test cocks and two drip tight shut-off valves.

.5 Checks shall be removable and serviceable, without the use of special tools

2.4 INSTANTANEOUS HOT WATER HEATERS

.1 Max Pressure 150 PSIG

.2 0.99 Power Factor

.3 Provide T&P relief, drained to grade

.4 Field Serviceable

.5 Size as specified on drawings.

2.5 ENCLOSURES

.1 .Provide NEMA 4X enclosure for recirculation station adjacent to building wall.

.2 Minimum Dimensions : 1800mm x 1500mm x 600mm

.3 Light to be installed on side of enclosure

.4 Enclosure to be lockable and keyed to EGD Standards

2.6 PUMP CONTROL SYSTEMS

.1 Provide DDC Controller with a minimum of 8 inputs and outputs. Points to be as listed on drawings. Standard of Acceptance: Alerton VLC-853

.2 Controller to be BACnet compliant and compatible with other systems at the graving dock

.3 All program Data to be backed up on non volatile flash memory

.4 0–158 deg. F (-17–70 deg. C). 0–95% RH, noncondensing

.5 24 VAC @ 10 VA min., plus binary output loads (80 VA max). Utilizes a half-wave rectifier, which allows a single transformer to power multiple VLCs. One leg of 24 VAC connects to earth (panel) ground.

.6 Motorola AZ60 processor with on-board flash memory. Flash memory provides nonvolatile program and data storage, and allows for encrypted updates to the program for future product enhancements

.7 Listed Underwriters Laboratory for Open Energy Management Equipment (PAZX) under the UL Standard for Safety 916; listing includes both U.S. and Canadian certification

.8 EMC Directive 89/336/EEC (European CE Mark)

.9 FCC Part 15, Subpart J, Class A

.10 Cat 6e Connection.

.11 Temperature Sensors- ACI, Greystone, Delta

- .1 Immersion transmitter 200mm (8"),
- .2 LCD display,
- .3 1/2" NPT fitting,
- .4 24 Vac/dc supply, 0-10VDC output and 32-212F range.
- .5 To be installed in a thermowell. Strap on sensors will not be accepted.

.12 Current Transducers- ACI, Greystone, Honeywell .

- .1 4-20 mA with range expected on sensor
- .2 Split Core Sensor to allow for replacement
- .3 True RMS measurement
- .4 Input / Output isolation via current transformer

2.7 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Provide appropriate protection apparatus.

.3 Ensure adequate clearances for servicing and maintenance.

.4 Provide labour and resources as required. Refer to Section 23 05 00 Common work Results for Mechanical for requirements.

2.8 INSTALLATION

.1 Installation shall follow standards specified in Section 22 11 00 Plumbing Piping & Fittings

2.9 THERMOMETERS AND PRESSURE GAUGES

.1 **General:**

.1 This section includes materials and installation for thermometers and pressure gauges in piping systems.

.2 References:

.1 ASME B40.100 - Pressure Gauges and Gauge Attachments.

.2 ASME B40.200 - Thermometers, Direct Reading and Remote Reading.

.3 CAN/CGSB 14.4 - Thermometers, Liquid in Glass, Self-Indicating, Commercial / Industrial Type.

.4 CAN/CGSB 14.5 - Thermometers, Bimetallic, Self-Indicating, Commercial / Industrial Type.

.3 **Products:**

.1 **Flow Fittings:**

.1 Use cast brass threaded on sizes 15mm through 50 mm. Sizes 65mm and over shall be cadmium plated cast steel with welding ends.

.2 Gage accuracy shall be plus or minus 1% and permanent pressure loss shall not exceed 25% of the pressure differential reading.

.3 Each flow fitting shall be complete with an identification tag, conversion chart, quick disconnect gauge fittings and shut off cocks. .10 One differential meter shall be complete with hoses, shut-off fittings, bleed valves and carrying case.

.4 Use Bell and Gossett (Type A) circuit sensors.

.2 **Pressure Gauges**:

.1 Gauges shall be 110mm diameter 1% accuracy cast aluminum case, aluminum ring, phosphor bronze bourdon tube, brass movement, front re-calibrator, and glass window.

.2 Dials shall read metric units kPa and PSI. Face of dial shall be 75mm and scale's midrange shall approximate the design operating value.

.3 All dials shall contain shatterproof glass.

.4 For the gauges on liquid service, provide a bronze pulsation damper and needle valve.

.5 For steam service, provide a straight pigtail syphon and needle valve.

.6 All pressure gauges **shall be liquid filled**.

.7 Pressure gauges shall be selected for the correct scale and range of the medium being measured. Full-scale range should be at the equipment's maximum output capability and the operating range should be approximately mid-scale. (e.g. a pumps is capable of delivering 60 PSIG but the system operates at 20 – 40 PSIG then a 0 to 60 PSIG gauge would be selected.

.8 All gauges shall be capable of accepting a maximum pressure input of twice their scale range without damaging the meter.

.9 The gauges shall meet the referenced standards cited above.

.3 **Pressure Gauge Taps:**

.1 Provide 6mm NPT needle valve.

.4 **Thermometers - Liquid Systems:**

.1 Direct Pipe Mount:

.1 Thermometers shall be 225mm scale adjustable angle, cast aluminum case, red reading mercury, and glass front and complete with 20mm NPT brass separable well, Celsius and Fahrenheit scale.

.2 The thermometers shall meet the referenced standards cited above.

.2 Remote Mount:

.1 Thermometers shall be 115mm scale, wall mountable aluminum case, gas filled dial thermometer, and shatterproof glass front and complete with 20mm NPT brass separable well, Celsius and Fahrenheit scale.

.1 Sensing bulb capillary line shall be encased in an interlock armour shield.

.2 The thermometers shall meet the referenced standards cited above.

.5 **Thermometer Wells:**

.1 Wells shall be machined from brass bar stock and complete with cap and chain and 15mm NPT thread.

.6 **Meter And Gauge Ranges:**

.1 Meter and gauge range shall be selected to read at midscale of normal operating conditions.

.7 **Test Points**

.1 "Pete's Plugs" shall be a 6mm MPT fitting to relieve either a temperature or pressure probe 3mm O.D.

.2 Fitting shall be solid brass with two valve cores of neoprene or Nordel (for heating water).

Part 3 EXECUTION

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 INSTALLATION

.1 All fluid meters and gages not using wells shall have isolation ball and device bleed valves valves installed between the device and the fluid, so that the device can be isolated and replaced without draining the fluid.

.2 All in-line fluid devices shall also have unions between them and the isolation valves.

.3 Install positive displacement meters with isolating valves. Provide valved bypass for liquid service meters.

.4 Provide one differential meter for venturi fittings. Provide meter for each range.

.5 Provide one pressure gauge per pump installing taps before strainers and on suction discharge of pump.

.1 Connect pipe to the gauge.

.2 Provide isolation gauge cocks on all pressure gauges.

.6 Pipes that are smaller than 65mm in diameter must be enlarged for installation of thermometer wells.

.1 Strap on temperature sensors will Not be accepted.

.7 Install gauges in locations and at angles such that they can be easily read from normal sight.

.1 If the gauge cannot be installed to provide a clear line of sight and an unobstructed view then a remote reading gauge shall be installed.

.2 Mount gauges on the wall at a low level.

.3 Label gauges as to primary sensing location and function with a lamacoid label. “DYO” tape label shall not be acceptable.

.4 Pressure gauges shall be wall mounted and interfaced to the piping network via a 3.2mm diameter copper or stainless steel tubing.

.1 Tubing shall be bent using tubing benders and follow piping and building lines in a neat and professional fashion.

.2 Install isolation valves at the piping connection and meter location.

.8 Provide thermometers and gauges on all mechanical systems. The installation of a direct digital control system DOES NOT removes the requirement for the installation of the thermometers and gauges.

3.3 METERS AND GAUGES SCHEDULE (ALSO REFER TO DRAWINGS)

.1 Locate meters and gauges in the following locations and as shown on the drawings.

.1 Pressure Gauges:

.1 Compressed air outlets

.2 Pumps - Suction and Discharge

.3 Domestic Water Supply Entry

.2 Stem Type Thermometers:

.1 Water Zone Supply and Return Mains

3.4 NAMEPLATES

.1 Install engraved lamacoid nameplates identifying medium.

3.5 PUMP CONTROLLER SEQUENCE OF OPERATION

.1 If Outside Air Temperature is below 4ºC then ENABLE lead pump

- .1 Alternate Lead Pump on a weekly basis
- .2 On a fail to start ENABLE Lag Pump and Flag Alarm

.2 If Entering Water Temperature drops below 3ºC then ENABLE lead Water heater

- .1 Alternate Lead Pump on a weekly basis
- .2 On a fail to start ENABLE Lag Pump and Flag Alarm

.3 If Outside Air rises above 4.5 ºC then DISABLE Pump

.4 If Entering Water temperature rises above 4ºC then DISABLE Electric Heater

.5 If Heating mode is on and there is no rise in temperature between entering water and leaving water, flag alarm.

.6 Alarm to Flag contact on SCADA and Yellow Light to turn on.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.1 Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.3 CSA B651-12 Accessible Design for the Built Environment.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 National Electrical Manufacturers Association (NEMA)

1.2 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.3 Language operating requirements: provide identification nameplates for control items in English.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 01 35 43 – Environmental Procedures and Sustainability and Section 01 35 33 – Health and Safety.

.3 Submit for review single line electrical diagrams in glazed frames and locate:

.1 Electrical distribution system in main electrical room.

.4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames at fire alarm control panel and annunciator.

.5 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of BC, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit one copy of drawings and product data in PDF digital format to authority having jurisdiction.

.6 If changes are required, notify Departmental Representative of these changes before they are made.

.7 Submit .dwg files for all approved switchgear shop drawings.

.6 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.7 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

.8 Submit one copy of all manufacturer specific software packages, including license certifications/quantities required for adjusting the settings and configuration of electrical and communication systems components. Software shall include all required licencing, specialty port adapters and communication protocols. List all manufacturer specific software packages provided.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentice’s program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:

.1 In accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).

.2 Site Meetings: as part of Manufacturer's Field Services described in Section 01 91 13 - General Commissioning (CX) Requirements, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

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

1.7 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.8 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 35 43 – Environmental Procedures and Sustainability.

.2 Do verification requirements in accordance with Section 01 35 43 – Environmental Procedures and Sustainability.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 10 - Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WARNING SIGNS

.1 Porcelain enamel signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Sizes as follows:

NAMEPLATE SIZES

Size 1 10 x 50 mm 1 line 3 mm high letters

Size 2 12 x 70 mm 1 line 5 mm high letters

Size 3 12 x 70 mm 2 lines 3 mm high letters

Size 4 20 x 90 mm 1 line 8 mm high letters

Size 5 20 x 90 mm 2 lines 5 mm high letters

Size 6 25 x 100 mm 1 line 12 mm high letters

Size 7 25 x 100 mm 2 lines 6 mm high letters

.2 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

.3 Allow for minimum of twenty-five (25) letters per nameplate.

.4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.6 Terminal cabinets and pull boxes: indicate system and voltage.

.7 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered and coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Conduit Prime Auxiliary

0 to 250 V Yellow

251 to 600 V Yellow Green

601 to 5 kV Yellow Blue

5 to 15 kV Yellow Red

> 15kV Yellow Purple

Telephone Green

Other Communication Systems Green Blue

Fire Alarm Red

Emergency Voice Red Blue

Other Security Systems Red Yellow

2.9 CABLING AND WIRING IDENTIFICATION

.1 Identify all feeders with coloured tags having 4 slotted tie holes and secured with 2 plastic tag ties as follows:

.1 Minimum of 1 tag for each feeder in each manhole, pull box, or building.

.2 Minimum of one tag on each side of every connector, splice assembly, or junction box.

.3 Size 150 mm x 50 mm.

.4 Material: 3-ply lamicoid, minimum 5 mm thick.

.2 Tags for 25 kV feeders: minimum 12 mm high engraving of black characters on red background, secured on trefoil bundles.

.3 Identify all other cables with plastic tie-tags. Markings to be indelible and shall identify cable end destinations and service description.

.4 Identify the phasing by colour coding and phase designation letter ("A," "B," "C") at each and every set of 25 kV, 15 kV, and 208 V conductors at each termination (both Line and Load ends) and at both sides of each intermediate connector and splice point, with adhesive cable markers. Maintain phase sequence and colour coding throughout.

.5 Identify concrete duct banks, service ducts and conduits for communication and power and other spare raceways where they enter or leave buildings, with engraved stainless steel marker plates indicating the type of raceway and buried depth. Install marker plates on the exterior wall immediately above point of entry. Obtain prior approval of the Departmental Representative for method of attachment to the building surface.

.6 Colour code: to CSA C22.1.

.7 Paint all exposed steel conduits and steel pull boxes carrying HV cables inside buildings with 100 mm wide yellow and 50 mm wide purple bands and stencil "DANGER 12.5 kV" (or 25 kV) in red characters.

.8 Where electrical conduits are encased in concrete in the Jetty structure, place bronze or stainless steel duct bank markers on 3 meter spacing for entire length of duct bank.

2.10 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: In accordance with CSA B651-12 Accessible design for built environment.

.2 Wall receptacles: In accordance with CSA B651-12 Accessible design for built environment.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: In accordance with CSA B651-12 Accessible design for built environment.

.5 Wall mounted telephone and interphone outlets: In accordance with CSA B651-12 Accessible design for built environment.

.6 Fire alarm stations: In accordance with CSA B651-12 Accessible design for built environment.

.7 Fire alarm bells: 2100 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Megger 600-2.4 kV circuits, feeders and equipment with a 5000 V instrument.

.4 High voltage cable 4.16kV and higher megger and hi-pot to recommended cable manufacturer’s testing procedures.

.5 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.6 Provide fault study, arc flash study, and protection & coordination study for all equipment installed in this contract. Study shall use values from existing protection and coordination study from SSSR to complete calculations. Studies to be signed and sealed by Professional Engineer registered in British Columbia.

3.8 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

1 GENERAL

1.01 SUMMARY

.1 Intent

.1 Provide demonstration and instruction sessions to familiarize the Owners operation and maintenance personnel with electrical systems and their operation and maintenance.

1.02 MANUFACTURER'S SITE SERVICES

.1 Arrange and pay for appropriately qualified manufacturer's representatives to provide or assist in providing electrical equipment and systems demonstration and instruction seminars for systems specified in this Section.

1.03 DEMONSTRATION AND INSTRUCTION SEMINARS

.1 Assist the owner to present Operator Training Seminar(s) including content specified by Division 1.

2 PRODUCTS

2.01 NOT USED

2.02 SYSTEM AND EQUIPMENT DEMONSTRATIONS AND INSTRUCTION SEMINARS

.1 Provide demonstration and instruction seminars for the following equipment and systems identified. Include in demonstrations and instruction seminars, the information specified for each piece of equipment and system.

.2 Training seminars shall be a combination of classroom session and "hands-on" field demonstrations.

.3 Turn over to the Consultant at the completion of each seminar a completed seminar attendance sheet indicating attendance, length of seminar, date of seminar and items covered. Sheet to be signed by each attendee indicating their agreement with the presented matter.

.4 Some systems may require two independent seminars, one for the maintenance staff and on seminar for the user groups. Accommodate split seminars as required.

.5 Times indicated for each seminar are approximate only and may be adjusted by the Owner or his representative as required.

.6 Normal Power Distribution:

.1 Panelboards: Time Allotted: [1] hour

.1 Types and sizes of breakers.
.2 Spare capacity.
.3 Visual maintenance inspections.
.4 Maintenance procedures.
.5 Testing requirements and procedures.
.6 Spare parts.

.2 Branch Circuits: Time Allotted: [2] hours
- .1 Power receptacle system.
- .2 Miscellaneous wiring devices.
- .3 Miscellaneous equipment.
- .4 Heat tracing.

.7 Fire Alarm System: Time Allotted: [1] sessions at [4] hours
- .1 Alarm silence.
- .2 Trouble conditions, alarm and silence.
- .3 Annunciator and control panel operation.
- .4 Mechanical systems control.
- .5 Control panel module replacement.
- .6 Alarm lamp replacement.
- .7 Power supply.
- .8 Sequence of operation under alarm conditions:
  - .1 First stage
  - .2 Central station tie-in
  - .3 Sprinkler system interface
  - .4 Fan shutdown
  - .5 Fire damper interface
  - .6 Troubleshooting procedures.
  - .7 Maintenance requirements and procedures.
  - .8 Spare parts.

.8 Lighting: Time Allotted: [2] hours
- .1 Interior/Exterior Lighting:
  - .1 Description of each luminaire with respect to lamp and ballast or any other special features:
    - .1 Troubleshooting procedures.
    - .2 Maintenance procedures.
    - .3 Re-lamp schedules.
    - .4 Spare parts.
  - .2 Lighting Controls:
    - .1 Line voltage switching.
    - .2 Low voltage switching.

.9 Relay replacement.
- .1 Photo-cell/time clock operation.
- .2 Master control unit programming.
- .3 Troubleshooting procedures.
- .4 Maintenance procedures.
- .5 Spare parts.

.10 Communication and Power SCADA Systems:
- .1 Telephone System: Time Allotted: [1] hour
  - .1 Modifications to existing system
  - .2 Type of cable used and routing.
  - .3 Troubleshooting procedures.
  - .4 Maintenance procedures.
- .2 Power SCADA system: Time Allotted: [1] hour
  - .1 Modifications to existing system
  - .2 Type of cable used and routing.
  - .3 Troubleshooting procedures.
  - .4 Maintenance procedures.

.11 Site Tours

.12 Provide a walk through Contractor guided tour of facility to allow operators to familiarize themselves with the buildings electrical systems modifications.

.13 Coordinate timing of tour with the Consultant. Allow for tours at approximately the following times.

.1 At Interim Acceptance of the Work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the materials and installation for wire and box connectors, rated to 1000V.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18 latest edition, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65 latest edition, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, latest edition, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies copper conductors rated 0-1000 Volts and the most common electrical insulation and covering materials.

.2 This section does not include fire rated building wire to ULC S139 and CSA C83, marine, hazardous, mining, instrumentation, communication and fire alarm wiring.

1.2 REFERENCES

.1 CSA C22.2 No .0.3 latest edition, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131 latest edition, Type TECK 90 Cable.

1.3 GENERAL REQUIREMENTS

.1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated.

.2 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.

.3 Flexible AC90 armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.

.4 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.

.5 Refer to Equipment Schedule(s) for detailed responsibilities.

Part 2 Products

2.1 WIRE AND CABLE GENERAL

.1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.

.2 Insulation to be 600 volt RW90XLPE (X link) for the general building wiring in conduit.

.3 Use RW90XLPE for underground installations.

.4 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1, latest edition.

.5 Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.

.6 TBS90 #14 AWG stranded shall be used in all switchgear assemblies. Current transformer secondary wiring shall be #10 AWG stranded. Current transformer leads shall incorporate ring type tongues for termination purposes.

.7 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131 latest edition.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1000 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable. Dry type connectors not accepted.

.2 Stainless steel or corrosion resistant aluminum.

2.3 TRAY CABLE

.1 General description: CSA Type TC-ER. Industrial grade tray cable, CSA approved as suitable for usage in cable trays, underground ducts and for limited exposed run without mechanical protection.

.2 Conductors:

.1 Grounding conductor: single, finely stranded copper.

.2 Circuit conductors: three or four, finely stranded copper, size as indicated.

.3 Insulation:

.1 Type: PVC/Nylon, 600 or 1000V

.4 Overall covering: Oil Resistant black PVC material.

.5 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1000 mm centers.

.3 Existing cable trays, cable tie fastening.

.4 Buried/concealed raceways or duct banks.

.5 Threaded rods: 6 mm dia. to support suspended channels.

.6 Connectors:

.1 Watertight, strain relief, gland type approved for TC cable. Dry type connectors not accepted.

.2 Stainless steel or corrosion resistant aluminum. Composite or plastic not acceptable.

2.4 TYPE G CABLE

.1 General description: CSA Type G or G-GC. Industrial and medium duty mining applications cable; CSA approved as suitable for usage in cable trays, underground ducts, submersible, surface and for applications requiring continuous movement and abrasion resistance.

.2 Conductors:

.1 Grounding conductor: four, finely stranded copper.

.2 Circuit conductors: three or four, finely stranded copper, size as indicated.

.3 Insulation:

.1 Type: EPDM 2000V

.4 Overall covering: Oil Resistant black CPE rubber material.

.5 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1000 mm centers.

.3 Cable trays, cable tie fastening.

.4 Buried/concealed raceways or duct banks.

.5 Where Type G cable required vertical support, provide stainless steel single eye support grip for strain relief. Provide at all locations where Type G cable is terminated or subject to sag.

.6 Connectors:

.1 Watertight, strain relief, gland type approved for Type G cable. Dry type connectors not accepted.

.2 Stainless steel or corrosion resistant aluminum. Composite or plastic not acceptable.

2.5 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: solid annealed copper conductors sized as indicated, with TWH over each conductor and overall covering of PVC jacket.

.3 600 V type: stranded copper conductors, sizes as indicated with R90 (x-link) ethylene-propylene rubber insulation type over each conductor and overall covering of PVC jacket.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In cable trays for electrical systems in accordance with Section 26 05 36.

.3 In underground ducts in accordance with Section 26 05 34.

.4 In wireways and auxiliary gutters in accordance with Section 26 05 37.

.5 All wires are to be pulled in together in a common raceway, using liberal amounts of lubricant.

.6 No combining of circuits onto common neutral will be permitted. Use 2 pole or 3 pole breakers for combined circuits, no connector clips will be allowed.

.7 Ensure that all single phase loadings are reasonably closely balanced over the main feeders.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels or in cable trays.

.2 Lay cable in cable trays for electrical systems in accordance with Section 26 05 36.

.3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF TRAY CABLES

.1 Group cables wherever possible with spacing and separation as noted.

.2 Lay cable in cable trays for electrical systems in accordance with Section 26 05 36.

.3 Draw cables in raceways in accordance with Section 26 05 43.01

.4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.4 INSTALLATION OF TYPE G CABLES

.1 Group cables wherever possible with spacing and separation as noted.

.2 Where Type G cables are subject to sag or droop, provide stainless steel single offset support grip for strain relief and cable support.

.3 Lay cable in cable trays for electrical systems in accordance with Section 26 05 36.

.4 Draw cables in raceways in accordance with Section 26 05 43.01

.5 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.5 INSTALLATION OF CONTROL CABLES

.1 Control cable and conduit will be supplied and installed by Mechanical Contractor. Controls wiring must be installed in conformance with Electrical Specifications. Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies U shape support channels either surface mounted. Suspended or set in poured concrete walls or ceilings.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41mm, 2.5mm thick, surface mounted, suspended, or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to surfaces with lead anchors or nylon shields as required.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1.5m on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 Common Work Results – Electrical

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Provide certified professionally sealed shop and placement drawings for all electrical equipment and equipment assemblies including runs of cable trays and conduit/cable racks showing the methods of attachment to the particular structure for each piece of equipment and assembly ***and provide anchorage/attachment details approved and sealed by a BC Professional Engineer for review by the Departmental Representative***.

.2 If requested by the Departmental Representative, calculations ***sealed by a Professional Engineer registered in BC*** shall be provided for the seismic restraint design shown on the shop drawings. Shop drawings shall show the equipment type, manufacturer's name, model number, and weight of the equipment to be restrained

1.3 SUBMITTALS

.1 Submit samples of materials required to complete the seismic restraint work for review if and when requested.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Earthquake snubbers for resiliently mounted major equipment.

.2 Expansion-deflection fittings for metal conduits crossing building expansion or seismic joints.

.3 Security bridles: Minimum #16 ASWG stranded stainless steel aircraft cable.

.4 All equipment shall be tested in an independent testing laboratory or shall be certified by a ***Registered Professional Engineer*** to demonstrate that the equipment meets the requirements of all Codes and Bylaws in terms of "withstanding" the lateral forces in any direction to be expected in the project seismic zone. ***Withstanding*** shall generally mean remaining in one piece and not breaking away from moorings.

Part 3 Execution

3.1 INSTALLATION

.1 Provide seismic restraint and anchorage for all equipment and services in accordance with the BC Building Code and all applicable Building Bylaws.

.2 Arrange and pay for the ***Professional Engineer*** who designed all anchorage/attachments to inspect same on site (note that multiple inspections will be required as the work progresses) and to provide typewritten Inspection Reports to the Departmental Representative throughout construction and to provide as required by the authorities having jurisdiction all required ***Letters of Assurance and Conformance*** with the specified Codes, Standards and Bylaws.

.3 Free-standing equipment shall be fastened to the basic structure using anchorage/attachments to overcome seismic overturning forces as designed by a Professional Engineer as noted in this Section.

.4 Resiliently-mounted major equipment such as standby generators and the core and coil of large power and distribution transformers shall be restrained by earthquake snubbers, selected for the weight of each piece of equipment to be protected. Securely bolt snubbers through floor or concrete base/housekeeping pad to basic structure and to the frame of equipment using anchorage/attachments, all as designed by a Professional Engineer as noted in this Section.

.5 All transformer core and coils shall be seismically restrained without short circuiting the sound isolation resilient mounting. All transformer enclosures shall be separately restrained against seismic forces.

.6 Provide seismic restraint for all cables, raceways, cable trays and bus ducts exceeding 50mm in any cross-sectional dimension and which are supported more than 300mm vertically from the basic structure.

.7 Provide slack cable restraint systems as designed by a Professional Engineer as described previously, but generally as follows

.1 Connect slack cable restraints to suspended equipment in such a way that the axial projection of the wires passes through the centre of gravity of the equipment.

.2 Orient restraint wires on suspended equipment at approximately 90° to each other (in plan), and tie back to the structure at an angle not exceeding 45° to the horizontal.

.3 Select each anchor in the structure for a load equal to twice the weight of the equipment with a safety factor of 4.

.4 Install cable using appropriate grommets, shackles, thimbles, U-bolts, and other hardware to ensure alignment of the restraints and to avoid bending the cables at connection points.

.5 Restraints shall be installed at least 50mm clear of all other equipment and services.

.6 Adjust restraint cables such that they are not visibly slack, but such that the flexibility is approximately 35mm under thumb pressure for a 1500mm cable length (equivalent ratio for other cable lengths).

.8 Provide transverse and axial restraints within 4m of a vertical bend.

.9 Trapeze hangers for cables, cable trays, raceways and bus ducts shall be restrained utilizing minimum 10mm diameter slack cable restraints which shall be provided at a maximum transverse spacing of 12.5m and longitudinal restraints at 25m maximum spacing, or as otherwise limited by anchor/slack cable performance. Adjacent spacing of restraints on a run shall vary by 10% to 30% to avoid coincident resonances.

.10 Transverse bracing for one raceway section may also act as longitudinal bracing for the raceway connected perpendicular to it, provided the bracing is installed within 610mm of the elbow or junction box. Branch runs shall not be used to restrain main runs.

.11 Install a 300mm length of flexible conduit and a braided bonding jumper in each surface-mounted conduit where it crosses a building expansion or seismic joint.

.12 Install expansion-deflection fittings in each conduit embedded in concrete where it crosses a building expansion or seismic joint. The fitting shall include an integral bonding strap where the conduit is metallic.

.13 Provide custom fabricated flexible sections allowing horizontal and vertical movement of cable trays at building expansion or seismic joint.

.14 Rigid support systems shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. (Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.) Provide loops in cables and flexible connections in raceways where such services leave a suspended trapeze rack or other support and extend down to floor braced equipment or wall-mounted equipment. Freedom of movement shall be up to 300mm in all directions.

.15 All recessed lighting fixtures in mechanical grid ceilings (e.g. T-bar) shall be restrained using at least two (2) security bridles per fixture tied to the basic building structure. Attach security bridles at ends of each fixture using a further attachment to each corner of the fixture and in such a manner that the fixture cannot fall lower than 300mm beneath ceiling.

.16 Surface-mounted lighting fixtures mounted on mechanical grid ceilings shall be attached to the ceiling system with positive clamping devices that completely surround the supporting members. Security bridles shall be attached between the clamping devices and the adjacent ceiling hanger or to the structure above in the same manner as described for recessed fixture supports.

.17 Pendant-hung lighting fixtures supported from their outlet boxes shall be provided with a security bridle from the outlet box to an adjacent ceiling hanger or to the structure above in the same manner as described for recessed fixture supports.

.18 Electrical outlet boxes flush-mounted in mechanical grid ceilings shall be anchored to the ceiling grid.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for splitters, junction boxes, pull boxes and cabinets.

1.2 PRODUCT DATA

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings for custom manufactured items showing materials, finish, dimensions, accessories, layout, and installation details.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Corrosion resistant, metallic construction; Marine grade aluminum or stainless steel.

.3 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.4 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Corrosion resistant, metallic construction; Marine grade aluminum or stainless steel.

2.3 CABINETS

.1 Sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard (if required) for surface or flush mounting as required.

.2 Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

.3 Corrosion resistant, metallic construction; Marine grade aluminum or stainless steel.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal blocks as required.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase, as appropriate to clearly indicate the enclosure use.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies rigid and flexible fasteners, fittings and installation.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES - GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SURFACE CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

2.3 FITTINGS – GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of foreign materials.

.3 Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections for particular mounting heights of outlet boxes where indicated.

.2 Support boxes independently of connecting conduits.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not to be used.

.4 All outlet boxes to be flush mounted in all areas.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies rigid and flexible conduits, fasteners, fittings and installation.

1.2 REFERENCES

.1 Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.

.2 Rigid metal conduit (RMC): to CSA C22.2 No. 45.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit (FMC): to CSA C22.2 No. 56.

.6 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

1.3 BASIC WIRING METHODS

.1 Underground or in concrete exterior to building:

.1 All wiring shall be in Schedule 40 RPVC conduit.

.2 Concrete walls and slabs interior to building:

.1 All wiring shall be in Schedule 40 RPVC conduit.

.3 Partition walls and ceilings:

.1 All wiring to be run in EMT conduit for:

.1 Branch circuits.

.2 Fire alarm.

.3 Low voltage systems.

.4 Distribution feeders and sub-feeders.

.5 Surface wiring in electrical and mechanical rooms.

.4 Motors, transformers and all vibrating equipment:

.1 Short (600mm to 1200mm) PVC jacketed flexible conduit with liquid tight connectors shall be used. Allow sufficient slack to avoid strain on connectors at extreme extension of equipment movement.

.5 Surface raceways - interior:

.1 All surface raceways shall be EMT, except if located without protection in areas susceptible to damage, which shall be rigid steel conduit.

.6 Surface raceways - exterior:

.1 All surface raceways shall be UV compensated Schedule 40 RPVC conduit, protected from damage and excessive heating to the Departmental Representative’s satisfaction.

1.4 LOCATION

.1 Electrical drawings are diagrammatic and do not show all conduits, wire, cable, etc. Electrical contractor to provide conduit, wire cable, etc., for a complete operating job to meet in all respects the intent of the drawings and specifications.

.2 Review the exact location criteria of each electrical outlet and device with the Departmental Representative prior to rough-in. Relocate any item installed without architectural confirmation as required by the Departmental Representative at no cost to the owner as long as the relocation is within 3m of the location originally shown on the electrical drawings.

.3 All junction boxes and other raceway access devices shall be mounted to avoid being visible from public areas. Obtain approval from Departmental Representative for any and all junction boxes that, due to the building design, cannot be concealed.

.4 All junction boxes mounted, out of necessity, on surface of solid walls shall be painted to match adjacent surface, with junction boxes painted to match designated systems.

Part 2 Products

2.1 RIGID PVC RACEWAY SYSTEM

.1 Rigid PVC fittings shall be of the same manufacturer as the conduit.

.2 All fittings with removable covers shall be complete with VC gaskets and brass securing screws and inserts. All metal components shall be brass or stainless steel.

2.2 RIGID METAL CONDUIT RACEWAY SYSTEM

.1 Rigid threaded metal conduits shall be installed as noted in drawings.

.2 All couplings and connection to enclosures shall used threaded fastening or locknuts; use of set screw type connections will not be accepted.

.3 Galvanized coating with easy pull internal treatment.

.4 All threads shall be tapered; Running threads will not be accepted.

.5 Factory formed threads shall be used where possible. When field threading is required, provide application of cold galvanizing paint or coating,

2.3 EMT RACEWAY

.1 Electrical Metallic Tubing (EMT) shall be galvanized steel of sufficient quality and thickness to allow smooth field formed bends.

.2 EMT couplings, connectors and fittings shall be steel. Cast type units shall not be used on this installation.

2.4 PVC JACKETTED FLEXIBLE CONDUIT

.1 PVC jacketed flexible conduit (liquid tight) shall be interlocking spiral aluminum conduit with continuous extruded PVC jacket.

.2 Conduit fittings shall be steel liquid tight type that fit over PVC jacket and seal uniformly all round.

2.5 FLEXIBLE ELECTRIC NON-METALLIC (ENT) TUBING

.1 Flexible electrical non-metallic tubing (ENT) **shall not** be used on this project.

2.6 OUTLET BOXES AND JUNCTION BOXES

.1 Except as noted for rigid PVC raceways, all outlet boxes and junction boxes shall be one piece formed or welded.

.2 Outlet boxes to be galvanized steel.

.3 Junction boxes to be galvanized steel or aluminum.

2.7 INNERDUCTS

.1 Provide and install High Density Poly Ethylene (HDPE) innerducts in underground conduits where called for on plans.

.2 Innerducts to be outdoor rated, smooth wall, suitable for use inside conduits as indicated on plans.

.3 Provide terminal fittings at each end of conduit to securely hold innerduct but still allow for access for pulling additional innerducts of cables around existing innerduct.

.4 Minimum innerduct size of 21mm.

2.8 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1500mm oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.9 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.10 EXPANSION FITTINGS FOR CONDUIT

.1 Threaded Concrete Encased Conduit Joints / Deflection Coupling

.1 Weatherproof expansion fittings suitable for pass seismic joints in concrete structure, allowing for the following degrees of movement:

.1 Axial expansion or contraction of 19mm

.2 Angular misalignment of the axes of the conduits in any direction by 30 degrees.

.3 Parallel misalignment of the axes of the conduit in any direction up to 19mm.

.2 Inner sleeve maintaining constant conduit inner diameter and a smooth insulated wireway.

.3 Watertight flexible neoprene outer jacket that is corrosion resistant and protects the grounding straps and connection points.

.4 Copper braided bonded straps.

.5 Stainless steel jacket clamps

.6 Standard tapered conduit threads for rigid threaded electrical conduits.

.7 Rigid threaded conduit hubs are iron alloy.

.8 Overall construction shall be corrosion resistant and suitable for occasion immersion in salt water without degradation of structure, function, finish or integrity.

.2 RPVC Above Ground Joints

.1 Rigid PVC expansion joints allowing for contraction and expansion of conduits where secured to a wall (or similar) and emerging from below grade.

.2 Solvent weld joints.

2.11 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Use rigid PVC conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.

.2 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.3 Minimum conduit size for lighting and power circuits: 19mm.

.4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.5 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.6 Install fish cord in empty conduits.

.7 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.8 Dry conduits out before installing wire.

.9 Conduits shall be installed mechanically continuous from outlet to outlet and without pockets. All the necessary standard bushings, elbows and bends shall be provided. All conduit bends shall have a radius of not less than six (6) times the internal diameter of the conduit and in no case shall the equivalent of more than four quarter bends from outlet to outlet be made. For all conduit sizes to be used for low voltage raceway, the conduits shall have a minimum bending radius of 230mm.

.10 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.

.11 On surface wall runs, all conduit shall be installed in true vertical or horizontal direction and on ceilings in true 90 degree angles or parallel to the walls. Crossings of conduits shall also be made at 90 degree angles. Parallel running conduit shall be kept on equal spacing on the entire length of run including bends.

.12 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).

.13 Raceways extending out concrete slabs shall be securely protected using rebar stubs or similar material. All duct stubs are to be kept sealed during construction

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on suspended or surface channels.

.3 Do not pass conduits through structural members except as indicated.

.4 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

3.4 CONDUITS IN CAST-IN-PLACE OR PRECAST CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

.8 Do not install conduits in slabs/concrete floors in lab areas.

3.5 CONDUITS IN CAST-IN-PLACE OR PRECAST SLABS ON GRADE

.1 Run conduits 25 mm encased in 75 mm concrete envelope.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.7 EXPANSION COUPLINGS

.1 Provide expansion/deflection couplings in concrete ductbanks where noted in drawings. Coordinate with structural details for location of seismic joints and orientation. Conduit shall maintain full diameter throughout joint and shall not be reduced or increased.

.2 Install RPVC expansion joints where RPVC conduit emerges from ground and is secured to a building, wall or similar immovable object to ensure the RPVC conduits do not shear or break due to settlement.

.3 Install RPVC expansion joints where RPVC is surface mounted and subject to excessive expansion or contraction as determined by Canadian Electrical Code.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section specifies materials and installation for metal cabletroughs and fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1 No.126.1, Metal Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 1, Metal Cable Tray Systems.

.2 NEMA VE 2, Cable Tray Installation Guidelines.

1.3 PRODUCT DATA

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.4 Identify types of cable trays used.

Part 2 Products

2.1 CABLE TRAY

.1 All ventilated tray to be aluminum, complete with angles, offsets, corners, saddles, tees, etc. as indicated and required to suit the installation. Radii on fittings shall be 300mm minimum.

.2 Provide solid bottom cable tray with solid bolt on cover where noted in drawings.

.3 All tray shall have 45 degree corners at all vertical and horizontal corners, tees and width change locations.

.4 Cable tray to have a minimum cable loading depth of 114mm. Cable tray width to be a minimum of 305mm wide for communications, or as indicated on drawings.

.5 Suspended tray supports to be trapeze style hangers of minimum 40mm square “Unistrut” supported from 9.5mm threaded rod hangers from preset or afterset concrete inserts or direct steel support.

.6 Barriers required where different systems are in same cable tray. Barriers to be continuous metal dividers for entire length of the tray.

.7 Fire Barrier Pillows to be self contained firestop product for use in through-penetration firestops. Product to achieve up to three (3) hours fire rating in accordance with ASTM E 814 tests.

.8 Observe cable spacing requirements for power cables to ensure correct deration factors as noted in drawings.

2.2 SUPPORTS

.1 Provide splices and supports for a continuously grounded system as required.

Part 3 Execution

3.1 GENERAL INSTALLATION – POWER & COMMUNICATIONS

.1 Provide cable tray in location and general routing as shown on drawings.

.2 Coordinate with EXISTING cable tray as noted in drawings.

.3 Provide dropouts when cables exiting all horizontal cable trays.

.4 Support suspended cable tray from trapeze style hangers with hangers spaced as recommended by the manufacturer based on a maximum load capacity for the tray. Support trays at all corners, offsets and tee fittings

.5 Where shown and appropriate, support cable tray from wall using a cantilever support arrangement. Cable trays may be supported using wall mounted support on masonry walls or from the building steel only.

.6 Cable tray location and mounting heights to be coordinated on site with other trades to provide minimum headroom and serviceability. Verify drawing details to allow for all services run in ceiling spaces. Provide vertical and horizontal offsets as required to suit job site conditions.

.7 Cable tray sections shall be joined by approved connector plates and rust-resistant (plated) hardware. Torque all hardware as per manufacturer's recommendations.

.8 Unless otherwise indicated, bond all cable tray with a minimum #6 AWG copper bonding conductor installed continuously within the full length of all cable trays. Securely connect the bond wire to the tray at each end and at a minimum of 15m intervals. Connect bonding conductor to the building ground system at one or both ends.

.9 Where cable tray passes through fire separations install fire pillows as required to maintain proper fire rating.

.10 Cable tray may require installation of risers, bend, etc. to adjust tray up or down as well as sideways for the tray routing to fit within limits of space available, and to clear other services, ducts, pipes etc. along the route. Routing may be adjusted somewhat as necessary to enable installation of services under other trades.

.11 Where tray runs change elevation, trays shall overlay each other when manufactured waterfall assemblies can not be used. To prevent cables stress install drop-outs on the top tray when overlap method is to be used. Further, tray sections shall be coupled together to provide some rigidity. This coupling maybe made by using a short length of tray and adjustable elbows or may be coupled by means of common support rods at the tray overlap.

.12 Sharp metal edges in cable trays which could cut the cable shall be smoothed and the cable dressed away from these edges. Manufacturer surface imperfections shall be touched up with a cold galvanizing coating before installing cable.

.13 There shall be no wiring joints or splices within the cable tray.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies wireways, auxiliary gutters and associated fittings and installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSAC22.2No.26-R1999, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00 Common Work Results - Electrical.

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22 No.26.

.2 Sheet steel with bolted covers to give uninterrupted access.

.3 Finish: baked grey enamel when inside building. All other locations to be marine grade aluminum or stainless steel, including within Jetty Mounts.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

.5 Tagged with ‘High Voltage’ and voltage, phasing and circuit numbers contained or as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 Common Work Results – Electrical

.2 Section 26 05 21 Wires and Cables (0-1000V)

1.2 REFERENCES

.1 Insulated Cable Engineers Association, Inc. (ICEA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.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 cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 10 - Product Requirements 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 off the ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.4 Store and protect cables from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

.2 Stainless steel or bright bronze material. Cast in place or epoxied flush to final surface level.

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 cable 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 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension. Pulling tensions to cable manufacturer's requirements and guidelines.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Install plugs and cap both ends of ducts to prevent entrance of foreign materials during and after construction.

.7 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign material.

.1 Pull stiff bristle brush through each duct immediately before pulling-in cables.

.8 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.9 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Mark cable every 3 m along duct runs and changes in direction.

.2 Lay markers flat and centred over cable with top flush with finish grade.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel.

.1 Include necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds.

.1 Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.6 PROTECTION

.1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

.1 Electrical Equipment and Systems Demonstration and Instruction — Section 26 05 00.25

.2 Electrical Starting and Testing by Contractor — Section 26 08 00.11

.3 CSA Z320.11 – Building Commissioning (included as Appendix A)

.4 PWGSC Commissioning Manual CP.1 (public document found here):

https://www.tpsgc-pwgsc.gc.ca/biens-property/sngp-npms/bi-rp/tech/miseenservice-commissioning/manuel-manual-eng.html

1.02 INTENT

.1 This Section specifies general requirements common to all starting and testing of electrical equipment and systems. Read this Section in conjunction with related sections, where specific portions of electrical starting and testing work will be specified.

.2 Except where otherwise specified, arrange and pay for the testing and related requirements specified in this and related sections.

.3 If test results do not conform with applicable requirements, repair, replace, or adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

SUBMITTALS

.4 Submit to the Consultant a list of equipment and instruments which will be used in starting, testing, balancing and adjusting electrical equipment. The owner may require changes to the proposed equipment and instruments.

.5 Submit to the Consultant sample forms, which will be used to record and monitor test results. Modify these forms as directed by the consultants.

1.03 COORDINATION WITH OWNER'S COMMISSIONING AUTHORITY

.1 The project will be subjected to a commissioning process by the Owner. The Owner will separately purchase from one or more agents, specific testing and commissioning activities typically but not limited to the following:

- .1 Testing and commissioning of all newly installed or modified medium and low voltage distribution equipment and cabling.
- .2 Testing of newly installed or modified electrical systems including SCADA system.

.2 In addition, the Owner's Commissioning Authority shall be allowed to witness any in-contract testing, adjusting, start-up, and demonstration procedures.

.3 Co-operate with Owner's Commissioning Authority and allow for all labour, equipment, and tools necessary to assist in completion of the commissioning process as defined herein.

- .1 Prior to execution of any testing, start-up or demonstration, verify with the Owner's Commissioning Authority any tests required to be witnessed. Provide

sufficient notice to Owner's Commissioning Authority and Consultant prior to commencement of procedures.

.4 Co-operate with the commissioning authority as follows:
- .1 Inform commissioning authority minimum 5 working days in advance of all testing.
- .2 Provide copies of manufacturer's operating and maintenance brochures and product bulletins for all major equipment. This information to be made available immediately after approval of shop drawings, but no later than three weeks prior to testing.
- .3 Allow Owner's Commissioning Authority free access to site during construction phase.

1.04 REPORT

.1 Submit Contractor Start-Up Report forms in accordance with Division 1 documenting starting and testing procedures performed, and observed tests results obtained.

1.05 FACILITY START-UP REPORTS

.1 Facility Start-up Reports form an integral part of the Commissioning Check Sheets. All start up reports must be completed and signed off by the applicable Trade contractors and his Sub-Sub Contractor.

.2 The Trade Contractor is responsible for ensuring completion of all Commissioning Check Sheets, and keeping same neatly assembled and available for review by the Commissioning Authority throughout the course of construction.

.3 Where start-up of equipment by a manufacturer is specified in these specifications, a separate report must be completed by the manufacturer detailing procedures and test results. These reports are to be inserted in the Commissioning Check Sheet Binder in the appropriate sections.

1.06 STARTING AND TESTING – GENERAL

.1 Prior to testing ensure all electrical equipment is cleaned and free of dust.

.2 After testing, protect equipment subject to dust from construction activities.

.3 Notify the Consultant when starting and testing of all systems has been completed.

.4 Do not conceal or cover equipment until inspected, tested and approved by the Consultant.

.5 Assume all liabilities associated with starting, testing and balancing procedures.

.6 Assume all costs associated with starting, testing, adjusting and balancing, including supply of testing equipment and witnessing of factory testing by Contractor and the Consultant.

1.07 WITNESSING OF STARTING AND TESTING

.1 The Owner's Commissioning Authority may witness elected starting, testing, and cleaning procedures.

.2 Provide sufficient notice (minimum five days) prior to commencing tests requiring witnessing by the Consultant and/or the Owner's Commissioning Authority.

.3 The Consultant or the Owner's Commissioning Authority may witness all or any portion of testing and starting procedures performed by Contractor or Contractor's Testing Agent.

.4 Advise the Owner's Commissioning Authority in advance that starting, testing, adjusting or cleaning processes are ready to commence. Consult with Owner's Commissioning Authority to determine which procedures they may elect to witness. Provide advance notice in writing prior to commencement of each procedure or series of procedures to allow the Owner's Commissioning Authority to allow for witnessing of tests.

1.08 MANUFACTURER'S STARTING RECOMMENDATIONS

.1 Prior to starting equipment or systems, obtain and review manufacturer's installation, operation and starting instructions. Read in conjunction with procedures specified in Section 26 08 00.11.

.2 Use manufacturer's and supplier's starting personnel where required to maintain validity of manufacturer's warranty. Confirm with manufacturer that all testing specified in this Section and Sections 26 08 00.11 will not void any warranties.

.3 Compare installation to manufacturer's published data and record discrepancies. Modify procedures detrimental to equipment performance prior to starting equipment.

1.09 MANUFACTURER'S SERVICE ON SITE

.1 Arrange and pay for qualified manufacturer's representatives to supervise starting and testing of following electrical equipment and systems:
  .1 Fire Alarm System

.2 Manufacturer's personnel shall be experienced in design and operation of equipment and systems being started and have ability to interpret results of readings, and tests and report results in a logical fashion.

.3 Pre-start-up checks and function tests for electrical equipment to be provided by authorized manufacturer's service representative. Electrical Contractor to include all costs for involvement of manufacturer's representatives for this work.

1.010 REFERENCE DOCUMENTS

.1 Perform tests in accordance with:
  .1 These Contract Documents.
  .2 Requirements of authorities having jurisdiction.
  .3 Manufacturer's published instructions.
  .4 Applicable CSA, IEEE, IPCEA, EEMAC, NEMA and ASTM standards.

.2 If requirements of any of the foregoing conflict, notify the Consultant before proceeding with tests and obtain clarification.

1.011 CONTRACTOR AND MANUFACTURER REPORTS

.1 Log and tabulate test results on appropriate Commissioning Check Sheets provided by the Owner's Commissioning Authority.

.2 Submit completed Check Sheets immediately after tests are performed.

.3 Where a particular Check Sheet does not provide space to record specific test results required as part of the specifications Trade Contractor shall submit his own test forms for review and input by the Consultant.
  .1 Record all data gathered on site on Commissioning Check Sheets or approved test report forms.
  .2 Note any damage, missing parts or incomplete work on the Check Sheets.
  .3 Record date of corrected deficiencies on form.
  .4 Maintain one photocopy on site of all data taken during starting and testing period.
  .5 Maintain one copy of all final starting, testing, balancing and adjusting reports on site up to interim acceptance of the work for reference purposes.

.4 Arrange for manufacturer to submit copies of all production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment to the Consultant prior to shipping.

.5 Arrange for manufacturer to submit brief step-by-step description of entire starting procedure a minimum of one week prior to starting equipment.

1.012 CORRECTION OF DEFICIENCIES

.1 Correct all contract deficiencies found during electrical starting and testing of equipment and systems and the Consultant's performance verification.

.2 Following Substantial completion Performance testing of electrical equipment and systems by the Trade Contractor will commence.

.3 The Owner’s Commissioning Authority may witness any or all tests or start-ups which are the responsibility of the Contractor as specified in Section 26 08 00.11 - Electrical Starting and Testing by Contractor.

.4 The Trade Contractor and/or his designated manufacturer’s representative will be fully responsible for completing all testing of systems as specified. The Owner’s Commissioning Authority may request certain functions and/or components of the systems to be demonstrated in detail.

1.013 CO-ORDINATION

.1 Co-ordinate starting of electrical equipment and systems with testing and demonstration and instruction of
  .1 Electrical equipment and systems specified in Electrical Contractor.
  .2 Mechanical equipment and systems specified in Mechanical Contractor.
  .3 Other equipment and system specified in other Divisions.

