PROJECT TITLE Boat Launch Rehabilitation

PROJECT NUMBER CCIW-001-Ji303

PROJECT DATE 2014-03-21 [ISSUED FOR TENDER]

This Specification represents work done by WorleyParsons Canada Services Ltd. performed to recognized engineering principles and practices. The work is based upon the project scope and design information as described herein and as provided by WorleyParsons' contractual Customer, Environment Canada (the "Customer"). This Specification has been prepared solely for the Customer. The extent of any warranty or guarantee of this Specification or the information contained therein in favor of the Customer is limited to the warranty or guarantee, if any, contained in the contract between the Customer and WorleyParsons. Any other users of this Specification do so entirely at their own risk and neither WorleyParsons, its subconsultants, WorleyParsons' Customer nor their respective employees assume any liability for any reason, including, but not limited to, negligence, for any information or representation herein.

END OF SECTION

Structural Engineer/Marine Engineer:

END OF SECTION

END OF SECTION

Drawing Number	Title	Revision
C1	ENVIRONMENT CANADA BOAT LAUNCH REHABILITATION BURLINGTON, ONTARIO CONSTRUCTION DETAILS	2
C2	ENVIRONMENT CANADA BOAT LAUNCH REHABILITATION BURLINGTON, ONTARIO CONSTRUCTION DETAILS	2

END OF SECTION

PART 1 - GENERAL

1.1 PRECEDENCE

.1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 RELATED SECTIONS

.1 Not used.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises renovation of the Canada Centre of Island Waters boat launch ramp, located at Burlington, Ontario, Canada.

.2 List of Work to be performed is presented to complement or clarify Drawings, Specifications, and other Contract Documents and does not constitute a complete list of Work of this Contract.

1.4 LIST OF WORK

.1 Submit method statements for Work to Departmental Representative for approval prior to mobilization.

.2 Accept the Site in its prevailing condition at time of commencement of Work. Allow for possibility water levels may rise above position of Work and may require below water work for fill slope construction and protection

.3 Provide and maintain all temporary facilities and services required to accomplish the Work in accordance with the Construction Schedule including material and equipment for construction access to Site, and waterway controls.

.5 Submit list of temporary buildings to be brought onto Site to Departmental Representative

.6 Provide temporary power as required for construction. No temporary construction power will be available at Site.

.7 Located and protect existing services in vicinity of Works for the duration of the Works.

.8 Establish lines required to set out Work from datum establish by Departmental Representative. Locate all reference points and lines, and take necessary action to prevent their destruction. Field verify dimensions noted on Contract Drawings and receive agreement from Departmental Representative prior to commencement of Work.

.9 Maintain existing and temporary roads and road surfaces on or near the Site in a safe and sound condition during the period of the Contract. Make good and repair damage arising from the Work.

.10 Maintain site cleanliness.

.11 Supply and transport to site materials and equipment required for performance of the Work, and store and locate such materials and equipment in lay down areas designated by the Departmental Representative.

.12 Comply with the requirements of WHMIS and maintain a library of material safety datasheets on Site.

.13 Maintain sufficient stock of material on Site to meet the demands of the Construction Schedule with adequate reserve to compensate for changes in the Work or Construction Schedule.

.14 Supply and erect temporary barriers around the Site as required for safety and protection of operating equipment. Supply and secure safe access to the Site for construction activities.

.15 Design and maintain temporary works to suit construction activities.

.16 Confirm lengths, dimensions, and dressing of new materials and receive approval by Departmental Representative prior to procurement and treatment.

.17 Supply new connection hardware for components that must be disconnected and reconnected for the Work. Receive permission from Departmental Representative to reuse existing hardware.

.18 Dispose off Site surplus materials arising from execution of the Works.

.19 Remove eight concrete slabs indicated in the Contract Drawings. Receive agreement from Departmental Representative prior to commencement of Work.

.20 Inspect slope fill beneath removed concrete slabs and communicate condition of slope fill to Departmental Representative. Carry out remedial work to slope fill if required. Receive agreement from Departmental Representative prior to commencement of slope fill remedial work.

.1 Use existing slope fill or add new fill material consisting of graded crushed stone with nominal stone size varying from 30 mm to 300 mm or similar approved clean fill containing no fines or particles smaller than 30 mm.

.21 Place articulating block mats on top of slope fill and fill with concrete in accordance to manufacturer's guidelines.

.22 Reinstate eight new precast or cast-in-situ reinforced concrete slabs to same position as removed concrete slabs.

.1 If precast concrete slabs are used, receive agreement from Departmental Representative of final position and level of precast concrete slabs.

.2 If cast-in-situ slabs are used, receive agreement from Departmental Representative of position and level of formwork prior to concrete pour.

1.5 SCHEDULE OF VALUES

.1 Provide schedule of values supported by evidence as Departmental Representative may reasonably direct and when accepted by Departmental Representative, be used as basis for applications for payment. Provide Schedule of values in the form of the following table:

Item	Description of Work	Quantity	Unit	Unit Rate	Total Price
1	Mobilization	1	L.S.		
2	Demobilization	1	L.S.		
3	Removal of concrete slabs	8	EA.		
4	Supply and install rock fill to rebuild substructure side slope	50	t		
5	Supply and install articulating block mat side slope protection	100	m^2		
6	Fill articulating concrete block mats with concrete	20	m^3		
7	Supply and install new steel reinforced concrete slabs	8	EA.		
				Price (Exclusive of HST)	

1.6 MEASUREMENT AND PAYMENT

.1 "Mobilization" will be paid for as a lump sum and includes supply, mobilization, and transportation of equipment.