.2 Where any equipment or systems requires testing prior to starting, ensure that such work has been completed prior to starting of electrical equipment and systems.

1.014 IMPLEMENTATION

.1 Except where otherwise specified, perform all testing and related requirements specified herein during Facility Start-Up, prior to Substantial Completion of the Work.

1.015 STARTING AND TESTING PHASES

.1 Starting and testing program generally consists of following five distinct phases:
  .1 Pre-Starting: visual inspection

.2 Starting: actual starting procedure.
.3 Post-Starting: operational testing, adjusting or balancing and equipment run-in phase.
.4 Substantial Completion of the Work: final cleaning, re-testing, balancing and adjusting and maintenance.
.5 Final Acceptance of the Work: re-testing and fine-tuning of system to prove all deficiencies have been corrected.

.2 After each distinct phase of work has been completed, correct deficiencies before commencing the next phase.

1.016 SCHEDULING

.1 Provide a detailed Facility Start-Up schedule as specified in Division 1. Schedules must include cross-references to other Trade Contractor's work as needed to ensure all components for the work are ready for testing.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 SAMPLE CHECK SHEETS

.1 A random sampling of Commissioning check sheets as they will be issued to the Trade Contractor has been included as part of these specifications. The sample Check Sheets do not constitute a complete Check Sheet Set, but has been included to assist the Trade Contractor in assessing his involvement with the commissioning process. Individual Commissioning Check Sheets will be issued for each system, system component and device on the project at the discretion of the Commissioning Authority.

END OF SECTION

Owner:	**PANELBOARD**
Project:	
	Distribution **Electrical**

Location: **Equip. Cat.:** **ALTERNATE TAG** **EQUIPMENT TAG**
System: **Norm Pwr** **Sub-Category:** **Distribution** **PNL - xx**

TECHNICAL DATA

☐ DATE / CHECKED BY: _____

	SPECIFIED	SHOP DRAWING	INSTALLED	VERIFIED CONTR. / COM.
Manufacturer				/
Model No.				/
Phase – Volts - Wires				/
# of Circuits				/
Bus Amperage / Bus Bracing				/
Enclosure Colour				/
Feeder Wire Size & Type				/

STATIC CHECKS

☐ DATE / CHECKED BY: _____

ENCLOSURE DETAILS	
- Flush or Surface	Flush___ Surface___
- Door Type	Door in Door___ Hinged___
BRANCH BREAKER	
- Bolt in or Plug in	Bolt In___ Plug In___
- Branch Lugs Torqued & Labelled?	Yes No
MISCELLANEOUS	
- Breaker Filler Pieces Installed?	Yes No
- Interior Clean?	Yes No

OPERATION CHECKS

☐ DATE / CHECKED BY: _____

Lamicoid Accurate?	Yes No
Directory Installed?	Yes No
MEASURED VALUES	
Line A ____ Amps	AB____ Volts / AN____Volts
Line B____ Amps	BC____ Volts / BN____ Volts
Line C____ Amps	CA____ Volts / CN____ Volts
Line N ____ Amps	

Signature: _____ **Design Consultant:** _____
Signature: _____ **Commissioning Agent:** _____

Owner:	**LOW VOLTAGE LIGHTING CONTROL**
Project:	**Lighting Control** **Electrical**

Location:		Equip. Cat.:		ALTERNATE TAG	EQUIPMENT TAG
System:	Lighting	Sub-Category:	Lighting Control		LVRC - xx

TECHNICAL DATA ☐ DATE / CHECKED BY: _____

	SPECIFIED	SHOP DRAWING	INSTALLED	VERIFIED CONTR. / COM.
System Manufacturer				/
Cabinet Model No.				/
*Model No. of Prog. Relay				/
*Model No. of Low Volt. Relay				/
Power Supply				/

STATIC CHECKS ☐ DATE / CHECKED BY: _____

- Cabinet Label	Yes	No
- No. Of Relay Circuits		
- Wiring	Ok	Def.
- Barrier Separation	Yes	No
- Enclosure Clean	Yes	No
- Wiring Labeled	Yes	No
- Spare Relays	Yes	No , No. of
- Drip Hood	Yes	No
- LED Indicating	Yes	No
- Proper Mounting	Yes	No

OPERATION CHECKS ☐ DATE / CHECKED BY: _____

LVR Scanner Operation	Ok	Other
LED's Operating	Yes	No
Network Interface Control	Yes	No
Command On / Off	Yes	No
Flick to Warn	Yes	No
As-Built Wiring Diagram	Yes	No

Signature: _____ **Contractor:** _____
Signature: _____ **Commissioning Agent:** _____

Owner:	**LIGHTING CONTROL - ROOM DATA SHEET**
Project:	**Lighting Control** **Electrical**

Room Number	**Switch Quantity**	**Switch Type**	**Correct Operation**	**Luminaires as per Drawings**	**Luminaires Condition**	– **Light Level Reading** – **4 samples and calculated average** **(If Required)**
		□ Line □ Low Voltage				#1______fc #2_______fc #3______fc #4______fc Average Light Level_______________fc
		□ Line □ Low Voltage				#1______fc #2_______fc #3______fc #4______fc Average Light Level_______________fc
		□ Line □ Low Voltage				#1______fc #2_______fc #3______fc #4______fc Average Light Level_______________fc
		□ Line □ Low Voltage				#1______fc #2_______fc #3______fc #4______fc Average Light Level_______________fc
		□ Line □ Low Voltage				#1______fc #2_______fc #3______fc #4______fc Average Light Level_______________fc
		□ Line □ Low Voltage				#1______fc #2_______fc #3______fc #4______fc Average Light Level_______________fc
		□ Line □ Low Voltage				#1______fc #2_______fc #3______fc #4______fc Average Light Level_______________fc
		□ Line □ Low Voltage				#1______fc #2_______fc #3______fc #4______fc Average Light Level_______________fc

Signature: ____________________ **Contractor:** ____________________
Signature: ____________________ **Commissioning Agent:** ____________________

1 GENERAL

1.01 RELATED SECTIONS

.1 Electrical Equipment and Systems Demonstration and Instruction — Section 26 05 00.25

.2 Electrical Starting and Testing General Requirements — Section 26 08 00.10

.3 CSA Z320.11 – Building Commissioning (included as Appendix A)

.4 PWGSC Commissioning Manual CP.1 (public document found here):

https://www.tpsgc-pwgsc.gc.ca/biens-property/sngp-npms/bi-rp/tech/miseenservice-commissioning/manuel-manual-eng.html

1.02 INTENT

.1 Read this Section in conjunction with Section 26 08 00.10, Electrical Starting and Testing – General Requirements and other related electrical starting and test sections.

1.03 SCOPE

.1 References to completion of the work in other sections requires that full function testing and operational demonstration be performed for each and every system included in the work of Electrical Contractor. Testing and startup for each system by Electrical Contractor to include the following activities:

.1 Pre-start visual inspection and testing.
.2 Startup for energization and full functional demonstration.
.3 Performance Testing and operational checks.
.4 All corrective and follow-up actions and any re-testing as necessary.

.2 Prior to the final demonstration and instructional seminars required, test and check all portions of the electrical system for satisfactory operation. All tests to be done in the presence of the Owner's Commissioning Agent and/or his representative, suitably logged, tabulated, signed and incorporated in project documentation.

All tests described to be neatly logged and tabulated on approved test forms. Testing forms for these tests to be provided by the Contractor. Test forms to be dated and signed by Contractor's authorized representative. Provide test forms for review by the Consultant 6 weeks prior to commencement of tests. Modify test forms as required by the Consultant.

.3 On site (field acceptance) testing, commissioning and verification to include, but not be limited to the following:

Test	Performance by	Specification Reference
Normal visual and mechanical inspections	electrical trade, low tensions systems installers	26 08 00.11
Megger tests	electrical trade	26 08 00.11
Load balance tests	electrical trade	26 08 00.11
Power system SCADA	electrical trade, low tensions systems installers	26 29 23.02

Lighting system	electrical trade	26 50 00
Commissioning of electrical distribution and panelboards	electrical trade	26 24 16
Pre-Verification of fire alarm system by manufacturer.	electrical trade and manufacturer	28 31 00
Witnessing of fire alarm verification	engineer	28 31 00
System Verification by Professional Engineer.	appointed and paid for by the Contractor	28 31 00

2 PRODUCTS

2.01 N/A

3 EXECUTION

3.01 BASIC ELECTRICAL STARTUP AND TESTING

.1 Energizing Main Electrical System
- .1 Prior to energizing main electrical system:
  - .1 Verify supply authority voltage and phase rotation.
  - .2 Megger all feeders and record results on approved test report forms.

.2 Testing of Wiring and Wiring Devices
- .1 Test conductors at switchboards, distribution centres and panelboards for insulation resistance to ground (megger test).
- .2 Test service grounding conductors for ground resistance.
- .3 Test all wiring devices for correct operation and circuitry.

.3 Load Balance Testing
- .1 Test load balance on all feeders at distribution centres, motor control centres and panelboards.
- .2 At the consultants discretion and if load unbalance exceeds 15%, reconnect circuits to balance loads. Revise panelboard directories and wiring identification accordingly.

.4 Voltage Testing and Adjusting
- .1 Test voltage at service entry point, motor control centres and secondary of transformers above 45 kVA. Record voltages at Substantial Completion during a normal work day.
- .2 Adjust transformer tap settings to compensate for under-voltage or over-voltage conditions, if directed to do so by the Consultant.

3.02 LIGHTING

.1 Function test all light switches, luminaires, and lighting control equipment such as photo-cells and time clock settings.

.2 Record all photo-cell and time-clock settings.

3.03 FIRE SAFETY SYSTEMS

.1 Prior to requesting verification of the Fire Alarm System, Electrical Contractor and the Fire Safety system manufacturer's technical staff shall:
- .1 Inspect system in conjunction with the manufacturer to ensure that fire alarm system is correctly installed, connected and fully operational in accordance with requirements of the Contract Documents and Manufacturers recommendations. This shall include all auxiliary equipment connected to fire alarm system such as elevators, central station tie-in, fan shut-down, sprinklers, door hold-open devices, etc.
- .2 Ensure that any subsequent work remaining to be performed on the above-noted items will not invalidate examinations and tests performed during verification procedure.
- .3 Ensure that operation and maintenance data has been submitted.
- .4 Ensure that spare parts and maintenance materials have been delivered.

.2 Certify to the Owner in writing that above prerequisites have been fulfilled and specifying known exceptions in the form of a list of items to be completed or corrected, prior to proceeding with verification.

.3 The Verification Agent will proceed with verification, or advise Owner that prerequisites are not adequately fulfilled.

.4 Fire Alarm Verification:
- .1 Assist and cooperate with the Verification Agent in verification procedure.
  - .1 Provide the following equipment:
    - .1 Velometer
    - .2 Artificial Smoke
    - .3 Rate of Rise Heat Detector Tester
    - .4 Minimum of four portable communication devices.
  - .2 Do not proceed with the verification unless the following parties are present at all times during verification procedures:
    - .1 Electrical Contractor.
    - .2 Fire Alarm System Manufacturer's Representative.
    - .3 Consultant verification representative.
  - .3 Disassemble and reassemble system components.
  - .4 Disconnect and reconnect wiring.
  - .5 Perform required field adjustments.
  - .6 Repair defective work and replace defective components.
  - .7 Perform all other work on system required by verification procedure.

3.04 TELEPHONE SYSTEM

.1 Ensure all equipment is properly installed and wiring correctly terminated.

.2 Ensure all handsets operate properly.

.3 Function test system as specified in 26 08 00.13 in the presence of the Owner's Representative.

3.05 POWER SYSTEM SCADA

.1 Ensure all equipment is properly installed and wiring correctly terminated.

.2 Ensure capacity and operation meets specified parameters.

.3 Verify operation and remote annunciation of all signals.

3.06 TELEPHONE/DATA CABLING

.1 Refer to Division 27 specifications.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS

.1 Submit shop drawings.

.2 Indicate:

.1 Dimensioned cable entry locations.

.2 Dimensioned cable termination height.

.3 Identified internal and external component layout on assembly drawing.

.4 Interconnection wiring, devices and arrangements.

1.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for circuit breaker and power connection equipment.

1.3 SCOPE OF WORK

.1 This project includes additions to an existing regulated power supply system. This system is capable of producing a voltage regulated power connection at a voltage ranging from 430 to 630VAC and up to 2000 amps. The major components have been installed, including two existing connection points at 2000 amps.

.2 Installation of a new 2000 amp circuit breaker in the existing regulated switchboard along with commissioning, testing and verification services.

.3 Installation of power and control cabling between distribution and control panel and Jetty Mount containing the 2000 amp connection.

.4 Installation of 2000 amp ‘Cam Lock’ connection assembly along with control devices, indicators and associated wiring as noted in the drawings.

.5 Provide complete operational verification of all operations of this portion of the system including operation of interlocks, control interfaces and protection elements including the existing systems as it affects the equipment installed as part of this project.

1.4 CONTROL OPERATION

The following is a brief narrative of the operation of this system. This operation is currently in place, but correct operation with the equipment installed within this contract must be verified.

.1 Regulated power supply as controlled by the voltage regulator and associated overcurrent protection devices shall function as follows:

.1 Control panel or software enabled voltage setpoints (440, 460, 480 and 600) will be target voltage settings. System shall operate to regulate the voltage at the system output terminals to maintain these nominal voltages regardless of loading of this system.

.2 System shall automatically adjust taps to maintain closest output to target voltage. A 30 second sampling period shall be used after which the appropriate tap will be selected on any of the three phases.

.3 If the system attempts to regulate the voltage and exceeds the maximum nominal overvoltage setpoint (as set through software) the secondary circuit breaker will open. This setpoint shall be indicated as a percentage of the preset nominal voltage and will apply to any setpoints (I.E. 120%)

.4 An arbitrary voltage target may be selected via software for the system to regulate to within the system output of 430 to 630 volts AC.

.5 Regulator system shall interface to PSS using Ethernet and provide full authority remote access and control to all parameters of the regulator system. The PSS will also monitor status of the system and trend log the output voltage, regulator position, liquid temperature and system health. Alarms will automatically be process through the PSS and recorded.

.6 The regulator shall provide a manual override function that allows for the user to select any regulation step and maintain this as a fixed point. These manual override controls shall be hardwired and accessible at the main control panel.

.2 Regulated power supply be constructed with and integrated to the PSS and low voltage protection system to provide automatic overcurrent adjustments suited to the cables connected to the 2000 amp dock power system.

.1 The dock power connector will incorporate limit switches fed back to the overcurrent protection system to detect the number of parallel cables installed and ensure that the connected cable ampacity meets or exceeds the protection settings. The breaker can only be closed when a complete contingent of cables is connected and will trip automatically if cables are withdrawn prior to opening the circuit breaker.

.2 The overcurrent device will be aware of the nominal voltage setpoint on the regulated power supply system to factor into power quality and voltage protection functions.

.3 The regulated power supply system can supply a maximum of 4 MVA of power at a common voltage. The control system will not allow connection/energization of loads in excess of this value.

Part 2 Products

2.1 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with CSA C88.

2.2 WARNING SIGNS

.1 Provide warning signs in accordance with Section 26 05 00 - Common Work Results - Electrical. Include warnings for tap changer operation and automatic operation of fans.

Part 3 Execution

3.1 INSPECTION

.1 Check factory made connections of unit for mechanical security and electrical continuity.

3.2 INSTALLATION

.1 Ensure concrete pad is fully cured before regulator is installed.

.2 Set and secure unit in place, rigid, plumb and square.

.3 Make connections.

.4 Connect unit ground bus to system ground.

.5 Control system for monitoring and remote control.

.6 Program system for operation, alarming, trending and function noted.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Ensure that system operates correctly and within the narrative presented.

.1 Verify that the system can identify correct cable connection capacity and permit the correct level of overcurrent settings.

.2 Verify system voltage apparent at the connection point is as selected by the system.

.3 Verify that system capacity cannot be exceeded by connected loads.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section specifies the materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 REFERENCES

.1 Use transformers of one manufacturer throughout the project.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No.47, Air Cooled Transformers (Dry Type).

.2 CSA C9, Dry Type Transformers.

1.3 PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal procedures.

Part 2 Products

2.1 STANDARD TRANSFORMERS

.1 Type: ANN, 600 volts, 3 phase delta primary.

.2 Primary taps: 2 x 2 1/2% full capacity taps above and 2 x 2 1/2% taps below the nominal voltage.

.3 Secondary: 3 phase, 60 Hz 120V/208V 4 wire Y (see drawings for kVA rating). Electrostatic shielded grounded star secondary.

.4 Class H, 180°C insulation with temperature rise not exceeding 115°C maximum in 40°C ambient.

.5 Efficiency: Energy Star rating & CSA

.6 Basic Impulse Level (BIL): standard.

.7 Windings: High grade copper windings.

.8 Impedance: per ANSI recommendations but must not be less than 4%.

.9 Average Sound Level: Noise emission shall not exceed requirements per ST20 standard.

.10 Impedance at 170 degrees C: standard.

.11 Enclosure: Encapsulated with electrical grade silica and resin compounds. NEMA 4X, stainless steel enclosure.

.12 Mounting: provide external vibration isolator kit. Wall or bulkhead mounted as noted in drawings.

.13 Finish: in accordance with Section 26 05 00 – Common Work Results - Electrical.

.14 Scott-T connected transformers not acceptable.

Part 3 Execution

3.1 MOUNTING

.1 Mount encapsulated transformers on vertical bulkhead surface as noted in drawings. Provide all required structural support for Jetty Mounts to support transformers and associated hardware.

3.2 CONNECTIONS

.1 Make primary and secondary connections in accordance with the manufacturers diagrams.

.2 Check all factory connections for correct tightness before energization.

.3 Torque the building system wiring transformer connections using a torque wrench set to the manufacturers recommended settings. Note the torque setting on the equipment identification label for future maintenance reference.

.4 All external wiring connections to transformer casing shall be enclosed in flexible conduit. Typically minimum 900mm flex to minimize vibration transmission to structure.

.5 Conduit to only enter transformers within the bottom third of the transformer casing,to minimize heat transfer to conduit.

.6 Energize transformers immediately after installation is completed, where practicable.

3.3 EQUIPMENT IDENTIFICATION

.1 Size 7 label in accordance with Section 26 05 00.

.2 Include the transformer identification (as indicted on the project drawings), primary power source equipment designation, equipment served and torque setting of connections. E.g. Transformer T1, served from CDPH-1, serving CDPL-1, Cable Connection Torque x Nm.

3.4 GROUNDING

.1 Provide a ground conductor with all feeder runs to dry type transformer installations. The ground shall be either green insulated or identified and connected as a ground to the ground pad in the transformer enclosure and then to the secondary neutral of the transformer. This ground conductor shall be connected to system ground and shall be run in conduit, not exposed in any way.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section specifies standard and custom panelboards and their installation.

1.2 SCOPE OF WORK

.1 Provide and install panelboards as indicated on the drawings, single line diagram, panel schedules and these specifications.

.2 Types of panelboards in this section include the following:

.1 Lighting and power panelboards

1.3 PRODUCT INFORMATION

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

.2 Shop drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 Shop drawings to include matching tub and trim details for factory installed low voltage relay cabinets where specified.

1.4 PLANT ASSEMBLY

.1 Install circuit breakers in panelboards before shipment from plant.

.2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.3 All panelboards to be of a common manufacturer.

1.5 FINISH

.1 Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Panel finish in electrical and equipment rooms and closets to be standard ASA Grey baked enamel. Confirm with Departmental Representative prior to shop finishing panels.

Part 2 Products

2.1 PANELBOARDS, DOORS AND TRIMS

.1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.

.2 Bus and breakers unless otherwise indicated on the drawings and in the specifications, shall be rated for:

.1 Minimum 10 kA at 208Y/120V.

.2 Minimum 22 kA at 480Y/277 and 600Y/347V.

.3 Tin plated copper bus with full size neutral.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.

.5 Mains capacity, number of circuits and number and size of branch circuit breakers as indicated.

.6 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.

.7 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.

.8 Panelboards to have flush doors.

.9 Provide two keys for each panelboard and key similar voltage and system panelboards alike.

.10 Panel tubs to be typically 600mm wide.

.11 All surface mounted enclosures to be complete with sprinkler drip cover.

.12 Provide door within door trims where indicated to facilitate ease of service maintenance Each tub trim cover to be hinged and self supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.

2.2 BREAKERS

.1 All breakers to be:

.1 Bolt on type molded case, non-adjustable and non-interchangeable trip, single, two and three pole, 120/208V , 277/480V or 347/600V and with trip free position separate from "On" or "Off" positions.

.2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard.

.3 Main breaker (where required) to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules or the Single Line Diagram.

.5 Provide spare circuit breakers as indicated on panel schedules or single line diagram as applicable.

.6 Provide breaker type Ground Fault Interrupter(s) (GFI) as indicated.

.7 Provide Lock-on devices as indicated and for Fire Alarm circuits, Security Equipment circuits, Exit sign circuits and Emergency Battery Equipment circuits.

2.3 PANELBOARD IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.

.3 Complete updated circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a "letter sized" paper copy of each directory in the project maintenance manual.

.4 Provide a plasticized typewritten information card fixed to the back of each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a "letter sized" paper copy of each information card in the project maintenance manual.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.

.2 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.

.3 Mount panelboards to height given in Section 26 05 00 or as indicated.

.4 Connect loads to circuits as indicated.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Provide spare breakers as indicated on panelboard schedules and on single line diagram.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies outdoor electrical structures and equipment to be contained therein. Refer to specialized sections for components related to specific subsystems as depicted in drawings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA G40.20/G40.21-98(June 2000), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.3 SCOPE OF WORK

.1 Electrical modifications to five existing Jetty Mounts for provision of additional equipment including:

.1 Fire alarm and Emegency alarm systems and fittings.

.2 Digital metering and SCADA equipment

.3 Communications equipment and cabling.

.4 Power connections and associated controls

.5 Power distribution and switching,

.6 Lighting, heating and accesory equipment and fittings.

.7 Mechanical connections and controls

.8 Grounding and bonding.

.2 Supply and installation of new power distribution kiosk (Tug Wharf Pedestal) complete with the following:

1. Power connections.
2. Protection equipment
3. Grounding and bonding.

1.4 SHOP DRAWINGS

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

.2 Indicate:

.1 Equipment layout.

.2 Equipment dimensions including door openings, draw-out equipment positions and workspace requirements.

.3 Dimensioned foundation template.

.4 Dimensioned cable entrance and exit locations.

.5 Dimensioned cable termination heights.

.6 Details of entry plate.

.7 Lifting/hoisting details and shipping weights.

.8 Details of door swings, closing mechanisms and weatherproofing.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for unit substation for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

.1 Submit manufacturer's type test certificates indicating switchgear cubicles and components tested as integrated assembly.

.2 Submit test procedures, at least 10 days prior to testing.

.3 Submit production test results before equipment is shipped from factory.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Locking mechanism (1).

.2 Door operating handle (2).

.3 Door weather stripping gasket (lengths enough for two doors).

.4 Bug screen/filters (two complete spare sets).

Part 2 Products

2.1 TUG WHARF PEDESTAL

.1 The housing shall be a minimum 12 gauge, marine-grade (copper free) Aluminum, rigid, free-standing, fabricated to EEMAC 3 standards with sufficient bracing to form a structure capable of withstanding wind, snow and ice loading.

.2 The roof shall have a minimum 25 mm overhang (500mm over opening doors) and provide rain gutters over all doors and openings. Gutters shall be oriented that overflow water is diverted away from access door areas.

.3 All hinges shall be weld on, lift off, with grease fittings.

.4 Ventilating louvres: vermin, insect an water proof with easily replaceable fibreglass filters.

.5 Use stainless steel bolts and hardware.

.6 Hinged door access from side only.

.7 Provide sloping recesses for mounting of marine receptacles.

.8 Full height outer door reinforced with stiffeners, gasketted, hinges on left or right as required for access, provision for multiple padlocking. Three point latch, stops, to open at least 135 degrees with hydraulic hold opens on all doors.

.9 Doors to open at least 90 degrees.

.10 Gaskets on removable covers.

.11 Removable cover bolts not accessible from outside of cubicle.

.12 Interior hinged and bolted mesh steel screens to prevent inadvertent contact with exposed live parts.

.13 Metal pocket on inside surface of door of main breaker and secondary breaker compartments to accommodate drawing and diagram prints.

2.2 SHOP FABRICATION

.1 Completely shop assemble enclosure prior to disassembly for shipping to site.

.2 After completion of factory assembly, prepare for shipment to site in sections, complete with hardware for re-assembly and re-connecting.

2.3 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 All exterior sheet metal shall be primed for corrosion protection and finish painted with a powder coat finish. The finish paint and color shall be smooth, glossy polyester powder coat with baked curing.

.3 Exterior color: Bare aluminum finish.

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.5 WARNING SIGNS

.1 Provide warning signs in accordance with Section 26 05 00 - Common Work Results - Electrical.

Part 3 Execution

3.1 INSTALLATION - PEDESTALS

.1 Set and secure pedestals in place, rigid, plumb and square, on bases.

.2 Ensure proper sealing and compression of gasket material along bottom edge of enclosure to prevent water ingress.

.3 Check factory made connections for mechanical security and electrical continuity.

.4 Connect grounding as noted in drawings and specifications.

.5 Provide sealing bead of polyurethane caulking effective sealing bottom edge of enclosure to concrete pad. Provide backer road to fill gaps larger than 6mm prior to application of caulking.

.6 Confirm correct, free operation of all doors, door holders, barriers and locking means.

3.2 INSTALLATION – JETTY MOUNTS

.1 Provide all noted modifications to existing Jetty Mount assemblies not limited to:

.1 Transformer mounting.

.2 Revise cable entrance and shrouding

.3 Modification and additions to local switches, control and power connections.

.4 Replacement of lighting and convenience power connections.

.5 Additional SCADA devices, metering and connection of mechanical flow meters to power and SCADA system.

.6 Addition of fire and emergency alarm hardware, initiation and annunciation devices including additional fabrication to Jetty Mount assembly.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section specifies switches, receptacles, wiring devices, power connection devices and cover plates and their installation.

1.2 PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
- .2 CSA-C22.2 No.42.1, Cover Plates for Flush Mounted Wiring Devices.
- .3 CSA-C22.2 No.55, Special Use Switches.
- .4 CSA-C22.2 No.111, General Use Snap Switches.

Part 2 Products

2.1 COLOUR

.1 All devices to be Decora style white.

2.2 SWITCHES

.1 Heavy duty specification grade.

.2 20 A, 120 V, single pole, double pole, three-way, four-way switches as indicated.

.3 Manually-operated general purpose ac switches as indicated and with following features:

- .1 Terminal holes approved for No.10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine molding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 White toggle (red toggle for emergency power circuits).

.4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rating capacity of motor loads.

.5 Switches of one manufacturer throughout project.

2.3 RECEPTACLES – GENERAL

.1 Heavy duty specification grade.

.2 Duplex receptacles, CSA type L5-15 R, 125 V, 15 A, U ground, with following features:

- .1 Nylon molded housing.
- .2 Suitable for No.10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and non riveted grounding contacts.
- .6 Suitable for marine applications with stainless steel terminals and contacts.

.3 Receptacles of one manufacturer throughout project.

2.4 RECEPTACLES – PARTICULAR APPLICATION

.1 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U ground, impact resistant nylon face, complete with breaker and reset button.

.2 20 Amp Receptacles (Housekeeping) Duplex receptacles – T-slot type CSA type L5-20R 125V. 20 Amp u ground with features matching 15 Amp rated Receptacles.

.3 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation. Suitable for marine applications with stainless steel terminals and contacts.

2.5 SINGLE CONDUCTOR RECEPTACLE CONNECTIONS

.1 Provide modifications or connections to switching equipment to support mulitple single conductor connections using ‘Cam Lock’ or compatible style receptacles. Voltage and ampacity as noted in drawings.

.2 Spacing between connectors shall be between 75 and 100mm center to center allowing adequate clearance for hand-hold with a populated connector assembly.

.3 Provide interlocking limit swith devices and control system as noted in drawings.

.4 400 amp connectors suitable for up to 600VAC.

.5 Provide blanking caps complete with lanyard to cover receptacle when not in use.

2.6 PIN AND SLEEVE RECEPTACLE

.1 600VAC, 100 amp, 3 phase 4 wire interlocking receptacle and molded case switch assembly.

.2 NEMA 4X enclosure, cast aluminum with epoxy coated finish.

.3 Pin and sleeve receptacle configuration to match existing receptacles on site.

.4 Existing device is compatible with Russell Stoll Maxguard, gated deadfront with screw cover sizes and voltage as specified.

2.7 COVER PLATES

.1 Stainless steel: Type 302 or 304, No. 4 finish, 1mm thick, accurately die cut, protective cover for shipping. Outlets in labs or as indicated in the drawings or specifications.

.2 All plates to be beveled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.

.3 Cast metal: die cast profile, ribbed for strength, flash removed, primed with grey enamel finish and complete with four mounting screws to box for special purpose wiring devices.

.4 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for wiring devices as indicated. Double doors for standard duplex receptacles. Cover plates to fasten to box by four screws.

.5 Gaskets: resilient rubber or close cell foam urethane.

.6 Cover plates for all wiring devices to be from one manufacturer throughout project.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.

.2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.

.3 All plates to be installed parallel or perpendicular to building lines.

3.2 INSTALLATION PARTICULAR

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.2 Receptacles:

.1 Install all receptacles in the vertical plane unless otherwise noted.

.2 Generally install the L5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle in mounted horizontal.

.3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.

.4 Ground fault interrupter duplex receptacles to be used where noted.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section specifies the materials, components, operational features and installation for air circuit breakers.

1.2 REFERENCES

.1 American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE C37.13-1993, Low Voltage AC Power Circuit Breakers Used in Enclosures.

.2 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 5- latest issue, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 SHOP DRAWINGS

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

.2 Include time-current phase protection coordination characteristic curves for breakers.

.3 Provide complete wiring diagrams for all auxiliary contacts, controls and communications interfaces.

Part 2 Products

2.1 AIR CIRCUIT BREAKER

.1 Air circuit breaker to: to ANSI/IEEE C37.13 and CSA C22.2 No.5.

.2 Supply and install new circuit breaker into existing, drawout chassis located in SSSR regulated power supply distribution board.

.3 As this is to be installed into an existing switchboard assembly, no alternates will be accepted.

.4 Circuit breaker shall have the following specifications and features:

.1 2000 amps frame, 100% rated.

.2 Schneider Electric Masterpact part number: WN4FFR74A3SCFCFXXXE; Drawout circuit breaker.

.3 Model number NW20H1 3 pole ANSI C37/UL1066 rated.

.4 65kAIC at 208V, 480V and 635VAC

.5 2000 amp trip sensors and Type A plug.

.6 Trip Unit: Type 6.0H with zone selective protection; residual ground fault protection; ground fault only trip; harmonic analysis and power meter functions.

.7 Modbus auxiliary module.

.8 4 auxiliary contacts

.9 Spring charging motor – 24-30VDC

.10 Shunt Trip - 100-130Vac
.11 Closing Coil with Communication - 24-30Vdc
.12 Overcurrent Trip (SDE) contact standard
.13 Electric Reset - 100-130Vac
.14 Automatic Spring Discharged Interlock Standard
.15 Push Button Electrical Close
.16 Cradle with backmold
.17 Secondary disconnect wiring for auxiliary
.18 2nd Alarm or Electric Reset Wiring
.19 Aux Contacts and Switch
.20 Communication wiring
.21 Shunt Trip, Shunt Close, Spring Charging
.22 Motor Wiring
.23 ZSI/MDGF/Neutral Sensor/24Vdc supply
.24 Standard 4 Form C contacts (total 4 OF)
.25 Cradle Rejection Kit - Standard
.26 OFF Push Button - Crank Interlock Standard
.27 Racking handle

Part 3 Execution

3.1 INSTALLATION

.1 Install air circuit breaker in existing cradle/cell as indicated.

.2 Connect remote open/close signals.

.3 Connect power source to breaker auxiliary controls.

.4 Connect serial interface from SCADA to breaker.

.5 Program SCADA system to tightly integrate breaker functionality and feedback into SCADA system for logging, auditing and monitoring purposes.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

.3 Section 26 23 00 - Low Voltage Switchgear.

.4 Section 26 28 20 - Ground Fault Circuit Interrupters - Class ‘A’.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include time-current characteristic curves for breakers with ampacity of 100A and over.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

.2 Separate for recycling all waste in accordance with Waste Management Plan.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips as noted.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating or as noted in drawings or panel schedules.

.7 All circuit breakers rated 1200 amps or larger OR as called for in the drawings shall be equipped with motor operators to facilitate remote opening and closing of the circuit breaker.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and/or ground fault short circuit protection.

.2 Overcurrent device shall provide power, current and power quality metering and remove open/close and status functions. Device shall communicate to the Power System SCADA system via Ethernet.

2.4 OPTIONAL FEATURES

.1 Refer to drawings, single lines and panel schedules for features to be included on moulded case breakers.

.2 Required features for all circuit breakers larger than 150 amps OR mounted in any of the main 208V, 480V, 430-630V 600V switchboards:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated open/close mechanism

.4 Integral metering device with communications link

.5 On-off locking device.

.6 Handle mechanism.

.7 RS485 serial interface using MODbus or compatible communications protocol to integrate air circuit breaker overcurrent, control and metering functions to SCADA using single SCADA software system.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers in switchboard or panel board assemblies as noted in drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 09 23.02 - Power Systems SCADA

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 UL61010B-1 Measuring, Testing and Signal Generation Equipment

.2 CAN3-C17- latest edition, Alternating - Current Electricity Metering

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2000 (R2008), Industrial Control and Systems: General Requirements.

.3 International Electrical Standards (IEC)

.1 IEC62052-11: Electricity metering equipment (AC) – general requirements, tests and test conditions

.2 IEC61010-1 (EN61010-1): Safety requirements for electrical equipment for measurement, control, and laboratory use

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.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 and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Include schematic, wiring, interconnection diagrams.

.2 Provide certificate of Revenue Canada Approval for devices requiring compliance and sealing.

1.4 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

1.5 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Storage and Handling Requirements:

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

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

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DIGITAL POWER METERS – TYPE M2-R

.1 Current/Voltage Inputs

.1 Have no less than 4 voltage inputs and 4 current inputs

.2 Shall be able to accept 600VAC LL / 347VAC LN without using potential transformers.

.3 Shall support nominal current ratings of 1A, 2A, 5A, 10A, and/or 20A and an overcurrent rating of 500A for 1s (5A nominal mode) or 200A for 1s (1A nominal mode).

.2 Power Supply

.1 95 to 240VAC (±10%) @ 47 to 440Hz / 120 to 310 VDC

.3 Measured Values

.1 Digital Meter shall provide at minimum the following voltage values:

.1 Voltage L–L Per-Phase

.2 Voltage L-L 3-Phase Avg

.3 Voltage L–N Per-Phase

.4 Voltage 3-Phase Avg

.5 Voltage % unbalanced

.2 Digital Meter shall provide at minimum the following current values:

.1 Current Per-Phase

.2 Current, Neutral (measured)

.3 Current 3-Phase Avg

.4 Current % Unbalanced

.3 Digital Meter shall provide at minimum the following power values:

.1 Real Power (Per-Phase, 3-Phase Total)

.2 Reactive Power (Per-Phase, 3-Phase Total)

.3 Apparent Power (Per-Phase, 3-Phase Total)

.4 Power Factor – True (Per-Phase, 3-Phase Total)

.5 Power Factor – Displacement (Per-Phase, 3-Phase Total)

.4 Digital Meter shall provide at minimum the following energy values:

.1 Accumulated Energy (Real kWh, Reactive kVARh, Apparent kVAh) (Signed/Absolute)

.2 Incremental Energy (Real kWh, Reactive kVARh, Apparent kVAh) (Signed/Absolute)

.3 Conditional Energy (Real kWh, Reactive kVARh, Apparent kVAh) (Signed/Absolute)

.4 Reactive Energy by Quadrant

.5 Digital Meter shall be capable of deriving values for any combination of measured or calculated parameter, using the following arithmetic, trigonometric, and logic functions (or equivalent PLC capabilities):

.1 Arithmetic functions: division, multiplication, addition, subtraction, power, absolute value, square root, average, max, min, RMS, sum, sum-of-squares, unary minus, integer ceiling, integer floor, modulus, exponent, PI.

.2 Trigonometric functions: COS, SIN, TAN, ARCCOS, ARCSIN, ARCTAN, LN, LOG10

.3 Logic functions: =, =>, <=, <>, <, >, AND, OR, NOT, IF

.4 Thermocouple linearization functions: Type J, Type K, Type R, Type RTD, Type T

.5 Temperature conversion functions: C to F, F to C

.4 Demand

.1 Digital Meter shall be able to provide min/max demand, present demand interval, running average demand, and predicted demand on multiple demand channels.

.2 Digital Meter shall be able to perform multiple accepted demand calculation methods including block, rolling block, and thermal demand with user-programmable demand period lengths.

.5 Accuracy

.1 Digital Meter shall meet ANSI C12.20 accuracy class 0.2.

.2 Digital Meter shall provide 4-quadrant metering

.3 Digital Meter shall be certified and sealed to Revenue Canada standard as applicable for devices to be used for reselling of energy.

.6 Sampling

.1 Digital Meter shall sample at 64 (or more) samples/cycle.

.2 Digital Meter shall be able to perform high speed sag/swell detection of voltage disturbances on a cycle-by-cycle basis, providing the duration of the disturbance, the minimum, maximum, and average value of the voltage for each phase during the disturbance. Disturbances less than one cycle in duration can be detected.

.7 Logging

.1 Digital Meter will store all critical internal and revenue data upon sudden power loss and shall have non-volatile memory.

.2 Digital Meter shall have a time-stamped event log with the following features:

.1 The number of records in the log is programmable.

.2 Each event is recorded with the date and time of the event, the cause and effect of the event, and the priority of the event.

.3 All events relating to setpoint activity, relay operation and self-diagnostics is recorded in the event log.

.4 Time stamps have a resolution of 1 millisecond.

.5 Time stamps can be synchronized to within 100 ms between devices on the same serial communications medium.

.6 Minimum event recording response time is ½ cycle (8.3ms 60Hz, 10ms 50Hz) for high speed events and 1 second for other events.

.7 The priority of setpoint events is programmable.

.3 Digital Meter shall be able to log any parameter in the meter including min/max and waveforms.

.8 Alarming

.1 Digital Meter have setpoint driven alarming capability

.2 Digital Meter shall be able to generate an email on an alarm condition.

.3 Digital Meter shall have millisecond timestamp resolution on alarm entries.

.4 Digital Meter shall support consecutive high-speed alarm conditions which trigger on a cycle-by-cycle basis with no “dead” time between events (i.e. no need for a rearming delay time between events).

.5 Digital Meter shall be able to operate relays on alarm conditions.

.6 Digital Meter shall be able to initiate datalog captures on alarm conditions.

.7 Digital Meter shall be able to control digital output relays in an AND or an OR configuration, using pulse mode or latch mode operation, for control and alarm purposes.

.8 Digital Meter shall be able to combine any logical combination of any number of available setpoint conditions to control any internal or external function or event.

.9 Communications

.1 The Digital Meter shall be capable of the following communications methods simultaneously and independently:

.1 Ethernet over copper media.

.2 Serial

.1 RS-232

.2 RS-485

.3 Serial

.1 RS-485

.4 Infra Red

.2 The Digital Meter shall support any one of the following communications protocols on any one port at any one time:

.1 ION

.2 Ethergate

.3 Modemgate

.4 DNP 3.0

.5 Modbus

.1 Modbus RTU

.2 Modbus TCP

.3 Modbus Mastering of serial RS485 slaves

.6 SMTP

.7 SNTP

.8 MV-90 compatibility

.9 XML compatibility

.10 SNMP

.11 HTTP (web pages)

.3 The PMS Instrument has an Modbus TCP gateway for reading Modbus serial devices connected to a serial port on the instrument

.4 The PMS Instruments that are equipped with an Ethernet port are internet enabled and supports the following functions:

.1 Automatically e-mail alarm notifications or scheduled system status updates. E-mail messages sent by the PMS instruments can be received like any ordinary e-mail message. Data logs can also be sent on an event-driven or scheduled basis.

.2 Built in web pages in the PMS instruments enables access to real-time values and basic power quality information using a standard web browser. Basic configuration of the PMS instruments can also be performed through the browser.

.3 Integration with custom reporting, spreadsheet, database and other applications with XML compatible data.

.1 The following logical nodes shall be supported in addition to LLN0 and LPHD (mandatory):

- MHAI - Harmonics
- MMTR - Metering
- MMXU - Measurement
- MSQI - Sequence and imbalance
- MSTA - Metering Statistics
- GGIO - The ability to view data from and control all I/O points in the meter.
- RDRE - Disturbance recorder function

.10 I/O Options

.1 Digital Meter shall be capable of having 4 digital inputs capable of ½ cycle timing resolution, and shall be fitted with 4 inputs.

.2 Digital Meter shall have digital outputs that support pulse output relay operation for kWh total, kWh imported, kWh exported, kVARh total, kVARh imported, kVARh exported, and kVAh values.

.3 Digital Meter shall have 4 optically isolated Form A outputs.

.11 Display

.1 Digital Meter shall have two display options: an integral display and a remote mounted display

.1 The integral display shall be a backlit LCD display

.2 The remotely mounted display shall be a color backlit LCD display, of similar size as to integral display

.3 The displays shall be suitable for NEMA 12 enclosures.

.2 Digital Meter shall support direct display of all parameters on the front panel.

.3 Digital Meter display shall support multiple languages, including English and French.

.12 Field Programmability

.1 Digital Meter is field programmable as follows:

.1 Basic parameters: Voltage input scale, voltage mode (Wye, Delta, single phase), current input scale, auxiliary input and output scales, and communications setup parameters are programmable from the front panel.

.2 All basic parameters described above, plus additional setpoint/relay and data log setup parameters may be programmed via the communications port using a portable or remotely located computer terminal.

.3 Custom configuration of all operating parameters is possible through a graphical, flexible programming language.

.4 The configuration of the device will be done using programmable modules. The modules can be linked together in an arbitrary manner to create arbitrary functionality. Some example module types include min, max, setpoint, digital input, and digital output.

.5 Programming through a computer can be secured by user ID and password.

.6 Programming through the front panel is secured by password.

.7 Programmability shall be sectioned such that when the meter is sealed, the meter shall still be configurable to an extent that does not affect the accumulation of revenue metering related data.

.13 Advanced Features

.1 The Digital Meter firmware shall be field upgradeable.

.2 Onboard meter clock can be paced by a choice of sources including GPS or internal clock.

.3 The Digital Meter shall have multi-level security which supports customized access for up to 16 users.

.4 The Digital Meter shall have revenue security capabilities including but not limited to the following:

.1 Password protected, no hardware lock, or

.2 Password protected and hardware locked, or

.3 The following data is protected from alteration when locked:

.1 kWh and kVARh (import, export, net and total)

.2 kVAh (total)

.3 kW, kVAR, kVA demand (thermal and sliding window)

.4 kWh, kVARh, kVAh pulse outputs

.5 The Digital Meter shall have provisions for creating periodic or non-periodic schedules for up to two (2) years. These schedules may be used to perform the following functions:

.1 Time of Use (TOU)

.2 Demand Control

.3 Load Scheduling

.4 Logging

.5 Periodic Resetting

Part 3 Execution

3.1 INSTALLATION

.1 Install Digital Meters as noted in drawings. All installations shall be fully integrated to main assemblies and shall be completely tested for operation prior to shipping to site.

.2 Use of Digital Meters with remote display units is applicable as required to facilitate compliant installation of meters using 600V voltage inputs. The use of potential transformers to permit mounting of metering on swinging doors is not acceptable when remote display is available.

.3 Connect Digital Meters to communications means as noted in drawings, typically copper Ethernet. All patch cables shall be STP (shielded twisted pair), CAT 6 with positively engaging locking tabs. Where optical fibre is noted in contract, provide a suitable media converter at both ends to connect Digital Meters to SCADA Ethernet network.

.4 Where Digital Meters are connected to additional devices using RS 485 twisted shielded media, ensure grounding of shielded cables is done at one end only. Provide end of line resistors as required for reflection/error free communications at the highest transmission speeds the Digital Meters are capable.

.5 Where Digital Meters are indicated as Revenue Sealed (R), ensure that all current transformer ratios installed coincide with those set in the sealed meter firmware.

.6 Connect Digital Meters to 120VAC UPS Source or 125VDC station service source as noted in drawings. Ensure that power supply on Digital Meter is compatible with connected source.

.7 All potential inputs to Digital Meters shall be fitted with protection fuses. Fuses shall be mounted in flip-open style fuse holder that will also provide isolation means for Digital Meter.

.8 Provide power supply fusing protecting each meter independently. Fuses shall be mounted in flip-open style fuse holder that will also provide isolation means for Digital Meter. Fuse holders shall be rated for disconnecting meter power supply under load.

.9 When Digital Meters use comment current and/or potential transformers with Protection Relays, provide Current Transformer shorting switches to allow removal of Digital Meter without disrupting service to other devices.

.10 When Digital Meters are Revenue Sealed, provide current transformer shorting switch to allow removal of Digital Meter for re-certification without taking circuit off-line. Provide isolation means for all voltage-sensing inputs.

.11 Provide protection or additional isolation when the Digital Meter is controlling circuit breakers or other equipment using contact closure. This protection to include but is not limited to): isolation relays, diodes, optoisolators, fuses, surge arrestors disconnect switches and terminals. Coordinate with all other product suppliers to ensure proper rating for relays with regards to closing/open coil requirements and contact ratings, etc.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

.5 Manufacturer shall coordinate to provide a complete factory demonstration of fully operational equipment prior to disassembly and sending to site.

.1 This demonstration to include primary current/voltage injection proving all metering points as well as operational verification of all digital inputs, analog inputs and digital outputs.

.2 Mockup of SCADA system for proving of Digital Metering communications is expected to facilitate demonstration of correct and satisfactory operation of all remote control functions, alarming, monitoring, trending and signalling.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 09 23.01 – Digital Metering

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No.14-10, Industrial Control Equipment.

.2 CAN3-C17- latest edition, Alternating - Current Electricity Metering.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2000(R2008), Industrial Control and Systems: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.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 and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 System riser/block diagram including all hardware, communications links, gateways, converters and computers and connection/integration to existing system.

.2 Samples of all HMI screens to be developed as well as those that are to be modified.

.3 Proposed points list for software level integration to existing and proposed devices included in this contract.

.4 Proposed points list for alarming, trending and alerts.

1.4 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Submittal Procedures.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Storage and Handling Requirements:

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

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

.3 Replace defective or damaged materials with new.

1.7 QUALIFICATIONS

.1 Due to the critical nature of the PSS, the integrator/developer who is to modify the existing PSS system must be an acknowledged representative of the PSS manufacturer and is certified for the programming and commissioning of their software, hardware and systems. Approval of the authorization of this technician and their suitability for performance of this work is the sole discretion of the Departmental Representative.

1.8 SCOPE OF WORK

.1 Scope of work for this project as related to the PSS entails, but is not limited to the following:

.1 Programming and integration of all SCADA, protection and control devices noted in these documents.

.2 Production and programming of new HMI screens based on standards set forth in the existing system.

.3 Modify existing HMI screens as required to support new equipment installed in this contract.

.4 Modify all trending logs, alarms, alerts, reporting and recording for new equipment installed.

.5 Commissioning and installation of all required communication cabling, devices, equipment and accessories required for an operational system to the expectations of these documents.

Part 2 Products

2.1 EXISTING SYSTEM - GENERAL DESCRIPTION

.1 The Power System SCADA (PSS) will be a complete replacement of the existing hardware and software of the system currently installed at the South Side Substation. These devices will connect to the existing server(s).

.2 Existing PSS System Arrangement

.1 The system consists of dual servers, complete with fully redundant RAID storage arrays. One of these servers is located at the PHS control room, the other at the SES control room. These servers will be configured such that in the event of a server failure, complete control will be brought up on the second server. The database for all historical logging and operational logic will be synchronized at both locations.

.2 The digital power meters located in the field will not only monitor standard energy, power quality and breaker status functions, but will also have remote and automated control authority for opening and closing circuit breakers to which they are connected.

.3 Monitoring of electrically related parameters, including transformer winding temperature and electrical room temperatures will be input into digital meters for trending and alarming.

.4 The PSS will provide automated functionality for control of circuit breakers for load control, power factor, priority loading, etc under certain conditions. These automated functions may not be enabled at the conclusion of this project but must be programmed and fully demonstrated in operation.

.5 The PSS will be largely Ethernet based, using direct copper Cat 6 STP (shielded twisted pair) cabling to new devices. New and existing optical fiber cabling will be used to tie into existing equipment on the site, as well as linking in between SES and SSSR.

.6 The PSS will include direct connection to protection relays, motor protection and control devices, and other systems from which information will be read using Ethernet based protocols. This data will include real-time power measurements, as well as alarm data, and general data that will be used for trending. All devices will integrate tightly using native protocols and programming languages.

2.2 EXISTING SYSTEM - PSS SOFTWARE

.1 General

.1 The existing PSS uses Schneider Powerlogic software for SCADA, metering and report generation.

.2 The system shall be modified to monitor and manage energy consumption throughout an enterprise across a network of facilities to improve energy availability and reliability, manage and measure energy consumption and provide trending/alarm for fault identification and resolution.

.3 The software shall be a standard product based on a successful, proven software platform.

Key features shall include:

.1 Data acquisition for metering devices, sensors, and other intelligent electronic devices.

.2 Power Quality analysis (including harmonics, and voltage and current sinusoids).

.3 Graphical displays of information.

.4 Reporting tools with standard reports.

.5 Automated (and manually activated) revenue metering reports for electrical energy and water.

.6 Interactive historical data analysis.

.7 Power Factor monitoring and control.

.8 Load monitoring and control.

.9 Third Party Device Integration through Modbus RTU and Modbus TCP protocols.

.10 Support real-time data display and control actions for multiple users for applications such as sub-metering, load monitoring / shedding, real-time pricing and generator control.

.11 Expansion of system through distributed IO servers.

.2 Redundancy

.1 The PSS will have a layer of redundancy as defined in this section. The redundancy will provide a means to run the PSS software from one of two servers. The redundancy software will determine which server is deemed the most fit to host the PSS software at any given time and run the software from that server.

.1 Handled Faults

.2 The system shall be capable of smoothly handling faults of the following nature: Network, Disk, Fan, Power supply, Temperature, Internal voltage, Memory, Motherboard, BMC, Processor and issues with Host software.

.1 Fault notification

.3 In the event of a fault listed above the PSS shall be capable of immediately notifying a pre-registered recipient of the problem.

.1 System Uptime

.4 The PSS shall have an annual uptime of 99.99%.

.3 Performance

.1 The PSS shall provide communications, view screen and event performance according to the specifications in this section.

.2 Real-Time

.1 Communications

Response Time

The response time of devices in the PSS will be less than or equal to the values below:

Ethernet Device: 0.5 seconds

Serial Device: 1 second

.2 Screens

Update Rate

The update rate of any screen in the system shall be less than or equal to the values below:

Update Rate: 5 seconds

Initial Load Time

The update rate of any screen in the system shall be less than or equal to the values below:

Load Time: 5 seconds

Alarming

Alarm Processing Time

The Alarm Processing Time system shall be less than or equal to the values below:

Load Time: 5 seconds

Alarm Notification Time

The Alarm Notification Time system shall be less than or equal to the values below:

Load Time: 10 seconds

.3 Effect of Off-Line Devices

.1 If any device on a serial loop goes off-line for any reason it shall not have any effect on the communications performance of any of the other devices on the same loop.

.4 Events

.1 Data Logs

.1 The Data Log Retrieval Time from any device shall be less than one minute.

.4 Modifications to the Existing System

.1 All metering and control functionality currently in place with the existing system shall be replicated in these additions to the PSS, including all trend logs, calculations, alarming, monitoring of ancillary inputs, automation, waveform capture and data display.

.2 All graphical interface screens currently in use with the existing System shall be replicated in the new PSS with modifications to correctly show physically and electrically the new electrical distribution. It is the responsibility of the contractor to review existing HMI layouts and functionality to provide the same level of integration, monitoring and recording to equipment added in this project.

.3 Provide new graphical interface screens to summarize power system status, operation, water meters, heater control panels alarms and functionality of the variable voltage system.

.4 Provide new graphical interface screens for each new protective relay or device, including a mimic of the front panel display, readout of all alarms, faults and real-time power data from the device. Operators will be able to remotely reset and control device from this screen.

.5 All HMI screens shall be developed for viewing and operation on all displays on site, sized for 1920x1080 resolution format.

.6 Facilitate new historical logs for new metering points installed.

.7 Create new alarm points and alerts for new devices installed in this contract.

.8 Develop regulator system displays and monitoring for addition of new circuit breaker and connection point.

.9 The existing system has extensive custom programming currently in use for alarming, energy monitoring, revenue billing and trending. Refer also to drawings for layout of existing system, including devices that are to remain in operation. It is the responsibility of the contractor to ensure that all existing functionality is brought forward and replicated in the new PSS.

2.3 PSS SYSTEM – HARDWARE

.1 Industrial Ethernet Switch

.1 Where Ethernet based communications is inside switchgear, control panels, kiosks or unitized electrical equipment, network cabling shall shielded twisted pair (STP), including all patch cords and terminations.

.2 Ethernet switches shall be industrial quality, suitable for mounting inside an enclosure.

.3 Suitable for temperatures from -40 to 85 degree C.

.4 Fiber uplink ports where noted.

.5 Rack and surface mount.

.6 Provide media converters for fibre to copper based Ethernet communications as required.

2.4 PSS SYSTEM – PROGRAM AND OPERATIONS

.1 General Description

.1 The PSS is a tightly integrated SCADA and automation system that collects information, provides alarming, trending and data analysis while also provide specific automatic and remote control of power system equipment.

.2 The PSS will integrate at a software level using ModBUS or similar protocols over Ethernet into motor control/protection relays, power system protection relays, ground fault detection/monitoring systems, air and molded case circuit breakers, and all equipment noted in the drawings.

.3 The existing system has many custom programming elements providing revenue metering, custom alarms, and trending. These must be replicated in the PSS for all new devices.

.4 The Variable Voltage shore power system shall be shall be fully integrated into the SCADA system for parameter editing; and monitoring, logging and display of status, fault and real-time data. The SCADA system will be used for revising current, voltage and protection settings into the shore power system remotely, with appropriate access control. New GUI screens shall be developed to effectively display this information. Status and alarm indications will be integrated into general status and alarming screens with automatic callout functions in the event of a trip or fault condition.

Part 3 Execution

3.1 INSTALLATION

.1 Existing System

.1 Review and thoroughly understand all existing programmed logic and installed hardware of the existing digital metering system, including inputs/outputs that are to be relocated to the automation system or that shall be read using software protocols.

.2 New PSS Devices

.1 Install, test and fully commission all communications cabling to appropriate EIA/TIA Category 6 STP standards prior to connecting to equipment. All communications equipment shall be fully tested and deemed acceptable by manufacturer’s representative prior to connecting to PSS.

.2 All Digital Meters, protection relays, motor controls, circuit breakers and other devices communicating via Ethernet or serial communications shall be configured to use a protocol or language native to both the field devices and the PSS software. Intermediate protocol or language convertors will not be accepted.

.3 All PSS communications equipment shall be grouped together and mounted in the Communications closet co-located at each substation. This equipment shall be arranged to be as compact as possible while not reducing access for maintenance, inspections or additions.

.4 PSS vendor/integrator/contractor shall provide all required time as need to fully commission, program, test and demonstrate the complete PSS system to the satisfaction of the Departmental Representative. This work phase shall be undertaken early enough such that unexpected delays do not hinder or delay to completion of the project to the schedule provided. Deployment of additional forces by the aforementioned parties to complete this project in a timely fashion is expected.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 DEMONSTRATION AND TRAINING

.1 The vendor of the PSS software and integrator shall provide a complete and thorough demonstration of all functionality of the PSS, including simulated alarms, trending, viewing of data, fault finding, waveform capture, sequence of operations, remote equipment operation and navigation around the PSS software.

.2 The demonstration will be conducted three times, with approximately six attendees in each session. Documentation and operational guides shall be provided to all attendees.

.3 Four training sessions shall be provide for four attendees per group. This training would be performed on site, on the actual equipment being operated on, or in meeting room facilities at the site. These sessions, with a duration of approximately 30 hours, upon completion would provide training to give confidence in the operators with regards to the following tasks:

.1 Viewing of data.

.2 Viewing and acknowledging alarms.

.3 Output data/waveforms/alarms to hardcopy or pdf format for export.

.4 Navigation around all standard and custom GUI screens.

.5 Viewing data in protection devices, including fault information and waveform captures.

.6 Basic data manipulation related to trend data (max, min, plotting graphs, etc.).

.7 Use of manual and automatic revenue report generation.

.8 Discussion of basic troubleshooting for normal issues or problems.

.9 Overview of actual installed hardware, servers and software systems, including specification communications topologies and unique operational arrangements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the materials and installation for luminaires for the entire project including exterior lighting fixtures.

.2 Modifications to the existing low voltage exterior lighting control system is included in this scope.

.3 Refer to the drawings for locations, mounting details and additional information.

1.2 REFERENCES

.1 CAN/CSA C22.1-09, Canadian Electrical Code, Part I.

.2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.

1.3 PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit complete photometric and heat dissipation data prepared by independent testing laboratory for proposed luminaires.

1.4 INTENT

.1 Provide lighting fixtures and accessories for all outlets as shown on drawings.

.2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.

.3 Ground all lighting equipment to grounding system.

.4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental Representative before ordering fixtures.

.5 Fixtures of the same or similar type shall be supplied by the same manufacturer.

.6 All fixtures, fasteners and accessory components shall be corrosion resistant and suitable for continuous exposure to a marine environment.

.7 Provide additional relays and programming for control of new exterior lighting provided in this project.

Part 2 Products

2.1 GENERAL

.1 All fixtures, fasteners and accessory components shall be corrosion resistant and suitable for continuous exposure to a marine environment.

.2 Use of plastic or composite components shall be at a minimum and where used shall be UV stabilized and suitable for exposure to a marine environment.

2.2 SOLID STATE LIGHTING

.1 Solid state lighting shall have a CRI greater or equal to the value indicated. In addition, the lamps shall have an R9 value greater then 50 measured under the same conditions as the CRI.

.2 Solid state lighting systems (including required drivers) shall have a power factor greater than 90 at full rated output.

.3 Solid state lighting lumen maintenance data shall be provided for L70 testing.

2.3 FIXTURES

.1 Accessories and components shall comply with relevant CSA Standards.

.2 Except where otherwise noted in the Luminaire Schedule, depth of recessed fluorescent fixtures shall not exceed 150 mm, including mounting yokes, or bridges. Design of reflector and lamp position shall be to provide high efficiency, even brightness and lack of lamp lines.

.3 All metal parts shall be thoroughly cleaned and finished in high reflectance baked enamel over corrosion-resistant primer. Finish as indicated in luminaire schedule.

.4 All internal fixture diffusers, lens panels, lens frames, etc., shall be securely and adequately supported and shall be removable without the use of tools for cleaning.

.5 Fixtures shall incorporate adequate gasketting, stops and barriers to form light traps and prevent light leaks.

.6 Fixtures shall be designed for adequate dissipation of ballast and lamp heat to avoid short ballast life, nuisance thermal tripping and decreased lamp output. Heat test reports by independent laboratories shall be provided where required by the Departmental Representative.

.7 Construction of all fixtures shall be such as to provide a rigid well aligned fixture. Formed or ribbed backplates, end plates, reinforcing channel, heavy gauge sockets, straps, etc., shall be used where required to accomplish this.

.8 The construction and performance of all fluorescent fixtures shall be subject to the acceptance of the Departmental Representative.

2.4 Luminaire Types

.1 **Navigation Lighting** - Red, LED Navigation Lamp with visibility from over 2 nautical miles meeting Canadian Coast Guard requirements. IP 67 enclosure with remote driver located in nearby pullbox. 100 watts power consumption. Connection suitable for 120VAC power with integral inverter. High strength, impact resistant acrylic lenses. Pedestal mounting. 360 distribution with adjustable shutters.

.2 **13000 lumen yard light** – Exterior, mast mounted yard flood light. LED, 3000K, 70 CRI; Medium Flood distribution; 347VAC; 130 watts. Full visor shield. Dark bronze color. Complete with mounting arrangements to suit pole indicated in drawings.

.3 **7500 lumen yard light** - Exterior, mast mounted yard flood light. LED, 3000K, 70 CRI; Medium and narrow Flood distribution; 347VAC; 60 watts. Full visor shield. Dark bronze color. Complete with mounting arrangements to suit pole indicated in drawings.

2.5 LOW VOLTAGE LIGHTING CONTROL

.1 Supply, install and program additional relays to support new lighting circuits added in this project.

.2 Existing lighting control panel is Douglas WE3 system requiring WR-6161 30 amp 347V relays.

.3 Program lighting control system such that new luminaires are scheduled to come on with existing lighting at the South Jetty.

Part 3 Execution

3.1 INSTALLATION AND SUPPORTS

.1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.

.2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.

.3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

.4 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Fixture Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.

.5 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.

.6 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile. Fixtures shall be supported from the quarter points.

.7 Wiring from outlet boxes to fluorescent fixtures and wiring through fluorescent fixture channels shall be rated for 90 degrees C.

.8 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Departmental Representative.

.9 Ensure navigation lights are correctly mounted, aimed and with effective shutter adjustment to ensure no glare or unintended illumination.

.10 Review yard lighting installation with and without visors in place. Review installation with Departmental Representative for most effective arrangement and adjust installation as required.

.11 Confirm correct scheduling and operation of low voltage lighting control system.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the materials and installation for communication cables including shielded and unshielded twisted pair (STP and UTP) copper cables.

1.2 SCOPE

.1 Supply and installation of a data/communication cabling system, complete with complete with provision of cables, connectors, and patch panels as indicated on the drawings and as required for a complete and fully functioning system.

.2 Fibre Optic System to be in accordance with Section 27 05 15.

.3 The complete data/communications system installation is to be in accordance with EIA/TIA-568 Standards.

1.3 REFERENCES

.1 Canadian Standards Association, (CSA International)

.1 CSA-T529-latest edition, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.2 CSA-C22.2 No. 214-latest edition, Communications Cables (Bi-national Standard, with UL 444).

.3 CAN/CSA-C22.2 No. 182.4-latest edition, Plugs, Receptacles, and Connectors for Communication Systems.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA-568-latest edition, Commercial Building Telecommunications Cabling Standards Set.

1.4 SYSTEM DESCRIPTION

.1 Structured system of telecommunications cables (copper) for distributing voice and data, including video signals.

.2 Installed in physical star configuration with separate horizontal and backbone sub-systems. Horizontal cables link work areas to telecommunications closet located on same floor. Telecommunications rooms linked to central equipment room by backbone cables.

Part 2 Products

2.1 CABLE AND CONNECTORS

.1 Each UTP and STP cable shall meet the requirements and will consist of four unshielded twisted pairs of 24 AWG (0.5mm) 100-ohm nominal characteristic impedance, solid round annealed copper conductors insulated with flame retardant polymer.

.2 All cables will be certified/approved by CSA Standard PCC FT4 flammability test and UL CMR.

.3 Where cables are drawn through conduits below grade or encased in ductbank they shall also have an OSP rating, suitable for wet locations.

.4 UTP cables will meet or exceed the requirements in the proposed National Electrical Manufacturers Association (NEMA) Standard for Low-Loss Extended Frequency Premises Telecommunication Cable. The cable will meet the performance requirements of Category cable of the Underwriters Laboratories Inc. specifications and cable surface markings shall indicate this classification.

.5 STP and UTP cabling indicated for data communications shall be Cat 6 rated.

.6 Cat 6 cabling used for SCADA or metering shall be STP.

.7 UTP cabling indicated for telephone only shall be Cat 5e.

2.2 COMMUNICATION OUTLETS AND TERMINAL CONNECTIONS

.1 Data/communications outlets are to consist of an enclosure with flush mounted outlets. Outlets to be complete with quantity of modular RJ45 jacks as indicated on plans.

.2 Cable runs will have 300mm length of cable left coiled up inside outlet box for termination of RJ45 jacks.

.3 All cables shall have all pairs connected using the EIA.TIA standard pin configuration 568A. When combined, telephone jacks are to mount in the top position of outlets, and data jacks in the lower position.

2.3 COVERPLATES

.1 Coverplates are to be brushed stainless steel in accordance with Section 26 27 26 complete with provision for data/communication jacks as indicated on plans.

.2 Cover plates to have 2, 4 or 6 cutouts for jacks.

.3 Provide blank filler plugs for all unused ports.

.4 The wall plates shall be clearly and permanently marked with icon identification for both service types as well as with clear identification of cable/termination numbers.

2.4 PATCH PANELS AND PATCH CORDS

.1 Provide wall or rack mounted horizontal path panels as noted in drawings. Patch panels are to be loose loaded, but fully fitted out with all jacks for the full capacity of the panel. 48 port high density in 2 Rack units (RU).

.2 Provide cable management rings for wall mounted patch panels.

.3 Provide horizontal wire management for rack mounted patch panels (1U in height).

.4 Provide hinged wall mounted blades for wall mounted patch panels.

.5 Label patch panel ports, indicating room locations of all outlets.

.6 Cross-connect ports shall be labelled to correspond to work station address and riser cable number.

.7 Provide cable support bars for wall mounted patch panels.

.8 Based on the functionality, the patch panels will be clearly labeled

2.5 IDC MOUNTING BLOCKS

.1 Voice horizontal cables shall be terminated onto Category 5e "BIX: style mounting blocks complete with BIX distribution connectors in telecommunications room.

.2 Provide BIX mounting blocks complete with BIX distribution connectors for termination of telephone inter-building cable, each end, for cross-connect to telephone horizontal field equipment.

.3 Label BIX connectors, indicating room locations of all outlets.

.4 Label riser cables.

2.6 GROUND BAR

.1 Label bus bar connections.

.2 All patch panels, racks, and cable trays must be bonded to ground with #6 Cu. green insulated ground wire.

2.7 LABELLING

.1 Labels on wall plates and patch panels computer printed, black lettering on white tape. Labelling identification numbering to be as directed by Owner's representative.

.2 All raceways shall be clearly and permanently marked at both ends to indicate destination and function. The markings shall be clearly visible after construction is completed.

.3 All empty raceways shall be clearly and permanently marked at both ends to indicate destination and function. The markings shall be clearly visible after construction is completed.

.4 Each cable shall be clearly marked with a permanent sequential identifier at each end of the cable. All horizontal cable terminations will be labelled at patch panels and at data/comm. outlets. Label of wiring to be the same identifier as the label at the termination point.

2.8 PERFORMANCE REQUIREMENTS

.1 The complete end-to-end installation, including jacks, cables, patch panels, and patch cords shall meet the industry standard performance parameters for enhanced Category 6 as recommended by CAN/CSA-T529, latest revision. Test parameters shall include: Attenuation, Return Loss, NEXT, Power Sum NEXT, ELNEXT, Power Sum NEXT, ELFEXT, ACR, Power Sum ACR, Propagation Delay, and Delay Skew.

Part 3 Execution

3.1 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Communications raceway shall be minimum 20mm EMT conduit stubbed into accessible ceiling space. All cables shall be installed in conduit or cable tray and as indicated on the drawings.

.2 Wires and cable shall be as short as practical except that sufficient slack shall be provided to:

.3 Prevent undue stress on cable forms, wires, and connections.

.4 Enable network components to be removed and replaced during servicing without disconnecting other parts.

.5 Facilitate movement of equipment for maintenance purposes.

.6 Wires and cables shall be placed and protected to avoid contact with rough surfaces or sharp edges. Where wires or cables run through holes in metal, they shall be protected by suitable grommets or bushings.

.7 Clearance between cables and heat emitting or interference generating devices shall be such as to avoid deterioration of these wires and cables due to heat dissipation from these devices, and to comply with industry standards. In particular cables shall have a minimum separation of 150mm from unshielded power lines and 600mm from fluorescent lighting.

.8 The horizontal wiring shall be continuous with no splice points. Bridged taps are not permitted and there will be no cross-connects between the outlet and the patch panel.

.9 The maximum cable length for each run is 90 metres and will allow for 3 extra metres at the work station/field end and 7 extra metres for the patch cord/cross-connect end.

.10 Each cable shall be clearly marked with a permanent sequential identifier at each end of the cable. All horizontal cable terminations will be labelled at cross-connects and at telecommunications outlets. Labelling will include room number or patch panel as per labelling requirements reference.

.11 Horizontal conduit fill must comply with the Canadian Electrical Code requirements.

3.2 INSTALLATION OF BACKBONE CABLES

.1 Install wiring and devices as indicated on plans

.2 The cabling components installed in the structured cabling system shall be warranted for a minimum of 25 years from the date of installation against defects in materials and workmanship.

.3 Leave a pullstring in each data/communications outlet conduit.

.4 Provide bushings on all conduit ends.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Test intra-building telephone cable for continuity.

.3 All data/communications cables shall be tested using testing equipment approved for Category 5e installations.

.4 Testing shall be conducted by authorized representative of cable and hardware manufacturer.

.5 Tests shall be performed from termination block to wall outlet jack on horizontal cables.

.6 Testing set-up shall be for a channel test, maximum length of 95m.

.7 Testing shall include verification of labelling integrity.

.8 Test results shall be documented and shall include the following information in addition to the cable parameters:

.1 Cable ID

.2 Transmit and Receive locations

.3 Test Equipment used to complete the test

.4 Contractor’s name

.5 Technician’s name and signature

.6 Date test was performed

.7 Relevant additional comments

.9 The complete end-to-end installation, including jacks, cables and patch panels shall meet or exceed industry standard performance requirements for Category 6. Cable test parameters are to include: Attenuation, Return Loss, NEXT, Power Sum NEXT, ELFEXT, Power Sum ELFEXT, ACR, Power Sum ACR, Propagation Delay, and Delay Skew. Permanent Link Test is required.

.10 Provide verification of the pin outs to CSA T529, ISDN (T568A) configuration.

.11 Test results must include the Telecommunication Room number from which the cables terminate and indicate the following information:

.1 Telecommunication Room

.2 Room number of outlet box location

.3 Communication jack number.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for fibre optic cable systems

1.2 SCOPE

.1 Installation of a complete fiber optic cabling system, complete with provision of cables, connectors, and patch panels as indicated on plans.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-T529-latest edition, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.2 CAN/CSA-C22.2 No. 182.4-latest edition, Plugs, Receptacles, and Connectors for Communication Systems.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA-568-latest edition, Commercial Building Telecommunications Cabling Standards Set.

1.4 DESCRIPTION OF SYSTEM

.1 Install a complete fiber optic data cabling system as defined on the drawings and in these specifications.

.2 The contract includes the supply and installation of cabling for a complete system, including but not limited to:

.1 Raceways and wireway systems as indicated on plans.

.2 Supply of fiber optic interconnect patch panels and components.

.3 Installation of connectors and terminations for all fibers.

.4 Testing of all fibers.

1.5 WARRANTY

.1 There shall be a minimum one year vendor warranty on all cables, components and equipment including installation. The one year warranty period begins upon substantial performance or when the system is fully functional, whichever is later.

1.6 PRODUCT DATA AND SHOP DRAWINGS

.1 Submit product data and shop drawings in accordance with Section 01 33 00 – Submittal Procedures. This includes any test results provided by the cable manufacturer, and cable test results as specified herein.

.2 Shop drawings to include dimensions and performance characteristics of equipment and cable routing diagrams.

1.7 MAINTENANCE AND OPERATIONAL DATA

.1 Provide maintenance data for all fiber optic cables and equipment for insertion into the project Operations and Maintenance Manual.

.2 Contractor shall supply the Departmental Representative with a complete, up-dated, and accurate set of "As-built" drawings at job completion. These drawings will form part of the project Operations and Maintenance Manual.

Part 2 Products

2.1 CONNECTORS

.1 All fiber connectivity components are to be included in contract.

.2 All fibers will be terminated using LC style epoxy connectors for multimode, and SC style 8º angle polished pigtails fusion spliced for single mode fibers.

2.2 FIBER OPTIC CABLES

.1 Fiber optic cables will be provided and installed by the electrical contractor.

.2 Fibre optic cables shall be:

.1 Singlemode: (strands as noted in drawings) 9µm/125µm indoor/outdoor distribution fibre.

.2 Multimode: (strands as noted in drawings) multimode 50µm/125µm indoor/outdoor distribution fibre.

.3 Provide WHMIS sheets for fiber cable supplied, showing characteristics of cable construction, etc.

2.3 PATCH PANELS

.1 All fibers will be terminated onto patch panels wall or rack mounted as noted.

.2 Electrical contractor is responsible for the supply of all required equipment and components including but not limited to the following:

.1 Cabinets and patch panels

.2 Splice trays

.3 Adapters, connectors, and pigtails

.4 Cable guides as part of an integrated cable management system

.5 Heat shrink sleeves

.3 Fiber splice panels shall be wall mounted.

.4 Fiber patch panels and splice trays shall be rack mounted.

2.4 NETWORK SWITCHES AND MEDIA CONVERTERS

.1 Copper based 1 Gigabit, industrial Ethernet switch. Port count as noted in drawings. Complete with fiber uplink port. Provide all required patch cables.

.2 Fiber to copper Ethernet media converter. Suitable for fiber type and connector style as noted in this documents. Connect as required. Provide all required patch cables.

Part 3 Execution

3.1 FIBER OPTIC CABLING – OTDR TESTING

.1 Test all fibers prior to and after installation to ensure fiber integrity.

.2 Arrange to obtain all required fiber optic cabling. This contractor is to terminate as necessary, and to perform optical time-domain reflectometer (OTDR) tests on cables intended for use on this project, prior to proceeding with, and after completion of installation, to ensure that the fiber optic cables are free from faults. Submit all test results to Departmental Representative.

.3 Transmission testing performance parameters:

Wavelength (nm)	Maximum Attenuation (dB/km)	Min. Information Transmission Capacity (MHz-km)
Multimode 850	3.2	1500
Multimode 1300	1.5	500
Single Mode 1310	1.0	N/A
Single Mode 1550	1.0	N/A

3.2 FIBER OPTIC CABLING – INSTALLATION

.1 Install all runs, terminations and patch panels in strict accordance with industry standards, grouped together by type and in sequence; top down and/or left to right.

.2 All fiber optic cables are to be installed in conduit or cable trays, for protection of cables.

.3 Do not apply excessive tension to the cable. Pulling tension shall be less than the cable manufacturer's recommendation.

.4 The cable shall be installed such that it will not be crushed or damaged during or after installation.

.5 Any damaged cable, or cable installed with excessive force will be replaced by the electrical contractor at no cost to the project.

.6 Do not exceed the minimum bend radius of 20 times cable outer diameter for installation, and 10 times cable outer diameter upon completion of the installation.

.7 Vertical run cables will be supported using intermediate tension relief as recommended by the manufacturer. Use a split wire mesh grip and install the cable from the top down. Vertical cables should be installed using a pulling grip to ensure the stress is placed on the cable itself and not the fiber.

.8 Cabling shall not be installed in 90º elbows or junction boxes unless the minimum bend radius requirements for the cable are met.

.9 If lubricant is used, ensure it meets the manufacturer's recommendations.

.10 Bushings and grommets shall be used on all metal ends, edges, and openings where cables pass through to ensure the cable is not damaged.

.11 Leave a minimum of 1.5m service loop each end of each cable at each point of termination.

.12 Cables will be continuous with no splice points.

.13 Label all individual cables.

.14 Install all fibre runs in separate conduits for other systems cables. Do not install fibre optic cables in conduits with copper cables.

.15 Terminate vertical cabling fibre at the top of each communications rack using LC terminations in a front serviceable fibre patch panel.

.16 Building entry fibre to terminate at the main communications rack using LC terminations in a front serviceable fibre patch panel.

3.3 INSTALLATION INSPECTION

.1 The completed installation will be inspected visually by the Departmental Representative prior to the commencement of functional and electrical performance testing. The installation will be inspected for compliance with the industry standards referenced above, and particular attention will be given to the following criteria:

- .1 Neatness, clamping and harnessing of cables and wiring.
- .2 Wire and cable management, identification, and labeling.
- .3 Overall system completeness.
- .4 Nameplates, identification plates and markings.
- .5 Construction and finishes.
- .6 System grounding
- .7 Mechanical installation including compliance with seismic restraint requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies empty telecommunications raceway systems with either overhead, cabletrough or cellular distribution system.

1.2 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consists of outlet boxes, cover plates, conduits, cable trays, pull boxes, sleeves and caps, fish wires, concrete encased ducts.

Part 2 Products

2.1 MATERIAL

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Underground cable ducts: in accordance with Section 33 65 73 - Concrete Encased Ductbanks and Manholes.

.3 Cable trays: in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.4 Junction boxes and cabinets: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.5 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.6 Fish wire: polypropylene type.

Part 3 Execution

3.1 INSTALLATION

.1 Install empty raceway system, including distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, service poles, miscellaneous and positioning material to constitute complete system.

.2 All conduits left as empty or space must be marked at each end with the termination location.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for fire detection and fire alarm systems.

1.2 REFERENCES

.1 NBC-latest edition, National Building Code of Canada.

.2 Government of Canada

.1 TB OSH Chapter 3-03, latest edition, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.

.2 TB OSH Chapter 3-04, latest edition, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S524-latest edition, Installation of Fire Alarm Systems.

.2 ULC-S525- latest edition, Audible Signal Appliances.

.3 CAN/ULC-S526- latest edition, Visual Signal Appliances, Fire Alarm.

.4 CAN/ULC-S527- latest edition, Control Units.

.5 CAN/ULC-S528- latest edition, Manual Pull Stations.

.6 CAN/ULC-S536- latest edition, Inspection and Testing of Fire Alarm Systems. .10 CAN/ULC-S537- latest edition, Verification of Fire Alarm Systems.

1.3 DESCRIPTION OF SYSTEM

.1 Existing fire alarm system is Edwards EST3 networked system with addressable zones and adequate capacity for the additional zones required.

.2 System is fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital and multiplexing techniques for data transmission.

.3 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to fire department.

.4 The system is fully addressable, zoned, non-coded single stage.

.5 System to be modular in design to allow for future expansion.

.6 Operation of system shall not require personnel with special computer skills.

.7 Emergency Alarm pullstations and annunciation devices are connected to the fire alarm system. Under and Emergency event (blue pullstation) the appropriate strobe is illuminated, horns sound and an automatic call is made to first responders. This is a functionality of the existing system. New Emergency Alarm devices will tie to the existing system as a new zone with this functionality.

.8 Existing system includes:

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.

.2 Power supplies.

.3 Initiating/input circuits.

.4 Output circuits.

.5 Auxiliary circuits.

.6 Wiring.

.7 Manual and automatic initiating devices.

.8 Audible and visual signalling devices.

.9 End-of-line resistors.

.10 Local and Remote annunciators and displays.

1.4 SCOPE OF WORK

.1 Supply and install field wiring, isolation modules, initiation devices, field connection receptacles, end of line devices, audible and visual signalling and all required hardware and acceessories for a complete and operational system as described in these documents.

.2 Provide all programming and verification services to complete the installation as noted in these documents. Existing verification reports and address mapping can be provided for the integrator at the time of installation for further coordination.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 To TB OSH Chapter 3-04.

.2 Subject to PWGSC Fire Protection Engineering Services approval.

.3 Subject to PWGSC Fire Protection Engineering Services inspection for final acceptance.

.4 To Canadian Forces Fire Marshal approval.

1.6 SHOP DRAWINGS

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

.2 Include:

.1 Layout of equipment.

.2 Zoning.

.3 Complete wiring diagram, including schematics of modules, splices, connections, isolation and booster devices.

1.7 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual.

.2 Include:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings.

.4 List of recommended spare parts for system.

1.8 EXTRA MATERIALS

.1 Include four (4) spare glass rods for manual pull box stations if applicable.

.2 Provide one spare device of each type used on site as part of this project.

1.9 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 In accordance with applicable CAN/ULC standards.

2.2 SYSTEM OPERATION

.1 Single stage operation. Operation of any alarm initiating device to:

.1 Cause audible signal devices to sound throughout building.

.2 Transmit signal to fire department via fire alarm transmitter.

.3 Cause zone of alarm device to be indicated on control panel and remote annunciator.

.4 Cause air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.

.5 Cause fire doors and smoke control doors if normally held open, to close automatically.

.2 Capability to program smoke detector status change confirmation on any or all zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

.1 Connect new zones to existing control panel.

2.4 BELL CIRCUIT POWER SUPPLY/BOOSTER

.1 120V, ac, 60Hz input, 24Vdc output from rectifier to operate alarm circuits, with standby power of gell cell batteries minimum expected life of 4 years, sized in accordance with BC Building Code.

2.5 MANUAL ALARM STATIONS

.1 Manual alarm stations: pull lever, glass rod, wall mounted surface type, non-coded single pole normally open contact for single stage English signage.

.2 Provide steel protective guards for pull stations installed where noted.

.3 Edwards – "SIGA-270"

.4 Red pullstations for Fire Alarm; Blue pullstations for Emergency Alarm.

.5 Pullstations are to be in a CSA approved weatherproof enclosure suitable for use with the fire alarm equipment, featuring a lift up front cover. Enclosure shall be red or blue to suit pull station within complete with large lamicoid indicating pertinent system.

2.6 EXTERIOR AUDIBLE SIGNAL DEVICES

.1 Horns: 95dB, weatherproof mounting, 24VDC with accessory hardware as required to suit indicated mounting arrangements.

.2 All audible devices must be programmed to a temporal pattern 3 for fire alarm, as required by the BC Building Code.

2.7 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.8 GRAPHIC DISPLAY

.1 Update existing graphic display at the front entrance gate to support new zones and areas added. A CAD version of the existing graphic will be supplied to the fire alarm vendor for their use, but will require updates and verification work completed under this contract.

2.9 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: flashing red, 24VDC for Fire Alarm Strobe, Blue for Emergency Alarm Strobe.

.2 Designed for surface mounting on exterior applications as indicated in drawings.

.3 Provide accessory mounting hardware to suit installation as noted in drawings.

2.10 ISOLATION MODULES

.1 Addressable zone isolation modules.

.2 Edwards – "SIGA-IM"

2.11 RELAY MODULES

.1 Addressable relay modules.

.2 Edwards – "SIGA-CR"

2.12 WIRE AND CABLE

.1 Conductor Insulation: Minimum rating 300 volts. Single conductor RW90XLPE (X-link).

.2 Multi-conductor cables 105°C with outer PVC jacket, colour coded, FAS rated or similar suitable for installation in below grade raceways subject to expose to ocean water.

.3 Conductor sizes as follows:

.1 To initiating circuits: #18 AWG minimum, and in accordance with manufacturer's requirements.

.2 To signal circuits: #16 AWG minimum, and in accordance with manufacturer's requirements.

.3 To control circuits: #12 AWG minimum, and in accordance with manufacturer's requirements.

.4 Size all fire alarm wiring for maximum 3% voltage drop at maximum load at last device in run.

.4 All wiring to be copper.

.5 All wiring to be tag identified at the points of connection.

.6 Provide a ground conductor with all system wiring and bond all metal parts including device boxes.

.7 All fire alarm system wiring to be in conduit except short drops from ceiling junction box to detectors mounted in T-Bar ceiling may be rated fire alarm system cable.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.

.2 Locate and install manual alarm stations and connect to alarm circuit wiring.

.3 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors.

.4 Connect alarm circuits to main control panel.

.5 Locate and install signal devices, bells, chimes, horns and visual signal devices and connect to signalling circuits.

.6 Connect signalling circuits to main control panel.

.7 Install end-of-line devices at end of alarm and signalling circuits.

.8 Install remote annunciator panels and connect to annunciator circuit wiring.

.9 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.10 Provide “SIGA-IM” isolation module at point where fire alarm cabling enters buildings.

.11 All initiating device wiring shall be Class ‘A’.

3.2 FIELD QUALITY CONTROL

.1 Perform tests as described herein and in accordance CAN/ULC-S537.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, and sprinkler system transmit alarm to control panel and actuate general alarm ancillary devices.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Manufacturer's technician to verify all new devices and reconnected existing fire alarm system equipment and components in accordance with ULC Standard S537.

.5 Provide a Certification of Verification.

.6 After verification, demonstrate and spot test system as required by Departmental Representative and PWGSC Fire Protection Engineering Services.

.7 Class A circuits.

.1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

3.3 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.2 Provide a minum of two, 2 hour sessions scheduled at the benefit of the Deparmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This is a general Section applicable to Sections 33 05 13 (Manholes and Catch Basins), 33 11 16 (Water Utility Distribution Piping), and 33 41 00 (Storm Utility Drainage Piping)

.2 This Section also covers upland bulk excavation of overburden materials at the East Approach Retaining Wall, including clearing and grubbing as required for the work and as shown on the Drawings.

.3 Transportation and disposal of upland bulk excavation of overburden materials at the East Approach Retaining Wall and other upland overburden excavations is to be stockpiled on EGD site at direction of Department Representative.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 11 55 (General Instructions)

.3 Section 01 74 21 (Waste Management and Disposal)

.4 Section 31 24 15 (General Fill)

.5 Section 32 11 16.01 (Granular Sub-Base)

.6 Section 32 11 23 (Aggregate Base Courses)

.7 Section 33 05 13 (Manholes and Catch Basins)

.8 Section 33 11 16 (Water Utility Distribution Piping)

.9 Section 33 41 00 (Storm Utility Drainage Piping)

1.3 MEASUREMENT AND PAYMENT

.1 No separate measurement or payment will be made for excavation associated with the work of Sections 33 05 13 (Manholes and Catch Basins), 33 11 16 (Water Utility Distribution Piping), and 33 41 00 (Storm Utility Drainage Piping) Measurement or payment for bulk excavation of overburden materials at the East Approach Retaining Wall will be made under this Section.

.2 No separate payment will be made for shoring support of excavations or for underpinning of structures.

.3 Measurement and payment for granular fills is covered under Section 31 24 15 (General Fill), Section 32 11 16.01 (Granular Sub-Base) and Section 32 11 23 (Aggregate Base Courses).

1.4 REFERENCES

.1 ASTM Cl17, Test Method for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soils Using Modified Effort (56,000 ft-lb/ft3 (2,700 kN-m/m3))

.4 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.5 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

1.5 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock: any sound or solid mass material in excess of 1.0 cubic metre, of such hardness and texture that can only be effectively loosened or broken down by mechanical ripping equipment and/or by means of heavy duty excavation equipment. Frozen material is not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation, also known as “Soil”.

.2 Minimum Line of Excavation: Line or plane, beyond which no soil or rock will be permitted to protrude.

1.6 SUBMITTALS

.1 Soil Management Plan: At least twenty-eight (28) days prior to commencing upland bulk excavation work, and in accordance with Section 01 33 00 (Submittal Procedures), submit for review by Departmental Representative design, drawings and supporting data prepared by qualified professional engineer registered or licensed in the Province of British Columbia, showing proposed method and sequencing of work and product data for excavation, shoring and underpinning for excavations. The Soil Management Plan shall address removal of surface vegetation, excavation of overburden materials at the East Approach Retaining Wall and other upland overburden excavations, and disposal on-site to an approved location as directed by Departmental Representative.

.2 Waste Reduction Work Plan: At least twenty-eight (28) days prior to start of bulk excavation work, submit detailed Waste Reduction Work Plan in accordance with Section 01 74 21 (Waste Management and Disposal) and indicate:

.1 Descriptions of types and anticipated quantities of materials to be salvaged, reused, recycled and land-filled.

.2 Schedule of excavation, shoring and underpinning.

.3 Number and location of dumpsters.

.4 Anticipated frequency of tippage.

.5 Names and addresses of haulers, waste facilities and waste receiving organizations.

Part 2 Products

2.1 MATERIALS

.1 Bedding and surround of underground services: Granular material as specified in Sections 33 41 00 (Storm Utility Drainage Piping), 33 11 16 (Water Utility Distribution Piping).

.2 Other backfill material below subgrade level: General Fill to Section 31 24 15, or selected material from excavation on site, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 During backfilling, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing to confirm that the gradations, physical and chemical properties, and compaction of the specified backfill materials conform to the relevant Sections of the specification. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.4 During placement, Departmental Representative may, at his discretion, inspect the backfilled materials for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's expense.

.5 Failure of a sample to meet any one of the specified gradation and physical and chemical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative.

Part 3 Execution

3.1 SITE PREPARATION

.1 Prior to start of excavation work, remove obstructions, ice, snow, trees, shrubs and all organic matter from surfaces to be excavated.

3.2 PROTECTION OF EXISTING FEATURES

.1 Comply with Section 01 11 55 (General Instructions) and applicable local regulations to protect existing features.

.2 Existing buried/overhead utilities, retaining walls and buried structures:

.1 Several utilities exist within the work area, such as: electrical power, control and telecommunication lines; electrical duct banks; potable water lines; high mast lighting; fire protection mains; compressed air lines; sanitary sewers and storm water drains.

.2 Many utilities and structures exist within the adjacent areas of the Esquimalt Graving Dock facility.

.3 Protect existing buried/overhead utilities, retaining walls and buried structures from damage while work is in progress and repair damage resulting from work.

.4 Where excavations cross or run adjacent to existing utilities, hand excavate in the vicinity of the existing utilities to determine actual location.

.3 Existing buildings and surface features:

.1 Protect existing buildings, structures, fences, bench marks and monuments from damage while work is in progress and repair damage resulting from work.

3.3 SHORING, BRACING AND UNDERPINNING

.1 Engage services of a qualified Professional Engineer who is registered in B.C. to design and inspect shoring, bracing and underpinning required for work.

.2 Construct temporary works to depths, heights and locations as required for the Works, and as required by the relevant Authorities and Codes.

.3 Shotcrete, if used by Contractor as temporary shoring for excavations, may be left in place permanently, except in the top 0.5 m below final grade. Soil nails, if used by Contractor as temporary shoring for excavations, may be left in place permanently, provided any soil nails are at a minimum depth of 1.0 m below final grade at the shored face and for the full length of the soil nails behind the shored face.

.4 Sheet- piling, if used by Contractor as temporary shoring for excavations, shall not be left in place permanently

.5 During backfill operations:

.1 Remove sheeting and shoring from excavations, except as allowed otherwise in this Section.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

3.4 DEWATERING AND HEAVE PROTECTION

.1 Keep excavations free of water while work is in progress.

.2 Avoid excavation below groundwater (tidal) level, except where indicated on the Drawings.

.3 Protect open excavations against flooding and damage due to surface run-off.

.4 Dispose of water in a manner not detrimental to any portion of work completed or under construction. Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers or the sea.

3.5 UPLAND EXCAVATION

.1 Do all work in accordance with approved Soil Management Plan and Waste Reduction Work Plan (as described in Clause 1.6 of this Section).

.2 Excavate upland overburden soils to the minimum lines of excavation as shown on the Drawings, or if minimum lines of excavation are not shown excavate to lines, grades, elevations and dimensions as indicated.

.3 Protect stockpiled materials from contamination and freezing.

.4 The upland overburden soils required to be excavated are contaminated. Stockpile excavated material on EGD site in accordance with Section 01 35 13.43 (Special Procedures for Contaminated Sites) and as directed by Departmental representative.

.5 The Departmental Representative will be responsible for testing of stockpiled materials.

.6 Excavation must not interfere with the foundation bearing support area at existing adjacent footings, defined as being within lines extending downwards from bottom edges of the footing at 45° outward splay from the vertical plane.

.7 Soil at inverts of excavations to be undisturbed soil or fill, level, free from loose, soft or organic matter.

.8 Notify Departmental Representative when bottom of excavation is reached.

.9 Obtain Departmental Representative approval of completed excavation.

.10 Remove unsuitable material from trench bottom to extent and depth as directed by Departmental Representative.

.11 Where required due to unauthorized over-excavation, correct by backfilling with general fill compacted as specified in Section 31 24 15 (General Fill), or to the specified compaction density for the backfill material for which the excavation was being prepared, as appropriate to the situation.

.12 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

3.6 BEDDING AND SURROUNDING OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated and as specified in Sections 33 41 00 (Storm Utility Drainage Piping), 33 11 16 (Water Utility Distribution Piping).

3.7 GENERAL BACKFILLING AND COMPACTION AT UPLAND EXCAVATIONS

.1 Do not proceed with backfilling operations at upland excavations until Departmental Representative has inspected and approved installations.

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

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

.4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations.

.1 Place bedding and surround material as specified elsewhere.

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

.3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 300 mm.

.6 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum fourteen (14) days or until it has sufficient strength to withstand earth and compaction pressure, and approval has been obtained from Departmental Representative.

.2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalanced loads, and leave in place until removal is approved by Departmental Representative.

.7 Compact general backfill as specified in Section 31 24 15 (General Fill).

3.8 RESTORATION

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes the supply and placement of otherwise unspecified fills in the Work, including trench backfill (between pipe surround and subgrade), and general backfill in excavations at the east end retaining wall and at other locations indicated on the Drawings.

.2 For supply and placement of Engineered Capping materials, refer to Section 35 37 10 (Engineered Capping).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 55 10 (Dust Control)

.3 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.4 Section 32 11 16.01 (Granular Sub-Base)

.5 Section 33 05 13 (Manholes and Catch Basins)

.6 Section 33 11 16 (Water Utility Distribution Piping)

.7 Section 33 41 00 (Storm Utility Drainage Piping)

.8 Section 35 37 10 (Engineered Capping)

1.3 MEASUREMENT AND PAYMENT

.1 General fill for manholes, catch basins, water utility distribution piping, storm utility drainage piping, concrete duct banks and vaults will not be measured separately, but considered incidental to the work. All costs in connection with such general fill shall be included in the relevant unit price tendered under Section 33 05 13 (Manholes and Catch Basins), Section 33 11 16 (Water Utility Distribution Piping), Section 33 41 00 (Storm Utility Drainage Piping), respectively.

.2 Except as described in Clause 1.3.1, general fill shall be measured after compaction in cubic metres of material actually incorporated into work at the various thicknesses shown to neat lines within the areas defined on the Drawings. No measurement will be made for material which is placed on a temporary basis or materials which are subsequently removed.

.3 Except as described in Clause 1.3.1, general fill will be paid for at the unit price tendered for GENERAL FILL. This payment shall be full compensation for supply, sampling and testing, processing, transporting, placing, re-handling, grading, moisture conditioning, trimming and compacting of general fill materials and all related activity necessary to complete the work as specified.

.4 Survey and other quality control activities will not be measured separately, but considered incidental to the work.

.5 Engineered Capping will be measured and paid for under Section 35 37 10 (Engineered Capping).

1.4 REFERENCES

.1 ASTM C117, Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Refer to Clauses 2.1.2 and 2.2.3 of this Section.

Part 2 Products

2.1 GENERAL FILL

.1 General fill shall consist of durable, natural granular material, free of organics, with no more than 8 % by weight passing the 75 μm (No. 200) sieve. Recycled materials from offsite sources, including but not limited to concrete, asphalt pavement, and glass, shall not be used as fill. The maximum particle size shall not exceed 150 mm.

.2 At least twenty-eight (28) days prior to commencing the placement of general fill material, the Contractor shall at his cost identify the proposed off site source(s) and, in accordance with Section 01 33 00 (Submittal Procedures), submit to Departmental Representative for review:

.1 Qualification test data, including material gradation curves, physical and chemical properties for each source, confirming that the proposed material(s) meet or exceed the requirements of this specification. Submit chemical properties in accordance with the requirements of Section 35 37 10 (Engineered Capping). Contractor shall also provide access for qualification sampling by Departmental Representative. Departmental Representative may, at his discretion, collect qualification samples from the proposed source(s) and carry out independent tests, all at no cost to Contractor;

.2 Details of the processing required, if any, to meet the gradation requirements; and,

.3 Details of the ongoing quality control procedures during production.

.3 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise Contractor of the acceptability of the proposed materials and procedures.

.4 During general fill material production, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the general fill materials conform to the specification. The material gradation testing rate for general fill shall be not less than one test for every 100 m3 placed in the work. The testing rate for in-situ compacted density of general fill shall be not less than one test for every **50 m^3** placed in the work; the testing rate for reference dry density (ASTM D1557) shall be not less than one test for every 100 **m^3** placed in the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.5 During placement, Departmental Representative may at his discretion inspect the general fill materials for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's expense.

.6 Failure of a general fill sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative.

Part 3 Execution

3.1 GENERAL

.1 All general fill shall be imported by road transport, unloaded directly within the Work site.

.2 Contractor shall provide adequate flag-persons and/or traffic signal devices to prevent interference with emergency vehicles or traffic of other dock users and contractors.

.3 Priority shall be given to all other traffic over Contractor's construction traffic.

.4 At the end of each working day, sweep roadway and clean up all fallen soil, dust and debris arising from fill deliveries, to Departmental Representative's satisfaction.

.5 Select appropriate fill material and placing methods, provide suitable equipment and sequence the work so that the specified quality of fill is produced.

.6 Fill above water level shall not be placed at temperatures which, in the opinion of Departmental Representative, will cause freezing of the materials before they are adequately compacted.

.7 Ensure no organic material, snow, ice, silt pockets, or other deleterious material is incorporated within the general fill.

.8 Cover or wet down general fill material to prevent blowing dust and sand, in accordance with Section 02 55 10 (Dust Control).

.9 Maintain and protect the general fill against erosion and other damage.

3.2 COMPACTION OF GENERAL FILL

.1 Contractor shall submit his proposed methodology for the compaction of the general fill, not less than twenty-eight (28) days prior to commencing the placing of the general fill. This submittal shall contain:

.1 List and specifications for compaction equipment;

.2 Name(s) and outline of relevant experience of shift superintendent(s);

.3 Proposed methods and sequence of work; and,

.4 A detailed schedule for the work.

.2 Place all general fill in maximum 300 mm lifts and compact to a minimum of 95 % modified Proctor maximum dry density per ASTM D1557 and corrected for oversize materials in accordance with ASTM D4718.

.3 Modify the moisture content of the material as necessary, or as directed by Departmental Representative, to obtain the specified density. If the material becomes excessively moist and cannot be properly compacted, it shall be removed and replaced with a suitable material.

.4 During the work only hand-operated compaction equipment shall be used within a distance of 0.6 m from any concrete structure.

.5 Ensure that the compaction does not impact or damage any structures.

.6 Repair any damage to structures arising from compaction.

.7 Fill densities and moisture contents shall be measured by nuclear methods in accordance with ASTM D2922 and ASTM D3017. All moisture contents measured using nuclear methods shall be confirmed by oven dry method in accordance with ASTM D2216 or microwave method in accordance with ASTM D4643. In the event of a discrepancy between moisture content determinations, the moisture content determined by oven dry method shall apply. Oversize materials shall be determined for each density test and the measured density corrected for oversize materials. Departmental Representative may, at his sole discretion, approve corrections to densities measured with a nuclear gauge for a material type, if Contractor provides site specific and material-specific correlation tests between nuclear density test methods and volumetric test methods approved by Departmental Representative.