.2 "Demobilization" will be paid for as a lump sum and includes Site clean-up, loading out, and transportation of equipment.

.3 "Removal of concrete slabs, total eight" will be paid as a lump sum for the removal and disposal of the concrete slabs.

.4 "Supply and install rock fill to rebuild substructure side slope, total approximately 50 t" includes the supply of new fill to fill ramp slope to construction levels as indicated in the Contract Drawings using the required rock fill stipulated in the Contract Documents. Original fill material at the site can be re-used upon agreement with the Departmental Representative. Measurement will be made on weigh scale ticket provided by the Contractor for material delivered and incorporated into the work as specified by the Departmental Representative.

.5 "Supply and install articulating block mat side slope protection, total approximately 100 m^2" includes the supply and installation of the articulating block mat stipulated in the Contract Documents and installed to the manufacturer's guidelines. Measure on site to determine amount of articulated block mat lining required, and receive agreement from the Departmental Representative prior to ordering articulated block mat or concrete. Contractor will be paid on the agreed amount of articulated block mat lining.

.6 "Fill articulating concrete block mats with concrete, total approximately 20 m^3" includes the supply and the proper filling of the articulated block mats with the approved concrete to the manufacturer's guidelines. Confirm the volume of concrete required as indicated in 1.6.5 of Summary of Work. Contractor will be paid on the volume of concrete used to fill the articulated block mat. Payment for this item will include concrete materials and independent testing of each concrete batch.

.7 "Supply and install new steel reinforced concrete slabs, total eight" includes the supply and installation of the reinforced concrete slabs as per the Contract Drawings and Contract Documents.

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 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 National Building Code 2010 (NBC):

.1 NBC 2010, Division B, Part 8 Safety Measures at Construction and Demolition Sites.

.3 Province of Ontario:

.1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
.2 O. Reg. 490/09, Designated Substances.
.3 Workplace Safety and Insurance Act, 1997.
.4 Municipal statutes and authorities.

.4 Treasury Board of Canada Secretariat (TBS):

.1 Treasury Board, Fire Protection Standard April 1, 2010 www.tbs-sct.gc.ca/pol/doc-eng.aspx ?id=17316&section=text.

1.2 SUBMITTALS

.1 Make all submittals to the Departmental Representative.

.2 Submit site-specific Health and Safety Plan within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.
.2 Results of safety and health risk or hazard analysis for site tasks and operations found in work plan.
.3 Measures and controls to be implemented to address identified safety hazards and risks.
.4 Contractor's and Sub-contractors' Safety Communication Plan.
.5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Site Emergency Response requirements and procedures provided by Departmental Representative.

.3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 7 days after receipt of comments from Departmental Representative.

.4 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.5 Submit names of personnel and alternates responsible for site safety and health.

.6 Submit records of Contractor's Health and Safety meetings when requested.

.7 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.

.8 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.

.9 Submit copies of incident and accident reports.

.10 Submit Material Safety Data Sheets (MSDS).

.11 Submit Workplace Safety and Insurance Board (WSIB) - Experience Rating Report.

1.3 FILING OF NOTICE

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

1.4 WORK PERMIT

.1 Obtain regulatory permits for marine construction related to project prior to commencement of Work.

1.5 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

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

1.7 REGULATORY REQUIREMENTS

.1 Comply with the Acts and regulations of the Province of Ontario.

.2 Comply with specified standards and regulations to ensure safe operations at site.

1.8 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Silica in concrete.

1.9 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.

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

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.11 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety

requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act for the Province of Ontario.

1.12 UNFORSEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.

.2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.13 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.

.1 Contractor's Safety Policy.
.2 Constructor's Name.
.3 Notice of Project.
.4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
.5 Ministry of Labour Orders and reports.
.6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
.7 Address and phone number of nearest Ministry of Labour office.
.8 Material Safety Data Sheets.
.9 Written Emergency Response Plan.
.10 Site Specific Safety Plan.
.11 Valid certificate of first aider on duty.
.12 WSIB "In Case of Injury At Work" poster.
.13 Location of toilet and cleanup facilities.

1.14 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

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

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

.2 Assign responsibility and obligation to Competent Supervisor to stop or start Work when, at Competent Supervisor's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

PART 2 - PRODUCTS

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 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-In-Place Concrete

.2 Section 03 41 00 - Precast Structural Concrete

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment in accordance with Section 01 11 00 – Summary of Work.

1.3 REFERENCES

.1 American Concrete Institute (ACI)
- .1 ACI SP-66-04, ACI Detailing Manual 2004.

.2 ASTM International
- .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- .2 ASTM A90/A90M-11, Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc Alloy Coatings.
- .3 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 ASTM G14-04(2010), Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).

.3 Concrete Reinforcing Steel Institute (CRSI)
- .1 CRSI Reference Guide, Field Handling Techniques for Epoxy-Coated Rebar at the Job Site.