.8 If an area of general fill compaction fails to meet the acceptance criteria, conduct additional tests, as directed by Departmental Representative, to delineate the extent of the area. Remediate the area and conduct additional tests, as directed by Departmental Representative, to confirm that the area meets the acceptance criteria. No additional payment will be made for these tests or remediation work.

.9 After compaction, the final surface of the general fill shall be graded to within a tolerance of +/- 25 mm, but not uniformly high or low. For final grade elevations, refer to the Drawings.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes the materials, equipment, installation and testing requirements for concrete-filled steel pipe piles (Type 1), rock socketed concrete-filled steel pipe piles (Type 2), and unfilled pipe piles (Type 3) for the tug boat wharf.

.2 Supply and fabrication of steel pipe piles is covered under Section 31 62 16.20 (Steel Pipe Piles).

.3 Rock sockets for steel (Type 2) pipe piles are covered under Section 31 63 19.13 (Rock Sockets for Piles).

.4 Requirements for extraction and disposal of temporary navigation piles, are covered in Section 01 41 16.01 (Structure Demolition).

1.2 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

.3 Section 01 50 00 (Mobilization & Demobilization)

.4 Section 03 20 00 (Concrete Reinforcing)

.5 Section 03 30 00 (Cast-in-Place Concrete)

.6 Section 03 37 26 (Underwater Placed Concrete)

.7 Section 03 39 00 (General Concrete Requirements)

.8 Section 03 41 00 (Precast Structural Concrete)

.9 Section 09 97 19 (Painting Exterior Metal Surfaces)

.10 Section 31 62 16.20 (Steel Pipe Piles)

.11 Section 31 63 19.13 (Rock Sockets for Piles)

.12 Section 35 37 10 (Engineered Capping)

.13 Section 02 41 16.01 (Structure Demolition)

1.3 MEASUREMENT AND PAYMENT

.1 Supply and installation of steel pipe piles shall be measured and paid for as specified in the Section 31 62 16.20 (Steel Pipe Piles).

.2 Supply and installation of rock sockets shall be measured and paid for as specified in the Section 31 63 19.13 (Rock Sockets for Piles).

.3 Removal of temporary navigation piles are covered in Section 02 41 16.01 Structure Demolition.

.4 All costs associated with design, installation, extraction of any temporary works that Contractor chooses to undertake will be considered as incidental to the Work.

.5 All costs associated with mobilization and demobilization of pile-driving equipment are covered under Section 01 50 00 (Mobilization & Demobilization).

.6 All costs associated with quality control and quality control testing (except as noted otherwise) will be considered as incidental to the Work.

.7 There will be no additional payment for delays or downtime incurred by marine vessel traffic, permit requirements, water quality requirements, closures required by Fisheries and Oceans Canada or other applicable agency, or shutdowns due to Contractor's non-compliance with regulations, permits, the Environmental Management Plan, and the Fisheries Authorization.

.8 Failure of Contractor to satisfy himself as to the acceptable means of undertaking the works in compliance with permits, the Environmental Management Plan, the Fisheries Authorization, and regulatory agency requirements shall not constitute a basis for any additional payment.

.9 Approved Stand-by Time, as defined and explained in Section 01 11 55 (General Instructions), shall be measured and paid for as specified in the Section 01 11 55 (General Instructions).

1.4 REFERENCES

.1 American Society for Testing and Materials, hereinafter referred to as ASTM: ASTM D4945, Standard Test Method for High-Strain Dynamic Testing of Piles.

1.5 DEFINITIONS

.1 See Section 01 11 55 (General Instructions) for all definitions related to the Contract documents.

1.6 SUBMITTALS

.1 At least twenty-eight (28) days prior to mobilization of pile-driving equipment to site, and in accordance with Section 01 33 00 (Submittal Procedures), submit to Departmental Representative a method statement for piling work (as a component of the Construction Work Plan). In the Method Statement provide details of proposed pile installation equipment, work methods, sequencing and construction schedule as follows:

.1 Proposed method for installing Type 1 and Type 3 steel pipe piles. If proposed piling method does not utilize vibratory piling hammer, then submit alternative equivalent method for review by Departmental Representative.

.2 Proposed method of installation of Type 2 steel pipe piles.

.3 Contractor's method designed to reduce underwater sound levels to no greater than 30 kPa at 1.0 m distance from face of pipe pile, and to monitor underwater sound levels during the pile-driving work.

.4 Impact hammers: provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.

.5 Non-impact methods of installation such as augering, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.

.6 Pile layout drawings, general installation sequence and overall construction schedule for pile-driving. For detailed submittal, refer to Clause 1.6.2 of this Section.

.7 Methods for vertical and lateral support of piles during pile installation, including method for protection of coatings against damage.

.8 Proposed method of pile head protection during pile driving, and proposed method of protection from abrasion and / or impact by Contractor's plant and equipment during the Work.

.9 Method of ensuring that the recently placed Engineered Cap is not disturbed.

.10 Repair methodology if Engineered Cap is disturbed during pile installation, or removal of temporary navigation piles and temporary construction piles (if used).

.11 Methodology for the removal of piles.

.2 At least fourteen (14) days prior to commencement of pile driving, and in accordance with Section 01 33 00 (Submittal Procedures), submit detailed pile layout drawings, detailed installation sequence and construction schedule for pile driving to Departmental Representative for review. Show proposed locations of Indicator Piles in each area of the work. Design work sequence to ensure that all pipe piles are installed accurately and correctly.

.3 Submit design details of pile splices, complete with signature and stamp of qualified professional engineer registered or licensed in Province of British Columbia, Canada.

1.7 QUALITY ASSURANCE

.1 Inspection and testing of piling materials may be carried out by testing laboratory designated by Departmental Representative at any time during course of work.

.2 Materials inspected or tested by Departmental Representative which fail to meet contract requirements will be rejected.

.3 Where tests or inspections by designated testing laboratory reveal work not in accordance with contract requirements, the Contractor shall pay costs for additional tests or inspections. Departmental Representative will verify acceptability of corrected Work.

1.8 REQUIREMENTS OF REGULATORY AGENCIES

.1 The scheduling of the piling work shall be carried out in strict accordance with all Acts, Regulations and permit requirements. Contractor shall hold harmless and protect PWGSC from all claims, costs and delays which could or do arise from Contractor's non-compliance with any Act, Regulation or permit requirement.

.2 Notwithstanding the acquisition of permits by Departmental Representative, Contractor shall investigate and satisfy itself as to the acceptable means of undertaking the works in compliance with the permits, the Environmental Management Plan, the Fisheries Authorization, and regulatory agency requirements. However, per Section 01 11 55 (General Instructions), Bidders shall not contact Fisheries and Oceans Canada about any aspect of this project during the tender period.

.3 Contractor shall notify Departmental Representative not less than five (5) days prior to commencing the piling work. If Contractor receives any directive from DFO, then Contractor is to inform Departmental Representative before carrying out any such DFO directive.

.4 Contractor shall notify the Queens Harbour Master and Canadian Coast Guard (MCTS Victoria) not less than fourteen (14) days prior to commencing the piling work, for major marine equipment moves during the work and at completion of the piling work, shall maintain liaison with both those parties as the work progresses, and shall keep Departmental Representative informed of all such communications.

.5 Ensure that equipment used in construction does not block marine navigation.

1.9 EXISTING CONDITIONS AND SITE INFORMATION

.1 For existing jetty conditions, refer to the Reference Drawings and Data Reports listed in the Specification Index.

.2 For geotechnical investigation reports, dive inspection reports (including dive video) and other background data, refer to the Data Reports listed in the Specification Index.

.3 Although the seabed in the area for pile-driving work has been dredged and the old timber piles have been removed, Contractor is informed that Obstructions may still lie fully embedded within the seabed soils in the area of the pile-driving work.

.4 Engineered Capping has been placed on the seabed within the Contractors Work Site. The Engineered Cap is the controlled, accurate placement of clean isolating material or materials to cover or isolate contaminated material from the aquatic environment. Engineered Cap composition and thickness can consist of a single layer of material, or multiple layers of different material types. Within the Contractor's Work Site, several Cap Types have been placed as shown on the Drawings.

.5 Contractor is informed that variable pile-driving conditions may be encountered in the work, especially in the area of the rubble mound foundation for the existing timber crib (as indicated on the Drawings).

.6 Notify Departmental Representative in writing if subsurface conditions at site differ from those indicated and await further instructions from Departmental Representative.

1.10 OPERATING ENVIRONMENT

.1 Management of environmental effects (such as wind, tidal state and sea state) during the work shall be the sole responsibility of Contractor.

.2 The steel pipe piles are to be installed in seawater. The normal tidal range at Esquimalt Harbour is indicated on the Drawings. Extreme tidal elevations including surge effects will exceed the indicated tidal range.

.3 The design ambient temperature range is from -5°C minimum to 23°C maximum.

.4 Historical wind records taken in the vicinity of Esquimalt Harbour may be obtained from Environment Canada.

Part 2 Products

2.1 MATERIALS

.1 Material requirements for piles are specified in Section 31 62 16.20 (Steel Pipe Piles).

Part 3 Execution

3.1 GENERAL

.1 Contractor is responsible for all temporary conditions during construction, including moorage and loads from floating construction equipment and environmental effects during the Work.

.2 Contractor's floating construction equipment shall not impede vessels entering the Esquimalt Graving Dock, or vessels visiting or moored at the North Landing Wharf, or vessels visiting or moored at DND's Naden facility in Pilgrim Cove. Comply with moorage requirements described on the Drawings during non-working hours.

.3 Make adequate provision for access and support of piling equipment during performance of the Work.

.4 Ensure that pile driving and methods of construction do not cause traffic disruptions, damage to existing jetty structures or jetty furniture, damage to existing utilities, or damage to the environment. In the event that Contractor

causes such damage, then he shall be responsible for all necessary repairs at Contractor's own expense.

3.2 PROTECTION

.1 Take all necessary precautions, including the provision of suitable screening fences and barriers to protect public, existing structures, facilities and services from damage due to pile installation and associated works.

.2 Protect existing structures, services and work of other Sections from hazards due to pile-driving operations and against damage caused by Contractor's floating construction equipment, tugboats, or by other construction activities.

.3 Protect public and construction personnel from hazards attributable to pile-driving operations.

.4 Sequence all pile-driving operations and methods to avoid damage to existing structures or to the Engineered Cap.

.5 Protect existing Engineered Cap from damage by pile driving activities, placement of barge spuds or anchors. Monitor the steeply sloping areas of the Engineered Cap after any in-water works have taken place that may impact the Cap. Monitoring shall be carried out by dive surveys and shall include an underwater video record, that will be made available to the Departmental Representative.

.6 Contractor shall visually monitor existing adjacent structures for damage or distress caused by pipe pile driving operations, and submit written monitoring reports to the Departmental Representative on a daily basis during periods when pipe pile driving is occurring within 25 m of the existing structure.

.7 Contractor shall survey existing adjacent structures to monitor for settlements / movements caused by pipe pile driving operations, and submit written monitoring reports to the Departmental Representative on a weekly basis during periods when pipe pile driving is occurring within 25 m of the existing structure. The monitoring surveys shall achieve an accuracy of +/- 5 mm in each orthogonal direction (plan and elevation). The nominated adjacent structures are:

.1 The timber crib (concrete faced), crib parapet wall, and the graving dock south entrance wall (built circa 1925), as far east as berthing sill #1.

.2 The steel-piled concrete jetty structure (1985).

.3 The tied-back sheet-piled bulkhead wall (1985).

.4 The high mast light foundation (2016).

.5 The small concrete retaining wall at the east end of the project site (1985).

.8 Contractor shall, within twenty-four (24) hours, repair any damage made to the existing jetty structures, jetty furniture, or utilities and restore to original or better condition at Contractor's sole expense.

3.3 PREPARATION

.1 Make provision for access and support of piling equipment during performance of Work.

.2 Use highly visible, contrasting colour of paint to clearly mark each pile with its number and its overall length. In addition, clearly mark each pile at intervals of 305 mm on opposing faces along its full length prior to driving. As a minimum, label every fifth mark with the appropriate value from pile tip.

3.4 PILING SEQUENCE AND INDICATOR PILES

.1 Contractor shall sequence the pile driving work to minimize construction duration.

.2 At the start of pile driving work for jetty support piles, install Indicator Piles to confirm pile lengths required for the work and to confirm driving criteria, as follows:

.1 A total of ten (10) Indicator Piles are required, of which five (5) shall be located within the west jetty area, and five (5) shall be located within the east jetty area.

.2 Contractor and the Departmental Representative shall decide on the best locations for the indicator piles.

.3 Of the five (5) Indicator Piles in the west jetty area, one (1) of these piles shall be a 914 mm diameter pile (located at 10/K). The remaining four shall be 762 mm diameter piles, with one located at 2/B1 and one located at 2/F1. The remainder to be spread evenly over the rest of the west jetty footprint.

.4 Of the five (5) Indicator Piles in the east jetty area, three (3) piles shall be 914 mm diameter piles, and two (2) piles shall be 762 mm diameter piles. The piles shall be spread evenly over the east jetty footprint.

.5 The location of the piles shall be to the Departmental Representative's approval.

.3 Upon acceptance of their installation by Departmental Representative, Indicator Piles will be incorporated into the work as jetty support piles, and will be measured and paid for as jetty support piles.

3.5 PILE DRIVING

.1 Pile-driving, re-driving and extraction work shall be in conformance with the Fisheries Authorization and Approvals for the Project, the Environmental Management Plan, and the requirements of this Section.

.2 Carry out pile driving, re-driving and extraction work in conformance with Township of Esquimalt noise by-laws, and City of Colwood noise by-laws.

.3 Use pile-driving equipment appropriate for the soil conditions. Use pile-driving equipment that generates the minimum amount of energy necessary to drive the piles.

.4 Use pile driving methods that will minimize the disturbance to the existing Engineered Cap.

.5 Select equipment suitable for installing piles into bedrock or dense granular or till-like soils without damage to the pile. The hammer should have adjustments to vary energy level for various expected ground conditions, such as driving shorter piles into rock, or longer piles into till. If a single-acting diesel hammer is used, it shall have a manufacturer's rated energy of no less than 512 kN-m (377 kip-ft).

.6 Submit details of pile driving equipment, in accordance with Clause 1.6 of this Section. Departmental Representative will provide termination criteria for pile installation upon review of proposed pile driving equipment; allow seven (7) working days for Departmental Representative's review.

.7 If proposed method to drive piles into the seabed does not utilize vibratory piling hammer, then submit alternative equivalent method for review by Departmental Representative, in accordance with Clause 1.6 of this Section.

.8 When required criteria as determined by Departmental Representative cannot be achieved with the proposed hammer, propose larger or alternate hammer as required and allow seven (7) working days for Departmental Representative's review.

.9 At start of, and during pile-driving work, monitor underwater sound pressures to confirm that the pressures do not exceed the maximum allowable levels.

.10 Underwater noise during pile-driving shall be controlled and monitored in accordance with the following performance criteria:

.1 Underwater sound levels shall not exceed 30 kPa at 1.0 m distance from the face of pipe pile;

.2 If underwater sound levels exceed 30 kPa at a distance of 1.0 m from the face of pipe pile, modify the pile -driving method to reduce the intensity of the sound generated to below the 30 kPa limit.

.11 Sequence the pile-driving work to minimize construction duration

.12 In the event that underwater sound levels exceed the performance criteria, implement mitigation measures to reduce underwater overpressure to comply with the performance criteria. The design of the mitigation measures shall be the responsibility of Contractor, but must meet DFO requirements and adhere to the Fisheries Authorization for the Project, including the Environmental Management Plan.

.13 Contractor shall provide equipment and all accessories necessary to install the piles as specified and to meet driving criteria as determined by Departmental Representative and as confirmed by Pile Driving Analyzer (PDA) testing.

3.6 INSTALLATION – TYPE 1 AND TYPE 2 DRIVEN PILES

.1 Acceptance of each installed pile will be subject to approval of Departmental Representative.

.1 Departmental Representative will be sole judge of acceptability of each pipe pile with respect to final driving resistance, depth of penetration, installation accuracy or other criteria used to determine load capacity.

.2 Do not remove pile-driving equipment from site until Departmental Representative has accepted final driving of all piles.

.2 All piles are to be installed open-ended.

.3 Drive each pile to termination criteria (practical refusal) into bedrock or dense granular or till-like soils. Termination criteria is anticipated to occur at approximately the tip elevations indicated on the Drawings. Termination criteria will depend on Contractor's proposed hammer, and is anticipated to be 15 blows per 25 mm of penetration using a Delmag D150 diesel hammer. Termination criteria for other equipment will be provided by Departmental Representative's geotechnical consultant after Departmental Representative's review of proposed pile driving equipment. Termination criteria will be confirmed in the field after driving of the Indicator Piles and testing with a Pile Driving Analyzer (PDA).

.4 Use driving caps and cushions to protect piles as necessary. Reinforce pile heads if necessary. Piles with damaged heads after cut-off will be rejected by Departmental Representative.

.5 Suitable vibratory hammer may be used for initial driving provided the last 5 m of pile installation is done with an impact hammer to determine penetration resistance and final set.

.6 Contractor shall be responsible for any damage to the pipe piles, and related costs for pile replacement if warranted.

.7 Hold piles securely and accurately in position while driving. Deliver hammer blows along axis of pile. Ensure pile is not overstressed.

.8 Drive all piles continuously to final penetration. Drive the last 5 m of pile above bedrock at location with hammer energy reduced to 50% of the rated energy to minimize the risk of damaging the pile when bedrock is encountered.

.9 Do not drive piles within 20 m of concrete which has been in place less than seven (7) days, including rock sockets.

.10 Survey the elevation of top of pile after installation and after piles within 10 m are installed to check for heave. Re-drive already driven piles which heave or lift more than 5 mm during driving of adjacent piles to re-establish set.

.11 Support all piles laterally to prevent damage to the piles until the formwork or pile caps provide adequate lateral support.

.12 Ensure that the leads of the pile-driving equipment do not exert lateral forces on the piles during driving. No adjustment of a possible misalignment will be permitted during driving, except at the very initial stage.

.13 During pile-driving, provide rubber rollers (or similar technique) for lateral support and to protect pile coating from damage.

.14 Ensure that pile driving equipment, including the hammer, leads, gates and other components that could "catch" coating and coating repairs, has provision to eliminate damage to the coating and coating patches during handling and driving. Submit, for review and approval, procedures, equipment modifications and measures that will accommodate the coating system.

.15 If conditions are encountered which make it difficult to drive a pile in the location shown and to advance the pile to the termination criteria, employ all reasonable means to advance the pile.

.16 Re-strike selected piles (up to 10 % of total number of piles) after a waiting period of one week or more, as directed by Departmental Representative, in order to check final set and assess any increase in capacity.

3.7 INSTALLATION OF TYPE 2 ROCK SOCKETED PILES

.1 Piles shall be installed open ended and advanced to bedrock, cleaning out as installation proceeds or by other means without damaging the pile or pile tip. Advancement method is the responsibility of the contractor.

.2 All pile tips shall be provided with a fabricated sacrificial pile shoe.

.3 Advancement of the pile to the required depths into bedrock may require pre-boring/drilling ahead of pile tip and/or fitting of sacrificial pile shoes capable of grinding through the hard granitic bedrock. Design of an appropriate pile shoe and advancement method is the responsibility of the contractor. Failure to reach the specified depth may require that the pile be abandoned or pulled out.

.4 Install steel casing by drilling and/or percussion methods a minimum distance equal to 1.0 m (as measured from the high side of bedrock surface) into bedrock, or to a depth as directed by the departmental representative to seat pile casing into bedrock as indicated in the drawings.

.5 Casing bits or under-reaming tools shall have maximum outside diameter that is 10mm larger than the outside diameter of the steel casing.

.6 The use of impact hammers shall not be permitted to seat type 2 piles into bedrock.

.7 Churn drilling methods shall not be permitted to seat type 2 piles into bedrock or construct sockets in bedrock.

3.8 FIELD SPLICES

.1 Make field splices only with written authorization of Departmental Representative. Splice piles in place during installation by complete joint penetration groove welds. To prevent distortion, tack opposite points first and then weld opposite sections. Use a backing ring for field splices. Hold members in alignment during splicing.

.2 Field welds shall be in accordance with CSA W59 Clause 11. Field splices shall be inspected and tested as specified for shop splices in Section 31 62 16.20 (Steel Pipe Piles).

3.9 INSTALLATION TOLERANCES

.1 Pile heads shall be within 75 mm of locations indicated on the Drawings.

.2 Piles shall not be more than 1/100 (1%) of length out of vertical alignment.

.3 Tolerances specified in Clauses 3.8.1 and 3.8.2 shall be met after all piles are driven.

3.10 DAMAGED OR DEFECTIVE PILES

.1 The integrity of the pipe piles shall remain at all times the responsibility of Contractor. Should any pile be damaged by overdriving or by pile installation techniques or other causes including attempting to pass an Obstruction, or be out of position as a result of improper survey or driving practice, drive an extra pile or piles in its place as directed by the Departmental Representative. Extract rejected piles and replace with new ones. No extra compensation will be made for removing and replacing piles, driving extra piles or other work made necessary through rejection of a defective or damaged pile.

.2 If, in the judgment of the Departmental Representative, the Contractor is unable to properly complete installation of any pile by resorting to reasonable methods, Departmental Representative may order an additional pile or piles to be installed for which the Contractor will be paid as an extra work item in accordance with the Contract. Piles abandoned because of Obstructions, as approved by the Departmental Representative, will be paid for as completed piles. Such abandoned piles may be removed if required by the Departmental Representative and their removal paid as an extra work item in accordance with the Contract.

.3 Repair all damaged sections of pile coating, both above and below the water level as specified in Section 31 62 16.20 (Steel Pipe Piles) and Section 09 97 19 (Painting Exterior Metal Surfaces). Ensure that personnel completing such repairs above water have been trained by the coating representative. Repairs completed below water shall be completed using a material suitable for application below water. Application below water shall be by personnel experienced with such application. Inspections by Departmental Representative shall not relieve the Contractor of his obligations for quality control.

3.11 PILE CUT OFF

.1 Cut off pipe piles neatly and squarely at the elevations indicated to tolerance of +/- 25 mm. Provide sufficient length above cut-off elevation so that the part damaged during driving is cut off. Remove cut-off lengths from site.

3.12 CONCRETE INFILL

.1 For pipe piles that are to receive concrete fill, perform internal visual inspection of steel pipe, joints and base prior to placing of concrete. Ensure pipe inside is free from foreign matter.

.2 Assemble and install reinforcement cages as indicated.

.3 Fill steel pipe piles with concrete as shown on the Drawings, using methods to limit free fall and to prevent segregation. Install concrete in accordance with Section 03 39 00 (General Concrete Requirements) and Section 03 37 26 (Underwater Placed Concrete). Ensure adequate vibration to completely fill cross section of pipe.

.4 Set dowels in concrete in accordance with details as indicated, and secure dowels until concrete is set.

3.13 PILE TESTING – TYPE 1 AND TYPE 3 PILES

.1 Departmental Representative will select a Pile Driving Analyzer (PDA) testing firm to evaluate hammer performance, estimate pile capacity, and confirm termination criteria.

.2 PDA testing will be performed in accordance with ASTM D4945 on twenty (20) selected piles during initial driving, as directed by Departmental Representative, and on ten (10) selected piles during re-strike.

.3 Additional piles may be selected for PDA testing depending on types and nature of hammers employed by Contractor.

.4 Additional piles may be selected for PDA testing if problems are encountered during pile driving.

.5 The Contractor shall notify Departmental Representative fourteen (14) days prior to driving the piles so that Departmental Representative can arrange for the PDA testing. The Contractor shall allow for the cost of providing assistance for PDA testing for up to thirty (30) selected piles as required by Departmental Representative.

.1 Departmental Representative's PDA testing firm will prepare piles to be instrumented by drilling and tapping holes for installation of strain transducers and accelerometers.

.2 Contractor to provide access as needed for Departmental Representative's PDA testing firm to set up instruments near the pile top as described above.

.3 Contractor to make allowance for probable interruption in driving for:

.1 Changing/modifying hammer, cap, cushions, or other equipment;

.2 Replacing/adjusting of transducers and accelerometers.

.6 Departmental Representative will use the PDA results to assess the capacity of piles and may request driving to deeper pile penetration, if required to achieve the design capacity.

3.14 PILE TESTING – TYPE 3 PILES

.1 Perform 1 compression pile test and prepare reports in accordance with ASTM D1143 except as specified .

.2 Pile testing alternatives to ASTM D1143 where end-bearing and shaft resistance of rock sockets can be determined using load application with instrumentation will be accepted, subject to review and approval of the Departmental Representative.

.3 Test pile location shall be selected by the Departmental Representative.

3.15 PILE INSTALLATION RECORDS – TYPE 1 AND TYPE 3 PILES

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

.1 Date, weather and tidal levels.

.2 Type and make of hammer, stroke and related energy.

.3 Other driving equipment including water jet, driving cap, cushion block type and thickness.

.4 Pile size, overall length, length pitched in the leads, splice positions, and location of pile.

.5 Sequence of installation of piles in pre-selected pile numbering system.

.6 Blow counts for each 305 mm of penetration for entire length of pile and for each 25 mm for the final 150 mm of penetration.

.7 Impact rate at least every 5.0 m of penetration including final set.

.8 Confirmation of any clean-out undertaken during driving to bedrock, and depth of soil plug at start and finish of clean-out.

.9 Elevation of bedrock where bedrock is encountered.

.10 Seating procedures where relevant.

.11 Final tip and cut-off elevations.

.12 Elevation of adjacent piles before and after driving of each pile.

.13 Other pertinent information such as interruption of continuous driving, pile damage.

.2 Provide Departmental Representative with pile driving records for all piles driven or partly driven at the end of each work shift.

.3 Provide Departmental Representative with three (3) copies of all pile driving records at completion of the Work.

3.16 PILE INSTALLATION RECORDS – TYPE 2 PILES

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

.1 Date, weather and tidal levels.

.2 Type and make of hammer, stroke and related energy used to install the pile through the overburden.

.3 Type and make of drill and/or percussion hammer used to seat piles into bedrock.

.4 Pile size, elevation at which bedrock was first encountered, and bottom elevation of the casing.

.5 Sequence of installation of piles in pre-selected pile numbering system.

.6 As built socket size, top elevation of socket, base elevation of socket, base elevation of the reinforcing steel cage installed in the socket, and location or designation of the socket.

.7 Time (to the nearest minute) consumed to drill the socket, clean the socket, insert the steel reinforcing cage, and concrete the pile. Provide time for each activity separately.

.8 Concrete volume required to fill each socket. Also, indicate the estimated theoretical concrete volume for each socket. Where the actual concrete volume exceeds the theoretical volume, provide an explanation.

.9 Other pertinent information such as interruption to pile installation, pile damage.

3.17 CLEANING

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes the requirements for supply and fabrication of concrete-filled steel pipe piles for jetty structures (and unfilled piles for the tug boat wharf), including welding inspection and testing

.2 Installation of concrete-filled steel pipe piles for jetty structures (and unfilled piles for the tug boat wharf), including requirements for Pile Driving Analyzer (PDA) testing, is covered under Section 31 61 13 (Pile Foundations General Requirements).

.3 Rock sockets for steel pipe piles are covered under Section 31 63 19.13 (Rock Sockets for Piles).

.4 Coating for steel pipe piles is covered under Section 09 97 19 (Painting Exterior Metal Surfaces).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 50 00 (Mobilization & Demobilization)

.3 Section 03 20 00 (Concrete Reinforcing)

.4 Section 03 30 00 (Cast-in-Place Concrete)

.5 Section 03 37 26 (Underwater Placed Concrete)

.6 Section 03 39 00 (General Concrete Requirements)

.7 Section 03 41 00 (Precast Structural Concrete)

.8 Section 09 97 19 (Painting Exterior Metal Surfaces)

.9 Section 31 61 13 (Pile Foundations General Requirements)

.10 Section 31 63 19.13 (Rock Sockets for Piles)

.11 Section 35 37 10 (Engineered Capping)

1.3 MEASUREMENT AND PAYMENT

.1 Steel pipe piles will be measured in linear metres of pipe pile actually incorporated into the work, measured from tip elevation to cut-off elevation at pile cap.

.2 Steel pipe piles will be paid for at the relevant unit prices tendered, as listed below. Payment shall include for all costs in connection with supply and installation of steel pipe piles as specified and as shown on the Drawings, including coatings where specified, and all costs for quality control testing. For

costs associated with Pile Driving Analyzer testing and assistance thereof, see clause 1.3.13 of this Section.

.1 JETTY SUPPORT PIPE PILES (762 DIA, COATED).

.2 JETTY SUPPORT PIPE PILES (762 DIA, UNCOATED).

.3 JETTY SUPPORT PIPE PILES (914 DIA, COATED).

.4 JETTY SUPPORT PIPE PILES (914 DIA, UNCOATED).

.5 DISPLACEMENT CONTROL PILES (762 DIA, UNCOATED).

.6 TUG BOAT WHARF PILES (914 DIA, COATED).

.7 TUG BOAT WHARF PILES (914 DIA, UNCOATED).

.8 EAST END RETAINING WALL PILES (762 DIA, UNCOATED)

.3 The supply and installation of splices, pile tip reinforcement, pile shoes, cap plates (where required) and other miscellaneous steel fabrications will not be paid for separately, but shall be included in the unit prices for pipe piles covered by this Section.

.4 No additional payment will be made for pile coating beyond the coating limits shown on the Drawings.

.5 All costs associated with manipulating and/or restraining the upper end of driven piles to facilitate the fit-up and squared-off installation of the precast concrete pile caps and fender panels as described on the Drawings and to the erection tolerances specified in Section 03 41 00 (Precast Structural Concrete) and in Section 31 61 13 (Pile Foundations General Requirements), will be considered as incidental to the Work.

.6 The supply and installation of the concrete and concrete reinforcing for the pile to pile cap connection, for concrete infill, and for rock sockets shall be measured and paid for as specified in the relevant Sections

.7 All costs associated with mobilization and demobilization of pile-driving equipment are covered under Section 01 50 00 (Mobilization & Demobilization).

.8 All costs associated with quality control and quality control testing (except as noted otherwise) will be considered as incidental to the Work.

.9 Departmental Representative will arrange and pay for Pile Driving Analyzer testing as specified in Section 31 61 13 (Pile Foundations General Requirements). All costs associated with assistance with Pile Driving Analyzer testing will be considered as incidental to the Work.

1.4 REFERENCES

.1 American Petroleum Institute (API) Spec 5L, Specification for Line Pipe.

.2 ASTM A27/A27M, Standard Specification for Steel Castings, Carbon, for General Application.

.3 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.4 CSA W47.l, Certification of Companies for Fusion Welding of Steel.

.5 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (developed in cooperation with the Canadian Welding Bureau).

.6 CSA W59, Welded Steel Construction.

.7 CSA W178.1, Certification of Welding Inspection Organizations

.8 CSA W178.2, Certification of Welding Inspectors.

.9 CAN/CSA Z245.1, Steel Line Pipe.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 At least twenty-eight (28) days prior to the start of fabrication submit to Departmental Representative for review, in accordance with Section 01 33 00 (Submittal Procedures), the following:

.1 Proposed pile source, pile type and details, schedule indicating proposed lengths of piles and splices, pile shoes, pile tip reinforcement, welding procedures and electrodes, with drawings and schedules as may be necessary. Provide adequate information to demonstrate that the metallurgy of the weld metal will match the metallurgy of the base metal.

.2 Mill certificates for steel piles, pile shoes and tip reinforcement materials signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties. Steel producer certificates to be provided in accordance with ASTM A572/A572M, ASTM A1008/A1008M and ASTM A1011/A1011M, and mill test reports in accordance with CAN/CSA-G40.20. Provide one (1) Charpy V-notch test result per heat.

.3 Certified test reports on fabrication welds and field splice welds. Provide certification for fusion welding in accordance with CSA W47.1 and CSA W47.1S1.

.4 Details of procedures and methods to avoid damaging the pile coating during transporting, handling and installing the piles as well as during general construction activities of the Work.

1.7 QUALITY CONTROL

.1 Welding practice and qualifications of fabricators shall conform to CSA W47.1 and CSA W59. Fabricator qualification shall conform to CSA W47.1 Division 2.1.

.2 Perform quality control inspection and testing on all welds. Quality control welding inspection and testing shall be carried out by a qualified independent agency approved by Departmental Representative, and all such inspection and

testing shall be deemed incidental to the Work. Quality control welding inspection shall be carried out in accordance with CSA W59 Clause 7. In addition to visual inspection, ultrasonic non-destructive testing (NDT) will be required for welds as specified.

.3 Perform quality control inspection and testing on coatings, as described in Section 09 97 19 (Painting Exterior Metal Surfaces). Quality control coating inspection and testing shall be carried out by a qualified independent agency approved by Departmental Representative, and all such inspection and testing shall be deemed incidental to the Work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Take special care to prevent damage to coated pipe piles.

.2 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.

.3 Use only nylon slings for handling of coated pipe piles. Do not use wire rope slings or metal pry bars.

.4 Stack pipe piles for transportation or storage using suitable padding to prevent contact between pipes or between pipes and transport carrier. Support bottom tier of pipe piles on timber saddles covered with suitable padding material. Use only padded nylon straps or polyethylene rope to secure pipe piles during transportation.

.5 Deliver new, undamaged materials to site, accompanied by certified test reports, with manufacturer's logo and mill identification mark provided on pipe piles.

.6 Store pipe piles above ground on wood supports or dunnage. Contact surfaces of supports or dunnage shall be smooth and covered with suitable padding material.

.7 Store pipe piles within designated laydown areas or on delivery barge. Ensure pile storage does not interfere with EGD operations, waterside or landside.

.8 Replace damaged piles as directed by Departmental Representative.

Part 2 Products

2.1 STEEL PIPE

.1 Steel pipe for piling shall be longitudinally welded pipe conforming to CAN/CSA-Z245.1 Grade 359 Category 1, or to API Specification 5L Grade X52.

.2 Spiral welded pipe shall not be used in the work, unless full technical and performance equivalence (including dynamic performance under cyclic loading) is demonstrated by Contractor to the satisfaction of Departmental Representative.

2.2 OTHER MATERIALS

.1 Rolled Steel for Backing Rings, Shear Rings, Steel Plate: to CAN/CSA G40.21, Grade 300W.

.2 Pile tip reinforcement: to CAN/CSA G40.21, Grade 300W.

.3 Pile driving shoes: to ASTM A27, Grade 65/35 or better.

.4 Welding Consumables: to CSA W48 series. The metallurgy of deposited weld metal shall match that of the base metal. Tensile strength of weld metal shall exceed tensile strength of base metal.

.5 Pile coating: refer to Section 09 97 19 (Painting Exterior Metal Surfaces).

2.3 FABRICATION

.1 Fabricate and supply full length piles to eliminate splicing during installation wherever possible.

.2 Splice piles only with written approval of Departmental Representative.

.1 When permitted, provide details for Departmental Representative review.

.3 Ensure correct alignment of spliced parts and use the minimum number of welds. Do not use pipe segments less than 3 metres long for pile fabrication.

.4 Carry out welding in accordance with CSA W59 Clause 11. Use complete joint penetration welds to splice pipe pile lengths.

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

.6 Except where field splices are unavoidable, splice piles in a workshop or similar protected and equipped facility to ensure good quality splices. Manipulate lengths to be joined in jigs so that only down-hand welding is employed.

.7 Use a backing ring for all welded splices of pipe piles. Tack weld backing ring to the inside of one section.

.8 Stagger the longitudinal welds of pile lengths to be joined by 90 degrees

.9 Do not weld until the end preparation of pipe sections has been inspected and approved by the Contractor’s quality control inspection and testing agency.

.10 Install pile tip reinforcement, splices, driving shoes and shear rings as indicated.

.11 Use internal pile shoes, unless noted otherwise. Use external pile shoes at displacement control piles that are to be rock-socketed.

.12 Tolerances shall conform to the following:

.1 Axial Alignment: Maximum deviation of the line of the pile at the splices not to exceed 3 mm when compared with a 3 metre straight edge.

.2 Straightness: Deviation from straight line over total length of fabricated pile shall not exceed L/1000, where L is the total length of the pile.

.3 End Squareness: When any pile section is placed with its end in contact with a plane perpendicular to the pile axis, no part of the circumference shall be more than 1.5 mm away from the plane.

.4 Matching of Ends: Root edges or root faces of lengths of piles that are to be butt welded shall not differ by more than 3 mm. Set up pile lengths so that the differences in dimensions are matched as evenly as possible.

2.4 FABRICATION AND QUALITY CONTROL

.1 All joint preparation and completed welds shall be visually inspected for conformance with the requirements of CSA W59 Clause 11.

.2 In addition, the full length of all pipe pile welded splices including splices for tips shall be inspected by means of ultrasonic testing in accordance with CSA W59 Clause 7, and shall be considered acceptable if they meet the acceptance criteria of CSA W59 Clause 11 for welds subject to tensile stress.

.3 Remove and replace portions of welds not meeting the acceptance criteria. Re-inspect repaired welds.

.4 Departmental Representative, at his sole discretion, may carry out additional quality assurance inspection and/or quality assurance testing of welds and splicing. Such additional inspection and/or testing will not augment or replace the Contractor's quality control, nor relieve him of his contractual responsibility.

.5 If Departmental Representative's inspection of a weld or splice should indicate poor alignment of the pipe, insufficient penetration of the weld, lack of fusion, slag inclusion, porosity, or otherwise fail to meet the requirements of this Section, take the necessary corrective measures to provide a full strength weld to the satisfaction of Departmental Representative. The cost of correcting defective welds and retesting shall be borne by the Contractor.

Part 3 Execution

3.1 GENERAL

.1 Install piles and place concrete infill in accordance with Section 31 61 13 (Pile Foundations General Requirements), Section 03 30 00 (Cast-in-Place Concrete), Section 03 37 26 (Underwater Placed Concrete), and Section 03 39 00 (General Concrete Requirements).

.2 Install rock sockets in accordance with Section 31 63 19.13 (Rock Sockets for Piles), Section 03 30 00 (Cast-in-Place Concrete), Section 03 37 26 (Underwater Placed Concrete), and Section 03 39 00 (General Concrete Requirements).

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the construction of rock sockets for steel pipe piles (Type 2 Piles), where required and as shown on the Drawings.

.2 Supply and fabrication of steel pipe piles is covered under Section 31 62 16.20 (Steel Pipe Piles). Coating for steel pipe piles is covered under Section 09 97 19 (Painting Exterior Metal Surfaces).

.3 Installation of concrete-filled steel pipe piles for jetty structures (and unfilled piles for the tug boat wharf), including use of pile driving analyzer, is covered under Section 31 61 13 (Pile Foundations General Requirements).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 20 00 (Concrete Reinforcing)

.3 Section 03 30 00 (Cast-in-Place Concrete)

.4 Section 03 37 26 (Underwater Placed Concrete)

.5 Section 03 39 00 (General Concrete Requirements)

.6 Section 09 97 19 (Painting Exterior Metal Surfaces)

.7 Section 31 61 13 (Pile Foundations General Requirements)

.8 Section 31 62 16.20 (Steel Pipe Piles)

1.3 MEASUREMENT AND PAYMENT

.1 Measure drilling of sockets for rock sockets in metres from bottom of steel pipe pile (as recorded at start of rock socketing procedure) to bottom of drilled hole. Removal of material from interior of pipe piles (below mud-line), socket clean-out, sounding and pile re-driving will be considered incidental to Work and will not be measured separately.

.2 Drilling of rock sockets will be paid for at the unit price tendered for DRILLING ROCK SOCKETS. Payment shall include for all costs in connection with supply and installation, and all costs for quality control testing.

.3 Reinforcing steel for rock sockets will be measured to Section 03 20 00 (Concrete Reinforcing). Spiders and spacers will be considered incidental to the Work and will not be measured separately.

.4 Concrete Type A for rock sockets will be measured to Section 03 30 00 (Cast-in-Place Concrete). Measure concrete for each pile socketed in rock in cubic metres placed in rock socket to neat lines as shown on the Drawings, adjusted for actual length of drilled socket. Payment shall include for all costs in connection with

rock socket concrete except for reinforcing steel, and shall include for all costs for quality control testing. Sounding and inspection by optical video and 3D sonar technology will be considered incidental to the Work and will not be measured separately.

1.4 REFERENCES

.1 Canadian Standards Association, hereinafter referred to as CSA:

.1 CAN/CSA-G30.18 Billet-Steel Bars for Concrete Reinforcement

.2 CSA-G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Submit, in accordance with Section 01 33 00 (Submittal Procedures), shop drawings indicating placement of reinforcing steel, methods of construction and operational sequence.

.2 Submit, in accordance with Section 01 33 00 (Submittal Procedures), information on equipment to be used to construct rock sockets:

.1 Describe equipment and methodology for installation of rock sockets.

.2 Provide details sufficient for Departmental Representative to evaluate the performance and suitability of Contractor's proposed equipment and methodology.

.3 Include details of equipment for excavating, drilling, cleaning out piles and rock sockets, installation of reinforcing steel and concreting of sockets.

.3 Rock Socket Inspection Submittal 1 Information shall be submitted, in sufficient detail to demonstrate that the proposed socket inspection methods will provide the required geotechnical information as described in this Specification. References to similar previously completed projects shall be provided. This submittal shall include, but not be limited to:

.1 Sonar Sensor Technology - A detailed description of the sensor technology proposed, and it's specific applicability to this project including operational methodology and a demonstration of how the performance requirements will be achieved. This includes launch and recovery systems (LARS), data collection, monitoring, storage and post processing as required to meet the requirements of these Specifications.

.2 Optical Survey Technology – A detailed description of the equipment and specifications proposed for video camera inspection of socket.

.3 Report - A sample/excerpt of the survey report, and real time survey output, in its expected format.

.4 Quality Assurance Submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Submit for review by Departmental Representative three copies of pile installation records as described in PART 3 - FIELD QUALITY CONTROL.

.4 Equipment lists: submit to Departmental Representative, list of equipment for installation before beginning work.

.1 Provide details sufficient to evaluate performance of equipment.

.2 Provide details of equipment and procedures for excavating, drilling, cleaning out piles and rock sockets and for drilling the probe holes.

.3 Provide details of pile casing shoe(s) used to drill and seat casing to bedrock to achieve an effective seal for socket construction.

.5 Submit legible and interpretable copies of the following field measurements to Departmental Representative on a weekly basis:

.1 Copies of drill logs and inspection information for each rock socket. These logs should contain information on areas with weak rock conditions and/or shear zones, and descriptions of other anomalies.

.2 Table(s) summarizing the pile casing size, elevation at which bedrock was first encountered, and bottom elevation of the casing.

.3 Table(s) summarizing the as built socket size, top elevation of socket, base elevation of socket, base elevation of the reinforcing steel cage installed in the socket, and location or designation of the socket.

.4 Table(s) summarizing the time (to the nearest minute) consumed to drill the socket, clean the socket, insert the steel reinforcing cage, and concrete the pile. Provide time estimates for each activity separately.

.5 Table(s) summarizing the actual concrete volume required to fill each socket. Also, indicate the estimated theoretical concrete volume for each socket. Where the actual concrete volume exceeds the theoretical volume, provide an explanation.

.6 Results of concrete strength testing.

Part 2 Products

2.1 MATERIALS

.1 Concrete: refer to Section 03 39 00 (General Concrete Requirements) and Section 03 37 26 (Underwater Placed Concrete).

.2 Reinforcing steel: refer to Section 03 20 00 (Concrete Reinforcing).

.3 Additional material, including spiders, spacers and reinforcing steel installation guides: as reviewed by Departmental Representative.

Part 3 Execution

3.1 PROTECTION

.1 Protect adjacent structures, services and work of other Sections from hazards due to rock socketing operations.

.2 Do not drill rock sockets within 20 m of concrete which has been in place less than seven (7) days, including other rock sockets.

3.2 PREPARATION

.1 remove overburden inside pile, don to tip of pile.

.1 Clean out material adhering to inside surface of pile.

.2 protect open piles from intrusion of foreign materials.

.3 Place steel casing firmly bedrock (top of rock socket)

.1 Tap casing using drop hammer or equivalent to establish firm contact between pipe pile and bedrock.

3.3 INSTALLATION OF ROCK SOCKETS

.1 Install steel casing by drilling and/or percussion methods a minimum distance equal to 1.0 m (as measured from the high side of bedrock surface) into bedrock, or to a depth as directed by the Departmental Representative to seat pile casing into bedrock as indicated in the drawings.

.2 Casing bits or under-reaming tools shall have maximum outside diameter that is 10mm larger than the outside diameter of the steel casing.

.3 The use of impact hammers shall not be permitted to seat piles into bedrock.

.4 4Churn drilling methods shall not be permitted to seat piles into bedrock or construct sockets in bedrock.

.5 Secure equipment in position during drilling. Centre the drill string in the pile using a centralizer or stabilizers arranged to support the string beyond the end of the pile. Reinforce the string as required to prevent sag of more than 75 mm in 9 metres.

.6 Drill sockets into bedrock as indicated. The use of drilling fluids or additives other than air, water, or air/water mist shall not be permitted during drilling of the rock socket. The method used to construct the rock socket shall produce a side wall in the bedrock that is free from loose rock, smearing of fine grained materials or other contamination which may diminish the bond between the concrete and the wall of the bedrock.

.7 Departmental Representative to determine condition of bedrock, elevation of top of rock and depth of socket required.

.8 Drill socket to minimum depth as indicated on the Drawings. During drilling, provide means to collect samples of drill cutting rock samples for provision to the Departmental Representative. Monitor and provide information on key drilling parameters (rate of

drilling, feed pressure and torque and other relevant information) to Departmental Representative.

.9 After drilling is completed and piles seated into bedrock, remove overburden inside pile down to bottom of pile casing. Thoroughly clean out material adhering to inside surface of pile by airlifts, high pressure water jets, wire brushing or other methods to the satisfaction of Departmental Representative. All cuttings, debris and other loose and deleterious material shall be removed from the interior and base of the rock socket and steel pipe pile.

.10 Protect open piles from intrusion of foreign materials.

.11 After socket has been cleaned out and inspected, allow to stand up to 24 h and inspect again for intrusion of material.

.1 Re-drill pile, as required to seal socket and repeat drilling, cleaning out and inspection process.

.2 If a seal cannot be achieved, place grout to seal pile casing-bedrock interface and construct socket.

.12 Perform internal optical video camera inspection and real time 3D sonic imaging of rock socket walls and base. Video camera to have sufficient light source and capable of multi-axis rotation to view in any direction (i.e. around, up, down). Sonar imaging equipment to be capable of providing a complete image of the socket walls and base such that areas of roughness and overbreak of the socket walls can be detected. The sonar scan surveys shall be performed continuously along the sockets; and shall have sufficient accuracy and resolution to enable detection of the geotechnical features described above. Survey information shall be processed in real time such that the 3D socket surface image can be viewed during the course of the inspection.

After socket has been cleaned out, inspected, and approved by Departmental Representative, place reinforcing steel cage and place concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete and Section 03 37 26 - Underwater Placed Concrete within 4 hrs. Re-inspect pile socket if longer than 4 hrs.

.13 Hold pile securely in position so that it does not move during concreting and until concrete has attained specified strength.

.14 Place concrete in one continuous operation to fill socket and pile up to specified elevation.

3.4 INSTALLATION OF REINFORCING STEEL

.1 Install pre-fabricated reinforcing cage in drilled socket and in pile. Locate relative to pile tip as indicated.

.2 Use locating devices to ensure reinforcing cage is placed in central location in pile and rock socket, and fixed securely to prevent movement or uplift until concreting is completed.

3.5 CONCRETE PLACEMENT

.1 Use concrete mix that has been demonstrated to produce required strength at temperature prevailing in socket and pile in specified time. Concrete mix and placement method shall be to the approval of Departmental Representative.

.2 Hold pile securely in position so that it does not move during concreting and until concrete has attained specified strength.

.3 Seek approval, from Departmental Representative, for rock socket concrete placement immediately prior to start of concrete placement. Do not place concrete until written approval from Departmental Representative is received.

.4 Immediately after installing reinforcing steel, place concrete in drilled sockets and in pile, all in accordance with Section 03 39 00 (General Concrete Requirements)and to Section 03 37 26 (Underwater Placed Concrete). Use tremie method, unless feasible to place concrete in the dry.

.5 At all times during pile installation and socketing, including driving, clean out, seating, drilling and concrete installation, the water pressure inside the pile must be maintained at or above tide level (unless concrete is being placed in the dry).

.6 The tremie pipe shall extend to the bottom of the socket before filling with concrete.

.7 Start placement with tremie pipe full of concrete by raising 150 mm and maintain the 150 mm clearance until at least 3 m of concrete has been placed. The tip of the pipe shall be maintained at least 3 m below the top surface of the concrete throughout the pour. Rapid raising or lowering of the delivery pipe shall not be permitted.

.8 If the seal is lost, or the pipe becomes plugged, the pipe shall be withdrawn, cleaned, and recharged and placement restarted by inserting the capped pipe 3 m in the previously placed concrete before restarting the flow of concrete.

.9 Concrete shall be placed from the bottom of the socket to the top of the reinforcing cage inside the pile in one continuous pour.

.10 If Tremie is interrupted so that a horizontal construction joint has to be made, cut surface laitance by jetting (within 24 hours) and remove loose material by pumping or air lifting before placing next lift.

3.6 FIELD QUALITY CONTROL

.1 Site tests and inspection:

.1 Provide method and equipment for inspection of each pile to ensure that pile and socket are properly cleaned out.

.2 Co-operate with and assist Departmental Representative to inspect each pile and rock socket.

.2 Maintain accurate records of drilling sockets including:

.1 Socket drilling progress (rate of advance in metre/hr, and other details).

.2 Clean-out procedures.

.3 Tremie concrete records including times and volumes.

.4 Survey data to confirm that piles did not move during driving of adjacent piles

.3 Provide Departmental Representative with three (3) copies of all pile socketing records.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, placement and compaction of the granular sub-base underlying granular base where shown on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 31 24 15 (General Fill)

.3 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.4 Section 32 11 23 (Aggregate Base Courses)

1.3 MEASUREMENT AND PAYMENT

.1 Granular sub-base shall be measured after compaction, in cubic metres of material actually incorporated into work at the various thicknesses shown to neat lines within the areas defined on the Drawings. No measurement will be made for material which is placed on a temporary basis or materials which are subsequently removed.

.2 Granular sub-base will be paid for at the unit price tendered for GRANULAR SUB-BASE. This payment shall be full compensation for supply of material, sampling and testing, placing, grading, moisture conditioning, compacting, trimming and all related activity necessary to complete the work as specified.

1.4 REFERENCES

.1 ASTM C117, Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

.4 ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Refer to Clause 2.1.3 of this Section.

Part 2 Products

2.1 GRANULAR SUBBASE

.1 Granular sub-base shall be hard, durable, crushed or pit run sand and gravel free of organic and any deleterious matter, and capable of forming a competent surface for the granular base.

TABLE 1 – SUB-BASE GRADATION

Sieve Size (U.S. Standard)	Gradation Limits (% Passing by Dry Weight)
75 mm (3 in)	100
19 mm (3/4 in)	65 – 100
4.75 mm (No. 4)	30 – 100
2.00 mm (No. 10)	15 – 100
0.40 mm (No. 40)	5 – 50
0.075 mm (No. 200)	0 – 5

.2 Material shall comply with the gradation limits given in Table 1, when tested in accordance with ASTM C117 and ASTM C136, and have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 At least twenty-eight (28) days prior to commencing granular sub -base placement, and in accordance with Section 01 33 00 (Submittal Procedures), Contractor shall submit to Departmental Representative for review the proposed material source(s) and placement procedures and provide, at Contractor's cost, qualification test results confirming that the proposed material from each source (gradation curves, physical and chemical properties) meets or exceeds the requirements of this specification. Submit chemical properties in accordance with the requirements of Section 35 37 10 (Engineered Capping).

.4 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise Contractor of the acceptability of the proposed materials and procedures.

.5 During granular sub-base production, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the granular sub -base material conforms to the specification. The material gradation testing rate for granular sub-base shall be not less than one test for every **200 m^3** placed in the work. The testing rate for in -situ compacted density of granular sub-base shall be not less than one test for every **50 m^3** placed in the work; the testing rate for reference dry density (ASTM D1557) shall be not less than one test for every **200 m^3** placed in the work. All quality control test reports

shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.6 During placement, Departmental Representative may, at his discretion, inspect the granular sub-base material for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's own expense.

.7 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected granular sub-base material may be used instead as general fill material.

Part 3 Execution

3.1 GENERAL

.1 All granular sub-base shall be imported by road transport, unloaded directly within the Work site.

.2 Contractor shall provide adequate flag-persons and/or traffic signal devices to prevent interference with emergency vehicles or traffic of other dock users and contractors.

.3 Priority shall be given to all other traffic over Contractor's construction traffic.

.4 At the end of each working day, sweep roadway and clean up all fallen rock, dust and debris arising from rock deliveries, to Departmental Representative's satisfaction.

3.2 PLACING

.1 Placing of granular sub-base material shall commence only after approval by Departmental Representative of the finished grade of excavations or finished grade of general fill, as appropriate to the location. Refer to Section 31 24 15 (General Fill) and Section 31 23 33.01 (Excavation, Trenching and Backfilling) for requirements.

.2 Surfaces shall at all times be kept free of snow, ice or any other deleterious material.

.3 Placement shall be conducted using methods that avoid segregation or degradation of the material. Any areas where segregation occurs shall be over-excavated, reworked, and replaced to the satisfaction of Departmental Representative.

.4 Material lift thickness shall not exceed 200 mm after compaction unless otherwise approved by Departmental Representative.

.5 Placing of subsequent lifts shall proceed only after acceptance by Departmental Representative of the compacted surface to be covered.

3.3 COMPACTING

.1 Granular sub-base material shall be compacted to a minimum of 95 % modified Proctor maximum dry density (ASTM D1557) corrected for oversize materials in accordance with ASTM D4718, and as shown on the Drawings.

.2 Modify the moisture content of the material as necessary, or as directed by Departmental Representative, to obtain the specified density. If the material becomes excessively moist and cannot be properly compacted, it shall be removed and replaced with a suitable material.

.3 During the work only hand-operated compaction equipment shall be used within a distance of 0.6 m from any concrete structure.

.4 Ensure that the compaction does not impact or damage any structures.

.5 Repair any damage to structures arising from compaction.

.6 Fill densities and moisture contents shall be measured by nuclear methods in accordance with ASTM D2922 and ASTM D3017. All moisture contents measured using nuclear methods shall be confirmed by oven dry method in accordance with ASTM D2216 or microwave method in accordance with ASTM D4643. In the event of a discrepancy between moisture content determinations, the moisture content determined by oven dry method shall apply. Oversize materials shall be determined for each density test and the measured density corrected for oversize materials. Departmental Representative may, at his sole discretion, approve corrections to densities measured with a nuclear gauge for a material type, if the Contractor provides site specific and material-specific correlation tests between nuclear density test methods and volumetric test methods approved by Departmental Representative.

.7 If an area of granular sub- base compaction fails to meet the acceptance criteria, conduct additional tests, as directed by Departmental Representative, to delineate the extent of the area. Remediate the area and conduct additional tests, as directed by Departmental Representative, to confirm that the area meets the acceptance criteria. No additional payment will be made for these tests or remediation work.

.8 Contractor shall make available compacted areas for density testing for quality assurance purposes, as required by Departmental Representative.

3.4 FINAL TOLERANCES

.1 Final compacted and graded surface shall be within ± 25 mm of the specified grade, but not uniformly high or low.

3.5 MAINTENANCE

.1 Maintain finished granular sub-base in same condition as that upon acceptance until granular base is placed.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, placement and compaction of the granular base underlying asphalt paving and underlying certain concrete structures as shown on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 39 00 (General Concrete Requirements)

.3 Section 31 24 15 (General Fill)

.4 Section 32 12 16 (Asphalt Paving)

.5 Section 32 11 16.01 (Granular Sub-Base)

.6 Section 35 37 10 (Engineered Capping)

1.3 MEASUREMENT AND PAYMENT

.1 Granular base shall be measured after compaction, in cubic metres of material actually incorporated into work at the various thicknesses shown to neat lines within the areas defined on the Drawings. No measurement will be made for material which is placed on a temporary basis or materials which are subsequently removed.

.2 Granular base will be paid for at the unit price tendered for GRANULAR BASE. This payment shall be full compensation for supply of material, sampling and testing, placing, grading, moisture conditioning, compacting, proof rolling, trimming and all related activity necessary to complete the work as specified.

1.4 REFERENCES

.1 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM C117, Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

.4 ASTM D4718, Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.

.5 ASTM D5821, Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Refer to Clause 2.1.3 of this Section.

Part 2 Products

2.1 GRANULAR BASE

.1 Granular base shall be hard, durable crushed sand and gravel free of organic and any deleterious matter, and capable of forming a smooth, competent surface for placement of asphalt paving or for use as foundation for miscellaneous concrete structures. Coarse aggregate to have a minimum of 50% fractured faces when tested in accordance with ASTM D5821.

TABLE 1 – GRANULAR BASE GRADATION

Sieve Size (U.S. Standard)	Gradation Limits % Passing by Dry Weight
25 mm (1 in)	100
19 mm (3/4 in)	85 – 100
9.5 mm (3/8 in)	60 – 85
4.75 mm (No. 4)	40 – 70
2.0 mm (No. 10)	25 – 50
0.40 mm (No. 40)	5 – 25
0.075 mm (No. 200)	0 – 5

.2 Material shall comply with the gradation limits given in Table 1, when tested in accordance with ASTM C136 and ASTM C117, and have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 At least twenty-eight (28) days prior to commencing granular base placement, and in accordance with Section 01 33 00 (Submittal Procedures), Contractor shall submit to Departmental Representative for review the proposed material source(s) and placement procedures and provide, at Contractor's own cost, qualification test results confirming that the proposed material from each source (gradation curves, physical and chemical properties) meets or exceeds the requirements of this specification. Submit chemical properties in accordance with the requirements of Section 35 37 10 (Engineered Capping).

.4 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise Contractor of the acceptability of the proposed materials and procedures.

.5 During granular base production, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the granular base material conforms to the specification. The material gradation testing rate for granular base shall be not less than one test for every **200 m3** placed in the work. The testing rate for in-situ compacted density of granular base shall be not less than one test for every **50 m3** placed in the work; the testing rate for reference dry density (ASTM D1557) shall be not less than one test for every **200 m3** placed in the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.6 During placement, Departmental Representative may, at his discretion, inspect the granular base material for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's expense.

.7 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected granular base material may be used instead as general fill material.

Part 3 Execution

3.1 GENERAL

.1 All granular base shall be imported by road transport, unloaded directly within the Work site.

.2 Contractor shall provide adequate flag-persons and/or traffic signal devices to prevent interference with emergency vehicles or traffic of other dock users and contractors.

.3 Priority shall be given to all other traffic over Contractor's construction traffic.

.4 At the end of each working day, sweep roadway and clean up all fallen rock, dust and debris arising from rock deliveries, to Departmental Representative's satisfaction.

3.2 PLACING

.1 Placing of granular base material shall commence only after approval of the granular sub-base by Departmental Representative. Refer to Section 32 11 16.01 (Granular Sub-Base) for granular sub-base requirements.

.2 Surfaces shall at all times be kept free of snow, ice or any other deleterious material.

.3 Placement shall be conducted using methods that avoid segregation or degradation of the material. Any areas where segregation occurs shall be over-excavated, reworked, and replaced to the satisfaction of Departmental Representative.

.4 Material lift thickness shall not exceed 200 mm after compaction unless otherwise approved by Departmental Representative.

.5 Placing of subsequent lifts shall proceed only after acceptance by Departmental Representative of the compacted surface to be covered.

3.3 COMPACTING

.1 Granular base material shall be compacted to a minimum of 95 % modified Proctor maximum dry density (ASTM D1557) corrected for oversize materials in accordance with ASTM D4718, and as shown on the Drawings.

.2 Modify the moisture content of the material as necessary, or as directed by Departmental Representative, to obtain the specified density. If the material becomes excessively moist and cannot be properly compacted, it shall be removed and replaced with a suitable material.

.3 During the work only hand-operated compaction equipment shall be used within a distance of 0.6 m from any concrete structure.

.4 Ensure that the compaction does not impact or damage any structures.

.5 Repair any damage to structures arising from compaction.

.6 Fill densities and moisture contents shall be measured by nuclear methods in accordance with ASTM D2922 and ASTM D3017. All moisture contents measured using nuclear methods shall be confirmed by oven dry method in accordance with ASTM D2216 or microwave method in accordance with ASTM D4643. In the event of a discrepancy between moisture content determinations, the moisture content determined by oven dry method shall apply. Oversize materials shall be determined for each density test and the measured density corrected for oversize materials. Departmental Representative may, at his sole discretion, approve corrections to densities measured with a nuclear gauge for a material type, if Contractor provides site specific and material-specific correlation tests between nuclear density test methods and volumetric test methods approved by Departmental Representative.

.7 If an area of granular base compaction fails to meet the acceptance criteria, conduct additional tests, as directed by Departmental Representative, to delineate the extent of the area. Remediate the area and conduct additional tests, as directed by Departmental Representative, to confirm that the area meets the acceptance criteria. No additional payment will be made for these tests or remediation work.

.8 Contractor shall make available compacted areas for density testing for quality assurance purposes, as required by Departmental Representative.

3.4 FINAL TOLLERANCES

.1 Final compacted and graded surface shall be within ± 10 mm of the specified grade, but not uniformly high or low.

3.5 PROOF ROLLING

.1 Proof roll top of granular base upon completion of fine grading and compaction.

.2 For proof rolling use a 50 tonne pneumatic roller, or a 20 tonne unballasted static mass vibratory roller operated at normal walking speed.

.3 Make sufficient passes with proof roller to subject every point on surface to two separate passes under the maximum load.

.4 Where proof rolling reveals areas of inadequate compaction, compact the granular base course and proof roll again.

.5 Where proof rolling reveals areas of defective or fines-contaminated general fill:

.1 Remove granular base, sub-base and general fill materials to depth and extent directed by Departmental Representative.

.2 Backfill excavated area with approved general fill and compact in accordance with Section 31 24 15 (General Fill).

.3 Replace granular sub-base material and compact in accordance with Section 32 11 16.01 (Granular Sub-Base); and,

.4 Replace granular base material and compact in accordance with this section.

3.6 MAINTENANCE

.1 Maintain finished granular base in same condition as that upon acceptance until asphalt or concrete is placed.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and placement of an asphalt tack coat on the vertical saw cut edge of the existing asphalt and on contact surfaces at existing concrete and asphalt features prior to application of a lift of asphalt paving.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 32 11 23 (Aggregate Base Courses)

.3 Section 32 12 13.23 (Asphalt Prime Coat)

.4 Section 32 12 16 (Asphalt Paving)

1.3 MEASUREMENT AND PAYMENT

.1 Asphalt tack coat will not be measured separately, but considered incidental to the work. All costs in connection with asphalt tack coat shall be included in the unit price tendered for asphalt paving under Section 32 12 16 (Asphalt Paving).

.2 No separate measurement or payment will be made for asphalt tack coat at overlapping areas, overspray or asphalt tack coat which must be re-applied due to weather conditions, contamination, disruption or other causes.

.3 No separate measurement or payment will be made for asphalt tack coat on contact surfaces at concrete structures.

1.4 REFERENCES

.1 ASTM D140, Practice for Sampling Bituminous Materials.

.2 ASTM D977 (2003), Standard Specification for Emulsified Asphalt.

.3 CAN/CGSB 16.1 M, Cutback Asphalts for Road Purposes.

.4 CAN/CGSB 16.2 M, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS, SAMPLES AND MATERIAL CERTIFICATION

.1 Make all submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit, in plastic containers, to Departmental Representative two 4.0 L samples of asphalt tack coat proposed for use at least fourteen (14) days prior to commencing work, if requested. Samples may be omitted if source and material is identical to that for asphalt prime and samples of asphalt prime have previously been provided.

.3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into work, in accordance with ASTM D140.

.4 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this Section.

Part 2 Products

2.1 MATERIAL

.1 Anionic emulsified asphalt material: To ASTM D977 grade SS 1 or SS-1h.

Part 3 Execution

3.1 EQUIPMENT

.1 Pressure distributor to be:

- .1 Designed, equipped, maintained and operated so that the asphalt material:
  - .1 Is maintained at even temperature.
  - .2 May be applied uniformly on variable widths of surface up to 5 m.
  - .3 May be applied at readily determined and controlled rates from 0.2 to 5.4 L/m^2 with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m^2.
- .2 Capable of distributing asphalt material in uniform spray without atomization at temperature required.
- .3 Equipped with meter registering metres of travel per minute visibly located to enable truck driver to maintain constant speed required for application at specified rate.
- .4 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
- .5 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
- .6 Equipped with accurate volume measuring device or calibrated tank.
- .7 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

3.2 APPLICATION

.1 Apply tack coat only on clean and dry surface. Obtain Departmental Representative's approval of surface before applying asphalt tack coat.

.2 Anionic emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative.

.2 Apply tack coat evenly to pavement surface at a minimum rate of 0.25 L/m^2, but do not exceed 0.7 L/m^2.

.3 Paint contact surfaces of concrete structures with thin, uniform coat of asphalt tack coat material.

.4 Do not apply tack coat when air temperature is less than 5 C or when rain is forecast within two (2) hours.

.5 Apply tack coat only to surfaces that are expected to be overlayed on same day.

.6 Where traffic is to be maintained, treat no more than one half width of surface in one application.

.7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.

.8 Re-tack contaminated or disturbed areas as directed by Departmental Representative.

.9 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.

.10 Keep traffic off tacked areas until tack coat has set.

.11 Permit tack coat to set before placing asphalt paving.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and placement of asphalt prime coat to the granular base surface prior to asphalt paving operations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 32 11 23 (Aggregate Base Courses)

.3 Section 32 12 13.16 (Asphalt Tack Coat)

.4 Section 32 12 16 (Asphalt Paving)

1.3 MEASUREMENT AND PAYMENT

.1 Asphalt prime will not be measured separately, but considered incidental to the work. All costs in connection with asphalt prime shall be included in the unit price tendered for asphalt paving under Section 32 12 16 (Asphalt Paving).

.2 No separate measurement or payment will be made for asphalt prime at overlapping areas, overspray or asphalt prime which must be re-applied due to weather conditions, contamination, disruption or other causes.

.3 No separate measurement or payment will be made for supply and application of sand blotter and sweeping of excess.

.4 No separate measurement or payment will be made for asphalt prime on contact surfaces at concrete structures.

1.4 REFERENCES

.1 ASTM D140, Practice for Sampling Bituminous Materials.

.2 ASTM D977 (2003), Standard Specification for Emulsified Asphalt.

.3 CAN/CGSB 16.1 M, Cutback Asphalts for Road Purposes.

.4 CAN/CGSB 16.2 M, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS, SAMPLES AND MATERIAL CERTIFICATION

.1 Make all submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit, in plastic containers, to Departmental Representative two 4.0 L samples of asphalt prime proposed for use at least fourteen (14) days prior to commencing work, if requested.

.3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into work, in accordance with ASTM D140.

.4 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

Part 2 Products

2.1 MATERIAL

.1 Asphalt material: To ASTM D977 grade SS 1 or SS-1h.

.2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.

Part 3 Execution

3.1 EQUIPMENT

.1 Pressure distributor to be:

.1 Designed, equipped, maintained and operated so that asphalt material:

.1 Is maintained at even temperature.

.2 May be applied uniformly on variable widths of surface up to 5 m.

.3 May be applied at readily determined and controlled rates from 0.2 to 5.4 L/m^2 with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m^2.

.2 Capable of distributing asphalt material in uniform spray without atomization at temperature required.

.3 Equipped with meter registering metres of travel per minute visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.4 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.5 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.6 Equipped with accurate volume measuring device or calibrated tank.

.7 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

3.2 APPLICATION

.1 Obtain Departmental Representative's approval of surface before applying asphalt prime.

.2 Anionic emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative.

.2 Apply diluted asphalt emulsion at a minimum rate of 0.9 L/m^2 but not to exceed 3.0 L/m^2.

.3 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.

.3 Paint contact surfaces of concrete structures with thin, uniform coat of asphalt prime material.

.4 Do not apply prime when air temperature is less than 5 C or when rain is forecast within two (2) hours.

.5 Where traffic is to be maintained, treat no more than one half width of surface in one application.

.6 Prevent overlap at junction of spreads.

.7 Do not prime surfaces that will be visible when paving is complete.

.8 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.

.9 Keep traffic off primed areas until asphalt prime has set.

.10 Permit prime to set before placing asphalt paving.

3.3 USE OF SAND BLOTTER

.1 If asphalt prime fails to penetrate within twenty-four (24) hours, spread sand blotter material in amounts required to absorb excess material.

.2 Sweep and remove excess blotter material.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, placement and compaction of hot mix asphalt concrete pavement to lines, grades and typical sections as shown on the Drawings for the apron roadway.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 41 13.14 (Asphalt Paving Removal)

.3 Section 32 11 23 (Aggregate Base Courses)

.4 Section 32 12 13.23 (Asphalt Prime Coat)

.5 Section 32 12 13.16 (Asphalt Tack Coat)

1.3 MEASUREMENT AND PAYMENT

.1 Asphalt concrete paving shall be measured in square metres of asphalt concrete paving actually incorporated into work for the various courses and thicknesses shown within the areas defined on the Drawings. No measurement will be made for material which is placed on a temporary basis or materials which are subsequently removed.

.2 Asphalt concrete paving will be paid for at the unit price tendered for ASPHALT PAVING. This payment shall be full compensation for supplying, placing and compacting the asphalt mix, adjustments to levels of catch basin gratings, quality control and all other work necessary and incidental thereto for which separate payment is not elsewhere provided. This payment shall include for all costs in connection with supplying and installing asphalt prime and asphalt tack coat.

.3 Removal of existing asphalt paving will be measured to Section 02 41 13.14 (Asphalt Paving Removal), and payment shall include all costs in connection with asphalt paving removal and disposal.

1.4 REFERENCES

.1 ASTM C88, Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.

.2 ASTM C117, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.3 ASTM C123, Test Method for Lightweight Pieces in Aggregate.

.4 ASTM C127, Test Method for Specific Gravity and Absorption of Coarse Aggregate.

.5 ASTM C128, Test Method for Specific Gravity and Absorption of Fine Aggregate.

.6 ASTM C131, Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.7 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.8 ASTM C1252, Standard Test Method for Uncompacted Void Content for Fine Aggregate.

.9 ASTM D995, Specification for Requirements for Mixing Plants for Hot Mixed, Hot Laid Bituminous Paving Mixtures.

.10 ASTM D1559, Test Method for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

.11 ASTM D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.12 ASTM D2726, Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

.13 ASTM D2950, Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.

.14 ASTM D3203, Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

.15 ASTM D4791, Test Method for Flat and Elongated Particles in Coarse Aggregate.

.16 ASTM D5821, Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

.17 CAN/CGSB 8.1, Sieves Testing, Woven Wire.

.18 CAN/CGSB 8.2 M, Sieves Testing, Woven Wire, Metric.

.19 BC MoT 2006 Standard Specification for Highway Construction: Section 951, Asphalt and Paving Materials for Highway Use; and Section 952, Asphalt Supply.

.20 Asphalt Institute MS-2, Sixth Edition 1993, Mix Design Method for Asphalt Concrete.

.21 AASHTO M320-5, Asphalt Cement.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS, SAMPLES AND MATERIAL CERTIFICATION

.1 Make all submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit aggregate gradation, asphalt concrete mix design and trial mix test results to Departmental Representative for approval at least twenty-eight (28) days prior to commencing work.

.3 At least twenty-eight (28) days prior to commencing work, inform Departmental Representative of proposed source of aggregates and provide access for sampling. Allow continual sampling by Departmental Representative during production. Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.

.4 Submit viscosity temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175°C at least twenty-eight (28) days prior to commencing work.

.5 Upon request, submit manufacturer's test data and certification that asphalt cement meets requirements of this Section.

Part 2 Products

2.1 ASPHALT CEMENT

.1 Asphalt cement: AASHTO PG 64-11 Grade or BC MoT Standard, Table 951-C, Penetration Grade 80-100 asphalt cement.

2.2 AGGREGATES

.1 Crushed stone or gravel consisting of sound, hard, durable, angular particles, free from soft, thin, elongated or laminated particles, clay lumps, cementation, minerals, organic material, frozen material and other substances that would act in a deleterious manner for the use intended.

.2 Material shall comply with the gradation limits given in Table 1 when tested in accordance with ASTM C136 and ASTM C117, sieve sizes to CAN/CGSB 8.1, and have a smooth curve without sharp breaks when plotted on a semi-log grading chart:

TABLE 1 – AGGREGATE GRADATION LIMITS

Sieve Size	Gradation Limits% Passing by Dry Weight	
	Fine Mix (Surface Course)	**Medium Mix (Lower Course)**
37.5 mm	-	-
25 mm	-	-
19 mm	-	100
12.5 mm	100	84-95
9.5 mm	90-100	73-90
4.75 mm	55-80	50-75
2.36 mm	32-64	35-57
1.18 mm	24-51	26-45
0.600 mm	17-40	18-34
0.300 mm	13-29	10-26
0.150 mm	8-18	6-17
0.075 mm	3-7	3-7

.3 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136

.4 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.

.5 Do not use aggregates having known polishing characteristics in mixes for surface courses

.6 Sand equivalent: to ASTM D2419. Min: 50.

.7 Magnesium Sulphate soundness: to ASTM C88. Max % loss by mass:

.1 Coarse aggregate: 12.

.2 Fine aggregate: 16.

.8 Los Angeles degradation: Grading B, to ASTM C131. Max % loss by mass:

.1 Coarse aggregate: 25.

.9 Absorption: to ASTM C127. Max % by mass:

.1 Coarse aggregate: 1.75.

.10 Loss by washing: to ASTM C117. Max % passing 0.075 mm sieve:

.1 Coarse aggregate: 1.20.

.11 Lightweight particles: to ASTM C123. Max % by mass less than 1.95 relative density: 1.50.

.12 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5). Max % by mass:

.1 Coarse aggregate: 10.

.13 Crushed fragments: 100% of particles by mass retained on the 4.75 mm sieve. Minimum 100% one fractured face, 95% two fractured faces. Material to be divided into ranges, using methods of ASTM C136.

.14 Uncompacted voids by ASTM C1252: minimum 45%.

.15 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

2.3 MINERAL FILLER

.1 Mineral filler is finely ground particles of limestone, hydrated lime, Portland cement or other approved non plastic mineral matter, thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Departmental Representative to improve mix properties.

.3 Mineral filler to be dry and free flowing when added to aggregate.

2.4 MIX DESIGN

.1 Job mix formula to be approved by Departmental Representative.

.2 Mix shall not contain Recycled Asphalt Pavement (RAP).

.3 Design of mix: by Marshall method to requirements below.

.1 Compaction blows on each face of test specimens: 75.

.2 Mix physical requirements shall conform to the values given in Table 2.

.4 Measure physical requirements as follows:

.1 Marshall stability and flow value: to ASTM D1559.

.2 Compute void properties on basis of bulk specific gravity of aggregate (to ASTM C127 and ASTM C128). Make allowance for volume of asphalt absorbed into pores of aggregate.

.3 Voids in mineral aggregates: to Asphalt Institute MS-2, chapter 4.

TABLE 2 – MIX DESIGN

Test Property	**Value or Range for Fine Mix (Surface Course)**	**Value or Range for Medium Mix (Lower Course)**
Marshall Stability at 60 C (kN), Minimum	10.0	10.0
Flow Value (mm), Range	2 - 4	2 - 4
Air Voids in Mixture (%), Range	3 - 5	3 - 5
Voids in Mineral Aggregate (%),Minimum	14	12
Index of Retained Stability (%),Minimum	85	85

.5 Do not change job mix without prior approval of Departmental Representative. Should change in material source be proposed, new job mix formula to be approved by Departmental Representative.

.6 Add dust to effective asphalt cement ratio of 0.6 to 1.2.

Part 3 Execution

3.1 PLANT AND MIXING REQUIREMENTS

.1 Batch and continuous mixing plants:

.1 To ASTM D995.

.2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders. Do not load frozen materials into bins.

.3 Feed cold aggregates to plant in proportions that will ensure continuous operations.

.4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

.5 Before mixing, dry aggregates to a moisture content not greater than 1% by mass or to a lesser moisture content if required to meet mix design requirements. Heat to temperature required to meet mixing temperature.

.6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job mix requirements.

.7 Store hot screened aggregates in a manner to minimize segregation and temperature loss.

.8 Heat asphalt cement and aggregate to mixing temperature appropriate for the approved mix design. Do not heat asphalt cement above 160 C.

.9 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, control the temperature of completed mix at plant and at paver after considering hauling and placing conditions.

.10 Maintain temperature of materials within plus or minus 5 C of specified mix temperature during mixing.

.11 Mixing time:

.1 In batch plants, both dry and wet mixing times shall be as required for the approved mix design. Continue wet mixing as long as necessary to obtain a thoroughly blended mix but not less than 30 s or more than 75 s.

.2 In continuous mixing plants, mixing time shall be as required for the approved mix design, but not less than 45 s.

.3 Do not alter mixing time unless allowed by Departmental Representative.

.2 Dryer drum mixing plant:

.1 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.

.2 Feed aggregates to burner end of dryer drum by means of a multi bin cold feed unit and blend to meet job mix requirements by adjustments of variable speed feed belts and gates on each bin.

.3 Meter total flow of aggregate by an electronic weigh belt system with an indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate and asphalt entering mixer remain constant.

.4 Provide for easy calibration of weighing systems for aggregates without having material enter mixer.

.5 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved. Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time. Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2 %.

.6 Make provision for conveniently sampling the full flow of materials from the cold feed.

.7 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.

.8 Provide a system interlock which will stop all feed components if either asphalt or aggregate from any bin stops flowing.

.9 Accomplish heating and mixing of asphalt mix in an approved parallel flow dryer mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with a printing recorder that can be monitored by the plant operator. Submit printed record of mix temperatures at end of each day.

.10 Mixing period and temperature to produce a uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer to be less than 2 %.

.3 Temporary storage of hot mix:

.1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 3 hours.

.4 While producing asphalt mix for this project, do not produce mix for other users unless separate storage and pumping facilities are provided for materials supplied to this project.

.5 Mixing tolerances:

.1 Permissible variation in aggregate gradation from job mix (percent of total mass) shall conform to the values given in Table 3.

TABLE 3 – VARIATION IN AGGREGATE GRADATION

Sieve Size	Maximum Variation in Aggregate Gradation (as % of total mass)
4.75 mm sieve and larger	5.0
2.36 mm sieve	4.0
0.600 mm sieve	3.0
0.180 mm sieve	2.0
0.075 mm sieve	1.0

.2 Permissible variation of asphalt cement from job mix: 0.25%.

.3 Permissible variation of mix temperature at discharge from plant: 5 C.

.6 Temperature Monitoring: Monitor temperature of completed mix at plant and/or paver after considering hauling and placing conditions.

3.2 EQUIPMENT

.1 Pavers: mechanical grade controlled self powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:

.1 Minimum drum diameter: 1,200 mm.

.2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.

.4 Haul trucks: of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Use only trucks which can be weighed in a single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass not less than 12 kg and a bearing area not exceeding 310 cm^2 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

3.3 PREPARATION

.1 Reshape granular roadbed if required and obtain approval of Departmental Representative prior to paving.

.2 When paving over existing asphalt surface, clean pavement surface. When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.

.3 When matching new pavement with existing pavement, make a vertical saw cut in the existing pavement at the junction with the new pavement.

.4 Apply prime coat and tack coat in accordance with Section 32 12 13.23 (Asphalt Prime Coat) and 32 12 13.16 (Asphalt Tack Coat) prior to paving.

.5 Prior to laying mix, clean surfaces of loose and foreign material.

3.4 TRANSPORTATION OF MIX

.1 Transport mix to job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution will be permitted.

.3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light.

.4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation. Do not dribble mix into trucks.

.5 Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.

.6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within range appropriate for the approved mix design, but not less than 135 C.

3.5 PROTECTION OF EXISTING FEATURES

.1 The existing dock apron pavement shall be fully preserved, except as indicated for pavement removal on the Drawings.

.2 Contractor shall, within 24 hours, repair any damage made to the dock pavement surface caused by Contractor.

3.6 PLACING

.1 Obtain Departmental Representative's approval of base, existing surface, tack coat and prime coat prior to placing asphalt.

.2 Place asphalt concrete to thicknesses, grades and lines as indicated or as directed by Departmental Representative.

.3 Placing conditions:

.1 Place asphalt mixtures only when air temperature is above 5 C;

.2 When temperature of surface on which material is to be placed falls below 10 C, provide extra rollers as necessary to obtain required compaction before cooling; and,

.3 Do not place hot mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

.4 Place asphalt concrete in compacted lifts of thickness not to exceed:

.1 **Surface Course: 40 mm** thickness of Fine Mix material; and,

.2 **Lower Course: 50 mm** thickness of Medium Mix material.

.5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.

.6 Commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.

.7 Spread and strike off mixture with self propelled mechanical finisher.

.1 Construct longitudinal joints and edges true to line markings on roadways. Contractor to establish lines for paver to follow, parallel to centerline of proposed pavement. Position and operate paver to follow established line.

.2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30 m apart.

.3 Maintain constant head of mix in auger chamber of paver during placing.

.4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.5 Correct irregularities in alignment left by paver by trimming directly behind machine.

.6 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.

.7 Do not throw surplus material on freshly screened surfaces.

.8 When hand spreading is used:

.1 Approved wood or steel forms, rigidly supported to assure correct grade and cross section, may be used. Use measuring blocks and intermediate strips to aid in obtaining required cross section.

.2 Distribute material uniformly. Do not broadcast material.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt. Avoid high temperatures which may burn material. Do not use tools at a higher temperature than temperature of mix being placed.

3.7 COMPACTING

.1 Roll asphalt continuously using a uniform rolling pattern.

.2 Do not change rolling pattern unless mix changes or lift thickness changes.

.3 Roll asphalt continuously to density not less than 98 % of 75 blow density in accordance with ASTM D1559, except as noted otherwise. At pavement joints, and at constricted areas where asphalt is placed using small hand-operated compaction equipment, the acceptance criteria is 95 % of 75 blow density in accordance with ASTM D1559. Average in-situ air void content shall be between 6 % and 7 % with no result higher than 8 %. In-situ air void content shall be based on Maximum Theoretical Specific Gravity of the Marshall samples.

.4 General:

.1 Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. When more than two rollers are required, one roller must be pneumatic tired type.

.2 Start rolling operations as soon as placed mix can bear weight of roller without undue displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.

.4 Use static compaction for levelling course less than 25 mm thick.

.5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 30 to 40 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing should not exceed compacted lift thickness.

.6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.

.7 Keep wheels of roller slightly moistened with water to prevent pick up of material but do not over water.

.8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side. Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.

.11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

.12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.5 Breakdown rolling:

.1 Commence breakdown rolling with static steel wheeled roller immediately following rolling of transverse and longitudinal joints and edges.

.2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.

.3 Operate breakdown roller with drive roll or wheel nearest finishing machine. Exceptions may be made when working on steep slopes or super-elevated sections.

.4 Use only experienced roller operators for this work.

.6 Intermediate rolling:

.1 Use pneumatic tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.

.2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.

.7 Finish rolling:

.1 Accomplish finish rolling with two axle or three axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks. If

necessary to obtain desired surface finish, Departmental Representative may specify use of pneumatic tired rollers.

.2 Conduct rolling operations in close sequence.

3.8 JOINTS

.1 General:

.1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.

.2 Paint contact surfaces of existing structures such as manholes, curbs or gutters or cold asphaltic concrete joints with bituminous material prior to placing adjacent pavement.

.2 Transverse joints:

.1 Offset transverse joint in succeeding lifts by at least 600 mm.

.2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.

.3 Compact transverse joints to provide a smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

.3 Longitudinal joints:

.1 Offset longitudinal joints in succeeding lifts by at least 150 mm.

.2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 C prior to paving of adjacent lane. If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.

.3 Overlap previously laid strip with spreader by 35 to 38 mm.

.4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with a lute or rake.

.5 Roll longitudinal joints directly behind paving operation.

.6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

.4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade. Feather joints may not be constructed without the approval of Departmental Representative. If Departmental Representative does not approve feather joint, construct full depth butt joint.

.5 Construct butt joints at locations and to details shown on the Drawings.

3.9 FINISH TOLLERANCES

.1 Finished asphalt surface to be within ± 5 mm of specified grade, but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with a 4.5 m straight edge placed in any direction.

.3 Water ponding is not permitted.

.4 Surface drainage: slopes to gutters, catch basins, etc. to conform with existing contours, in accordance with Drawings and eliminating puddles and ponds.

.5 Paving shall be placed with a slight fall (2% min.) away from buildings.

3.10 TEST PROGRAM

.1 Contractor shall undertake a Quality Control program at his cost to ensure the material supplied and the placement of the paving complies with the specification.

.2 The following test program shall form part of Contractor's Quality Control program.

.1 Aggregate Gradation: Regular sieve analysis to determine aggregate gradation during the crushing operation in accordance with ASTM C136. One (1) test will be carried out for each 300 to 500 tonnes of production, or a minimum of once per day.

.2 Mix Quality:

.1 Marshall Stability: One (1) test of three (3) briquettes for each asphalt mix per production day.

.2 Specific Gravity: as above.

.3 Air Voids and VMA: as above.

.4 Flow Index: as above.

.5 Asphalt Content Extraction: as above.

.6 Maximum Theoretical Specific Gravity: as above.

.3 Density Testing: In-place density testing shall be carried out for Quality Control at representative areas of the asphalt pavement placed, including at joints, areas near shoulders and areas near the centre of the mat. The acceptance criteria for compaction of asphalt pavement shall be the density as specified herein, measured to ASTM D2726 (bulk specific gravity method). Density testing program shall be as follows:

.1 Carry out Quality Control field density testing on a continuous basis (i.e. while the product is still warm and compactable) throughout the paving production work, to ASTM D2950 (nuclear method). These initial test results may be used as a general guide to the level of compaction achieved, but are not the acceptance criteria for pavement compaction. The Contractor shall be aware that compaction test results to ASTM D2950 (nuclear method) often overestimate the actual compaction achieved as measured by pavement cores to ASTM D2726 (bulk specific gravity method), and he shall interpret the initial ASTM D2950 (nuclear method) compaction results accordingly.

.2 Carry out Quality Control testing for pavement acceptance purposes as follows:

.1 Field Density: After asphaltic concrete has been laid and compacted, extract pavement core(s) for determining the compacted (in-place) density of the pavement. Determine the compacted density to ASTM D2726 (bulk specific gravity method). Obtain one (1) core for every 50 m of pavement strip placed. In addition, for joint density testing, obtain one (1) core for every 50 m of joints. Locations of pavement cores shall be determined in consultation with Departmental Representative.

.2 Pavement Thickness: Measure pavement cores that are extracted for field density as described above to determine the compacted thickness of the pavement in place.

.3 Should any core sample fail to meet the specified field density and thickness requirements, additional sampling/testing of cores and remedial action may be required as directed by Departmental Representative, at Contractor's own expense, to correct such deficiencies.

.4 Contractor shall backfill core holes.

.5 Contractor shall pay all costs in connection with sampling and testing of aggregates and finished paving which fail to meet specified requirements.

.6 A testing agency retained and paid for by Departmental Representative will undertake such tests as Departmental Representative may carry out, at his sole discretion, for Quality Assurance purposes.

3.11 DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.

.2 Repair areas showing checking, rippling, or segregation.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.12 MAINTENANCE

.1 Contractor shall be responsible for maintaining the condition of, and cleaning of the asphalt pavement throughout the entire duration of the Contract. Unless Contractor can prove otherwise, defects shall be attributed to Contractor's construction activities, and Contractor shall correct any such defects or irregularities (i.e. cracking, rutting, depression) prior to final acceptance.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section applies to the supply and application of Traffic Marking Paint and Special Markings on concrete or asphalt surfaces.

.2 The composition and consistency of the Paint will be at the discretion of the manufacturer. Paint shall be supplied in white or yellow colours accepted by the Department Representative.

1.2 MEASUREMENT FOR PAYMENT

.1 Pavement marking: measured in square metres of painted surface for large flat areas on the concrete deck, in metres of solid lines or painted length of dash lines of minimum 100mm width and in meters of concrete bullrail painted on both the top and inside vertical edge.

.2 Symbols and letters: measured in [units].

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.5-99, Low Flash Petroleum Spirits Thinner.

.2 CAN/CGSB 1.74-01, Alkyde Traffic Paint.

.2 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - [current edition].

.5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-[A2007], Architectural Coatings.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit [two] copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.

.3 Samples:

.1 Submit to [Departmental Representative] [DCC Representative] [Consultant] following material sample quantities at least [4] weeks prior to commencing work.

.1 One Liter samples of each type of paint.

.2 Sampling to MPI Painting Manual.

.2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, MPI specification number and formulation number and batch number.

1.5 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 off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Paint:

.1 To MPI -EXT 2.1B, Alkyd zone/traffic marking.

.2 Colour: to MPI listed, yellow and white.

.3 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.

.2 Thinner: to MPI listed manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.

.3 Remove any curing compound or loose material from new concrete surface by wire brushing or other acceptable means prior to application of paint.

.4 Proceed with Work only after unacceptable conditions have been rectified.

.5 Remove all hardware and fixtures from the surfaces to be coated. If these cannot be removed from the area protect them from damage by surface preparation and coating overspray.

.6 Reinstall all hardware when coating is complete.

.7 Scrape and vacuum efflorescence from concrete.

.8 The concrete surfaces prior to coating shall be clean and free of dust. The surfaces shall be vacuumed prior to coating to remove dust if required by the manufacturer.

.9 pH of concrete to be in range of manufacturers requirements prior to coating application.

.10 Patch existing scaled areas and remove debris and other contaminants which might interfere with the bond of the new coating system.

.11 Patch surface holes with patching material approved by manufacturer.

3.2 EQUIPMENT REQUIREMENTS

.1 Paint applicator: approved pressure type mobile with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

3.3 APPLICATION

.1 Pavement markings: Lay out pavement markings.

.2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.

.3 Apply traffic paint evenly at rate of 3 m^2/L.

.4 Do not thin paint unless approved by Departmental Representative.

.5 Symbols and letters to dimensions indicated.

.6 Paint lines: of uniform colour and density with sharp edges.

.7 Thoroughly clean distributor tank before refilling with paint of different colour.

.8 Minimum width of paint lines is 100mm.

3.4 TOLERANCE

.1 Paint markings: within plus or minus 12 mm of dimensions indicated.

.2 Remove incorrect markings.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning. Waste Management.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION OF COMPLETED WORK

.1 Protect pavement markings until dry.

.2 Repair damage to adjacent materials caused by pavement marking application.

3.7 GUARANTEE

.1 The Coating work will be guaranteed for five (5) years from the date of completion with a joint labour and materials guarantee. This guarantee stipulates that the coating work is done according to the applicable standards specified and that any defects in the work due to faulty workmanship or materials supplied in accordance with the specifications only which appear within 5 years of the date of completion will be corrected at the contractors expense.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section is a reference section for storm utility drainage piping.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 20 00 (Concrete Reinforcing)

.3 Section 03 30 00 (Cast-in-Place Concrete)

.4 Section 03 39 00 (General Concrete Requirements)

.5 Section 05 50 00 (Metal Fabrications)

.6 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.7 Section 32 11 23 (Aggregate Base Courses)

.8 Section 33 41 00 (Storm Utility Drainage Piping)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid for under the following Sections:

.1 Covers, frames and miscellaneous metalwork for storm utility drainage manholes and catch basins will not be measured individually, but considered incidental to the work of this Section. These covers, frames and miscellaneous metalwork shall be paid for within the lump sum price tendered for storm utility drainage under Section 33 41 00 (Storm Utility Drainage Piping), and payment shall include for all costs in connection with supplying and installing these items.

.2 All other work in this Section will not be measured individually. All other work in this Section shall be paid for within the lump sum price tendered for storm utility drainage under Section 33 41 00 (Storm Utility Drainage Piping).

1.4 REFERENCES

.1 ASTM A536, Ductile Iron Castings.

.2 ASTM C139, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

.3 ASTM C478M, Specification for Precast Reinforced Concrete Manhole Sections.

.4 ASTM C990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

.5 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

.6 CAN/CSA-A5-M, Portland Cement.

.7 CAN/CSA-A85-M, Masonry Cement.

.8 CAN/CSA-A23.1-M, Concrete Materials and Methods for Concrete Construction.

.9 CAN/CSA A82.56-M, Aggregate for Masonry Mortar.

.10 CAN3-A165 Series-M, CSA Standards on Concrete Masonry Units.

.11 CAN/CSA G30.18-M, Billet Steel Bars for Concrete Reinforcement.

.12 CAN/CSA G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS AND MATERIAL CERTIFICATION

.1 At least twenty-eight (28) days prior to commencing work, submit manufacturer's test data and certification that materials meet requirements of this Section. Include manufacturer's drawings, information and shop drawings where pertinent.

.2 These submissions are to comply with Section 01 33 00 (Submittal Procedures).

Part 2 Products

2.1 MATERIAL

.1 Concrete: to Section 03 39 00 (General Concrete Requirements).

.2 Concrete reinforcement: to Section 03 20 00 (Concrete Reinforcing).

.3 Precast round manhole and catch basin sections: to ASTM C478M, to size(s) indicated on the Drawings. Top sections flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by Departmental Representative and set on concrete slabs cast in place. Manhole and catch basin sections and lids shall be designed to withstand loads specified on the Drawings.

.4 Joints: to be made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.

.5 Mortar:

.1 Aggregate: to CAN/CSA-A82.56.

.2 Cement: to CAN/CSA-A85.

.6 Ladder rungs: to CAN/CSA-G30.18, 20M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164. Rungs to be safety pattern (drop step type).

.7 Adjusting rings: to ASTM C478M.

.8 Frames, covers and gratings, to dimensions as indicated and following requirements:

.1 Metal covers and gratings to bear evenly on frames. A frame with cover or grating to constitute one unit. Assemble and mark unit components before shipment.

.2 Manhole and catch basin frames, covers and gratings to ASTM A536 Grade 65-45-12.

.3 Castings to be sand blasted or cleaned, and ground to eliminate surface imperfections, and then coated with two applications of asphalt varnish.

.4 Manhole and catch basin frames, covers and gratings: The model numbers shown on the Drawings are provided to indicate style and size only, and do not necessarily indicate their load carrying capacity. All manhole and catch basin frames, covers and gratings shall be designed to withstand loads specified on the Drawings. Stormwater manhole covers shall be marked "STORM" in the casting.

.9 Granular base foundation at manholes and catch basins: to Section 32 11 23 (Aggregate Base Courses). During granular base production, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the granular base material conforms to the specification. The testing rate for in-situ compacted density of Granular Base shall be not less than one test for every manhole and catch basin structure installed in the work; the testing rate for reference dry density (ASTM D1557) shall be not less than two tests for the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.10 During placement, Departmental Representative may, at his discretion, inspect the granular base material at manholes and catch basins for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's own expense.

.11 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected granular base material may be used instead as general fill material.

Part 3 Execution

3.1 EXCAVATION AND BACKFILLING

.1 Excavate and backfill in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

.2 Obtain approval of Departmental Representative before commencing installation of catch basins.

3.2 CONCRETE WORK

.1 Do concrete work in accordance with Section03 39 00 (General Concrete Requirements).

.2 Place concrete reinforcement in accordance with Section 03 20 00 (Concrete Reinforcing).

.3 Position metal inserts in accordance with dimensions and details as indicated.

3.3 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.

.3 Dewater excavation and remove soft and foreign material before placing concrete base.

.4 Cast bottom slabs directly on undisturbed fill or, when use of precast concrete bases are permitted by Departmental Representative, set precast concrete base on 150 mm minimum of granular base compacted to a minimum of 95 % of modified Proctor corrected maximum dry density (ASTM D1557).

.5 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with Departmental Representative approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination thereof.

.2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.3 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.6 For sewers:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Connect concrete and PVC pipe into manhole and catch basin using manhole adaptor ring and fill hole with shrinkage compensating grout. Roughen PVC prior to applying grout.

.3 Bench to provide a smooth U-shaped channel. Side height of channel to be level with the crown of the highest sewer inlet. Slope adjacent floor at 8 %. Curve channels smoothly. Slope invert to establish sewer grade.

.7 Set frame and grating or cover to required elevation on no more than six (6) concrete rings. Join rings to frame with cement mortar. Parge and make smooth and watertight.

.8 Place frame and grating or cover on top section to elevation as indicated. If adjustment is required use concrete ring.

.9 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and installation of fire water mains (surface run and buried), hydrants, valves, and valve boxes for the South Jetty Wharf Development, as shown on the Drawings. Surface run pipe includes pipework in the trenches and pipework hung under the jetty deck.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 00 (Closeout Submittals)

.3 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.4 Section 03 30 00 (Cast-in-Place Concrete)

.5 Section 03 39 00 (General Concrete Requirements)

1.3 MEASUREMENT AND PAYMENT

.1 Fire water mains will not be measured individually. Fire water mains will be paid for at the Lump Sum price tendered for FIRE WATER MAINS. Payment shall be full compensation for trenching, laying, jointing, installation, flushing, testing, backfill, supply and delivery of materials including pipe, fittings, valves, hangers, supports, heat tracing and insulation, thrust blocks and all work necessary or incidental thereto for which separate measurement is not provided elsewhere.

1.4 REFERENCES

.1 ANSI/AWWA B300, Hypochlorites.

.2 ANSI/AAW B301, Liquid Chlorine.

.3 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

.4 ANSI/AWWA C207, Steel Pipe Flanges for Waterworks Service, 4 in. – 44 in.

.5 ANSI/AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings.

.6 ANSI/AWWA C509, Resilient-Seated Gate Valves for Water-Supply Service.

.7 ANSI/AWWA C502, Standard for Dry-Barrel Fire Hydrants.

.8 ANSI/AWWA C601, Flushing and Disinfecting.

.9 ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75 mm through 1200 mm), for Water.

.10 ANSI/AWWA C150/A21.50, Thickness Design of Ductile-Iron Pipe.

.11 ANSI/AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.12 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

.13 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.14 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.15 ASTM C117, Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

.16 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

.17 ASTM D3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

.18 ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

.19 AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

.20 AWWA M23, PVC Pipe – Design and Installation.

.21 CAN/CGSB-8.1, Sieves Testing, Woven Wire.

.22 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

.23 CGSB 1-GP-12c, Standard Paint Colours.