.4 CSA International
- .1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CSA A23.3-04(R2010), Design of Concrete Structures.
- .3 CSA A23.4-09, Precast Concrete – Materials and Construction.
- .4 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
- .5 CSA G40.20-04(R2009)/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .6 CSA S6-06, Canadian highway Bridge Design Code.
- .7 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.5 International Organization for Standardization (ISO)

.1 ISO 4892-1:1999, Plastics – Methods of Exposure to Laboratory Light Sources – Part 1: General Guidance.
.2 ISO 4892-2:1999, Plastics – Methods of Exposure to Laboratory Light Sources – Part 2: Xenon-Arc Lamps.

.6 Reinforcing Steel Institute of Canada (RSIC)
.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make all submittals to the Departmental Representative.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.1 Indicate placing of reinforcement and:
.1 Bar bending details.
.2 Lists.
.3 Quantities of reinforcement.
.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated. Provide tension lap splices unless otherwise indicated.

1.5 QUALITY ASSURANCE

.1 Mill Test Report: Provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.

.2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

.3 Coat epoxy-coated rebar at a plant certified under the CRSI Epoxy Coating Plant Certification Program. Submit copies of preshipping tests to the Departmental Representative.

1.6 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 and protect from prolonged exposure to weather.
.2 Handle and store epoxy-coated reinforcing steel in accordance with CRSI "Field Handling Techniques for Epoxy-Coated Rebar at the Job Site".
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Use non-corroding, non-conductive bar supports and coated tie wire with epoxy-coated reinforcing bars.

.2 Substitute different size bars only if permitted in writing by Departmental Representative.

.3 Reinforcing steel: billet steel, grade 400W, deformed bars to CSA-G30.18, unless indicated otherwise, bearing identifying marks indicating size and grade.

.4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.

.5 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.

.6 Epoxy coating of non-prestressed reinforcement: to ASTM A775/A775M.

.7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2. Support devices contacting surfaces exposed to earth or weather to be non-corroding. Mortar or concrete bar supports to have concrete strength equal to or greater than that of structural concrete.

.8 Mechanical splices: subject to approval of Departmental Representative.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1 and A23.4, and RSIC Reinforcing Steel Manual of Standard Practice, unless indicated otherwise.

.2 Design and detail lap lengths and bar development lengths to CAN/CSA S6 unless otherwise indicated

.3 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on the Construction Drawings.

.4 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.5 Ship epoxy coated bars in accordance with ASTM A775/A775M.

PART 3 - EXECUTION

3.1 PROTECTIVE COATING

.1 Epoxy coat non-prestressed reinforcement in accordance with ASTM A775/A775M where indicated on the Construction Drawings

.2 Provide compatible patching material for field repair and touch-up of epoxy coating. Material to be designed for the specific climatic conditions at the site. Provide 0.5 kg patching material for every tonne of epoxy-coated reinforcement shipped.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA A23.1 and A23.4.

.2 Ensure materials, before being placed, are free of loose scaly rust, dirt, oil, paint or other bond breaking coating.

.3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.4 Provide minimum concrete cover for reinforcement in accordance with CSA A23.1, unless indicated otherwise on Construction Drawings.

.5 Protect epoxy coated portions of bars with covering during transportation and handling.

.6 Place epoxy-coated bars in accordance with CRSI "Field Handling Techniques for Epoxy-Coated Rebar at the Job Site".

.7 Clean reinforcing steel with potable water to remove all contaminants and salt water prior to concrete placement.

3.4 TOLERANCES

.1 Tolerances for placing reinforcing steel shall be in accordance with CSA A23.1 and A23.4.

3.4 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00 - Concrete Reinforcing

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment in accordance with Section 01 11 00 – Summary of Work

1.3 REFERENCES

.1 ASTM International:
- .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
- .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM C494/C494M-11, Standard Specification for Chemical Admixtures for Concrete.
- .4 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.2 CSA International:
- .1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA A23.3-04(R2010) - Design of Concrete Structures
- .3 CSA A283-06(R2011), Qualification Code for Concrete Testing Laboratories.
- .4 CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .5 CSA S269.3-M92, Concrete Formwork

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make all submittals to the Departmental Representative.

.2 At least 4 weeks prior to beginning Work, inform Departmental Representative of proposed source of aggregates and provide access for sampling

.3 At least 3 weeks prior to beginning Work, submit complete mix designs to Departmental Representative for review.

.4 At least 3 weeks prior to beginning work, submit proposed quality control procedures to Departmental Representative for review on the

following items:
1. Falsework erection.
2. Hot weather concreting.
3. Cold weather concreting.
4. Curing.
5. Finishes.
6. Formwork Removal.
7. Joints.

.5 Submit manufacturer's datasheets and printed instructions for joint sealant and primer proposed for use in the Work to Departmental Representative.

.6 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.7 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.5 QUALITY ASSURANCE

.1 Perform concrete Work to requirements of CSA A23.1.

.2 Perform concrete tests to requirements of CSA A23.2.

.3 Concrete testing to be performed by an independent testing agency approved by Departmental Representative and retained by Contractor. Submit concrete test results to Departmental Representative.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
.1 Submit deviations to Departmental Representative for approval.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Divert unused metal materials from landfill to metal recycling facility.