.24 CSA 137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.25 CGSB 1-GP-59M, Enamel, Exterior Gloss Alkyd Type.

.26 IEEE 515.1, Recommended Practice for the Testing, Design, Installation, and Maintenance of Electrical Resistance Heat Tracing for Commercial Applications.

1.5 DEFINITIONS

.1 NOT USED

1.6 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 (Submittal Procedures).

1.7 MATERIAL CERTIFICATION

.1 At least twenty-eight (28) days prior to commencing work, submit manufacturer's test data and certification that pipe materials meet the requirements of this section. Include manufacturer's drawings, information and shop drawings where pertinent.

1.8 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Schedule work to minimize variations in sub-grade quality. All fire water mains are to be installed and backfilled prior to placing granular sub-base.

.3 Notify fire department and Departmental Representative a minimum of fourteen (14) days prior to any planned interruption of water supply to hydrants. Notify fire department and Departmental Representative immediately of any accidental interruption of water supply to hydrants.

.4 Provide "Out of Service" sign on hydrant not in use.

1.9 CLOSE OUT SUBMITTALS

.1 Provide record drawings, including directions for operation valves, details of pipe material, location of air and vacuum release valves, hydrant details, heat tracing and insulation, maintenance and operating instructions in accordance with Section 01 78 00 (Closeout Submittals).

.2 Include on the record drawings top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

.1 Buried pipe to be polyvinyl chloride (PVC) pressure class 225, DR14 PVC, 1 MPa pipe to ANSI/AWWA C900. Pipe shall be certified by the Canadian Standards Association to CSA B137.3.

.2 Joints for PVC pipe to be push-on integrally thickened bell and spigot type to ASTM D3139 with single elastomeric gasket to ASTM F477. Flanged joints shall be Class 125 in accordance with AWWA C207.

.3 All internal surfaces of the gasket ring (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61. Exterior surfaces of the gasket ring shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

.4 PVC fittings to ANSI/AWWA C907.

.5 Surface run pipe shall be galvanized steel water pipe to ASTM A53/A53M Grade A, Schedule 40, unless noted otherwise on the Drawings.

.6 Steel pipe joints to be grooved end mechanical pipe couplings.

.7 Movement joints, required at locations indicated on the Drawings, are to accommodate 300 mm of relative movement (measured from the installed position) . This is intentionally larger than the required movement joints for sanitary, stormwater and compressed air runs.

2.2 PIPE-TO-FLANGE JOINTS

.1 Mechanical joints between pipe and flanges shall be restrained flange adapters made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with mating flange design.

.2 Restraint for flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to achieve proper initial set of gripping wedges.

.3 The flange adapters shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6 inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

.4 Flanges to ANSI/AWWA C207, class B hub type.

2.3 PUSH-ON PIPE JOINT RESTRAINTS

.1 All push-on-pipe joints will have pipe joint restraints.

.2 Push-on pipe joints for PVC pipe supplied to ANSI/AWWA C900 shall consist of a spilt-ring joint restraint system designed for PVC C900 pipe and PVC C907 fittings.

.3 A split ring shall be utilized on the PVC fitting bell. A serrated ring shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring. The combination shall have a minimum working pressure rating equivalent to the pipe.

.4 Ductile iron used for split-ring joint restraints shall conform to ASTM A536.

.5 Coating for pipe joint restraints shall consist of a minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.

2.4 VALVES AND VALVE BOXES

.1 Gate valves: to ANSI/AWWA C509, standard iron Class 125 body, resilient wedge valves with non-rising stems, minimum 1040 kPa working pressure with flanged joints to ANSI/AWWA C110/A21.10. Valves to open counter clockwise.

.2 Ball valves: Class 150, stainless steel body, three piece.

.3 Valve Boxes: three piece sliding type adjustable over minimum of 450 mm complete with valve operating key of such length that when set on valve operating nut top of rod will not be more than 150 mm below cover.

.1 Base to be large round type with minimum diameter of 300 mm.

.2 Top of box to be marked "WATER".

.4 Automatic Breach Containment Valves: to ANSI/AWWA B16.42, Ductile Iron grade ASTM A536 body material.

.1 Install Automatic Breach Containment Valves on both ends of the Timber Crib (see Drawings M4 and M8). **Note**: These two valves are intended to prevent loss of water pressure in the event that failure of the articulation slab (under seismic

conditions) causes a breach in the pipework crossing the gap between the timber crib and the concrete jetty deck.

.2 Approved Product: Automatic Breach Containment Valves system shall be as follows:

.1 Clo-Val, model # 685-09-1.

2.5 HYDRANTS

.1 Post type hydrants shall be cast iron body, full bronze mounted, compression type, suitable for a working pressure of 1,700 kPa conforming to AWWA C502 and CAN/ULC-S520.

.2 Connections: two 65 mm threaded hose outlets, one 100 mm threaded pumper connection, minimum 150 mm riser barrel, and minimum 125 mm bottom valve. Nozzle configurations shall conform to British Columbia Standards for Fire Hydrant.

.3 The hydrant inlet connection shall be 150 mm diameter. The joint shall have a preformed rubber gasket suitable for connection to the pipe being used. The bell shall have harnessing lugs for tie-rod anchorage.

.4 Hydrants to open counter clockwise, threads to local standard, fittings to be internal lug quick-connect to CAN4-S543. Provide metal caps and chains.

.5 Provide key operated gate valve located 1 m from hydrant.

.6 Depth of bury 1 m.

.7 Hydrant paint: exterior enamel to CAN/CGSB-1.88. Finished paints above ground shall be red. The hose and pumper nozzle caps shall be painted white.

2.6 HANGARS AND SUPPORTS

.1 Pipe hangers and supports as shown on the Drawings.

.2 Pipe hangers and supports: hot dipped galvanized after manufacture.

.3 Pipe hanger and support to manufacturer's standard production components, parts and assemblies.

2.7 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material shall be crushed or screened stone, gravel or sand consisting of hard, durable particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials with gradation within the limits given in Table 1, when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

2.8

TABLE 1 – PIPE BEDDING AND SURROUND

Sieve Size (U.S. Standard)	**Gradation Limits (% Passing by Dry Weight)**
19 mm (3/4 in.)	100
12.5 mm (1/2 in.)	70 - 100
9.5 mm (3/8 in.)	50 - 85
4.75 mm (# 4)	30 - 60
2.0 mm (# 10)	15 - 40
0.40 mm (#40)	10 - 30
0.075 mm (#200)	0 - 5

.1 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 39 00 (General Concrete Requirements), Type F.

.2 At least twenty-eight (28) days prior to commencing pipe bedding/surround placement, the Contractor shall notify Departmental Representative of the proposed material source(s) and placement procedures and provide, at Contractor's cost, qualification test results confirming that the proposed material from each source meets or exceeds the requirements of this specification.

.3 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise the Contractor of the acceptability of the proposed materials and procedures.

.4 During pipe bedding/surround production, the Contractor shall conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the fill materials conform to the specification. The material gradation testing rate for pipe bedding/surround shall be at least **two (2) tests** over the course of the work. The testing rate for in-situ compacted density of pipe bedding/surround shall be not less than **one test for every 20 m** length of trench; the testing rate for reference dry density (ASTM D1557) shall be not less than **two (2) tests** over the course of the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.5 During placement, Departmental Representative may, at his discretion, inspect the pipe bedding/surround material for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to the Contractor, unless material does not conform, whereon the testing shall be at the Contractor's expense.

.6 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected pipe bedding/surround material may be used instead as General Fill material.

2.9 BACKFILL MATERIAL

.1 General Fill in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

2.10 PIPE DISINFECTION

.1 Use sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.

.2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

2.11 HEAT TRACE AND INSULATION FOR WATER PIPES

.1 Heat trace all surface run pipe.

.2 Heat trace shall be an industrial self-regulating cable, powered by 277V AC, with 5 W/ft of thermal output power and shall run the entire length of all exposed waterworks including intrenches.

.3 Heat trace shall include a thermostat to cut power to the system for ambient temperatures of 5 degrees Celsius and above.

.4 Heat trace shall include aluminum (for thermal contact) and fibreglass bonding tape (for mechanical protection).

.5 Provide a heat tracing control system, including distribution panel, to control all runs from a central location. The distribution panel shall consist of an enclosure, including a panelboard with groundfault protection devices (30mA trip level). The panels shall provide ground-fault alarm capabilities. A main contactor shall be used. The panels shall operate with ambient -sensing or proportional ambient-sensing controllers. The panel shall be capable of remote temperature monitoring and alarming of individual heat-tracing circuits. The panels shall be capable of providing audible and visible alarms.

.6 All control and monitoring systems shall be capable of communicating with a host PC for central programming, status review, and alarm annunciation. All systems shall include, but not be limited to, the following:

.1 Alarm limits and setpoint temperatures shall be programmable from the central monitoring and control panel in °F and °C. The system shall include an alphanumeric display with multi-language support and password protection or lockable cabinet to prevent unauthorized access to the system.

.2 The system shall be switched by an external solid-state or mechanical relay with a minimum rating of 30 Amps.

.3 The system shall be capable of assigning one or more resistance temperature detectors (RTDs) to a circuit to monitor temperature. One RTD can be applied to control the heater circuit, and a second RTD for another control point or to measure sheath temperature of a heater for high temperature cutout.

.4 The system shall monitor temperature, and line current to the systems.

.5 The system shall monitor ground-fault current and offer the option of alarm only or alarm and trip if the ground fault exceeds the selectable level.

.7 Provide appropriate warning labels to indicate that the waterworks are wired with heat trace.

.8 Approved Product: Heat trace system shall be as follows:

.1 Raychem Self-Reg Heating Cable model # 5XL2-CR.

.2 Raychem Power connection and end seal model # RAYCLIC-PC.

.3 Raychem XL-Trace termination kits and tapes.

.4 Digitrace Heat Tracing Control System model # NGC-30.

.9 Heat trace system shall include alarm contacts connected to a fire control panel.

.10 Insulate straight runs of pipe and bends with 1" mineral wool (i.e. not required at valves and other fittings).

.11 Each heat trace circuit shall be provided with a ground-fault protection device set at 30 mA, with a nominal 100-ms response time.

.12 The heating cable shall have a tinned copper braid with a resistance less than the heating cable bus wire resistance as determined in type test (ASTM, B193, Section 5). The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket.

.13 The system shall be compatible with all types of heating cables and capable of performing the following functions:

.1 Controlling and monitoring pipe temperatures.

.2 Providing real-time temperature and alarm log readouts.

.3 Providing alarms in the event of low or high pipe temperature, low or high heater current, high ground-fault current, ground-fault trip, relay failure, and sensor failure.

.4 Providing remote alarm annunciation.

.5 Interfacing with personal computers and distributed control systems (DCS).

.14 The system shall provide three (3) isolated solid-state alarm relays or dry contact relays on the user interface terminal (UIT) and one (1) isolated solid state alarm relay or a dry contact relay on each control board for alarm annunciation back to a distributed control system (DCS). The three alarm relays on the UIT shall be user programmable to indicate on any alarm or any combination of available alarms. Each of the three alarm relays shall be independently programmable.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

.2 Trench depth to provide cover over pipe of not less than 1000 mm from finished grade.

.3 Trench alignment to be uniform and free of dips, bends or deviations in grade.

.4 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.3 Shape transverse depressions in bedding as required to suit joints.

.4 Compact each layer full width of bed to at least 95 % modified Proctor maximum dry density to ASTM D1557.

.5 Fill excavation below design elevation of bottom of specified bedding with compacted general fill in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

3.4 PIPE INSTALLATION

.1 Lay and join pipes to manufacturer's standard instructions and specifications except as noted otherwise herein: PVC pipe to AWWA M23 and C605.

.2 Handle pipe by methods approved by Departmental Representative. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.3 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Remove and replace defective pipe. Correct pipe which is not in true alignment or grade, or pipe which shows undue settlement after installation.

.4 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.5 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.6 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.7 Position and join pipes with equipment and methods approved by Departmental Representative.

.8 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.9 Align pipes carefully before jointing.

.10 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.11 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.12 Install pipe joint restraints in accordance with manufacturer's written instructions.

.13 Complete each joint before laying next length of pipe.

.14 Minimize deflection after joint has been made.

.15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.18 Do not lay pipe on frozen bedding.

.19 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material. Backfill remainder of trench.

3.5 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated on the Drawings.

.2 Install underground post-type indicator valves as indicated.

3.6 HANGAR AND SUPPORT INSTALLATION

.1 Install hangers and supports to manufacturer's recommendations.

.2 Install hanger so that rod is vertical under operating conditions.

.3 Adjust hangers to equalize load.

3.7 THRUST BLOCKS

.1 Do concrete work in accordance with Section 03 39 00 (General Concrete Requirements)

.2 Place concrete thrust blocks at valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings on undisturbed ground or compacted fill as indicated.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within twenty-four (24) hours after placing.

3.8 HYDROSTATIC AND LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Notify Departmental Representative at least twenty-four (24) hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.

.3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five (5) days after placing concrete, or at least two (2) days if high early strength concrete is used.

.4 Leave valves, joints and fittings exposed.

.5 When testing is done during freezing weather, protect valves, joints and fittings from freezing.

.6 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.7 Open valves.

.8 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.

.9 Thoroughly examine exposed parts and correct for leakage as necessary.

.10 Apply hydrostatic test pressure of 1040 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of one (1) hour.

.11 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.12 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.13 Repeat hydrostatic test until all defects have been corrected.

.14 Apply a leakage test pressure of 1040 kPa after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of two (2) hours.

.15 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for two (2) hours.

.16 Do not exceed allowable leakage of 0.03 litres/mm diameter per 300 m of pipe, including lateral connections, per hour.

.17 Locate and repair defects if leakage is greater than amount specified.

.18 Repeat test until leakage is within specified allowance for full length of water main.

3.9 PIPE SURROUND

.1 Upon completion of pipe laying and after Departmental Representative has inspected work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 3 m of exposed pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Compact each layer from pipe invert up to underside of backfill to at least 95 % modified Proctor maximum dry density to ASTM D1557.

3.10 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to subgrade level.

.2 Compact backfill to at least 95 % modified Proctor maximum dry density to ASTM D1557.

3.11 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations to be witnessed by Departmental Representative.

.2 Flush water mains through available outlets with a sufficient flow to produce a velocity of 2 m/s, within pipe for ten (10) minutes, or until foreign materials have been removed and flushed water is clear.

.3 Provide connections and pumps for flushing as required.

.4 Open and close valves, hydrants and service connections to ensure thorough flushing.

.5 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.

.6 Rate of chlorine application to be proportional to rate of water entering pipe.

.7 Chlorine application to be close to point of filling water main and to occur at same time.

.8 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.9 Flush line to remove chlorine solution after 24 hours. Dispose chlorinated water to sanitary sewer.

.10 Measure chlorine residuals at extreme end of pipe-line being tested.

.11 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or recur during this period, repeat disinfecting procedure.

.12 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.13 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.

.14 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.12 HEAT TRACE FOR SURFACE RUN WATER PIPES

.1 Install heat trace system to manufacturer's directions. Affix warning labels in prominent location on hung pipe and inside trenches.

.2 Factory inspections and tests for heater cables shall include the following:

.1 Testing shall be done per the latest IEEE Standard 515 test section and applicable manufacturer's standards.

.2 In the field, all heater cables shall be tested for insulation resistance. The following separate field megohmmeter readings shall be taken on each self-regulating and each M.I. heater cable:

.1 When received at jobsite before installation.

.2 After installation, but before insulation is applied.

.3 After insulation has been installed.

.3 All three of the above field megohmmeter readings shall be greater than 20 megohms. Otherwise, the heater cable is not acceptable and shall be replaced.

.4 Field megohmmeter tests shall be recorded for each heater cable, and certified reports shall be submitted to Departmental Representative.

3.13 OPERATIONS AND MAINTENANCE MANUALS

.1 Provide operation and maintenance manuals, as stipulated in Section 01 78 00 (Closeout Submittals), for the following:

.1 Backflow preventer valves, gate valves, automatic breach containment valves fire hydrants, and heat tracing; and,

.2 All other supplied mechanical and electrical equipment.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers provision of permanent stormwater surface drainage, including oil-water separators and outfalls to marine environment, as shown on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 00 (Closeout Submittals)

.3 Section 03 20 00 (Concrete Reinforcing)

.4 Section 03 30 00 (Cast-in-Place Concrete)

.5 Section 03 39 00 (General Concrete Requirements)

.6 Section 05 50 00 (Metal Fabrications)

.7 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.8 Section 31 24 15 (General Fill)

.9 Section 33 05 13 (Manholes and Catch Basins)

1.3 MEASUREMENT AND PAYMENT

.1 The storm utility drainage system will not be measured individually. Storm utility drainage will be paid for at the Lump Sum price tendered for STORM UTILITY DRAINAGE. Payment shall be full compensation for the scope of work described on the Drawings and in the Specification, or incidental thereto for which separate measurement is not provided elsewhere, for supply and installation of the storm utility drainage piping, deck drains/covers, deck drain junction boxes, catch basins, manholes, miscellaneous metalwork related to permanent storm utility drainage, oil-water separators, outfalls, concrete and reinforcing associated with storm drainage.

1.4 REFERENCES

.1 ASTM Cl4M, Specifications for Concrete Sewer, Storm Drain and Culvert Pipe.

.2 ASTM Cl17, Test Method for Material Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM C443M, Specification for Joints for Circular Concrete Pipe and Manholes, Using Rubber Gaskets.

.5 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

.6 ASTM D3034, Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.7 ASTM D3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

.8 ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

.9 CAN/CSA-A5, Portland Cement.

.10 CAN/CSA-A257-M, Standards for Concrete Pipe.

.11 CAN/CSA-B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

.12 CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.13 CAN/CGSB-8.1, Sieves Testing, Woven Wire.

.14 CAN/CGSB-8.2-M, Sieves Testing, Woven Wire, Metric.

.15 Ministry of Transportation Electrical and Signing Material Standards, section 402.

.16 CSA C22.3 No. 7-94 Underground Systems.

.17 CSA C22.1-02 and BC Electrical Safety Branch Amendments.

.18 CSA C22.2 No. 211.2-M, Rigid PVC (Unplasticized) Conduit.

.19 CSA C22.2 No.211.1-M, Rigid types EBI and DB2/ES2 PVC Conduit.

.20 CSA C22.2 No. 131-M, Type TECK 90 Cable.

.21 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.22 Abbreviations for electrical terms: to CSA Z85.

.23 ASTM D1056-91, Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

1.5 DEFINITIONS

.1 NOT USED

1.6 SCHEDULING OF WORK

.1 Contractor shall be responsible throughout construction for providing and maintaining temporary stormwater drainage within the work site. The routing of any temporary stormwater drainage runs shall be subject to Departmental Representative’s approval, and shall account for treatment of the runoff before discharge.

.2 Schedule work to minimize variations in sub-grade quality.

.3 All storm sewers (including catch basins, manholes and oil-water separators) are to be installed and backfilled prior to placing granular sub-base for asphalt pavement.

1.7 MATERIAL CERTIFICATION

.1 At least fourteen (14) days prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this Section.

1.8 SUBMITTALS

.1 At least twenty-eight (28) days prior to commencing the construction of any permanent stormwater drainage facilities, submit drainage shop drawings and oil-water separator details to Departmental Representative for review in accordance with Section 01 33 00 (Submittal Procedures).

Part 2 Products

2.1 CONCRETE PIPE

.1 Non-reinforced circular concrete pipe and fittings to ASTM C14M, 450 mm dia., Class IV as indicated, designed for flexible rubber gasket joints to ASTM C443M.

2.2 PLASTIC PILE

.1 Poly Vinyl Chloride (PVC) pipe manufactured to specifications for pipe size ranges as follows:

.1 100 mm dia. – 375 mm dia. to ASTM D3034

.2 Pipes to be certified by Canadian Standards Association to CAN/CSA-Bl82.2.

.3 Standard Dimensional Ratio (SDR): 35.

.4 Joints: To conform to ASTM D3212; pipe to include integral bell and spigot ends with stiffened wall section and formed groove for rubber gasket; elastomeric gaskets to ASTM F477.

.5 Movement joints, required at locations indicated on the Drawings, are to accommodate 51 mm of relative movement (measured from the installed position).

2.3 PIPE BEDDING AND SURROUND MATERIAL

.1 Pipe bedding and surround material to be crushed stone, gravel or sand consisting of hard, durable, particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Gradations to be within the limits specified in Table 1 when tested to ASTM C136 and ASTM C1l7. Sieve sizes to CAN/CGSB-8.1.

.2

TABLE 1 – PIPE BEDDING AND SURROUND

Sieve Size (U.S. Standard)	Gradation Limits (% Passing by Dry Weight)
19 mm (3/4 in.)	100
12.5 mm (1/2 in.)	70 - 100
9.5 mm (3/8 in.)	50 - 85
4.75 mm (No. 4)	30 - 60
2.0 mm (No. 10)	15 - 40
0.40 mm (No.40)	10 - 30
0.075 mm (No.200)	0 - 5

.3 Concrete mixes and materials required for bedding, cradles, encasement, supports, manhole, catch basin and oil-water separator bases, manhole benching to Section 03 39 00 (General Concrete Requirements)Type F.

.4 At least twenty-eight (28) days prior to commencing placement of pipe bedding or surround materials, Contractor shall notify Departmental Representative of the proposed material source(s) and placement procedures and provide, at Contractor's own cost, qualification test results confirming that the proposed material from each source meets or exceeds the requirements of this Section of the Specification.

.5 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise Contractor of the acceptability of the proposed materials and procedures.

.6 During pipe bedding/surround production, Contractor shall conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the fill materials conform to the specification. The material gradation testing rate for pipe bedding/surround shall be at least **two (2) tests** over the course of the work. The testing rate for in-situ compacted density of pipe bedding/surround shall be not less than **one test for every 20 m** length of trench; the testing rate for reference dry density (ASTM D1557) shall be not less than **two (2) tests** over the course of the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.7 During placement, Departmental Representative may, at his discretion, inspect the fill materials for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's own expense.

.8 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental

Representative's agreement, rejected pipe bedding or surround materials may be used instead as general fill.

2.4 BACKFILL MATERIAL

.1 General fill in accordance with Section 31 24 15 (General Fill).

2.5 MISCELLANEOUS METAL WORK

.1 Deck drains/covers, bends, tees, deck drain junction boxes and other miscellaneous metalwork to be in accordance with Section 05 50 00 (Metal Fabrications).

2.6 OIL-WATER SEPARATORS

.1 Each permanent oil-water separator shall conform to the following minimum performance specifications for sediment and oil removal at the design treatment capacity of 80 l/s:

TABLE 3: PERMANENT OIL-WATER SEPARATORS

Description	Specification
Design Treatment Capacity	80 l/s
Sediment Storage	0.9 cu.m
Removal of Annual Total Suspended Solids (50 micron particle size)	80 %
Removal of Floatable Free Oil	95%

.2 Oil-water separators shall be designed to not allow re-suspension of trapped sediments or re-entrainment of floating contaminants at flow rates up to and including the specified design treatment capacity. Oil-water separators shall be designed to not allow surcharge of the upstream piping network during dry weather conditions.

.3 Each oil-water separator shall be able to accommodate an inlet pipe invert at a minimum of 1.0 m below the finished surface level. The inlet and outlet pipes of each oil-water separator shall be at 90 degrees to each other (on plan), or as otherwise shown on the Drawings.

.4 Each oil-water separator shall include physical access for environmental monitoring and sampling at the unit discharge point. This environmental monitoring and sampling will be conducted by EGD Operations personnel, at their sole discretion, once the oil -water separators have been installed.

.5 Each oil-water separator shall be of a type that has been installed and used successfully for a minimum of five (5) years. The manufacturer shall have been regularly engaged in the engineering design and production of oil-water separator

systems for the physical treatment of stormwater runoff for a minimum of five (5) years.

Part 3 Execution

3.1 PREPARATION

.1 Clean new pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

.2 Where drainage piping is to be connected to existing piping, clean the existing pipes and fittings of debris. Carefully inspect the existing piping for damage and defects, and inform Departmental Representative if any damage or defects are found.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling) and as shown on the Drawings.

.2 Do not allow contents of any sewer, or sewer connection, to flow into trench.

.3 Ensure trench alignment and depth are to approval of Departmental Representative, prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.3 Shape transverse depressions as required to suit joints.

.4 Compact each layer full width of bed to at least 95 % modified Proctor maximum dry density to ASTM D1557, and as shown on the Drawings.

.5 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted general fill.

3.4 INSTALLATION - GENERAL

.1 Handle pipe by approved methods. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.2 Lay and join pipe in accordance with manufacturer’s recommendations. Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.3 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.4 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.5 Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.

.6 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.7 Position and joint pipes by methods approved by Departmental Representative.

.8 Install PVC pipe and fittings in accordance with CAN/CSA-B182.11.

3.5 JOINTS FOR CONCRETE PIPES

.1 Install gaskets as recommended by manufacturer.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and to maintain concentricity until gasket is properly positioned.

.3 Align pipes carefully before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer’s recommendations.

.9 When any stoppage of work occurs, restrain pipes to prevent “creep” during down time.

.10 Plug lifting holes with Departmental Representative approved prefabricated plugs, set in shrinkage compensating grout.

.11 Cut pipes as required for special inserts, fittings or closure pieces in neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.12 Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available.

.13 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.

.14 Plug open upstream ends of pipes with removable watertight concrete, steel or wooden bulkheads.

3.6 PIPE SURROUND

.1 Upon completion of pipe laying and after Departmental Representative has inspected work in place, surround and cover pipes as specified.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 3 m of pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Compact each layer from pipe invert up to underside of backfill to at least 95 % modified Proctor maximum dry density to ASTM D1557.

.5 Install concrete encasement where indicated on the Drawings. Use Type F concrete to Section 03 39 00 (General Concrete Requirements).

3.7 OIL-WATER SEPARATORS

.1 Install each oil-water separator at elevation and location as shown on the Drawings, or as otherwise directed by Departmental Representative.

.2 Installation of the oil-water separator system shall be carried out in accordance with the manufacturer's instructions.

3.8 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to subgrade level.

.2 Compact backfill to at least 95 % modified Proctor corrected maximum dry density to ASTM D1557.

.3 Install wooden stake markers on the ground surface at plugs and caps such that the ends of the buried pipes can be easily located by others.

3.9 FIELD TESTING

.1 Repair or replace pipe, pipe joints or bedding found defective.

.2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Departmental Representative may carry out inspection of installed sewers by television camera, photographic camera or by other related means. Provided no defective work is found by such inspections, Departmental Representative will pay costs for inspectors, trained operators, equipment rental and materials. If defective work is found by such inspections, pay Departmental Representative a part of total inspection cost proportional to number of defective sections of sewer to total number of sections inspected. A section is defined as length of pipe between successive catch basins and/or manholes. Regardless of the inspection

outcome, Contractor shall assist Departmental Representative to gain access to the storm water drainage system, provide safety precautions in compliance with WorkSafeBC regulations, and provide temporary electrical power/lighting as required for inspection and testing.

3.10 OPERATION AND MAINTENANCE MANUALS

.1 Provide operation and maintenance manuals, as stipulated in Section 01 78 00 (Closeout Submittals), for all supplied mechanical and electrical equipment.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section includes methods and procedures for procurement, fabrication, construction, maintenance, and repair of silt curtains required during completion of the East End slope excavation work

1.2 MEASUREMENT AND PAYMENT

.1 All costs associated with silt curtains shall be considered incidental to the work and shall be included in the tender price for EAST END SLOPE EXCAVATION AND DISPOSAL.

1.3 RELATED SECTIONS

.1 35 20 23 - East End Slope Excavation.

.2 35 37 10.01 – East End Slope Capping

1.4 AQUATIC WATER QUALITY CONTROL

.1 Prepare, as part of the Environmental Protection Plan (EPP), a silt curtain control plan, which describes how the Contractor will limit the dispersion of suspended solids away from excavation activities by use of a silt curtain during completion of its slope excavation activities.

.2 Silt curtain fabrication shall not begin until a silt curtain control plan, to be submitted as part of the EPP, has been reviewed and accepted by the Departmental Representative. At a minimum, the silt curtain control plan shall contain the following information:

.1 The type and make of all materials and parts proposed for use as part of the silt curtain system.

.2 Layout of silt curtain system, dimensions, and silt curtain anchoring plan.

.3 Methods and procedures for Contractor inspection, maintenance, and repair of silt curtain system during construction.

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

Part 2 Products

2.1 SILT CURTAIN

.1 The Contractor shall be responsible for design, procurement, installation, operation, inspection, maintenance, and repair of all silt curtains required for this work.

.2 The silt curtain shall be used to contain turbidity generated during completion of in-water construction activities. The silt curtain shall be furnished by the Contractor, and will surround the excavation activities specified in Part 3 – Execution of this Specification section. The curtain shall be supported by floats at the top and weighted at the bottom. The curtain shall extend from the water surface to the seabed and shall comply with water quality requirements in the EMP and the Fisheries Act Authorization.

Part 3 Execution

3.1 SILT CURTAIN IMPLEMENTATION

.1 The silt curtain shall be used during completion of East End slope excavation activities, and as additionally required by permits.

.2 Provide daily inspection of silt curtain system to ensure it is properly installed and effectively containing suspended sediment.

.3 Should Contractor inspection or PWGSC environmental monitoring indicate that the silt curtain is not effectively containing suspended sediment, is damaged, or is improperly installed, the Contractor shall take immediate action to repair the silt curtain, adjust use of the silt curtain, or any additional actions necessary to comply with water quality requirements and permit conditions at no additional cost to PWGSC.

3.2 PROTECTION OF AQUATIC WATER RESOURCES

.1 General

.1 Compliance with conditions of any permits and clearances obtained for the work is the Contractor's responsibility.

.2 Discharge of effluent from the Contractor's construction activities shall meet all water quality requirements per the EMP and permit conditions.

.2 Disposal

.1 Except as provided in the Contract, disposal of any wastes, effluents, trash, grease, chemicals, or other contaminants in water bodies shall not be allowed.

.2 If any waste material is dumped in unauthorized areas, the material shall be removed and the area restored to its pre-project condition.

3.3 AQUATIC WATER QUALITY MONITORING

.1 The Departmental Representative will perform water quality monitoring, consistent with the EMP.

.2 The Contractor shall familiarize itself with water quality requirements and with other PWGSC monitoring plans and activities, as they pertain to this Contract.

.3 In no event does the Departmental Representative's monitoring activities alleviate the Contractor's responsibility to monitor its own operations to ensure that the Contractor is meeting water quality requirements.

.4 Comply with all permits and approvals and the requirements of the EMP in conducting the work. For site-specific water quality requirements refer to the EMP.

.5 The Contractor shall provide safe access to the Environmental Monitor to conduct water quality monitoring at the specified distances from the work activity.

.6 Any exceedance of the water quality requirements, as described in the Fisheries Act Authorization and EMP, may result in a requirement to stop work or modify work activities at the discretion of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes details regarding East End slope excavation from the Contractor's Work Site. Excavation includes completion of Required Excavation work to remove contaminated sediments from the East End top of slope area (as shown on the Drawings) and to establish the base surface for Engineered Capping (Capping) of the East End Capping area. The excavation area limits are shown on the Drawings and Contractor shall take care to note offset areas from existing structures or shoreline areas to prevent potential undermining of those structures.

.2 The Contractor is responsible for reviewing the information provided in the Specifications, Environmental Management Plan (EMP), and other Contract Documents regarding nature of material, structural conditions and site access to be encountered at the Contractor's Work Site, and selecting appropriate land based excavation equipment that will allow for removal of this material.

.3 Specialized excavation techniques may be required to protect existing structures adjacent to the work.

.4 Excavation activities shall be performed from the landside in the dry (to the extent practicable) within a full length silt curtain or other acceptable re-suspension barrier that fully encloses the excavation activity. This requirement is intended to prevent contaminated sediment from spreading and contaminating recently remediated areas outside of the East End slope excavation and capping area.

.5 During Required Excavation activities, the Contractor shall implement best management practices (BMPs) to minimize potential for recontamination to areas outside of the East End slope area. The Contractor shall include details and descriptions of the BMPs (including use of a full length silt curtain) that will be implemented to prevent recontamination as part of the Construction Work Plan.

.6 The Contractor shall load excavated sediment directly into haul trucks that are lined to prevent leakage/spillage during transport. No temporary stockpiling of excavated materials is allowed.

.7 Descriptions of material to be excavated are provided in the Appendices and Reference Documents attached to the Specifications. The Contractor shall review this information and use it to inform the Contractor's work.

.8 The Contractor becomes the owner of, and is responsible for, any soil, sediment, excavated material, debris, waste, or other material once it is removed or excavated to be loaded onto a vehicle or vessel for transport to a Contractor provided Disposal Facility.

.9 The Contractor is responsible for selecting the appropriate excavation equipment and excavation means and methods that considers the site conditions (including equipment reach, and loading restrictions of the upland area adjacent to the

excavation area), character of materials, facility usage, and existing structures adjacent to the excavation areas that may be encountered during excavation operations. By submitting its Tender, the Contractor acknowledges that it has carefully considered these conditions and other project considerations and included appropriate means and methods for excavation activities.

.10 Table 35 20 23-1 provides the estimated surface area and anticipated volume associated with Required Excavation, and is presented for Contractor convenience only.

Table 35 20 23-1

Anticipated Excavation Volume

Surface Area (m^2)[1]	270
Excavation Volume (m^3)[1,2]	330

Notes:

(1) Surface areas and volumes presented in this table are estimates only and shall be verified by Contractor's pre-construction survey.

(2) Excavation Volume is for Required Excavation (includes Allowable Overexcavation).

1.2 MEASUREMENT AND PAYMENT

.1 Payment for excavation shall be made on a Lump Sum basis, as a part of the price tendered for EAST END SLOPE EXCAVATION AND DISPOSAL, once all required excavation and certified disposal has been accepted (upon comparison of Contractor's pre-and post-construction surveys and excavation plan) by the Departmental Representative.

.2 The actual in-situ volume of excavated material the Contractor removes to achieve the required excavation elevation is dependent upon the Contractor's excavation means and methods. The Overexcavation Allowance is the maximum extent of excavation below the Required Excavation Elevation that the Contractor is allowed to remove to; excavation below the Overexcavation Allowance is Excessive Excavation. The Contractor shall select its means and methods to conduct its excavation work to stay within the Overexcavation Allowance limits to the extent practicable. Should the Contractor's excavation means and methods result in Excessive Excavation, the Contractor shall account for potential Excessive Excavation volume in its pricing consideration and may be required to backfill Excessive Overexcavation at no cost to PWGSC.

.3 For Tendering purposes, the Contractor shall assume that all excavated material is classified for disposal as industrial IL+ waste material under the current regulations for classification and disposal of contaminated sediment in British

Columbia. The IL+ material is to be transported in accordance with Laws and Regulations by a hauler licensed for such waste.

.4 All costs associated with removal, handling and disposal of any encountered debris shall be considered incidental to the work and shall be included in the tender price for EAST END SLOPE EXCAVATION AND DISPOSAL.

1.3 RELATED SECTIONS

.1 Section 01 35 13 43.01 - Silt Curtain

.2 Section 02 21 13 –Surveying and Positioning Control for East End Slope Excavation and Capping

.3 Section 35 20 23.01 – East End Slope Excavation Upland Transportation and Disposal

.4 Section 35 37 10.01 – East End Slope Capping

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to the Contract documents..

1.5 SUBMITTALS

.1 As part of the detailed Construction Work Plan, in accordance with Section 01 33 00 (Submittal Procedures), the Contractor shall prepare a section that describes the approach that will be implemented for excavation, material transportation and off-site disposal. Work activities shall not begin until: 1) the Construction Work Plan has been reviewed and accepted by the Departmental Representative; and 2) authority-required notifications and review have been completed. At a minimum, the Construction Work Plan shall contain the following information:

.1 Equipment Layout

.2 Reference to the construction work schedule that identifies timing and sequencing for completion of excavation, upland transportation and disposal activities, as they relate to other major elements of the work.

.3 Number, types, and capacity of equipment to be used.

.4 Upland transportation route to the Contractor provided Disposal Facility.

.5 Means and methods for excavation, upland transportation, and off-site disposal activities:

.6 BMPs proposed by the Contractor and/or as required the EGD Facility, and by the EMP during excavation, upland transportation of excavated materials to the Contractor provided Disposal Facility.

.2 Daily Reporting: As part of the Daily Construction Report, as described in Section 01 33 00 (Submittal Procedures), the Contractor shall keep a daily record of the area(s) excavated, the estimated volume removed, Progress Surveys, and a

summary of other details of the work. The Daily Construction Report shall be signed by the Contractor's site superintendent and quality control manager.

1.6 REFERENCES

.1 Canadian Transportation of Hazardous Goods Act – Transportation of Hazardous Goods Regulation.

.2 British Columbia Environmental Management Act (SBC 2003, Chapter 53).

.3 Esquimalt Harbour – Practices and Procedures, Section 7: Towing of Ships.

1.7 QUALITY CONTROL

.1 The Contractor is responsible for providing all necessary quality controls to successfully complete the work.

.2 The Departmental Representative may, at the Departmental Representative's sole discretion, inspect the excavation, upland ttransportation, and disposal activities for quality assurance purposes. Departmental Representative inspection shall in no way release the Contractor from its obligation to comply with the Specifications and all permit requirements, and shall in no way be construed as acceptance of work.

1.8 ENVIRONMENTAL PROTECTION

.1 All work shall be performed in accordance with environmental protection requirements, as stated in Section 01 35 13.43 (Special Procedures for Contaminated Sites), Section 01 35 43 (Environmental Procedures and Sustainability), the EMP, and in accordance with Laws and Regulations and Project Permits

1.9 REGULATORY REQUIREMENTS

.1 See Section 01 11 55 (General Instructions) for regulatory requirements pertaining to this Contract.

1.10 FLOATING EQUIPMENT

.1 Floating equipment (if used) to be employed on this work shall be of Canadian registry, make, or manufacture, or must receive certificate of qualification from Industry Canada, Marine Directorate, and this certificate of qualification must be provided to the Departmental Representative within ten (10) calendar days following Notice of Award.

.2 The Coasting Trade Act shall apply to all vessels utilized by the Contractor for the work.

1.11 SITE INFORMATION

.1 Character of Materials:

.1 Subsurface investigations were performed to characterize the physical and chemical quality of the excavated material. Detailed results from geotechnical and chemical testing of the sediments are provided in the attached Appendices and Reference Documents.

.2 The Contractor shall satisfy itself regarding the nature of materials present at the site prior to Tender. The type of materials encountered at the Contractor's Work Site may vary from the conditions described in the attached Appendices and reference drawings. Variations in the type of materials encountered may occur that do not differ materially from those indicated in the Specifications, and if encountered, will not be considered as basis for claims due to differing Work Site conditions.

.3 Hard material in its natural state is defined as material requiring blasting, and includes boulders or fragments too large to be removed in one piece by the excavation equipment, as well as till-like material that may be present within the Excavation Area. The Contractor shall anticipate that within the Required Excavation area, that there will be significant quantities of existing riprap, many types of debris, and broken and embedded timber piling, which can be removed in one piece by appropriately sized excavation equipment.

.2 Debris:

.1 Debris, such as rebar, cables, chains, straps, wood, and other man-made items, may be encountered during excavation operations. Some of this debris material may not be suitable for disposal at the authorized Disposal Facility(ies) with sediment, as the authorized Disposal Facility(ies) may require that waste slated for disposal as daily cover be free of rebar, cables, and other debris. The Contractor shall coordinate with the Disposal Facility(ies) to determine whether debris needs to be screened out of the sediment prior to upland transport and disposal. The Contractor shall provide all necessary debris removal screening, transport, and disposal, and the costs for this work shall be considered incidental to the work and included in the bid price for EAST END SLOPE EXCAVATION AND DISPOSAL.

.2 Debris shall be disposed of at an authorized Disposal Facility and in accordance with Laws and Regulations.

.3 The Contractor shall immediately notify the Departmental Representative if any debris is encountered that is considered Hazardous Waste Quality Sediment and the Departmental Representative will determine its disposition.

1.12 MISPLACED MATERIAL

.1 Should the Contractor, during the execution of the work, lose, dump, throw overboard, sink, or misplace any material, floating equipment, machinery, or appliance (collectively termed as misplaced materials), the

Contractor shall promptly recover and remove the misplaced materials. The Contractor shall give immediate verbal notice, followed by written confirmation, of the description and location of such misplaced materials to the Departmental Representative and shall mark and buoy such misplaced materials until they are removed.

.2 Should the Contractor refuse, neglect, or delay compliance with this requirement, such misplaced materials may be removed by the Departmental Representative, in which case the cost of such removal operations shall be paid by the Contractor.

.3 The Contractor shall be responsible for any fees, fines, penalties, or other costs resulting from misplaced materials, and shall not pass costs to the Departmental Representative.

Part 2 Products – not used

Part 3 Execution

3.1 SEQUENCING

.1 This Section describes detailed sequencing considerations.

.2 Excavation, upland transportation, and disposal activities shall not begin until the Departmental Representative has completed its review and accepted the Construction Work Plan.

.3 The Contractor shall select its means and methods to conduct its excavation work to stay within the Overexcavation Allowance limits to the extent practicable.

.4 Contractor shall complete all Required Excavation and obtain Departmental Representative acceptance before starting engineered capping work at the East End. Once Required Excavation activities are considered by the Contractor to be completed, the Contractor shall conduct the Post-Construction Survey (for Required Excavation) to verify Required Excavation Elevations. If high spots remain above the required excavation elevations, the Contractor shall remove such high spots to the satisfaction of the Departmental Representative and re-do the Post-Construction Survey, at the Contractor's own cost.

.5 Once any remaining high spots are removed, the Departmental Representative will review the Contractor's Post-Construction Survey for acceptance as complete for Required Excavation.

3.2 EXCAVATION

.1 The Contractor shall excavate the Required Excavation area to the elevation and limits shown on the Drawings, using land-based equipment.

.2 The Contractor shall remove all material above the Required Excavation Elevation within the excavation area. The Contractor shall not directly remove material from outside of the excavation area.

.3 The Contractor shall take care to prevent Excessive Excavation and to avoid excavation within the structural offsets as shown on the Drawings to avoid potentially adversely impacting slope and/or structural stability. The Contractor shall repair any damage caused by Excessive Excavation at no additional cost to PWGSC.

.4 The Contractor may conduct excavation activities using a bucket type and size of the Contractor's choice, provided that water quality requirements of the EMP and permit requirements are satisfied.

.5 All excavation activities shall be performed in accordance with the requirements of the Specifications and using the BMPs presented in the Specifications and EMP to protect water quality during completion of the work, and the EGD Environmental Best Management Practices (EBMPs) as referenced in the Specifications. If water quality criteria exceedances are observed during excavation activities, the Contractor may be required to modify the construction methods at the Contractor's own cost.

.6 Excavation shall be undertaken in a manner to minimize disruption, disturbance, and resuspension of seabed sediments.

.7 The Contractor shall place excavation material into lined trucks in such a manner that prevents loss of sediment.

.8 If daily Progress Survey results indicate that the Contractor is excavating excessively, or is excavating outside of the excavation area, the Contractor shall modify its operations and/or positioning control immediately to avoid additional Excessive Excavation. Corrective action to mitigate Excessive Excavation, if performed, will be paid for by the Contractor at the Contractor's own cost.

.9 Upon completion of the work, and after acceptance by the Departmental Representative, the Contractor shall promptly remove the excavation plant and associated equipment, including ranges, buoys, piles, and other markers or obstructions placed by the Contractor in the water or on shore.

3.3 WATER QUALITY CRITERIA COMPLIANCE

.1 The water quality monitoring requirements are in Section 01 35 13 43.01 (Silt Curtain) and in the EMP.

.2 The Contractor shall provide a full length silt curtain that fully encloses the excavation activities to prevent recontaminating previously remediated areas adjacent to the East End excavation area (Section 01 35 43.01 (Silt Curtain)).

.3 The Contractor is responsible for complying with all water quality criteria as defined in the Specifications and the EMP, and shall conduct its own water quality monitoring as needed to provide quality control of the Contractor's work.

.4 The Contractor shall describe in its Construction Work Plan what means, methods, and procedures will be used to prevent water quality criteria exceedances, and what contingency actions will be taken to restore compliance with water quality criteria should water quality exceedances occur during completion of excavation and in-water transportation activities (if applicable).

.5 Delays caused by complying with water quality criteria shall not be cause for additional compensation to the Contractor.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Work under this section to be performed by the Contractor includes furnishing of all labor, equipment, materials, and other incidentals required for upland transportation and off-site disposal of excavated material. For the purposes of Tender, the Contractor shall assume that all excavated material will require disposal at a Disposal Facility according to the British Columbia Contaminated Sites Regulation (CSR) industrial land use standards (i.e., waste quality or IL+).

.2 Treatment of contaminated sediment to reduce the level of contamination is allowed, but is not required as part of this Contract. If treatment activities are to be completed as part of this Contract, the Contractor shall provide to the Departmental Representative (as part of the Construction Work Plan) a proposal describing the means and methods by which treatment activities will be completed. This proposal must be reviewed by the Departmental Representative prior to conducting treatment activities as part of this Contract.

.1 Notwithstanding treatment, all excavated material must be disposed of at a Disposal Facility.

.3 The Contractor may choose to conduct additional testing or treatment, at no additional cost to PWGSC, to re-classify the contaminated sediment and obtain acceptance from the Disposal Facility to dispose of contaminated sediment at a lower disposal threshold than CSR industrial waste (IL+). The Contractor shall conduct any proposed re-classification in accordance with federal and provincial regulations, guidance, procedures, and protocols, including British Columbia Ministry of Environment Technical Guidance No. 1 and 2, and shall still be required to dispose of material at a Disposal Facility.

.4 Treatment activities shall be performed at a Treatment Facility. The Contractor shall not conduct treatment activities at the Contractor Off-Site Offload Facility unless documentation can be provided that the facility is a Treatment Facility.

.5 The Departmental Representative reserves the right to inspect all off-site Contractor facilities, including collection of sediment samples for characterization and assessment purposes.

.6 No material designated for excavation from the Contractor's Work Site has been identified as Hazardous Waste.

.7 The Contractor becomes the owner of, and is responsible for, any soil, sediment, or other material once it is loaded on a vehicle or vessel for transport to a final Disposal Facility or Treatment Facility.

.8 The Contractor shall complete final disposal of all excavated material, and shall submit its Certificate of Disposal to the Departmental Representative within 45 calendar days after the Departmental Representative has accepted that all excavation work is complete. The Contractor shall not move waste from one Disposal Facility to another Disposal Facility once the Contractor submits the Certificate of Disposal.

1.2 MEASUREMENT AND PAYMENT

.1 All costs associated with upland transportation to the Disposal Facility, and disposal of material at the Disposal Facility shall be included in the tender price for EAST END SLOPE EXCAVATION AND DISPOSAL.

1.3 RELATED SECTIONS

.1 35 20 23 - East End Slope Excavation.

1.4 DEFINITIONS

.1 See Section 01 11 55 (General Instructions) for all definitions associated with these Contract documents.

1.5 SUBMITTALS

.1 As part of the detailed Construction Work Plan, the Contractor shall prepare a section that describes the approach that will be implemented for upland transportation and disposal activities. Upland transportation and disposal activities shall not begin until: 1) the Construction Work Plan has been reviewed and accepted by the Departmental Representative; and 2) agency-required notifications and review have been completed. At a minimum, the upland transportation and disposal approach description shall contain the following information:

.1 Reference to the construction work schedule that identifies timing and sequencing for completion of upland transportation and disposal activities, as they relate to other major elements of the work.

.2 Order and sequence in which the work is to be performed, including a description of equipment to be used and methods of operation.

.3 Methods and procedures for completion of upland transportation and disposal activities, including means and methods for providing environmental protection. Specifically, the Contractor shall provide the following information as part of the Construction Work Plan:

.1 Methods, procedures, and controls to be used to segregate, handle, store, transport, and dispose of waste to an appropriate Disposal Facility(ies), in accordance with applicable guidelines, protocols, procedures, and regulations.

.2 Location of Treatment Facility (if treatment activities are to be completed), and copies of permits, certificates, and approvals for operation of the facility.

.3 Methods, procedures, and controls to be used to sample, assess, treat, and potentially reclassify contaminated sediment at a Treatment Facility. Methods must specifically address how proposed treatment activities are in line with provincial and federal protocols, procedures, regulations, and guidance, and how dilution of contaminants will be avoided.

.4 Methods, procedures, and equipment to be used for loading and upland transport of waste to the Disposal Facility(ies), including procedures for meeting federal, provincial, and local regulations including preventing release of water, dust, and sediment during transportation.

.5 Methods, procedures, and controls to protect existing facilities against damage.

.4 Best Management Practices (BMPs) proposed by the Contractor and/or as required by the Environmental Management Plan (EMP) during upland transportation and disposal activities.

.2 As part of the Daily Construction Report, as described in Section 01 33 00 (Submittal Procedures), the Contractor shall keep a daily record of upland transportation and disposal activities, truck weight measurements for material sent off site for disposal at the Disposal Facility or treatment at the Treatment Facility, certified weight tickets from the Disposal Facility, and a summary of other details of the work. The Daily Construction Report shall be submitted to the Departmental Representative the morning following completion of the work for that day. The Daily Construction Report shall be signed by the Contractor's site superintendent and quality control manager.

.3 The Contractor shall submit to the Departmental Representative copies of all Certificates of Treatment supported by laboratory analytical data for the contaminants of potential environmental concern as necessary to account for and demonstrate the treatment and/or Re-classification of the material (if applicable).