.3 Divert unused concrete materials from landfill to local facility.

.4 Divert unused chemical admixtures from landfill to official hazardous material collections site.

.5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material, and remove for disposal. Dispose waste in accordance with local provincial, and national regulations.

PART 2 – PRODUCTS

2.1 FORMWORK MATERIALS

.1 Formwork materials: to CSA S269.3.

.2 Contact surfaces or lining of formwork to be suitably smooth to provide finished concrete surfaces meeting requirements of this section.

.3 Form ties: threaded disconnecting type, leaving no holes larger than 15 mm diameter in concrete surface.

.4 Form release agent: non-staining chemically active release agent, compatible with form material which will prevent adherence of concrete to forms.

2.2 REINFORCING STEEL

.1 Reinforcing steel in accordance with Section 03 20 00 – Reinforcing steel.

2.3 CONCRETE MIXES

.1 Reinforced concrete slabs:

.1 Portland Cement: to CAN/CSA-A3000, Type GU but with tricalcium aluminate (C3A) content less than 8.0%, and total alkali content not greater than 0.60% sodium oxide equivalent.
.2 Supplementary Cementing Materials: Fly ash measuring a minimum of 10% by mass of total cementitious materials and silica fume measuring a minimum of 5% by mass of total cementitious materials.
.3 Supplementary Cementing Materials: to CSA-A3000, Type F fly ash or Type U silica fume.
.4 Water: to CSA A23.1/A23.2.

.5 Aggregates: to CSA A23.1/A23.2.
.6 Maximum water/cementing materials ratio: 0.40
.7 Mimumum compressive strength at 28 days: 35 MPa.
.8 Exposure Class: C-1
.9 Nominal maximum size of coarse aggregate: 20 mm.
.10 Slump before addition of superplasticizer: 60 mm ± 20 mm.
.11 Slump after addition of superplasticizer: 125 mm ± 20 mm.
.12 Air content: 5% to 8%.
.13 Air Entraining Admixtures: to ASTM C260.
.14 Chemical Admixtures: to ASTM C494 / C494M. Departmental Representative to approve type and use of accelerating or set-retarding admixtures during cold and hot weather placing.
.15 Super plasticizing admixture: to ASTM C1017 / C1017M.
.16 Retarder: to ASTM C494 / C494M.
.17 Pre-bagged proprietary blending cement and granular mixed materials subject to the approval by the Departmental Representative. Aggregate to be 20 mm or less.
.18 Concentration of corrosion-inducing chemicals from all sources in concrete mix, expressed as a percentage of the mass of the total cementitious materials, not to exceed the following limits when tested according to the noted methods:
.1 Chlorides: 0.06% (ASTM D512)
.2 Fluorides: 0.06% (ASTM D1179)
.3 Sulphites: 0.08% (ASTM D1339)
.4 Nitrates: 0.10% (ASTM D3867)

.2 Articulating block mat concrete mix to manufacturer’s recommended guidelines.

.3 Do not change concrete mix without prior approval of Departmental Representative. Should change in material source be proposed, submit new mix design to Departmental Representative for approval.

.4 Provide quality management plan for verification of concrete quality to specified performance.

.5 Prepare pre-bagged concrete mixes to manufacturer’s written instruction. Execute concrete tests as agreed with Departmental Representative.

2.4 CONCRETE PRODUCTION

.1 Measure, batch, and mix concrete in accordance with CSA A23.1.

.2 Prior to unloading concrete at Site, furnish the Departmental Representative with a delivery ticket for each batch of concrete in accordance with CSA A23.1.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Obtain Departmental Representative's written approval before placing concrete.
  .1 Provide 48 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:
  .1 Development of cold joints not allowed.
  .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after approval of equipment and mix.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

3.2 FORMWORK

.1 Construct and erect form work to CSA S269.3

.2 Assemble forms to produce finished concrete conforming to shape, dimensions, locations, and levels indicated within tolerances required by CSA A23.1.

.3 Align form joints and make watertight. Use minimum number of form joints.

.4 Clean formwork in accordance with CSA A23.1 before placing concrete.

.5 Leave formwork in place for five days after placing reinforced concrete, unless noted otherwise.

.6 Earlier formwork removal will be permitted if high early strength concrete mixes are used with the approval of the Departmental Representative.

3.3 PLACING OF CONCRETE

.1 Place concrete in the dry.

.2 Handle, deposit, and consolidate concrete in accordance with CSA A23.1. Take care not to disturb forms or reinforcing steel when depositing and consolidating concrete.

.3 Ensure that spare internal vibrators or external form vibrators are on hand during placing of concrete.

.4 Unless specified otherwise, where fresh concrete will be placed against hardened concrete, bond the fresh concrete to the hardened concrete in accordance with CSA A23.1.

3.4 CURING AND PROTECTION

.1 Cure and protect concrete in accordance with CSA A23.1 and as specified below.

.2 Cure topping concrete by the application of wetted burlap immediately after completion of finishing operations. Maintain burlap in a saturated condition using soaker hoses wrapped in burlap and installed on top of the deck surface. When the daily mean ambient temperature is above 5 deg. C, cure continuously for a minimum of seven days or for the time necessary to attain 70% of the specified 28 day compressive strength.