.4 The Contractor shall submit to the Departmental Representative copies of all Certificates of Disposal to account for and demonstrate the disposal of all material excavated in relation to Section 35 20 23 (East End Excavation). The Certificates of Disposal must be from the final resting place of the material. Certificates of Disposal for all excavated material shall be submitted no later than 45 calendar days after the Departmental Representative has accepted that all excavation work has been completed.

.5 The Contractor shall submit to the Departmental Representative copies of all manifests, weight tickets, and other documentation to demonstrate and track the final disposition of the sediment and debris at a Disposal Facility(ies). The documentation shall track the material from the point of leaving the Contractor's Work Site to final disposal at the Disposal Facility(ies).

1.6 REFERENCES

.1 British Columbia Ministry of Environment Technical Guidance No. 1 and 2.

.2 *Canadian Transportation of Hazardous Goods Act* – Transportation of Hazardous Goods Regulation, amended May 19, 2010.

.3 *British Columbia Environmental Management Act* – Contaminated Sites Regulation, BC Reg. 343/2008, with amendments to January 1, 2009.

1.7 CONTRACTOR QUALITY CONTROL

.1 The Contractor is responsible for providing all necessary quality controls to successfully complete the work.

.2 The Departmental Representative will periodically inspect the upland transportation and disposal operations (and treatment operations as applicable) to verify compliance with the Contract documents, and all applicable permits.

.3 The Contractor shall provide Daily and Weekly Construction Reports that include description of upland transportation and disposal activities and photo-documentation of these activities.

1.8 ENVIRONMENTAL PROTECTION

.1 Upland transportation and disposal activities shall be performed in accordance with environmental protection requirements, the EMP, the Environmental Protection Plan, and in accordance with the permits.

1.9 REGULATORY REQUIREMENTS

.1 Material transported by barge (if applicable) requires that the Contractor obtain an authorization from the Queen's Harbour Master (QHM) pursuant to the Canada Marine Act.

.2 The Contractor shall ensure that sediment and debris upland transport, treatment (as applicable) and disposal is performed in compliance with federal, provincial, and local laws and regulations including, but not limited to:

.1 *Canadian Transportation of Hazardous Goods Act* – Transportation of Hazardous Goods Regulation, amended May 19, 2010.

.2 *British Columbia Environmental Management Act* – Hazardous Waste Regulation, BC Reg 63/88, amended April 1, 2009.

.3 *British Columbia Environmental Management Act* – Contaminated Sites Regulation, BC Reg. 343/2008, with amendments to January 1, 2009.

1.10 LOCATION, PERMITTING, AND TRACKING

.1 The Contractor shall provide as part of their Construction Work Plan locations of all proposed Disposal Facilities.

.2 Disposal and Treatment Facilities are defined in Section 01 11 55 (General Instructions). The Contractor shall provide documentation acceptable to PWGSC that the materials can be accepted at the Disposal Facility and Treatment Facility. Copies of all valid and subsisting permits, certificates, approvals, or any other form of authorization issued by a province or territory for the facility must be submitted to the Departmental Representative within ten (10) working days of award of the Contract.

.3 For all Disposal Facilities and Treatment Facilities proposed by the Contractor, the Contractor must provide the following information:

.1 Location and owner of proposed Disposal Facility and Treatment Facility.

.2 Documentation that proposed Disposal Facility and Treatment Facility is licensed and suitable for acceptance, treatment, and disposal of the waste.

.3 Methodology of treatment, as appropriate.

.4 Elimination of liability and acceptance of ownership at the Disposal Facility.

.5 Type of disposal and/or treatment documentation to be provided by the Disposal Facility and Treatment Facility.

.4 No Disposal Facility shall be created for the specific use of this Contract.

1.11 INSPECTION OF FACILITIES

.1 The Departmental Representative may inspect the Contractor Treatment Facility (if applicable) and Disposal Facility(ies) proposed by the Contractor prior to the start of

construction, and at any time during completion of upland transportation and disposal activities to ensure that the Contractor Treatment Facility (if applicable) and Disposal Facility meet the requirements of these Specifications.

.2 The Contractor shall provide access to the Departmental Representative or designee to inspect the facility(ies), including providing health and safety orientation and access to machinery to facilitate sampling, assessment, and documentation.

Part 2 Products – NOT USED

Part 3 Execution

3.1 SEQUENCING

.1 This section describes more detailed sequencing considerations associated with upland transportation and disposal activities.

.2 Upland transportation and disposal activities shall not begin until the Departmental Representative has reviewed and accepted the Contractor's Construction Work Plan.

3.2 TRANSPORTATION TO TREATMENT FACILITY AND DISPOSAL FACILITY

.1 The Contractor shall employ all BMPs as described in these Specifications, the EMP, and included in the permits when transporting waste to the Treatment Facility and Disposal Facility.

.2 The Contractor shall be responsible for the safe transport of all waste materials (including all excavated material) in accordance with federal, provincial, and local laws and regulations, and conditions of the permits.

.3 Waste transported by truck will be tarped and adequately secured in watertight containers (or lined truck bed), to minimize release of odors and dust and to ensure no spillage occurs, to the satisfaction of the Departmental Representative.

.4 The Contractor is responsible for preparing and signing all manifests and obtaining all acceptances for the transportation of all materials. Waste manifests shall be provided to the Departmental Representative. The Contractor must provide sufficient documentation to track all material from the Contractor's Work Site, to the Treatment Facility (if applicable) and Disposal Facility.

3.3 TREATMENT, DESTRUCTION, AND DISPOSAL

.1 Treatment, Re-classification, and Destruction of waste is permitted under this Contract, and treatment and/or destruction activities must be completed in accordance with this Specification and applicable federal and provincial regulations, guidance, procedures, and protocols. The Departmental Representative reserves the right to inspect treatment and destruction activities that are being completed at the Treatment Facility at any time, including independent sampling and testing of waste. The Contractor shall provide all Certificates of Treatment or Certificates of Disposal prior to final disposal of waste at the Disposal Facility and issuance of final Certificates of Disposal.

.2 Treatment of waste must be performed at a Treatment Facility.

.3 The Contractor shall not change location of its Treatment Facility or Disposal Facility without prior notification to, and review and acceptance by, the Departmental Representative.

.4 Sediment or other material sent to a Treatment Facility must be disposed of at a Disposal Facility.

.5 Sediment or other material sent to a Disposal Facility must be permanently stored at that facility.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section describes the requirements for repairing or reinstating the portions of the existing Engineered Cap that the Contractor damages or alters due to pile driving, removal of temporary piles, removal of existing piles, removal of buried obstructions preventing the driving of piles, spudding, dragging of anchors, or any other cause that damages the cap.

.2 This section also covers placing of rock on the seabed adjacent to the timber crib, as a leveling course for seating of the precast concrete displacement control pile caps.

.3 Contractor shall reinstate engineered caps, (using rock armour, and, if required also filter material and sand) in areas where the cap has been damaged or has moved such that the underlying materials are exposed. The purpose of the engineered cap is to isolate potential remaining contamination and to create stable surfaces and slopes that are capable of resisting erosive forces associated with propeller scour, vessel wakes, and wind waves. Repairs to the engineered cap are to match the type of capping used in the remediation, as shown on the drawings and in the appendices.

.4 Contractor shall fill holes in seabed from the removal of navigation and temporary piles as described in Section 02 41 16.01 STRUCTURE DEMOLITION clause 3.7.

.5 Holes caused by temporary piles, shall be similarly filled at Contractors expense.

.6 This work includes furnishing all labour, materials, tools, equipment, and incidentals required for repairing or reinstating the Engineering Capping as described in the Specification.

.7 Contractor shall monitor the Engineered Cap using divers and recording underwater video, which shall be made available to the Departmental Representative. Monitoring of the Engineered Cap shall be done after the first row of piles have been installed, and thereafter, once at least three rows of piles have been installed. Payment for the monitoring shall be incidental to the works.

1.2 MEASUREMENT AND PAYMENT

.1 All costs associated with repairing Engineered Capping damaged by contractor will be incidental to the work.

.2 Measurement and payment for placing 0.15 m Armour Rock on seabed to level the area for the Displacement Control Pile Caps shall be the in-situ cubic meter price tendered under DISPLACEMENT CONTROL PILE CAP LEVELING as calculated by comparison of the Contractor’s pre- and post-placement surveys (for Engineered Capping activities). Payment shall include all costs in connection with

supply and placement of Engineered Capping materials including all equipment, labour, materials.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

.3 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.4 Section 01 35 43 (Environmental Procedures and Sustainability)

.5 Section 01 45 00 (Quality Control)

.6 Section 02 21 13 (Survey and Position Control)

.7 Section 35 37 10.01 (East End Slope Capping)

1.4 DEFINITIONS

.1 See Section 01 11 55 (General Instructions) for all definitions related to the Contract documents.

.2 Damage to the Engineered Cap is defined as any area along the cap that has lost the surficial armouring of rock, due to slope movement or displacement from pile driving activities. Lack of rock armour on the surface will allow potential scour of the underlying filter and sand materials from propwash or wave action.

1.5 SUBMITTALS

.1 Contractor shall prepare a methodology that describes the approach that will be implemented for Engineered Capping repair or reinstatement activities. Engineered Capping repair or reinstatement activities shall not begin until: 1) the methodology has been reviewed and accepted by Departmental Representative; and 2) agency-required notifications and review have been completed. At a minimum, the Engineered Capping approach description shall contain the following information:

.1 Order and sequence in which the work is to be performed, including a description of equipment to be used and methods of operation.

.2 Reference to the construction work schedule that identifies timing and sequencing for completion of Engineered Capping activities, as they relate to other major elements of the work.

.3 Contractor shall provide documentation of the origin (e.g., supplier, location, environmental quality) of the imported sand, filter, rock armour and testing certificates, as described in this Specification, provided by the supplier for Departmental Representative review prior to the start of work.

.4 Contractor shall provide identification and certification documents for the independent, certified analytical laboratory that will conduct required testing for all Engineered Capping materials that will be used in the work, as described in this Specification.

.5 Methods and procedures for completion of Engineered Capping activities shall include means and methods for providing Environmental Protection, as described in Section 01 35 13.43 (Special Procedures for Contaminated Sites) and Section 01 35 43 (Environmental Procedures and Sustainability).

.2 Samples of sand materials to be used for the work shall be provided to Departmental Representative a minimum of two (2) weeks in advance of use at the EGD Work Site. Samples shall consist of approximately 20 kilograms (kg) of sand material. Each sample of sand material should be composited from no less than five subsamples taken throughout any one source. Contractor shall ensure that the samples are representative of all materials to be imported and used for placement at the EGD Work Site.

.3 Contractor shall obtain laboratory test reports, as described in these Specifications. All laboratory test results shall be submitted to Departmental Representative no less than two (2) weeks prior to the start of Engineered Capping activities.

1.6 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM D6437, Standard Test Method for Measuring Specific Gravity.

.2 ASTM D5240, Standard Test Method for Measuring Aggregate Soundness.

1.7 QUALITY CONTROL

.1 Contractor is responsible for providing all necessary quality controls to successfully complete the work.

.2 Departmental Representative may, at Departmental Representative's sole discretion, inspect the Engineered Capping activities for quality assurance purposes. Departmental Representative inspection shall in no way release the Contractor from its obligation to comply with the Specification and all permits, and shall in no way be construed as acceptance of work.

1.8 ENVIRONMENTAL PROTECTION

.1 Engineered Capping activities shall be performed in accordance with environmental protection requirements, as stated in Section 01 35 13.43 (Special Procedures for Contaminated Sites), and Section 01 35 43 (Environmental Procedures and Sustainability), the EMP, and in accordance with the permits.

1.9 INSPECTION OF MATERIALS

.1 Imported sand material, and rock armour materials shall be visually inspected by Contractor upon delivery. Materials shall be inspected for the presence of foreign, recycled, or reprocessed material or debris, to assure that imported materials are natural, native, virgin materials and free of contaminants. The presence of such materials is to be reported to Departmental Representative, who will determine if the import materials are acceptable in the event of rejections, it shall be the

responsibility of Contractor to remove all rejected material from the EGD Work Site at Contractor's own cost. Acceptance or rejection of import materials brought to the Contractor's Work Site will be provided by Departmental Representative within 24 hours of material being brought to the Contractor's Work Site.

.2 Departmental Representative may, at any and all times, perform an independent inspection of sand, filter, and rock armour. Materials may be rejected if identified as substandard or if test results show it to be substandard, based on the sole discretion of Departmental Representative. All sand, and rock armour materials may be segregated for testing based on appearance or odor. Segregated materials may be tested according to designated procedures at Departmental Representative's discretion

.3 Inspection of Source: The borrow source(s) for all Capping Materials shall be inspected by Contractor. During such inspection, Contractor shall ensure that the materials to be delivered to the EGD Work Site will meet the appropriate requirements of the Specification. Contractor shall provide notice to Departmental representative within five (5) calendar days of such inspections. At the discretion of Departmental Representative, Departmental Representative may accompany Contractor to witness such inspections. This witnessing shall in no way release Contractor from complying with the Specification, and shall in no way be construed as approval of any particular source of material.

1.10 REGULATORY REQUIREMENTS

.1 See Section 01 11 55 (General Instructions) for regulatory requirements pertaining to this Contract.

1.11 MISPLACED MATERIAL

.1 Should the Contractor, during the execution of the work, lose, dump, throw overboard, sink, or misplace any material, dredge, barge, machinery or appliance (collectively termed as misplaced materials), Contractor shall promptly recover and remove the misplaced materials. Contractor shall give immediate verbal notice, followed by written confirmation, of the description and location of such misplaced materials to Departmental Representative and shall mark and buoy such misplaced materials until they are removed.

.2 Should the Contractor refuse, neglect, or delay compliance with this requirement, such misplaced materials may be removed by Departmental Representative, in which case the cost of such removal operations shall be paid by Contractor.

.3 Contractor shall be responsible for any fees, fines, penalties, or other costs resulting from misplaced materials, and shall not pass costs to Departmental Representative.

Part 2 Products

2.1 SAND MATERIAL (TYPE 1)

.1 Sand material shall meet the testing requirements as described in the Specification.

.2 Sand material shall not contain any synthetic or recycled material or debris.

.3 Sand material shall be granular material, free of organic material, and conforming to the gradation stipulated in Table 35 37 10-2. It is anticipated that dredged Fraser River sand will not meet the sand material type 1 gradation requirements.

Table 35 37 10-2

Sieve Designation (mm)	Percent Passing
37.5	100
19	90 – 100
4.75	60 - 85
1.18	20 – 70
0.42	10 – 55
0.15	0 – 35
0.075	0 – 5

2.2 FILTER MATERIAL

.1 Filter material shall meet the testing requirements as described in the Specifications.

.2 Filter material shall not contain any synthetic or recycled material or debris.

.3 Filter material shall be a gravelly material, free of organic material, and shall be composed of crushed granular materials. Filter material shall conform to the British Columbia Ministry of Transportation and Infrastructure specifications for Open Graded Base OGB 75 millimetres (OGB 75 mm), gradation as shown in Table 35 37 10-5 for convenience.

.4 Fractured faces to be greater than or equal to 50% in accordance with MoTI test method SS 202 Fractured Faces Method A (note: Method A only applies for portion of material greater than 4.75 mm in size).

Table 35 37 10-5

Sieve Designation (mm)	Percent Passing
75	100
50	70 – 100
37.5	50 - 85

19	15 – 55
6.3	0 – 20
2.36	0 – 10
0.3	0 – 8
0.075	0 – 5

2.3 ARMOUR MATERIAL: 0.15 m ROCK

.1 Armour material: 0.15 m rock must meet the testing requirements as described in these Specifications.

.2 Armour material: 0.15 m rock shall not contain any synthetic or recycled material or debris.

.3 Armour material: 0.15 m rock shall consist of average diameter (D_{50}) material of approximately 0.15 metres (m).

.4 Armour material: 0.15 m rock shall conform to the British Columbia Ministry of Transportation and Infrastructure specifications (Standard Specification for Highway Construction, Table 205-B) for Class 10 kilogram riprap.

2.4 ARMOUR MATERIAL: 0.3 m ROCK

.1 Armour material: 0.3 m rock must meet the testing requirements as described in these Specifications.

.2 Armour material: 0.3 m rock shall not contain any synthetic or recycled material or debris.

.3 Armour material: 0.3 m rock shall consist of D_{50} material of approximately 0.3 metres (m).

.4 Armour material: 0.3 m rock shall conform to the British Columbia Ministry of Transportation and Infrastructure specifications (Standard Specification for Highway Construction, Table 205-B) for Class 25 kilogram riprap.

2.5 SAND MATERIAL AND ROCK ARMOURING MATERIAL TESTING

.1 Sand material chemical concentrations must be lower than the Canadian Council for Ministers of the Environment (CCME) Sediment Quality Guidelines “Probable Effects Levels” (PEL) and British Columbia Contaminated Sites Regulation (BC CSR) Generic Numerical Sediment Criteria for typical sites. For Light Extractable Petroleum Hydrocarbons (LEPH) and Heavy Extractable Petroleum Hydrocarbons (HEPH), concentrations must be lower than the CSR numerical soil standards for residential land use.

.2 Based on material sources and results of the testing, the Departmental Representative may request that additional parameters be analyzed for the sand material (type 1). The frequency of the testing may also be increased or decreased by the Departmental Representative if considered appropriate based on the results of the testing or visual assessment of the imported material.

.3 The Contractor shall provide information regarding the source of the sand material to the Departmental Representative. The Contractor shall also collect one sample for every one thousand (1,000) m^3 of sand material imported to the EGD Work Site and analyze the samples for metals, LEPH, and HEPH. The frequency of testing may be increased or decreased by the Departmental Representative if considered appropriate based on the results of testing or visual assessment of imported material.

.4 The laboratory selected to undertake analysis must have the appropriate accreditation with ISO/IEC Standard 17025. The Contractor shall submit documentation demonstrating that the laboratory is accredited for the specific parameters to be analysed and the analytical methods.

.5 The Contractor shall provide the sand material testing data and reports to the Departmental Representative for review prior to import of the material to the EGD Work Site, in accordance with the timeline described in the Specifications.

.6 Sand materials will be rejected by the Departmental Representative, at the Contractor's sole cost and responsibility, if the Specification is not met.

.7 Chemical testing of filter material and rock armour materials is required to assess the acid rock drainage (ARD) and metal leaching (ML) potential of the materials as this can negatively impact water quality. The following laboratory tests shall be performed an independent, certified testing laboratory, hired by the Contractor:

.1 ARD Potential: Acid Base Accounting (ABA) testing.

.2 ML Potential: Multi-Element Analysis (ICP-MS).

.3 Shake Flask Extraction (SFE) testing.

.8 Guidelines for ARD/ML have been developed for mine sites in Canada and shall be used as general guidance in assessing ARD and ML potential for non-mining projects.

.9 Results of laboratory testing of metal leaching shall be compared, as a screening benchmark, with the British Columbia Water Guidelines (BCWG) criteria and the CCME guidelines for freshwater (maximum and 30-day) and marine aquatic life. If tests results do not meet requirements for acceptance by these guidelines, then the Contractor shall submit a letter of professional opinion regarding suitability recommendation for use of material at the EGD Work Site. Acceptance will be at the discretion of the Departmental Representative. If the cap material is not accepted, the Contractor will be required to provide the cap material from an alternate source that is acceptable and conforms to the requirements in this Section, at the Contractor's own cost.

.10 The following additional tests are required to assess durability of filter material and rock armour materials:

.1 Specific gravity per ASTM D6437; a bulk density of the material shall be determined using results of this specific gravity analysis.

.2 Aggregate soundness per ASTM D5240.

.11 One sample for every one thousand (1,000) m^3 of filter material, and rock armour material imported to the EGD Work Site will be collected and analyzed per the above

tests. The frequency of testing may be increased or decreased by the Departmental Representative if considered appropriate based on the results of testing or visual assessment of imported material.

.12 The Contractor shall provide the testing data to the Departmental Representative for review prior to transport of material from the source site to the EGD Work Site, in accordance with the timeline described in the Specifications. If the material does not meet the requirements in this Section and is not accepted by the Departmental Representative, the Contractor will be required to provide the cap material from an alternate source that is acceptable and conforms to the requirements in this Section, at the Contractor's own cost.

.13 Rock armour materials shall have less than one (1) percent fines content upon arrival at the EGD Work Site. The Departmental Representative reserves the right to reject rock armour materials that are identified to have fines content greater than one (1) percent.

Part 3 Execution

3.1 ENGINEERED CAP MATERIAL PLACEMENT

.1 The Contractor shall provide truck weigh bills for all capping material that will be placed from land, as they arrive at the EGD Work Site.

.2 The Contractor shall provide barge displacement measurements for all capping material that will be placed from water.

3.2 WATER QUALITY CRITERIA COMPLIANCE

.1 The water quality monitoring requirements are described in the Specifications and the EMP/Water Quality Monitoring Plan (WQMP) and are provided in Section 01 35 13.43 (Special Procedures for Contaminated Sites).

.2 In accordance with the EMP/WQMP, the Departmental Representative or Environmental Monitor will conduct water quality monitoring, for quality assurance, during completion of Engineered Capping activities. The Contractor is responsible for complying with all water quality requirements as defined in the Specifications and the EMP/WQMP, and shall conduct its own water quality monitoring as needed to provide quality control of the Contractor’s work.

.3 The Contractor shall describe in its Construction Work Plan what means, methods, and procedures will be used to prevent water quality criteria exceedances, and what contingency actions will be taken to restore compliance with water quality criteria should water quality exceedances occur during completion of Engineered Capping activities.

.4 Delays caused by complying with water quality criteria shall not be cause for additional compensation to the Contractor.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 The Contractor shall construct an engineered cap (including discrete layers of sand, filter, and rock armour) at the Contractor's Work Site, as shown on the Drawings, in order to isolate potential remaining contamination and to construct stable surfaces and slopes that are capable of resisting erosive forces associated with propeller scour, vessel wakes, and wind waves.

.2 This work includes furnishing all labour, materials, tools, equipment, and incidentals required for Slope Cap Placement in support of the overall project as described in the Drawings and in the Specifications.

.3 Table 35 37 10-1 provides the estimated slope capping placement volumes, and is presented for Contractor convenience only.

Table 35 37 10.01-1

East End Slope Capping Surface Area and Volumes

Surface Area (m^2)	1,850
Sand Material (m^3)	1,540
Filter Material (m^3)	830
Armour Material, 0.15 m Rock (m^3)	830

Notes:

(1) Cap placement volumes presented in this table are estimates only.

(2) Cap placement volumes include Overplacement Allowances, as described in the Specifications and as shown on the Drawings.

1.2 MEASUREMENT AND PAYMENT

.1 Payment for slope capping shall be made on a Lump Sum basis as part of the price tendered for EAST END SLOPE CAPPING. Payment shall include all costs in connection with supply and placement of Engineered Capping materials.

.2 The actual in-situ volume of Slope Capping material that the Contractor places to achieve the required Minimum Required Thicknesses or required elevations and grades is dependent upon the Contractor's placement means and methods. The Overplacement Allowance is the maximum extent of placement above the Minimum Required Thickness (or required elevations and grades). The Contractor shall select its means and methods to conduct its placement work to stay within the Overplacement Allowance limits to the extent practicable. Should the Contractor's placement means and methods result in Excessive

Overplacement, the Departmental Representative may direct the Contractor to remove Excessive Overplacement at the Contractor's own cost.

.3 No payment shall be made for Overplacement of material.

1.3 RELATED SECTIONS

.1 Section 01 35 13.43.01 (Silt Curtain)

.2 Section 02 21 13 (Surveying and Positioning Control for East End Slope Excavation and Capping)

.3 Section 35 20 23 (East End Slope Excavation)

.4 Section 35 37 10 (Existing Engineered Capping)

1.4 DEFINITIONS

.1 See Section 01 11 55 (General Instructions) for all definitions related to the Contract documents.

1.5 SUBMITTALS

.1 As part of the detailed Construction Work Plan, the Contractor shall prepare a section that describes the approach that will be implemented for Slope Capping activities. Slope Capping activities shall not begin until: 1) the Construction Work Plan has been reviewed and accepted by the Departmental Representative; and 2) authority-required notifications and review have been completed. At a minimum, the Slope Capping approach description shall contain the following information:

.1 Order and sequence in which the work is to be performed, including a description of equipment to be used and methods of operation.

.2 Reference to the construction work schedule that identifies timing and sequencing for completion of Slope Capping activities, as they relate to other major elements of the work.

.3 Methods and procedures for work to be performed, including spillage control measures.

.4 The Contractor shall provide documentation of the origin (e.g., supplier, location, environmental quality) of the imported sand, filter, rock armour and testing certificates, as described in this Specification, provided by the supplier for Departmental Representative review prior to the start of work.

.5 The Contractor shall provide identification and certification documents for the independent, certified analytical laboratory that will conduct required testing for all Slope Capping materials that will be used in the work, as described in this Specification.

.2 Samples of sand material and filter material to be used for the work shall be provided to the Departmental Representative a minimum of two (2) weeks in

advance of use at the Contractor's Work Site. Samples shall consist of approximately 20 kilograms (kg) of sand and filter material. The sample of sand material should be composited from no less than five subsamples taken throughout any one source. The Contractor shall verify that the samples are representative of all materials to be imported and used for placement at the Contractor's Work Site.

.3 The Contractor shall obtain laboratory test reports, as described in these Specifications. All laboratory test results shall be submitted to the Departmental Representative no less than two (2) weeks prior to the start of Slope Capping activities.

.4 Daily Reporting: As part of the Contractor's Daily Construction Report, the Contractor shall keep a daily record of the area(s) where Slope Capping materials have taken place, the estimated quantity of material removed and placed (including barge displacement measurements), daily Progress Surveys, certified weight tickets from the supplier, and a summary of other details of the work. This daily record shall be submitted to the Departmental Representative on the morning following completion of the work for that day. The Daily Construction Report shall be signed by the Contractor's site superintendent and quality control manager.

.5 Weekly Reporting: As part of the Contractor's Weekly Construction Report, as described in Section 01 33 00 (Submittal Procedures), the Contractor shall summarize the week's work in Slope Capping activities. The Weekly Construction Report shall also identify anticipated work to be completed in the present week, and present the latest Post-Construction (i.e., post-placement) Survey and Progress Surveys. The Weekly Construction Report shall be signed by the Contractor's site superintendent and quality control manager.

1.6 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM D6437, Standard Test Method for Measuring Specific Gravity.

.2 ASTM D5240, Standard Test Method for Measuring Aggregate Soundness.

1.7 QUALITY CONTROL

.1 The Contractor is responsible for providing all necessary quality controls to successfully complete the work.

.2 The Departmental Representative may, at the Departmental Representative's sole discretion, inspect the Slope Capping activities for quality assurance purposes. Departmental Representative inspection shall in no way release the Contractor from its obligation to comply with the Specifications and all permit requirements, and shall in no way be construed as acceptance of work.

1.8 ENVIRONMENTAL PROTECTION

.1 Slope Capping activities shall be performed in accordance with environmental protection requirements, the Environmental Management Plan (EMP), the Environmental Protection Plan, and in accordance with the Laws and Regulations and Project Permits.

1.9 INSPECTION MATERIALS

.1 Barges of imported sand, filter, and rock armour materials shall be visually inspected by the Contractor upon delivery. Materials shall be inspected for the presence of foreign, recycled, or reprocessed material or debris, to verify that imported materials are natural, native, virgin materials and free of contaminants. The presence of such materials is to be reported to the Departmental Representative, who will determine if the import materials are acceptable. In the event of rejections, it shall be the responsibility of the Contractor to remove all rejected material from the Contractor's Work Site at the Contractor's own cost. Acceptance or rejection of import materials brought to the Contractor'sWork Site will be provided by the Departmental Representative within 24 hours of material being brought to the Contractor'sWork Site.

.2 The Departmental Representative may, at any and all times, perform an independent inspection of sand, filter, and rock armour. Materials may be rejected if identified as substandard or if test results show it to be substandard, based on the sole discretion of the Departmental Representative. All sand, filter material, and rock armour materials may be segregated for testing based on appearance or odor. Segregated materials may be tested according to designated procedures at the Departmental Representative's discretion.

.3 Inspection of Source: The borrow source(s) for all Capping Materials shall be inspected by the Contractor. During such inspection, the Contractor shall verify that the materials to be delivered to the Contractor'sWork Site will meet the appropriate requirements of the Specifications. The Contractor shall provide notice to the Departmental representative within five (5) calendar days of such inspections. At the discretion of the Departmental Representative, the Departmental Representative may accompany the Contractor to witness such inspections. This witnessing shall in no way release the Contractor from complying with the Specifications, and shall in no way be construed as approval of any particular source of material.

1.10 REGULATORY REQUIREMENTS

.1 See Section 01 11 55 (General Instructions) for regulatory requirements pertaining to this Contract.

1.11 MISPLACED MATERIAL

.1 Should the Contractor, during the execution of the work, lose, dump, throw overboard, sink, or misplace any material, floating equipment, machinery, or appliance (collectively

termed as misplaced materials), the Contractor shall promptly recover and remove the misplaced materials. The Contractor shall give immediate verbal notice, followed by written confirmation, of the description and location of such misplaced materials to the Departmental Representative and shall mark and buoy such misplaced materials until they are removed.

.2 Should the Contractor refuse, neglect, or delay compliance with this requirement, such misplaced materials may be removed by the Departmental Representative, in which case the cost of such removal operations shall be paid by the Contractor.

.3 The Contractor shall be responsible for any fees, fines, penalties, or other costs resulting from misplaced materials, and shall not pass costs to the Departmental Representative.

Part 2 Products

2.1 SAND MATERIAL (TYPE 3)

.1 Sand material shall meet the testing requirements as described in the Specifications.

.2 Sand material shall not contain any synthetic or recycled material or debris.

.3 Sand material shall be a mixture of sand and gravelly material, free of organic material, and shall be composed of a mixture of crushed granular materials that conform to the gradation as provided in Table 35 37 10.01-2.

.4 Fractured faces to be greater than or equal to 50% in accordance with MoTI test method SS 202 Fractured Faces Method A (note: Method A only applies for portion of material greater than 4.75 mm in size).

Table 35 37 10.01-2

Sieve Designation (mm)	Percent Passing
75	100
50	80 – 100
37.5	70 – 90
19	50 – 75
9.5	30 – 65
4.75	20 – 50
2.36	15 – 40
1.18	10 – 30
0.3	5 – 15
0.075	0 – 5

2.2 FILTER MATERIAL

.1 Filter material shall meet the testing requirements as described in the Specifications.

.2 Filter material shall not contain any synthetic or recycled material or debris.

.3 Filter material shall be a gravelly material, free of organic material, and shall be composed of crushed granular materials. Filter material shall conform to the British Columbia Ministry of Transportation and Infrastructure specifications for Open Graded Base OGB 75 millimetres (OGB 75 mm), gradation as shown in Table 35 37 10-3.

.4 Fractured faces to be greater than or equal to 50% in accordance with MoTI test method SS 202 Fractured Faces Method A (note: Method A only applies for portion of material greater than 4.75 mm in size).

Table 35 37 10-3

Sieve Designation (mm)	Percent Passing
75	100
50	70 – 100
37.5	50 – 85
19	15 – 55
6.3	0 – 20
2.36	0 – 10
0.3	0 – 8
0.075	0 – 5

2.3 ARMOUR MATERIAL: 0.15 M ROCK

.1 Armour material: 0.15 m rock must meet the testing requirements as described in these Specifications.

.2 Armour material: 0.15 m rock shall not contain any synthetic or recycled material or debris.

.3 Armour material: 0.15 m rock shall consist of average diameter (D_{50}) material of approximately 0.15 metres (m).

.4 Armour material: 0.15 m rock shall conform to the British Columbia Ministry of Transportation and Infrastructure specifications (Standard Specification for Highway Construction, Table 205-B) for Class 10 kilogram riprap.

2.4 SAND MATERIAL, FILTER MATERIAL, AND ROCK ARMOUR MATERIAL TESTING

.1 Sand material chemical concentrations must be lower than the Canadian Council for Ministers of the Environment (CCME) Sediment Quality Guidelines "Probable Effects Levels" (PEL) and British Columbia Contaminated Sites Regulation (BC CSR) Generic Numerical Sediment Criteria for typical sites. For Light Extractable Petroleum Hydrocarbons (LEPH) and Heavy Extractable Petroleum Hydrocarbons (HEPH), concentrations must be lower than the CSR numerical soil standards for residential land use.

.2 Based on material sources and results of the testing, the Departmental Representative may request that additional parameters be analyzed for the sand material). The frequency of the testing may also be increased or decreased by the Departmental Representative if considered appropriate based on the results of the testing or visual assessment of the imported material.

.3 The Contractor shall provide information regarding the source of the sand material to the Departmental Representative. The Contractor shall also collect one sample for every one thousand (1,000) m^3 of sand material imported to the Contractor'sWork Site and analyze the samples for metals, LEPH, and HEPH. The frequency of testing may be increased or decreased by the Departmental Representative if considered appropriate based on the results of testing or visual assessment of imported material.

.4 The laboratory selected to undertake analysis must have the appropriate accreditation with ISO/IEC Standard 17025. The Contractor shall submit documentation demonstrating that the laboratory is accredited for the specific parameters to be analysed and the analytical methods.

.5 The Contractor shall provide the sand material testing data and reports to the Departmental Representative for review prior to import of the material to the Contractor'sWork Site, in accordance with the timeline described in the Specifications.

.6 Sand materialwill be rejected by the Departmental Representative, at the Contractor's sole cost and responsibility, if the Specification is not met.

.7 Chemical testing of filter material and rock armour materials is required to assess the acid rock drainage (ARD) and metal leaching (ML) potential of the materials as this can negatively impact water quality. The following laboratory tests shall be performed an independent, certified testing laboratory, hired by the Contractor:

.1 ARD Potential: Acid Base Accounting (ABA) testing.

.2 ML Potential: Multi-Element Analysis (ICP-MS).

.3 Shake Flask Extraction (SFE) testing.

.8 Guidelines for ARD/ML have been developed for mine sites in Canada and shall be used as general guidance in assessing ARD and ML potential for non-mining projects.

.9 Results of laboratory testing of metal leaching shall be compared, as a screening benchmark, with the British Columbia Water Guidelines (BCWG) criteria and the CCME guidelines for freshwater (maximum and 30-day) and marine aquatic life. If tests results do not meet requirements for acceptance by these guidelines, then the Contractor shall submit a letter of professional opinion regarding suitability recommendation for use of material at the Contractor'sWork Site. Acceptance will be at the discretion of the Departmental Representative. If the cap material is not accepted, the Contractor will be required to provide the cap material from an alternate source that is acceptable and conforms to the requirements in this Section, at the Contractor's own cost.

.10 The following additional tests are required to assess durability of filter material and rock armour materials:

.1 Specific gravity per ASTM D6437; a bulk density of the material shall be determined using results of this specific gravity analysis.

.2 Aggregate soundness per ASTM D5240.

.11 One sample for every one thousand (1,000) m^3 of filter material, and rock armour material imported to the Contractor'sWork Site will be collected and analyzed per the above tests. The frequency of testing may be increased or decreased by the Departmental Representative if considered appropriate based on the results of testing or visual assessment of imported material.

.12 The Contractor shall provide the testing data to the Departmental Representative for review prior to transport of material from the source site to the Contractor's Work Site, in accordance with the timeline described in the Specifications. If the material does not meet the requirements in this Section and is not accepted by the Departmental Representative, the Contractor will be required to provide the cap material from an alternate source that is acceptable and conforms to the requirements in this Section, at the Contractor's own cost.

.13 Rock armour materials shall have less than one (1) percent fines content upon arrival at the Contractor'sWork Site. The Departmental Representative reserves the right to reject rock armour materials that are identified to have fines content greater than one (1) percent.

Part 3 Execution

3.1 SEQUENCING

.1 When placing the Slope Capping materials on slopes, sand material, filter material, and rock armour materials shall be placed continuously from the bottom (toe) of the slope upward, such that placed cap materials are supporting of cap materials placed further up the slope.

.2 When placing the Slope Cap, first place the base sand material layer as required to meet the Minimum Required Thickness, elevations, or grades as shown on the

Drawings. Verify compliance using Progress Surveys and Post-Construction Surveys.

.3 Once the Departmental Representative accepts completion of sand material layer placement, the Contractor may commence with placement of the filter material layer as required to meet the Minimum Required Thickness, elevations, or grades as shown on the Drawings. Verify compliance using Progress Surveys and Post-Construction Surveys.

.4 Once the Departmental Representative accepts completion of filter material layer placement, the Contractor may commence with placement of rock armour materials to meet the Minimum Required Thickness, elevations, or grades as shown on the Drawings.

.5 The Contractor shall conduct Progress Surveys and Post-Construction Surveys (and other field verification as the Contractor determines necessary to assess compliance with Minimum Required Thicknesses and Over-Placement Allowances) in accordance with Section 02 21 13 (Surveying and Positioning Control). The Departmental Representative will review Post-Construction (for placement activities) Survey data and, if satisfactorily completed, will accept the Slope Capping activities as complete.

.6 If the Minimum Required Thickness is not achieved at all specified placement locations as shown on the Drawings, or Excessive Overplacement occurred, the Contractor shall correct placement deficiencies to the satisfaction of the Departmental Representative and at the Contractor's own cost.

3.2 SLOPE CAPPING MATERIAL PLACEMENT

.1 The Contractor shall provide barge displacement measurements for all loaded material barges as they arrive at the Contractor'sWork Site. Barge displacement measurements shall also be collected, and provided as part of the Daily Construction Report, at the end of each work shift, and following placement of all Slope Capping material stockpiled on the Contractor's material barges.

.2 Place the sand materialfilter material, and rock armour materials to meet the Minimum Required Thicknesses shown on the Drawings; no compaction is required. Place each layer in such a manner as to construct a discrete layer and avoid mixing the underlying and overlying layers to the extent practicable.

.3 Excessive Over-Placement will not be paid for. If the Contractor's means and methods require Excessive Over-Placement to meet the Minimum Required Thicknesses, the Contractor shall account for this unpaid volume in the Contractor's Tender price for the work.

.4 If the Contractor's operations result in Excessive Overplacement, the Departmental Representative reserves the right to require the Contractor to remove the Excessive Overplacement materials and, if necessary, other corrective actions (including repair or rebuilding the Slope Cap) to meet Specification requirements, all at the Contractor's own cost.

.5 When placing materials on slopes, sand material, filter material, and rock armour materials shall be placed from the bottom (toe) of the slope upward. Materials shall be placed in lifts that allow for complete coverage of the designated area and minimize disturbance to the existing seabed surface. Each discrete Slope Capping layer shall be completed by the Contractor, and then accepted by the Departmental Representative, prior to Contractor placement of the next layer.

.6 The Contractor shall use extra caution during placement of cap materials on 2H:1V (or steeper) grades such that cap materials do not become unstable. This may require a slow and controlled rate of placement. Detailed methods specific to placement of cap materials on steep slopes (2H:1V or steeper) shall be included in the Construction Work Plan for review and acceptance by the Departmental Representative.

.7 The Contractor shall place filter and rock armour materials as soon as possible following placement of sand material on steep slopes (2H:1V or steeper) to minimize potential movement of the sand material .

.8 The Contractor shall employ means and methods to construct the Slope Caps in a careful manner, taking extra care to place each Cap layer in a discrete layer, avoiding mixing with the underlying material, such that the final Engineered Cap as-built section will have discrete individual layers.

.9 The Contractor shall employ placement means and methods that will minimize the potential for re-suspending sea bed sediment during placement activities, and prevent excessive mixing of the placed materials with the sea bed sediment. The Contractor shall place sand material, filter material, and rock armour materials by one or more of the following acceptable placement methods, unless the Contractor proposes, and the Departmental Representative accepts, an alternate placement method:

.1 Re-handling sand material, filter material, and rock armour materials from a material barge and placing directly on the bottom using a clamshell or re-handling bucket using limited drop distance from bucket to bottom (i.e., less than approximately 1.0-m drop)

.2 Controlled discharge of sand material, filter material, and rock armour materials using high speed conveyor, skip box, clamshell, or re-handling bucket, to lay down material over areas in the dry (i.e., located above the water surface during low tides). Drop distance may vary and is not restricted as long as method meets other requirements in this Specification.

.10 The Contractor shall not place sand materials, filter material, and rock armour materials by rapid dumping a barge load.

.11 The Contractor shall not place barge anchors or spuds or other equipment on the newly constructed Slope Cap surface.

3.3 WATER QUALITY CRITERIA COMPLIANCE

.1 The water quality monitoring requirements are in Section 01 35 13 43.01 (Silt Curtain) and in the EMP.

.2 In accordance with the EMP, the Departmental Representative or Environmental Monitor will conduct water quality monitoring, for quality assurance, during completion of Slope Capping activities. The Contractor is responsible for complying with all water quality requirements as defined in the Specifications and the EMP, and shall conduct its own water quality monitoring as needed to provide quality control of the Contractor's work.

.3 The Contractor shall describe in its Construction Work Plan what means, methods, and procedures will be used to prevent water quality criteria exceedances, and what contingency actions will be taken to restore compliance with water quality criteria should water quality exceedances occur during completion of Slope Capping activities.

.4 Delays caused by complying with water quality criteria shall not be cause for additional compensation to the Contractor.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and installation of foam-filled rubber Floating Fenders. Due to the nature of this part of the works, the Contractor shall either confirm his intention to use the Floating Fender design as indicated on the Drawings, or submit his proposed Alternative Floating Fender design for approval as an alternative in accordance with Clause 1.7 of this Section.

.2 This Section also covers the supply and installation of rubbing strip “D” shape rubber fenders.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 11 55 (General Instructions)

.3 Section 03 39 00 (General Concrete Requirements)

.4 Section 03 41 00 (Precast Structural Concrete)

.5 Section 05 50 00 (Metal Fabrications)

.6 Section 09 97 19 (Painting Exterior Metal Surfaces)

1.3 MEASUREMENT AND PAYMENT

.1 Floating Fenders will be measured per unit incorporated into the work.

.2 Floating Fenders will be paid for at the unit price tendered for FLOATING FENDERS. Payment shall include for all costs in connection with supplying and installing the complete fender system, including elastomeric fenders, bolts/fastenings, anchor bolts, steel brackets, chains, shackles, turnbuckles and all other materials and costs to complete the work as shown on the Drawings, or approved alternative drawings, as specified, and to the satisfaction of the Departmental Representative.

.3 Rubbing strip “D” shape rubber fenders will be measured per linear metre of extruded rubber fender incorporated into the work.

.4 Rubbing strip “D” shape rubber fenders will be paid for at the unit price tendered for RUBBING STRIP FENDERS. Payment shall include for all costs in connection with supplying and installing the complete rubbing strip fender system, including elastomeric fenders, anchor bolts/fastenings and all other materials and costs to complete the work as shown on the Drawings, as specified, and to the satisfaction of the Departmental Representative.

1.4 REFERENCES

.1 CAN/CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA-S16.1, Limit States Design of Steel Structures.

.3 CAN/CSA-W47.l, Certification of Companies for Fusion Welding of Steel.

.4 CAN/CSA-W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.5 CAN/CSA-W59, Welded Steel Construction.

.6 ASTM A36, Specification for Structural Steel.

.7 ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.8 ASTM A153/Al53M, Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware.

.9 ASTM A193, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.

.10 ASTM A194, Specification for Carbon and Alloy-Steel Nuts for Bolts for High Pressure and High Temperature Service.

.11 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile Strength.

.12 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength.

.13 ASTM A563, Specification for Carbon and Alloy-Steel Nuts.

.14 ASTM B695, Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

.15 ASTM D256, Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials.

.16 ASTM D395, Test Methods for Rubber Property - Compression Set.

.17 ASTM D412, Test Methods for Rubber Properties in Tension.

.18 ASTM D429, Test Methods for Rubber Property - Adhesion to Rigid Substrates.

.19 ASTM D471, Test Methods for Rubber Property - Effect of Liquids.

.20 ASTM D476, Specification for Titanium Dioxide Pigments.

.21 ASTM D570, Test Methods for Water Absorption of Plastics.

.22 ASTM D573, Test Method for Rubber - Deterioration in an Air Oven.

.23 ASTM D624, Tear Strength of Conventional Vulcanized Rubber and Thermo Plastic Elastomers.

.24 ASTM D638, Test Method for Tensile Properties of Plastics.

.25 ASTM D1052, Measuring Rubber Deterioration Method for Cut Growth Using Ross Flexing Apparatus.

.26 ASTM D1053, Test Method for Rubber Property-Stiffening at Low Temperatures: Flexible Polymers and Coated Fabrics.

.27 ASTM D1171, Test Method for Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber.

.28 ASTM D1630, Rubber Property Abrasion Resistance, Tests for NBS Abrader.

.29 ASTM D1667, Flexible Cellular Materials – Vinyl Chloride Polymers and Co-Polymers (Closed Cell Foam).

.30 ASTM D1894, Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting.

.31 ASTM D2137, Test Methods for Rubber Property - Brittleness Point of Flexible Polymers and Coated Fabrics.

.32 ASTM D2240, Test Method for Rubber Property - Durometer Hardness.

.33 ASTM D3575, Flexible Cellular Materials Made from Olefin Polymers.

.34 SSPC-SP10, Near-White Blast Cleaning..35PIANC Guidelines for the Design of Fender Systems: 2002

1.5 DEFINITIONS

.1 Definitions are generally listed in Section 01 11 55 (General Instructions). However, definitions specific to marine fenders are listed here:

.1 Floating Fender : Each Floating Fender shall comprise the foam-filled fender, internal chains and end fittings, support chains, turnbuckles, shackles, and anchor bolts/fastenings to the wharf structure, all as shown on the Drawings, except as permitted by Clause 1.7 (Alternative Floating Fenders).

.2 Berthing Design Energy: The minimum energy to be absorbed by each Floating Fender at rated deflection. For each design vessel, the Berthing Design Energy is the nominal calculated berthing energy plus a 10% allowance for normal manufacturing tolerances, as stipulated in Table 1 in this Section.

.3 Velocity Correction Factor (VCF): A factor to account for the difference between the speed at which fender rating tests were conducted and design berthing velocity. VCF is incorporated by some fender manufacturers into their published energy/reaction curves without any indication as to its inclusion. Other manufacturers do not apply VCF.

1.6 DESIGN CRITERIA FOR FLOATING FENDERS

.1 Each Floating Fender shall be between 1,325 mm and 1,375 mm outside diameter (O.D.), and between 2,400 mm and 2,600 mm long. Each Floating Fender shall be capable of absorbing the Berthing Design Energy associated with the specified

design ships, at rated deflection, at all tidal states. Design parameters for Floating Fenders are given in Table 1, and further criteria are given in Clause 1.7.1.

.2 Each Floating Fender shall exhibit a rated reaction no greater than 425 kN at rated deflection, for a berthing approach angle of zero degrees. No reaction adjustment allowance is required to account for normal manufacturing tolerances.

.3 The use of Velocity Correction Factor (VCF) will not be permitted. Fender approval submittals shall include a statement by the manufacturer that VCF has not been included in fendering selection.

TABLE 1 - DESIGN PARAMETERS FOR FLOATING FENDERS

Parameter	Halifax Class Patrol Frigate (FELEX program)	Protecteur Class Supply Ship (AOR)	Spirit "S" Class (BC Ferry)
Deadweight, DWT	835 tonne	9,462 tonne	2,645 tonne
Displacement,	5,235 tonne (max draft)	26,115 tonne (10,552 tonne light)	11,681 tonne
Length (overall), L	135.5 m	172.5 m	167.5 m
Beam, B	16.4 m (hull face)	23.20 m (hull face)	27.5 m (rubbing strip)
Maximum Draft, D_{MAX}	6.15 m (but 8.45 m to sonar dome)	* 10.3 m (no sonar dome)	5.03 m
Lightship Draft, D_{LT}	4.836 m	7.30 m	4.09 m
Maximum Hull Pressure	25 tonnes/m^2	25 tonnes/m^2	25 tonnes/m^2
Approach Velocity, V_N	0.15 m/sec	0.15 m/sec	0.15 m/sec
Berthing Approach Angle	10 degrees	10 degrees	10 degrees
Point of 1st Berthing Contact	¼ point	¼ point	¼ point
Number of Compression Cycles for Fender Design	Range 10 – 100	Range 10 – 100	Range 10 – 100
Nominal Berthing Energy	5.25 tonne-m	9.86 tonne-m	9.23 tonne-m
Berthing Design Energy (includes 10% allowance for normal manufacturing tolerances)	**5.78 tonne-m**	**10.85 tonne-m**	**10.15 tonne-m**

* Note: At maximum draft the HMCS Protecteur cannot berth at the South Jetty, so lightship condition is used as the fendering design criterion for this vessel.

1.7 ALTERNATIVE FLOATING FENDERS

.1 Alternative Floating Fenders which are proposed by Contractor in accordance with Section 01 33 00 (Submittal Procedures) and Clause 1.1.1 of this Section, shall comply with the requirements of this Section of the Specification, the fendering design parameters given in Table 1, and the following criteria:

.1 Each Floating Fender shall be capable of absorbing the Berthing Design Energy associated with each design ship listed in Table 1, at rated deflection, at all tidal states. Rated fender energy and reaction shall be adjusted by the appropriate factor for the tabulated berthing approach angle, and by the appropriate factor for the specified number of compression cycles for fender design (to account for decay in fender performance).

.2 Floating Fenders shall be net-less foam-filled elastomeric fenders and shall absorb energy by controlled and repeatable elastic deformation. Floating Fenders shall be of similar shape, size and function to the fenders shown on the Drawings.