.3 When the air temperature is at or above 27 deg. C, or when there is a probability of its rising to 27 deg. C during the placing period (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 305R - Hot Weather Concreting.

.4 When the air temperature is at or below 5 deg. C, or when there is a probability of its falling below 5 deg. C within 24 hours of placing (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 306R - Cold Weather Concreting.

3.5 FINISHES

.1 Finish concrete as indicted on Contract Drawings

3.6 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1 Straightedge Method.

3.7 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
- .1 Ensure testing laboratory is certified to CSA A283.
- .2 At a minimum, conduct testing as follows:
  - .1 One "test" per batch of any mix.
  - .2 One "test" per day of concrete placement regardless of the total quantity placed that day.
  - .3 A "test" will consist of a slump test, an air entrainment test, and samples collected for compression testing.

.2 Departmental Representative will pay for costs of tests.

.3 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.4 Pumped concrete will be sampled both at the truck discharge and at the point of final placement to determine if any changes in the slump, air content, or other significant mix characteristics occur. The concrete at the forms will meet the requirements of this section.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00 - Concrete Reinforcing.

.2 Section 03 30 00 - Cast-in-Place Concrete.

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment in accordance with Section 01 11 00 – Summary of Work

1.3 REFERENCES

.1 ASTM International:
- .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
- .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM C494/C494M-11, Standard Specification for Chemical Admixtures for Concrete.
- .4 ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.2 CSA International:
- .1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA A23.3-04(R2010) - Design of Concrete Structures
- .3 CSA A23.4-09 - Precast Concrete – Materials and Construction
- .4 CSA A283-06(R2011), Qualification Code for Concrete Testing Laboratories.
- .5 CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .6 CSA S269.3-M92, Concrete Formwork

1.4 DESIGN REQUIREMENTS

.1 Design precast elements to CSA A23.3 and CSA A23.4 to carry handling stresses.

1.5 PERFORMANCE REQUIREMENTS

.1 Tolerance of precast elements to CSA A23.4.

1.6 SUBMITTALS

.1 Make all submittals to the Departmental Representative.

.2 Submittals: As required by Section 03 30 00 – Cast-in-Place Concrete.

.3 Submit shop drawings in accordance with CSA A23.3 and CSA A23.4 and include following items:
- .1 Design calculations for items designed by manufacturer.
- .2 Details of reinforcement and their connections.
- .3 Camber.
- .4 Finishing schedules.
- .5 Methods of handling and erection.
- .6 Openings, sleeves, inserts and related reinforcement.

.4 Shop Drawings: submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Ontario, Canada.

.5 At least 3 weeks prior to beginning work, submit proposed quality control procedures to Departmental Representative for review.

.6 Submit internal quality assurance program test results to Departmental Representative as requested.

1.7 QUALITY ASSURANCE

.1 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Departmental Representative verifying compliance that concrete provided meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.8 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 in appropriate category.

.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, erection until warranty expires.

.4 Welding companies certified to CSA-W47.1.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle and store precast units according to manufacturer's instructions.

.2 Separate waste materials for reuse and recycling.

1.10 WARRANTY

.1 Contractor warrants that precast elements will not spall or show visible evidence of cracking, except for normal hairline shrinkage cracks, in accordance with General Conditions, but for 12 months warranty period, which is extended to 24 months.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 Reinforcing steel: in accordance with Section 03 20 00 – Reinforcing Steel.

.2 Concrete materials and concrete mixes: in accordance with Section 03 30 00 – Cast-in-Place Concrete.

2.2 SOURCE QUALITY CONTROL

.1 Provide Departmental Representative with certified copies of quality control tests related to this project as specified in CSA A23.4.

.2 Provide records from in-house quality control programme 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 should keep complete records of supply source of concrete material, steel reinforcement and provide to Departmental Representative for review upon request.

.5 Departmental Representative may perform inspections during manufacture and take sample for separate Quality Assurance testing of concrete.

PART 3 – EXECUTION

3.1 MANUFACTURE

.1 Manufacture units in accordance with CSA A23.4.

.2 Manufacture units only after authorization from Departmental Representative.

.3 Provide hardware suitable for handling elements.

.4 Provide additional reinforcing steel required for handling and erection of precast units and submit drawings and calculations to Departmental Representative for approval.

.5 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit not be exposed.

.6 Galvanize steel embedments after fabrication and touch up with zinc-rich primer after welding.

.7 Dimension precast concrete slabs to exact same as existing concrete slabs.

3.2 FINISHING AND CURING

.1 Finishing and curing: in accordance with Section 03 30 00 – Cast-in-Place Concrete.

3.3 ERECTION

.1 Do precast concrete work in accordance with CSA A23.4, CSA A23.3 and CSA S6.

.2 Do welding in accordance with CSA W186 for welding of reinforcement.

.3 Non-cumulative erection tolerances in accordance with CSA A23.4.

.4 Set elevations and alignment between units to within allowable tolerances before connecting units.

.5 Fasten precast units in place as indicated on reviewed shop drawings.

.6 If temporary lifting and handing device are cast into precast, remove by burning off 25 mm below surface of concrete and patch with grout as directed by Departmental Representative.

3.4 PROTECTION

.1 Protect precast units from damage during transportation, storage, and installation.

.2 Protect installed units from damage during completion of Work.

3.5 VERIFICATION

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in Part 2 - Products, by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

END OF SECTION

PART I - GENERAL

1.1 SUMMARY OF WORK

.1 The Contractor shall furnish all labor, materials, equipment, and incidentals required to perform all operations in connection with the installation of the proposed Articulating Block Lining in accordance with the lines, grades, design, and dimensions shown on the Contract Drawings and as specified herein.

1.2 DESCRIPTION

.1 The work shall consist of installing an unreinforced concrete lining by positioning specially woven, double-layer synthetic forms on the surface to be protected and filling them with a pumpable, fine aggregate concrete (structural grout) in such a way as to form a stable lining of required thickness, weight and configuration.

PART II - MATERIALS

2.1 FINE AGGREGATE CONCRETE

.1 Fine aggregate concrete shall consist of a proportioned mixture of Portland cement, fine aggregate (sand) and water.

.2 The consistency of the fine aggregate concrete delivered to the concrete pump shall be proportioned and mixed as to have an efflux time of 9-12 seconds when passed through the 19 mm orifice of the standard flow cone that is described in ASTM C 939. Pozzolan, fluidifier or pumping aid conforming to this Specification may be used at the option of the Contractor.

.3 The mix shall exhibit a compressive strength of 13.8 MPa at 28 days, when made and tested in accordance with ASTM C 31 and C 39.

.4 Portland cement shall conform to ASTM C 150, Type I or Type II.

.5 Fine aggregate shall conform to ASTM C 33, except as to grading. Aggregate grading shall be reasonably consistent and shall not exceed the maximum size which can be conveniently handled with available pumping equipment.

.6 Water for mixing shall be clean and free from injurious amounts of oil, acid, salt, alkali, organic matter or other deleterious substances.

.7 Pozzolan, if used, shall conform to ASTM C 618, Class C, F or N.

.8 Plasticizing and air entraining admixtures, if used, shall conform to ASTM C 494 and ASTM C 260, respectively.

2.2 FABRIC FORMS

.1 The fabric forms shall be composed of synthetic yarns formed into a woven fabric.

.2 Yarns used in the manufacture of the fabric shall be composed of nylon and/or polyester. Forms shall be woven with a minimum of 50% textured yarns (by weight) to improve adhesion to fine aggregate concrete and to improve filtration.

.3 Each layer of fabric shall conform to the minimum physical, mechanical and hydraulic requirements referenced in Table 1.

.4 The fabric forms shall be free of defects or flaws which significantly affect their physical, mechanical, or hydraulic properties.

.5 Fabric forms shall consist of double-layer woven fabric joined together by narrow perimeters of interwoven fabric into a matrix of rectangular compartments that form a concrete articulating block mat with finished nominal block dimensions of mass per unit area of 440kg/m2. Cords shall connect the two layers of fabric at the center of each compartment. The cords shall be interwoven in two sets of four cords each, one set for the upper layer and one set for the bottom layer. Each cord shall have a minimum breaking strength of 710 N when tested in accordance with ASTM D 2256. Fabric form compartments shall be offset one half a compartment length, in the mill width direction, to form a bonded concrete block pattern.

.6 Fabric form compartments shall each have six grout ducts, two on each of the long sides and one on each of the short sides to allow passage of the fine aggregate concrete between adjacent compartments. The fine aggregate concrete filled, cross- sectional area of each grout duct shall be no more than 10 percent of the maximum filled cross sectional area of the block transverse to the duct.

.7 Mill widths of fabric shall be a minimum of 1.92 m. Each selvage edge of the top and bottom layers of fabric shall be reinforced for a width of not less than 35 mm by adding a minimum of 6 warp yarns to each selvage construction. Mill width rolls shall be cut to the length required, and the double-layer fabric separately joined, bottom layer to bottom layer and top layer to top layer, by means of sewing thread, to form multiple mill width panels with sewn seams on not less than 182 cm centers.

.8 All factory-sewn seams shall be downward facing as shown on the Contract

Drawings. All seams sewn in the factory shall be not less than 15.7 kN/m when tested in accordance with ASTM D 4884. All sewn seams and zipper attachments shall be made using a double line of U.S. Federal Standard Type 401 stitch or equivalent. All stitches shall be sewn simultaneously and be parallel to each other, spaced between 6 mm to 19 mm apart. Each row of stitching shall consist of 4 to 7 stitches per 25.4 mm. Thread used for seaming shall be nylon and/or polyester.

.9 Grout stops shall be installed at predetermined mill width intervals to regulate the distance of lateral flow of fine aggregate concrete. The grout stop material shall be nonwoven filter fabric. The grab tensile strength of the filter fabric shall be not less than 400 N when tested in accordance with ASTM D 4632.

.10 Fabric Form Shipment and Storage: The fabric forms shall be kept dry and wrapped such that they are protected from the elements during shipping and storage. If stored outdoors, they shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light. The fabric forms shall be labeled as per ASTM D 4873, "Guide for Identification, Storage and Handling of Geosynthetic Rolls."

.11 Cables shall be installed in the longitudinal direction between the two layers of fabric. A minimum of two longitudinal cables shall pass through each compartment in a manner which provides for the longitudinal and lateral binding of the finished articulating block mat. The cables shall enter and exit the compartments through opposing grout ducts. The longitudinal cables shall be on approximately 25 cm centers, when measured along the finished mat. All cables within each filled concrete block shall be completely embedded in the fine aggregate concrete.