.3 Each Floating Fender shall be designed for a minimum service life of 25 years under tidal seawater and wave splash conditions, with abrasion under compression and/or shear against vessel hull and concrete wharf.

.4 The contact pressure on the compressed Floating Fender shall not exceed the tabulated maximum hull pressure.

.5 Longitudinal and vertical shear loads generated by ship movements shall be resisted by the floating fender and chain attachment system.

.6 For the design of all chains, the coefficient of friction between the ship's hull and Floating Fender, and the coefficient of friction between the floating fender and the concrete support surface, shall be taken as industry accepted values, and a safety factor of three (3.0) shall be used in the chain system design.

.7 The fender's support brackets and chains shall be arranged so that the vertical and longitudinal movements of the Alternative Floating Fenders at all tidal states, and under rated fender deflection, are controlled in exactly the same way as shown for the designed fender system on the Drawings. Attachments to the wharf structure must be at the elevation and lateral positions shown on the Drawings.

.8 The (undeflected) overall standoff from wharf face shall be 1,350 mm, with a tolerance of ± 25 mm. The minimum, fully deflected standoff shall not be less than 540 mm ± 15 mm (i.e. 60% rated deflection).

.9 Alternative Floating Fenders may require minor modifications to the wharf structure to accommodate the proposed fendering system fixings. Details of the required modifications shall be submitted with the alternative fendering proposal. The impact of these modifications on the design and construction of the wharf structure will be considered during the evaluation of proposed Alternative Floating Fenders.

.10 In addition, Alternative Floating Fenders will be evaluated on the basis of operational adequacy, durability, maintenance and reliability as demonstrated by case histories of similar fender installations. The manufacturer of the proposed alternative fendering system shall have been in the business of manufacturing rubber marine fender systems of this type

for at least ten (10) years, and show proof of five (5) similar installations each having been in service for at least eight (8) years.

.11 Departmental Representative reserves the right not to approve any proposed Floating Fender alternative on any of the above grounds.

.12 The following data shall be submitted with proposed Alternative Floating Fenders:

.1 Description of fenders with fully detailed drawings.

.2 Performance details including energy absorption, load/deflection and terminal reaction under at rated deflection.

.3 Details of anchor bolts/fastenings and chain system (including calculated chain loads), and details of surface coatings.

.4 Location of manufacturing plant.

1.8 SUBMITTALS

.1 At least twenty-eight (28) days before making any fenders, submit shop drawings for Floating Fenders and for Rubbing strip "D" shape rubber fenders in accordance with Section 01 33 00 (Submittal Procedures). Indicate the following items on fully detailed shop drawings:

.1 General arrangement of fenders, including colour description;

.2 Location, sizes and details of anchor bolts;

.3 Structural details and design calculations for chain system (including calculated chain loads), and fixings;

.4 Performance details including energy absorption, load/deflection and terminal reaction at rated deflection. Include a statement by the manufacturer that VCF has not been included in fender selection;

.5 Details of surface coatings; and,

.6 Location of manufacturing plant.

.2 Submit written confirmation that representative samples of the following materials have been tested or are certified by the supplier and provide copies of the test results and / or certification:

.1 Elastomer / rubber compound;

.2 Polyethylene foam core;

.3 Internal chains and swivel clevis fittings.

.3 Submit pre-tested fender type certification with third party approval in accordance with PIANC Guidelines for the Design of Fender Systems: 2002.

.4 Submit certificates indicating manufacturer's recommended minimum safe working load for all chain, shackles, links and similar steel components. Provide confirmation by manufacturer that representative samples of steel chains, shackles, links and similar components have been proof loaded to at least twice the specified safe working load. Provide confirmation by manufacturer that

representative samples of steel chains, shackles, links and similar components have been tested to ultimate failure and have failed at forces at least three (3.0) times the specified safe working load.

.5 Submit confirmation that the fender manufacturer has been in the business of manufacturing rubber marine fender systems of this type for at least ten (10) years, and show proof of five (5) similar installations each having been in service for at least eight (8) years.

1.9 QUALITY CONTROL

.1 Certification for Floating Fenders:

.1 Elastomer / rubber compound;

.2 Polyethylene foam core;

.3 Internal chains and swivel clevis fittings;

.4 Individual chain/turnbuckle assemblies and components;

.5 Other steel materials, fabrication and coatings;

.6 Bolting and embedded materials;

.7 Galvanizing.

.2 Certification for rubbing strip "D" shape rubber fenders:

.1 Each rubber fender shall be clearly identified by a serial number.

.2 Each rubbing strip "D" shape rubber fender, upon delivery, shall be accompanied by a quality control report. This report shall attest that each rubbing strip "D" shape rubber fender conforms to the requirements of this Specification, and shall include certified test data covering:

.1 Elastomer / rubber compound;

.2 Bolting, other steel materials, fabrication and coatings;

.3 Galvanizing.

1.10 OPERATING ENVIRONMENT

.1 For design purposes assume that the Floating Fenders and rubbing strip "D" shape rubber fenders will be intermittently exposed to:

.1 Partial and/or complete immersion in seawater that may be contaminated by oil products;

.2 Wave attack in seawater splash zone; and,

.3 Abrasion under compression and/or shear against vessel hull and concrete wharf.

.2 The normal tidal range at Esquimalt Harbour is indicated on the Drawings. Extreme tidal elevations including surge effects will exceed the indicated tidal range.

.3 The design ambient temperature range is from -5° C minimum to 23° C maximum. Floating Fenders and rubbing strip "D" shape rubber fenders are to provide consistent service within the design ambient temperature range.

Part 2 Products

2.1 MATERIALS FOR FLOATING FENDERS

.1 Fender Type and Configuration: Floating fenders shall be net-less foam-filled elastomeric marine fenders conforming to the fender size and performance criteria stipulated in Clauses 1.6 and 1.7 in this Section. The cylindrical mid-body shall extend to at least 60% of the overall fender (end-fitting to end-fitting) length, with rounded or conical shaped ends terminating in an end fitting on the cylinder's centreline at each end. Fender ends shall be equal in length and in the form of a cone or hemisphere distorted at the end fittings so that compression-induced tensile stresses will be minimal. Acceptable products are:

.1 SeaGuard Foam Fender, 1,350 mm diameter by 2,500 mm long, standard foam grade.

.2 Ocean Guard

.3 Trelleborg

.2 Fender Identification: Emboss, permanently attach or otherwise provide unique identification on each elastomeric fender outer skin as follows:

.1 Each fender shall have the manufacturer's name, and a unique reference identifying nominal size, date of manufacture, and identifier for that specific fender.

.2 Fender identifications shall be located at both ends and in areas where abrasion or other mechanisms will not cause removal. Fender identifications shall be repeated around the perimeter of the fender sufficient times to enable them to be read from the jetty deck with the fender in any orientation.

.3 Fender Skin: The fender outer skin shall be a minimum of 30 mm thick and constructed of elastomer and filament reinforcing as specified. The filament wraps shall be evenly distributed in the inner coating thickness. The outer elastomer shall have no filament reinforcing. The elastomer and filaments shall be applied in a continuous manner to ensure adhesion between the various layers. Fender skin shall be non-marring type, to Departmental Representative's approval. Colour: **grey**.

.4 Elastomer: The elastomer used in the fender outer skin shall be polyether urethane elastomer, with the following unreinforced properties:

.1 Shore (A) Durometer hardness: 75 to 95 (ASTM D2240).

.2 Tensile strength: 13.8 MPa minimum (ASTM D412).

.3 Elongation: 400 % minimum (ultimate) ASTM D412).

.4 Tear strength: 32.4 N/mm minimum (ASTM D624).

.5 Flex life (Ross): 10,000 cycles min. (ASTM D1052-85).

.5 Filament Wrap: Construct each filament reinforcing wrap of continuous filaments applied in a helical pattern, at a helix angle of 45-60 degrees to the longitudinal axis of the fender. A single wrap shall consist of two such filament helixes of equal but opposing helix angles. The spacing between the filaments in the same helix shall be no more than 3 mm, measured in a direction parallel to the longitudinal axis of the fender and shall also encase the fender end fittings and secure them to the fender body.

.6 Filament Reinforcing: The reinforcing filaments in the fender outer skin shall be nylon tire cord of 2,520 denier weight with the following properties:

.1 Breaking strength: 230 N minimum.

.2 Elongation (ultimate): 16 % minimum.

.7 Foam Core: The interior of the fender shall be completely filled with an energy absorbing foam core. The energy absorbing foam core shall be resilient closed-cell, cross-linked polyethylene foam with the following properties. Use of chipped or granulated particulate foam is not acceptable. Foam core shall conform to the following test properties, per ASTM D 3575-93:

.1 Density: in range 52.8 to 68.9 kg/m^3.

.2 Tensile strength: 0.41 MPa minimum.

.3 Elongation (ultimate): 100 % minimum.

.4 Water absorption: less than 0.98 kg/m^2 cut surface.

.8 Internal Chain and End Fittings: Fittings at either end of the fender body shall be connected through the centre of the fender by a tight chain, and shall terminate in a swivel clevis fitting which allows the end fitting to rotate freely on the axis of the fender. Conform to the following details:

.1 End fittings and internal chain shall be steel, of a heavy duty design, and galvanized per ASTM A123 or A153 as applicable.

.2 Design and size internal connecting chain and fender end fittings so that they will not fail when subjected to three (3) times the safe working load of the weakest component in the fender internal and attachment hardware.

.3 Ensure that each end clevis is of appropriate size for support chain/shackle attachment by others.

.4 Interconnect fender end fittings using regular forged swivels and tight (minimum 44 mm size) stud link chain or a comparable linkage, subject to the approval of Departmental Representative.

.5 Arrange internal fender end-fitting linkage so that it will not kink or permanently interlock during abusive fender usage, and so that it will be sufficiently tight to immediately transmit lateral forces without impact.

.6 Design fender end fittings to bear on sufficient fender material so that they will fail before permanently damaging the fender material.

.7 Design fender end zones so that the integrity of the fender will not be damaged by axial forces in the end fittings.

.8 Emboss end fittings and swivels with the name of the manufacturer and a reference mark to enable clear identification of the piece, unless otherwise approved by Departmental Representative.

.9 Fender attaching bolts shall conform to the following:

.1 Bolts, nuts and washers for attaching fenders to the chain system and for attaching the chain system to the precast fender support structure, shall be of size and quantity recommended by fender manufacturer.

.2 Bolts shall conform to ASTM A307, galvanized per ASTM A153 or B695, 316SS per ASTM A193, class 2, grade B8M2.

.3 Washers shall be carbon steel, galvanized per ASTM A153 or B695, 316SS.

.4 Nuts shall conform to ASTM A563, grade A heavy hex galvanized per ASTM A153 or B695, 316SS per ASTM A194, grade 8M heavy hex.

.5 Locking nuts (or cotter pins) shall be provided at all fender attaching bolts.

.10 Chain Assemblies: Chains shall be provided as necessary for proper functioning of the system within the constraints of the Specification. Each chain shall be selected to withstand its maximum design load with a minimum factor of safety (based on breaking) of three (3.0), but with a stock size of not less than 32 mm. All chain assembly components shall be galvanized in accordance with ASTM A123 or A153, as applicable. Shackles, turnbuckles, and other fittings shall be of same grade material and shall have strength comparable to the chain.

.11 Fender Anchors/Concrete Embedments: Concrete embedments (anchor bolts, anchor bolt inserts, sleeves and chain anchors) shall be no closer than 250 mm to an edge of a concrete structure, and designed to resist a pullout of 25 % greater than the breaking strength of the male threads or chains attached to them. Concrete pullout resistance shall be based on concrete compressive strength of 35 MPa.

2.2 MATERIALS FOR RUBBER STRIP FENDERS

.1 Rubbing strip “D” shape rubber fenders shall be elastomeric marine fenders moulded (or extruded) from rubber, homogeneous and free from any defects, impurities, pores or cracks.

.2 Rubbing strip fenders shall be sized as shown on the Drawings, and shall be capable of absorbing a Berthing Design Energy of at least **8.5 kNm** at 50% deflection.

.3 The rubber from which the rubbing strip fenders are formed shall be natural or synthetic material tested to the requirements of ASTM Standards D2240 (hardness), D412 (tensile strength and elongation), D573 (heat resistance), D395 (compression set), Dl171 (resistance to ozone), D471 (water resistance), D2137 (low temperature resistance), or alternative equivalent national standards.

.1 Shore (A) Durometer hardness: 75 +/- 5 (ASTM D2240).

.2 Tensile strength: 13.8 MPa minimum (ASTM D412).

.3 Elongation: 400 % minimum (ultimate) (ASTM D412).

.4 Fender attaching bolts: conforming to Clause 2.1.9 of this Section.

Part 3 Execution

3.1 STEEL FABRICATION

.1 Welding shall only be performed by a fabricator certified by the Canadian Welding Bureau to the requirements of CAN/CSA-W47.1 for Division 1 or 2.

.2 Welding shall be in accordance with CAN/CSA-W59. All welds shall be continuous and watertight. Exposed welds shall be ground smooth and flush with adjacent metal.

.3 Holes shall be drilled and tapped as shown on the approved shop drawings.

3.2 INSTALLATION

.1 Install all components of Floating Fenders in accordance with manufacturer's instructions and as indicated on the Drawings.

.2 Do not make alteration to Floating Fender system components without written permission of Departmental Representative.

.3 Adequate provision shall be made to keep all components of the Floating Fenders plumb and in true alignment during installation.

.4 Prevent damage in storing, handling and installing the Floating Fenders.

.5 Miscellaneous metal fabrications to be embedded in concrete, or grouted, shall be accurately set and held firmly in position while concrete or grout is being placed and cured. Any embedded fabrications that are incorrectly placed or that move during embedment to an extent that will affect their proper operation shall be removed and replaced correctly or shall be corrected by other approved means.

.6 All damage to coatings shall be restored by touch-up to provide an unbroken coating film equal to the original coating.

.7 Floating Fenders shall be installed in accordance with the approved shop drawings and the manufacturer's instructions. Alterations to the Floating Fender components shall not be made without the written permission of Departmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and installation of Mooring Devices (i.e. bollards and cleats).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 11 55 (General Instructions)

.3 Section 03 10 00 (Concrete Forming and Accessories)

.4 Section 03 20 00 (Concrete Reinforcing)

.5 Section 03 39 00 (General Concrete Requirements)

.6 Section 05 50 00 (Metal Fabrications)

.7 Section 04 05 12 (Grout)

.8 Section 09 97 19 (Painting Exterior Metal Surfaces)

1.3 MEASUREMENT AND PAYMENT

.1 Mooring Devices will be measured per unit incorporated into the work for each type of mooring device.

.2 Mooring Devices will be paid for at the unit prices tendered for MOORING BOLLARDS: 100 TONNE and MOORING CLEATS: 34 TONNE, as appropriate. Payment shall include for all costs in connection with supplying and installing the bollards/cleats at the concrete support structures including anchor bolts, nuts, washers, anchor plates, painting, grout and all other materials and costs to complete the work as shown on the Drawings, and to the satisfaction of Departmental Representative.

.3 Anchor bolts and other miscellaneous steel fabrications will not be measured separately, but considered incidental to the work. All costs in connection with anchor bolts and other miscellaneous steel fabrications shall be included in the unit prices tendered for the associated work covered by this Section.

.4 No measurement or payment will be made for reinforcing bars required for anchorage of Mooring Devices.

.5 Reinforced concrete required for Mooring Devices will be measured to Section 03 30 00 (Cast-in-Place Concrete).

1.4 REFERENCES

.1 ASTM A148/148M-01, Specification for Steel Castings, High-Strength, for Structural Purposes.

.2 ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A153/Al53M, Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware.

.4 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength.

.5 ASTM E1030-00, Standard Test Method for Radiographic Examination of Metallic Castings.

.6 ASTM E186-93, Standard Reference Radiographs for Heavy-Walled (2" to 4.5") Steel Castings.

.7 CAN/CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.8 CAN/CSA-S16.1, Limit States Design of Steel Structures.

.9 CSA G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.5 DEFINITIONS

.1 Mooring Device: For definition refer to Section 01 11 55 (General Instructions).

1.6 DESIGN CRITERIA FOR ALTERNATIVE MOORING DEVICES

.1 In the event that the Contractor proposes alternative Mooring Devices, the alternative shall comply with the requirements of this Section of the specification and the following criteria:

.1 Each Mooring Device (bollard/cleat and its anchor bolts) shall be rated by the supplier to carry the specified mooring line loading for each application: 100 tonnes for bollards; and 34 tonnes (37.5 tons) for cleats. Each bollard/cleat and its anchor bolts shall be capable of resisting the specified mooring line loading with a minimum factor of safety, based on breaking, of 2.0. The direction of loading shall be any waterside direction within a 180° arc centered on a line normal to the dry dock face (at the mooring device location) in the horizontal plane, and in the vertical plane from horizontal up to +30° above horizontal;

.2 Bollards/cleats shall be cast steel as specified herein formed in a single casting operation, and shall be twin horn/post type of the shape and size shown on the Drawings;

.3 Alternative Mooring Devices, and in particular their anchor bolt arrangement, may require modifications to the concrete structures. Details of the proposed structural modifications shall be submitted with the alternative Mooring Device proposal. The impact of these modifications on the design and on construction will be considered during the evaluation of proposed alternative Mooring Devices;

.4 In addition, alternative Mooring Devices will be evaluated on the basis of operational suitability, durability, maintenance and reliability as demonstrated by case histories of similar bollard/cleat installations. The manufacturer of the proposed alternative Mooring Devices shall have been in the business of

manufacturing cast steel bollards/cleats for at least twenty (20) years, and show proof of five (5) similar installations each having been in service for at least ten (10) years;

.5 Departmental Representative reserves the right not to approve any proposed bollard/cleat alternative on any of the above grounds; and

.6 The following data shall be submitted with proposed alternative mooring device schemes: Description of bollards/cleats, anchor bolts and plates with fully detailed drawings; throat height and load rating for bollards/cleats; load rating for anchor bolts; steel grades for all components; details of surface coatings; and location of manufacturing plant.

1.7 OPERATING ENVIRONMENT

.1 Mooring bollards/cleats and anchor bolts will be located in the seawater splash and spray zones.

.2 The seawater may be contaminated by oil products.

.3 The design ambient temperature range is from -5°C minimum to 23°C maximum.

.4 Coated surfaces of the mooring bollards/cleats will be subject to abrasion from tensioned mooring lines.

1.8 SUBMITTALS

.1 At least twenty-eight (28) days before making any bollard/cleat castings, submit shop drawings for Mooring Devices, in accordance with Section 01 33 00 (Submittal Procedures). Indicate the following items on the fully detailed shop drawings:

.1 Description and general arrangement for each type of mooring device;

.2 Location, sizes and details of anchor bolts and anchor plates;

.3 Throat height and load rating for bollards and cleats;

.4 Load rating for anchor bolts;

.5 Steel grades for all components;

.6 Details of surface coatings; and,

.7 Location of manufacturing plant.

.2 At least twenty-eight (28) days before making any castings, submit confirmation that the bollard/cleat manufacturer has been in the business of manufacturing cast steel bollards and cleats for at least twenty (20) years, and show proof of five (5) similar installations each having been in service for at least ten (10) years.

.3 At least fourteen (14) days before installation of castings in the work submit, to Departmental Representative for his review, certification of all castings per ASTM A148/A148M supplementary requirement S6.

1.9 QUALITY CONTROL

.1 Submit certified test report, or certificate of conformance or compliance, attesting that mooring bollards/cleats and anchor bolts furnished under this specification meet the rated capacity requirements herein.

Part 2 Products

2.1 MATERIALS

.1 Mooring bollards and cleats shall be cast steel to ASTM A148M/A148M-01, Grade 80-50, formed in a single casting operation and shall be free of cracks or other defects. Make castings and perform tensile testing as specified in ASTM A148/A148M-01. Inspect and repair, as necessary, all castings. All mooring bollards and cleats shall be clearly embossed with rated capacity in a prominent location visible from the dock apron. Approved Products are as follows:

.1 Mooring Bollards: 100 tonne Type A-19-1X Elliott Steel load rated bollard with a 305 mm (12 in) modified throat height, as supplied by Magnum Fabricators Ltd, 12294 – 104th Avenue, Surrey, B.C. Tel (604) 589-9191, Fax (604) 589-9199.

.2 Mooring Cleats: 34 tonne (37.5 ton) Type B-2X Elliott Steel load rated cleat, as supplied by Magnum Fabricators Ltd, 12294 – 104th Avenue, Surrey, B.C. Tel (604) 589-9191, Fax (604) 589-9199.

.2 In the event that Contractor proposes alternative Mooring Devices, the alternative shall comply with the design criteria of Clause 1.6 of this Section, and all the other requirements of this Section.

.3 Perform non-destructive quality control testing on bollards/cleats as specified, before painting. ASTM A148/A148M-01 supplementary requirement S1 (magnetic particle testing) applies to the first single casting made for each type of bollard and cleat. In addition, perform straight- beam ultrasonic non-destructive testing on the first single casting made for each type of bollard and cleat. The ultrasonic testing is intended to find internal voids/inclusions in the castings. The magnetic particle testing is intended to find surface cracking which might be missed by ultrasonic testing.

.1 Await acceptance, by Departmental Representative, of the results of the magnetic particle and ultrasonic tests before proceeding with the remaining casting work; and,

.2 If the magnetic particle and ultrasonic tests reveal unacceptable flaws in the first casting of each type of bollard or cleat, then make appropriate modifications to casting methodology to produce acceptable test results. Perform such modifications and subsequent acceptance testing at no cost to Departmental Representative.

.4 ASTM A148/A148M-01 supplementary requirement S6 (certification) applies to all castings. Provide certification of all castings.

.5 Anchor bolts shall conform to strength and ductility requirements of ASTM A325 or approved equal. The upper 300 mm length of anchor bolts (minimum), including nut and washer, shall be galvanized to ASTM A153 or equivalent. Contractor shall ensure that, after galvanizing, the anchor bolts still conform to the strength and ductility requirements of ASTM A325M.

.6 Anchor plates shall conform to CAN/CSA G40.21-M Grade 300W.

.7 Mooring bollards and cleats shall be coated as specified in Section 09 97 19 (Painting Exterior Metal Surfaces), with finish paint colour as selected by Departmental Representative from available colours.

.8 Bedding grout shall be shrinkage compensating non-metallic cementitious "flowable" grout, with 7-day compressive strength not less than 35 MPa, and as specified in Section 04 05 12 (Grout).

Part 3 Execution

3.1 INSTALLATION

.1 Install mooring bollards and cleats in accordance with the manufacturer's instructions.

.2 Contractor shall not damage metal fabrications or coatings in storing, handling and installing the bollards/cleats and hardware.

.3 Adequate provision shall be made to keep the metal fabrications plumb and in true alignment during installation.

.4 Anchor bolts and plates to be embedded in concrete shall be accurately set and held firmly in position while concrete is being placed and cured. Any embedded fabrications that are incorrectly placed or that move during embedment to an extent that will affect their proper operation or alignment shall be removed and replaced correctly or shall be corrected by other approved means.

.5 Bolt recesses in the bollard base plates shall be filled with grout after installation.

.6 Exposed surfaces of the bollards and cleats shall be thoroughly cleaned and painted as specified by Section 09 97 19 (Painting Exterior Metal Surfaces). The underside of the base plates shall not be painted.

.7 Ensure that paintwork is fully cured before installing bollards or cleats in the work. All damage to painting shall be restored by Contractor with touch-up painting to provide an unbroken paint film equal to the original coating. Protect coated surfaces against damage until completely hardened.

3.2 GROUTING

.1 Set all mooring bollards and cleats at locations and elevations as indicated. After positioning of shims/wedges and tightening of anchor bolts, grout under bollard/cleat base plate.

.2 Mix and apply grout in accordance with Section 04 05 12 (Grout).

.3 Ensure that temperatures of foundation, air, base and grout are within range specified by grout manufacturer.

.4 Ensure the grout completely fills the gap between base plate and concrete surface to provide full contact bearing area under the bollard or cleat.

.5 Plug inspection holes in bollards/cleats to prevent loss of grout.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section covers the requirements for the design and installation of a corrosion protection system. The system type and configuration shall be determined by the contractor. See Appendix D6d EGD Cathodic Protection Study - Corrosion Services (2016)Rev 1 for some cathodic protection system design and related details..

.2 The corrosion protection design/install contractor shall provide all engineering services, materials, equipment, AC services, labor, and supervision for the installation of a system. The system is intended to provide corrosion control to the existing sheet pile wall, the existing steel piles and the new steel piles.

.3 The existing sheet pile wall and piles have been previously protected using an impressed current system, which has been reinstalled subsequent to dredging and placement of the Engineered Capping material under the existing concrete deck.

.4 All engineering services shall be provided by a Corrosion Specialist who is accredited by the National Association of Corrosion Engineers International as a Senior Corrosion Technologist, Corrosion Specialist or Cathodic Protection Specialist with impressed current system experience. The system shall be designed by a Corrosion Specialist with experience in cathodic protection for marine structures.

.5 The design life of the system will be 25 years.

1.2 RELATED SECTIONS

.1 Section 00 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

.3 Section 02 41 16.01 (Structure Demolition)

.4 Section 26 05 00 (Common Work Results - Electrical)

.5 Section 26 05 05 (Existing Buildings, Facilities And Site Conditions)

.6 Section 26 05 20 (Wire And Box Connectors 0-1000v)

1.3 MEASUREMENT AND PAYMENT

.1 Design, installation and commissioning of the Corrosion Protection (CP) will be paid for at the Lump Sum price tendered CP SYSTEM. Payment shall be full compensation for all the materials and work required to provide a fully functioning corrosion protection system as specified and as shown on the Drawings, except for providing electrical connectivity between the steel components to be protected.

.2 The cost to supply and install electrical connectivity between the various steel components for the CP System to provide corrosion protection shall be measured and paid for at the Lump Sum tendered for CP SYSTEM CONNECTIVITY, and shall be done by the Contractor doing the concrete work, under the guidance of the CP System designer. The method of connecting the steel components shall be subject to approval by the Departmental Representative.

1.4 REFERENCES

.1 All work furnished shall be in accordance with A.W.W.A. Standard D104, ANSI/NSF 61 and features included in this specification.

.2 NACE SP0176-2007: Corrosion Control of Submerged Areas of Permanently Installed Steel Offshore Structures Associated with Petroleum Production

.3 NACE SPO169-2013: Control of External Corrosion on Underground or Submerged Metallic Piping Systems

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 The cathodic protection contractor shall submit the following information to the purchaser for approval by the Owner or his representative

.1 Drawings showing system design/configuration.

.2 Description of system components.

.3 Design calculations for required voltage, amperage & life expectancy.

.4 Drawings and calculations for cathodic protection system shall be stamped by a Professional Engineer.

.5 Details of how electrical connectivity is achieved.

Part 2 Products

2.1 MATERIAL

.1 Not Used

Part 3 Execution

3.1 GENERAL REQUIREMENTS

.1 Provide a complete operating current cathodic protection system.

3.2 INSTALLATION

.1 New power supply will be installed in the concrete deck as shown on th Electrical drawings.

.2 Use the existing AC power supply.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and installation of protective wraps on steel piles currently supporting the existing concrete jetty. Existing piles include both plum piles and battered piles.

.2 This work is considered provisional to the contract, and depending on the tendered price, may or may not be included, solely at the discretion of PWGSC.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 35 43 (Environmental Procedures and Sustainability)

.3 Section 01 74 11 (Cleaning)

.4 Section 35 90 00 (Corrosion Protection)

1.3 MEASUREMENT AND PAYMENT

.1 Protective wraps shall be measured after installation, in linear meters of pile covered as specified herein.

.2 Protective wraps will be paid for at the unit price tendered for PACKAGE 'B' – PROTECTIVE PILE WRAP, measured by linear meter of Pile Wrap System installed. This payment shall be full compensation for all labor, materials, documentation, tools and equipment necessary for pile surface preparation, primer paste and petrolatum-based tape application, outer High Density Polyethylene (HDPE) jacketing installation, epoxy grout, and all other related Work in accordance with requirements as specified.

1.4 REFERENCES

.1 ASTM A123, Standard Specification for Zinc (Hot- Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, with sufficient time for review, prior to mobilization.

.1 Cleaning and Surface Preparation Procedures and Materials

.1 Standard materials and procedures to be used by the Contractor as required by manufacturer specification

.2 Containment Practices

.2 Shop Drawings

.1 Pile Wrapping System

.3 Product Data

.1 Submit product data and technical/engineering specifications including material specifications, manufacturer's instructions for surface preparation, required environmental conditions, etc., for supply and installation of the complete pile wrap and jacketing systems, including sufficient information to verify that the product selected and planned installation methodology meet the requirements of this specification.

.4 Qualifications and Quality Control

.1 Contractor shall arrange for manufacturer representative to be on-site during initial installation of pile jacketing to ensure proper methods, procedures and process are being followed by the Contractor.

.5 Work Plan

.1 Submit work plan for installation of pile jacket systems. Plan shall address sequence, means and methods, equipment, for pile preparation and installation of complete pile jacketing system.

.6 As-Built Drawings

.1 As-built drawings shall be submitted immediately after completion of installation, and shall show the following items for each pile:

.1 Type of Pile Wrap System

.2 Type of Coating System

.3 Top of wrap elevation

.4 Bottom of wrap elevation

.5 Manufacturer-observed installation locations

Part 2 Products

2.1 MATERIALS

.1 General

.1 All materials shall meet or exceed the minimum requirements listed by current manufacturer specifications.

.2 All components of the Pile Wrap system shall be supplied or warranted by a single manufacturer. Combining proprietary products from multiple companies will not be allowed.

.2 Primer/Paste

.1 Primer shall be non-toxic and comprised of saturated petroleum hydrocarbons (petrolatum), inert fillers and passivating agents.

.2 The paste is used to displace moisture, passivate surface oxides and fill surface imperfections.

.3 Mastics

.1 The mastics shall be comprised of saturated petroleum hydrocarbons (petrolatum), inert fillers, reinforcing fibers and thermal extenders. Variations may contain beads of cellular polymer and flow control additives.

.2 Mastics shall be industrial grade, designed specifically for use in the marine environment.

.3 Mastics shall be cold applied and self-supporting for molding around irregular shaped fittings to provide a suitable profile for applying the petrolatum tape.

.4 Marine Tape

.1 The tape shall be comprised of a non-woven synthetic fabric carrier, fully impregnated and coated with a neutral petrolatum-based compound with inert siliceous fillers and corrosion inhibitors.

.2 Tape shall be non-toxic and have a character stable in composition and plasticity over a wide temperature range.

.3 The tape shall be non-hardening and non-cracking with the ability to accommodate vibration and extreme movement.

.4 Tape shall be highly resistant to mineral acids and alkalis.

.5 Pile Wrap

.1 The wrap shall be comprised of High Density Polyethylene (HDPE) or multi-layer urethane coated reinforced polyester composite material. It shall be new, seamless virgin material. Use of reprocessed resin is prohibited.

.1 HDPE outer wrap shall be at least 2mm thick.

.2 Reinforced polyester composite material shall be at least 0.75mm thick

.2 The sheet shall be uniform throughout, free from dirt, oil and other foreign matter and free from cracks, creases, wrinkles, bubbles, pin-holes and any other defects that may affect its service.

.3 Wrap shall be equipped with a "flange"-type connection.

.6 Fasteners and Hardware

.1 Connections shall consist of the following items:

.1 Fasteners shall be 316 Marine Grade stainless steel, 9.5mm diameter minimum.

.2 Nuts shall be 316 Marine Grade stainless steel with nylon inserts. Alternately, two 316 Marine Grade stainless steel nuts shall be applied to prevent loosening.

.3 Washers shall be 316 Marine Grade stainless steel.

.4 Fasteners shall be spaced evenly depending on the size and length of the wrap, in accordance with manufacturers written recommendations.

2.2 PRODUCT HANDLING

.1 Materials shall be stored and staged out of direct sunlight at temperatures similar to site conditions, and with dunnage, as needed, to reduce the chance of warping.

2.3 QUALITY ASSURANCE

.1 Contractor shall select a system that has been successfully protecting steel piling from corrosion in the intertidal and splash zones within 1000km of the Contractor's Work Site.

Part 3 Execution

3.1 GENERAL

.1 The Protective Wrap System shall be applied to each existing steel pile, from the underside of pile cap to an elevation 5.0m below the underside of pile cap or to seabed, whichever is less.

.2 Existing steel piles are generally considered to be epoxy-coated, with the condition and existence of coating varying from pile to pile.

.3 The majority of piles have significant barnacle and other similar marine growth through the intertidal elevations.

3.2 PREPARATION

.1 Remove marine growth, loose rust, paint and foreign matter by hand and/or power tool cleaning.

.2 Remove weld splatter, sharp points and edges.

.3 A hydraulic whirl away or high pressure water blasting may be used to prepare the surface, provided that appropriate collection/containment measures are in place to prevent dispersion of removed debris.

3.3 INSTALLATION

.1 Primer/Paste

.1 Apply paste by hand, brush, glove, rag or roller.

.2 Apply a thin uniform film over the entire surface to be wrapped with petrolatum tape.

.3 Note: special requirements may apply for underwater application.

.2 Mastics

.1 To protect complex surfaces and sharp intersections, apply mastic by filling and packing to achieve smooth uniform contour to which tape can be applied without bridging or voids.

.2 Use mastic to fill cavities and smooth voids over 1.5mm deep.

.3 Marine Tape – Application to Cylindrical Pile

.1 Tape shall be installed within 24 hours of surface preparation.

.2 Once installed, marine tape must be covered by pile wrap as soon as possible.

.3 Application shall begin at the designated low point of the area and proceed upward to the high point creating a weatherboard effect.

.4 Hold end of tape firmly against the starting point and firmly press on the surface. Unroll the tape, keeping the roll close to the surface. Do not get a long lead of tape as it will tend to fold and gap on the surface being wrapped.

.5 Apply sufficient tension to provide continuous adhesion, but do not stretch the tape. As application proceeds, press out all folds and air pockets that may occur.

.6 The tape shall be spirally wrapped onto the pile using a 55% overlap, to ensure a double thickness of tape throughout.

.7 Maintain a minimum 150mm overlap when overlapping a new role with that previously applied.

.4 Pile Wrap

.1 Place the pile wrap tightly around the pile and align holes within the fastener bars. Secure in place in accordance with manufacturer recommendations.

.2 The extreme top terminus shall be aligned to the pile to pile cap interface.

.3 Intermediate joints shall be aligned to be perpendicular to the longitudinal axis of the pile.

.4 The extreme bottom terminus shall be aligned to be perpendicular to the longitudinal axis of the pile.

.5 Press adjacent sections as closely as possible, overlapping as required by the manufacturer.

.6 The joint interface between two butting sections shall be smooth and free of jagged edges creating more than 25mm discontinuity in 300mm arc length.

.7 Wraps shall be no less than 1.2m without written approval from the Department Representative.

.8 Wraps shall be no more than 2.45m without written approval from the Department Representative.

.9 A combination of shop and field fitting is likely required to meet installation tolerances.

.1 All fitting operations are considered incidental to the work and within the Measurement and Payment clauses within this specification.

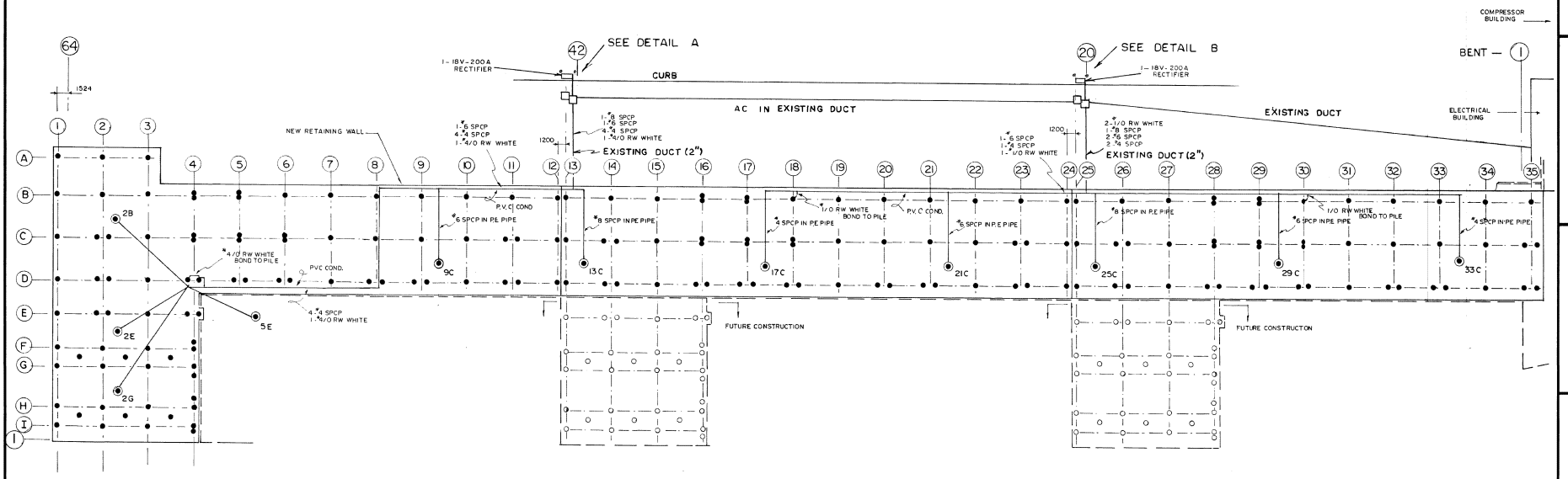
.2 Field cuts shall be smooth and flush, with variations less than 25mm longitudinally per transverse 300mm.

.5 Fasteners

.1 A washer shall be placed at each nut and bolt head.

.2 A thin coat of anti-seize shall be applied to bolt prior to tightening to prevent possible galling.

END OF SECTION

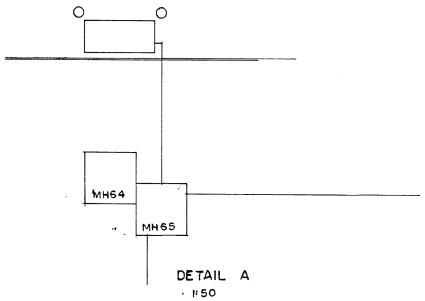


PLAN

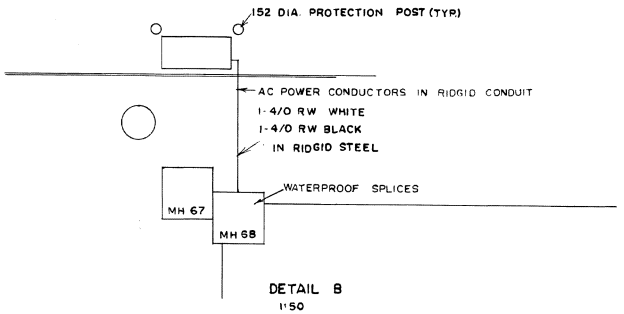
1 : 300

LEGEND

- LEAD SILVER ANODES
- STEEL PIPE PILE
- FUTURE PIPE PILE



DETAIL A
1:50



DETAIL B
1:50

Public Works Canada / Travaux publics Canada

revisions | date

A detail no. / no. du détail
B location drawing no. / sur dessin no.
C drawing no. / dessin no.

project / projet

ESQUIMALT GRAVING DOCK IMPROVEMENTS

CONTRACT NO. 3

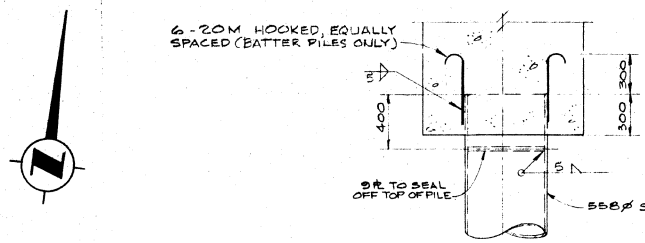
drawing / dessin

CATHODIC PROTECTION SYSTEM

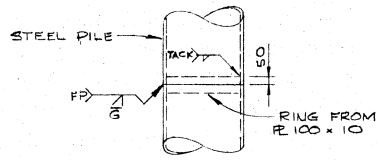
"BC036962"

designed W. L. H / conçu
date 85/10/07
drawn G.V.D / dessiné
date 85/10/15
reviewed / examiné
date
approved / approuvé
date
Tender / Soumission
PWC Project Manager / Administrateur de projets TPC
project number / no. du projet
PR. 100772
drawing no. / no. du dessin
15 OF 75

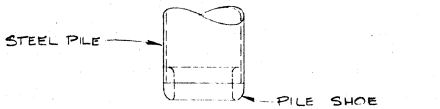
PWC A1



PILE CAP



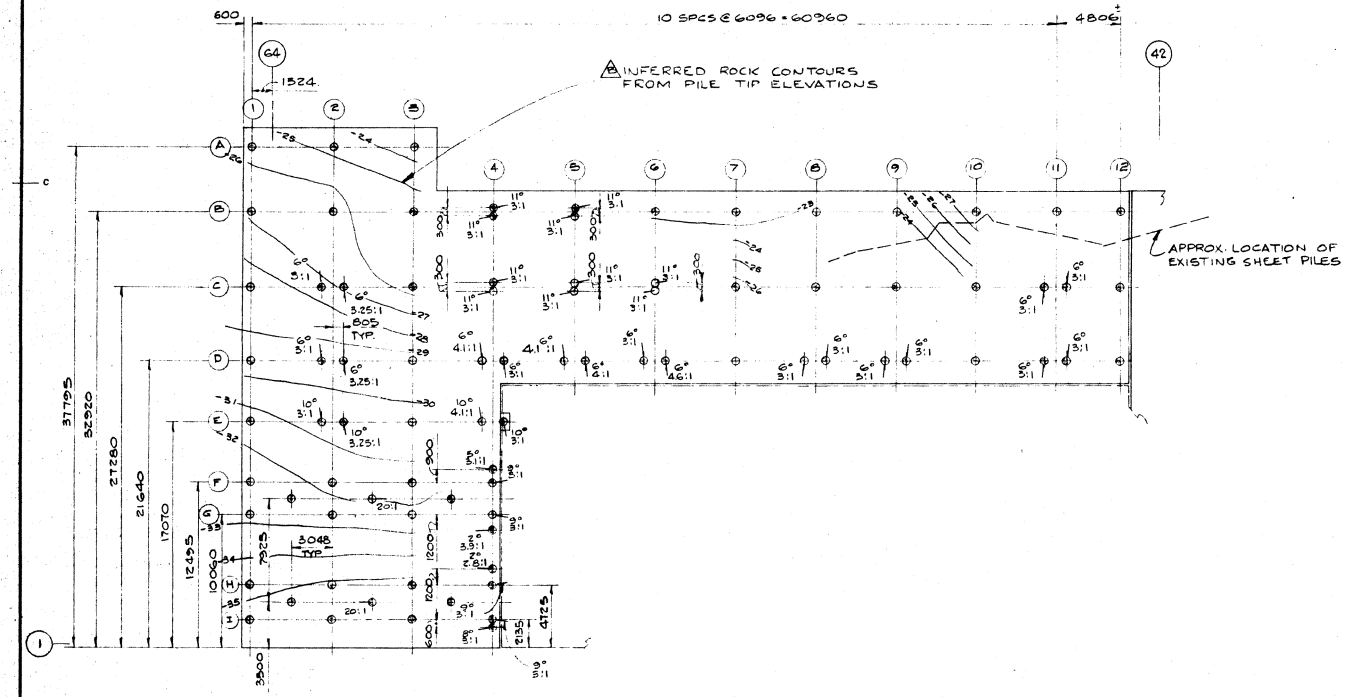
PILE SPLICE



PILE SHOE

PILE DETAILS - TYPICAL DWG 57, 58 & 59

1:20



PLAN

1:200

LEGEND:

● — INDICATES NEW PILE LOCATIONS.

⊘ — INDICATES NEW BATTER PILE LOCATIONS.

EXAMPLE:

INDICATES DEGREES OF BEVEL 10°
SLOPE OF PILE 3:1

NOTES:

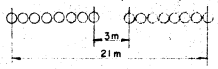
1.) UNIFORMLY DISTRIBUTED LIVE LOAD ; 28.7 kPa (600 PSF).

2.) UNIFORMLY DISTRIBUTED DEAD LOAD (INCLUDING PRECAST) 13.2 kPa (275 PSF)

3.) HIGHWAY LOADING : HS20.

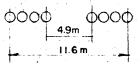
4.) CRANE : (NOTE CRANE RAIL BEAMS DESIGNED FOR FUTURE CRANE OF 7.925 m (26') GAUGE , UTILIZING THE WORST CASE OF THE FOLLOWING 3 CRANES. THE FOLLOWING LOADINGS WITHOUT 15% IMPACT INCLUDED IN DESIGN.)

A) NEW 30 TONNE CRANE (ASSUMED):



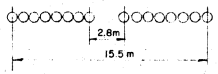
MAXIMUM WHEEL LOAD = 260 kN

B) EXISTING 25 TON CRANE



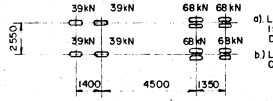
MAXIMUM WHEEL LOAD = 320 kN

C) EXISTING 50 TON CRANE



MAXIMUM WHEEL LOAD = 258 kN

5.) SPECIAL TRUCK LOADING , 65 TON RUBBER TIRED CRANE



a) LOADS DO NOT INCLUDE 15% IMPACT USED IN DESIGN .

b) LOADING APPLIED ANYWHERE ON DECK.

6.) SPECIAL CRANE OUTRIGGER LOAD :

LOAD OF 530 kN (118.5*) APPLIED AT ONE POINT, SOUTH OF NORTH CRANE RAIL ONLY. LOAD DOES NOT INCLUDE 15% IMPACT USED IN DESIGN . LOAD APPLIED ON 715 mm DIAMETER OUTRIGGER, WITHOUT ANOTHER VEHICLE WITHIN 2m.

7.) EARTHQUAKE LOAD 13% OF DEAD LOAD .

8.) SHIP IMPACT FORCES :

FENDER FORCES ARE FOR SHIPS WITH THE FOLLOWING CHARACTERISTICS.

a.) DEAD WEIGHT TONNAGE.	40,000
b.) LENGTH OVERALL	213 m
c.) DEPTH	16.8 m
d.) DRAFT (LIGHT)	4.6 m
f.) VELOCITY OF APPROACH NORMAL TO BERTH FACE	0.15 m / SEC.
g.) ANGLE OF APPROACH	5°
h.) BENT RADIUS OF BOARD AT LOAD LINE.	85 m

FORCE ON WHARF at FENDER LOCATION (TONNES) BASED ON FENDER SIZE SPECIFIED ON DWG. NO. 47

BERTHING LOCATION	F1	F2	F3	F4	TOTAL FORCE ON WHARF
BETWEEN F2 & F3	50	70	70	50	240
AT F3	0	55	80	55	190
AT F2	55	80	55	0	190
AT F4	0	10	70	110	190
AT F1	110	70	10	0	190
LONGITUDINAL FORCE TO BE 30% LATERAL FORCE ON WHARF.					

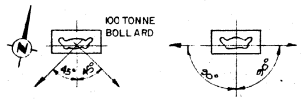
F1 IS RUBBER FENDER AT WEST SIDE OF GROUP.

F4 IS RUBBER FENDER AT EAST SIDE OF GROUP.

9.) MOORING FORCES :

MOORING FORCES ARE FOR SHIPS WITH THE FOLLOWING CHARACTERISTICS.

a) TONNAGE	40,000
b) LENGTH OVERALL	213 m
c) DEPTH	16.8 m
d) DRAFT (LIGHT)	4.6 m
f) DESIGN WIND PRESSURE	0.58 kN/m²
g) GUST FACTOR	2.0



HORIZONTAL LINE ANGLE RANGES.
MAXIMUM VERTICAL ANGLE 30° TO HORIZONTAL.

PILES DESIGNED FOR ALL BOLLARDS TO BE LOADED CONCURRENTLY, INCLUDING ADDITIONAL 50 TONNE UNITS IN AREA OF FUTURE WORK, AT SOUTH FACE OF DOCK. APPROXIMATE LOCATIONS ARE GRID LINES 3, 9, 25, 31, 47 & 53.

10. BATTER PILE DESIGN BASED ON TENSION PILE ADHESION VALUES SUPPLIED BY HARDY & ASSOCIATES.
CLAY ADHESION : 11.5 kPa
SILT ADHESION : 0 kPa AT TOP OF LAYER
11.5 kPa AT BOTTOM OF LAYER

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consulting engineers
VICTORIA VANCOUVER PRINCE RUPERT
FILE NO. 25125

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA C. J. GRANT

"BC041488"

revisions		date
B	AS BUILT	JUNE 11/85
A	EXISTING SHEET PILES ADDED	SEPT. 12/84

A detail no. no. du détail
B location drawing no sur dessin no
C drawing no dessin no.

project / projet
ESQUIMALT GRAVING DOCK IMPROVEMENTS
ESQUIMALT, B.C.
CONTRACT NO. 3

drawing / dessin
IMPROVEMENTS TO SOUTH LANDING WHARF
65 TON CRANE PADS & WHARF EXTENSION
PILE LAYOUT
BENT 42 TO 64

designed C.J.G. / conçu
date MAY 1984.
drawn H.C.G. / dessiné
date MAY 1984.
reviewed / examiné
date
approved / approuvé
date
Tender / Soumission
C.J.G. Project Manager / Administrateur de projets TPC

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57 OF 75-A

PWC 41