.11 Cables shall be constructed of high tenacity, low elongation, continuous filament polyester fibers.

.12 Cable fittings shall be selected so that the resultant cable splice shall provide a minimum of 80 percent of the rated breaking strength of the cable. All cable splices shall have a minimum cable overlap of 15.3 cm and be made with aluminum compression fittings.

.13 The Contractor shall submit a manufacturer's certificate that the supplied fabric forms meet the criteria of these Specifications, as measured in full accordance with the test methods and standards referenced herein. The certificates shall include the following information about each fabric form delivered:

.1 Manufacturer's name and current address.

.2 Full product name.

.3 Style and product code number.

.4 Form number(s).

.5 Composition of yarns.

.6 Manufacturer's certification statement.

.14 Alternative fabric formed concrete lining materials may be considered. Such Materials must be pre-approved in writing by the Departmental Representative prior to the bid date. Alternative material packages must be submitted to the Departmental Representative a minimum of fifteen (15) days prior to the bid date. Submittal packages must include, as a minimum, the following:

.1 Manufacturer's name and current address.

.2 Full product name.

.3 Style and product code number.

.4 Form number(s).

.5 Composition of yarns.

3.0 DESIGN REQUIREMENTS

.1 The average thickness, mass per unit area and hydraulic resistance of each concrete lining shall withstand the hydraulic loadings (depth, duration, type of wave, wave height and period, and pressure distribution) for the design wave.

.2 The stability analysis for the concrete lining shall be accomplished using the factor-of-safety methodology. A minimum factor of safety of 1.5 shall be required.

.3 The Contractor shall provide to the Departmental Representative calculations and design details, provided by the manufacturer or a professional engineer, attesting to the suitability of each fabric formed concrete lining for the purpose contemplated.

.4 Each concrete lining shall be accepted only when accompanied by hydraulic stability calculations derived from mathematical models developed specifically for fabric formed concrete linings and for this purpose.

.5 The Departmental Representative reserves the right of approval of any Contractor or Sub-Contractor for this portion of the work. Approval will be based in part, on documented successful experience in performing work of similar nature. Documentation required will be Project Name, Engineer's name, address, and phone numbers, project description and size and type of material used. This documentation is to provide

evidence of the installation of at least 50,000 m2 of similar material over the most recent 5 years.

PART 4 - CONSTRUCTION AND INSTALLATION

4.1 SITE PREPARATION

.1 Areas on which fabric forms are to be placed shall be constructed to the lines, grades, contours, and dimensions shown on the Contract Drawings. All obstructions such as roots and projecting stones shall be removed. Where such areas are below the allowable grades, they shall be brought to grade by placing compacted layers of select material. The thickness of layers and the amount of compaction shall be as specified by the Departmental Representative. Where required by the Contract Specifications, soft and otherwise unsuitable subgrade soils shall be identified, excavated and replaced with select materials in accordance with the Contract Specifications.

.2 Excavation and preparation of aprons as well as anchor, terminal or toe trenches shall be done in accordance with the lines, grades, contours, and dimensions shown on the Contract Drawings.

.3 Immediately prior to placing the fabric forms, the prepared area shall be inspected by the Departmental Representative, and no forms shall be placed thereon until the area has been approved.

4.2 FABRIC FORM PLACEMENT

.1 A filter fabric shall be placed on the graded surface approved by the Departmental Representative.

.2 Fabric forms shall be placed over the filter fabric and within the limits shown on the Contract Drawings. Anchoring of the fabric forms shall be accomplished through the use of anchor, terminal and toe trenches.

.3 Adjacent fabric form panels shall be joined before filling with fine aggregate concrete by field sewing or zippering the two bottom layers of fabric together and the two top layers of fabric together. All field seams shall be made using two lines of U.S. Federal Standard Type 101 stitches or equivalent. All sewn seams shall be downward facing, and zipper seams shall be fastened as shown on the Contract Drawings, except with the approved of the Departmental Representative.

.4 When conventional joining of fabric forms is impractical or where called for in the Contract Drawings, adjacent forms may be overlapped a minimum of three feet (one meter) to form a lap joint, pending approval by the Departmental Representative. Based on the predominant flow

direction, the downstream edge of the form shall overlap the upstream edge of the next form. In no case shall simple butt joints between forms be permitted.

.5 Expansion joints shall be provided as shown on the Contract Drawings, or as specified by the Departmental Representative.

.6 Immediately prior to filling with fine aggregate concrete, the assembled fabric forms shall be inspected by the Departmental Representative, and no fine aggregate concrete shall be pumped therein until the fabric seams have been approved. At no time shall the unfilled fabric forms be exposed to ultraviolet light (including direct sunlight) for a period exceeding five days.

4.3 FINE AGGREGATE CONCRETE PLACEMENT

.1 Following the placement of the fabric forms, small slits shall be cut in the top layer of the fabric form to allow the insertion of the filling pipe at the end of the fine aggregate concrete pump hose. These slits shall be of the minimum length to allow proper insertion of the filling pipe. Fine aggregate concrete shall be pumped between the top and bottom layers of fabric, filling the forms to the recommended thickness and configuration.

.2 Fine aggregate concrete shall be pumped in such a way that excessive pressure on the fabric forms and cold joints are avoided. A cold joint is defined as one in which the pumping of the fine aggregate concrete into a given form is discontinued or interrupted for an interval of forty-five or more minutes.

.3 Holes in the fabric forms left by the removal of the filling pipe shall be temporarily closed by inserting a piece of nonwoven fabric or similar material. The nonwoven fabric shall be removed when the concrete is no longer fluid and the concrete surface at the hole shall be cleaned and smoothed by hand. Foot traffic on the filled form shall be restricted to an absolute minimum for one hour after filling.

.4 After the fine aggregate concrete has set, all anchor, terminal and toe trenches shall be backfilled and compacted, as specified by the Departmental Representative.

TABLE 1. PROPERTY REQUIREMENTS – FORM FABRIC

Property		Test Method	Units	Values
Physical:				
Composition of Yarns				Nylon or polyester
Mass Per Unit Area (double-layer)		ASTM D 5261	oz/yd^2 (g/m^2)	12 (403)
Thickness		ASTM D 5199	mils (mm)	25 (0.6)
Mill Width			in (m)	76 (1.92)
Mechanical:				
Wide-Width Strip Tensile Strength	- Machine	ASTM D 4595	lbf/in (kN/m)	140 (24.5)
	- Cross		lbf/in (kN/m)	110 (19.3)
Elongation at Break	- Machine	ASTM D 4595	%	20
	- Cross		%	30
Trapezoidal Tear Strength	- Machine	ASTM D 4533	lbf (N)	150 (665)
	- Cross		lbf (N)	100 (445)
Hydraulic:				
Apparent Opening Size (AOS)		ASTM D 4751	U.S. Standard Sieve (mm)	40 (0.425)
Flow Rate		ASTM D 4491	gal/min/ft^2 (l/min/m^2)	90 (3665)
Flow Rate through Filter Point or Band (if applicable)		ASTM D 4491	gal/min/ft^2 (l/min/m^2)	7 (285)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Not used.

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment in accordance with Section 01 11 00 – Summary of Work

1.3 REFERENCES

.1 ASTM International
- .1 ASTM C127-12, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
- .2 ASTM D422-63(2007), Standard Test Method for Particle Size Analysis of Soils.
- .3 ASTM D854-10, Standard Test Method for Specific Gravity of Soil Solids by Water Pycnometer.
- .4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 NBCC 2010 Part 8, Safety Measures at Construction and Demolition Sites.

.3 CAN/CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 At least 2 weeks prior to beginning Work, submit following information to Departmental Representative.
- .1 Construction sequencing indicating steps taken and implementation for each stage of Work including sediment controls, removals and dive plan.
- .2 Locations of erosion and sediment control measures.
- .3 Component of densification Work which may affect adjacent fish and fish bearing waters, and measures to maintain water quality within limits set by regulatory authorities.
- .4 Materials to be used for Work.

.2 At least 2 week prior to Work, submit concrete slab removal methodology to Departmental Representative for approval.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Use only clean material, free of dirt, debris, sediment, fines, oil or grease that may be introduced into waterway.

.2 Rock fill: graded crushed stone, nominal stone size varying from 30 mm to 300 mm, or similar approved clean fill containing no fines or particles smaller than 30 mm.

.3 Articulating block mats: concrete articulating block mat with finished nominal block dimensions of mass per unit area of 440 kg/m2. The fine aggregate concrete mix shall exhibit a compressive strength 13.8 MPa at 28 days.

PART 3 - EXECUTION

3.1 GENERAL

.1 Schedule Work such that no in-water Work will be performed between September 30th to November 15th, and March 15th to July 15th of any year.

.2 Identify and accept level of risk associated with potential fluctuations in water levels, and select methods and design capacity accordingly.

.3 Carry out work in the dry as much as reasonably practicable.

.4 Employ protection measures and mitigation when in-water Work is required.

.5 Obtain permits necessary for Work.

.6 Immediately advise and obtain further direction from Departmental Representative when obstruction prevents completion of Work.

.7 Maintain daily record of Work with photographs showing each stage of Work. Photographs mush show existing condition prior to each stage of Work and after each stage of Work is complete.

3.2 CONCRETE SLAB REMOVAL

.1 Contractor to determine method of concrete slab removal. Removal by pressurized water or hydro demolition is not permitted.

3.3 ROCK FILL

.1 Place graded crushed stone in 300 mm deep layers and hand tamp.

3.4 ARTICULATED BLOCK MAT

.1 Install articulated block mat in accordance with manufacturer's written instructions.

3.5 PROTECTION

.1 Take precautions necessary to prevent movement, settlement, or damage of adjacent structures.

.2 Inspect site and review utility files and be aware of restrictions.

.3 Take reasonable precautions to avoid release of sediment into marine waters and report release to Departmental Representative.

.4 Meet environmental procedures by environmental authority having jurisdiction for Work.

3.6 ACCEPTANCE OF WORK

.1 Acceptance of Work is based on review by Departmental Representative. If the Work is deemed unsatisfactory, carry out Work as directed by Departmental Representative.

END OF SECTION