SPECIFICATIONS

Rideau Canal National Historic Site of Canada
Parks Canada Agency – Ontario Waterway Unit

Poonamalie Lock 32
Heritage Stone Masonry Repairs

Project No. 30029880
August 2017

ISSUED FOR BID

Prepared By

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JCAL Project No. 17026

Part 1 General

1.1 SUMMARY

.1 Requirements Included

.1 This section outlines the General Requirements that shall be administered by the Contractor. While the specification section establishes the requirements for each trade, the Contractor shall directly supervise and administer all contract requirements to ensure the provision of materials, labour and equipment necessary to complete the work on time and to the quality specified.

.2 Title and description of work: Rideau Canal National Historic Site of Canada, Poonamalie Lock 32 Heritage Stone Masonry Repairs, 22 Poonamalie Road (off Highway 15), Rideau Lakes, Ontario.

.3 During construction, provide continuous safe access across the site at all times for the PCA tenant occupying the residence (old Lockmaster's House) on the island to the NW side of the Canal. Include for snow removal along the route, from the tenant parking location to the door of their residence.

.4 Allow long lead time for stone delivery.

.2 Scope of Work

.1 The general scope of work shall include but not be limited to the following:

.1 Provide scaffolding and site protection as necessary to perform work of this Contract. Erect temporary bracing as required to perform the work in a safe manner and conforming with the requirements of Section 01 35 30 – Health and Safety Requirements.

.2 Provide all necessary access to complete the work, including the approved cofferdam structures, as indicated on the drawings.

.3 Provide protective barricades to the work site to prevent public access to the work area.

.4 Provide and maintain a safe mode of access to the service road along the island earth dam, during the period of construction.

.5 Take all necessary precautions to reduce impact on natural environment and waterway surrounding the site.

.6 Prior to start of masonry work, clean the lock to remove zebra mussels, algae and debris. Dispose of waste.

.7 Install approved cofferdam structures and turbidity curtains, at location outside of the stop log gain locations, upstream and downstream.

.8 Install approved Waste Water Treatment structures/equipment.

.9 Dewater floor of lock chamber to allow for concrete and masonry repairs as noted on drawings.

.10 Provide enclosure and heating as required.

.11 Rake out and remove all loose and deteriorated mortar to the extent noted on the drawings.

.12 Repoint as noted on the drawings.

.13 Repair/replace quantities of existing stone as necessary.

.14 Remove and reset stone at locations noted on drawings.

.15 Install specified anchors, as required and as noted on drawings.

.16 Remove deteriorated concrete and provide concrete or stone repairs, as noted on drawings.

.17 Grout voids in centre core of walls, as noted on the drawing.

.18 Restore landscaping to original condition, upon completion of project. Re-sod where required.

.19 Include for installation and removal of stop logs, or equipment supplied by Contractor, at upstream and downstream log gains, if required, so that work can proceed inside the lock no later than March 14, 2018.

.2 Sequence of Work – General

.1 Work on this project is scheduled to be completed in 2 phases during successive, non-navigation seasons of the Rideau Canal. Non-navigation periods are, in general, from October 2017 to May 2018 and from October 2018 to May 2019. Contractor to completely demobilize from site between phases.

.2 Work outside the lock chamber, where cofferdams are required to allow for work in dewatered areas, is to be completed in Phase 1. Phase 2 to include work that can be accomplished inside a dewatered lock chamber with only stop logs installed in the lock stop log gains.

.3 Sequence of Work – Phase 1

.1 Obtain Historic Canal Regulations Permit before mobilizing to site. Issuance of Permit is contingent upon receipt of Environmental Management Plan, acceptable to PCA Environmental Regulators.

.2 All work that can be started without impact on the Public use of the lock, excluding that Work associated with the lock, is to commence as soon as possible after award of Contract.

.3 Coordinate cofferdam staging as indicated on drawings, with Parks Canada Agency.

.4 Until after Thanksgiving, the Contractor's work area must not impact on the Public. Coordinate with Parks Canada Agency, to transport materials to site via the waterway and set up a staging area.

.5 After Thanksgiving, expand work area to include lock chamber. Protect against public access, using fencing as per staging plan. Install cofferdams and dewater lock, after October 10, 2017.

.6 Complete all in-water work while cofferdams are installed.

.7 Complete all work at log gains, (2m inside and all approach masonry walls outside) first, then install logs; work on lower two courses of masonry inside lock and remove cofferdam by March 14, 2018.

.8 Do not commence work inside log gains until raking out, backpointing and preparation for stone repairs is completed for areas noted under Item .7 and approved by Departmental Representative.

.9 All in-water work is prohibited after March 14, 2018. Cofferdams must be removed by that date.

.10 Work may continue inside log gains past March 14, 2018, if stop logs are installed in the gains. Include for stop log removal at end of work Phase.

.11 Demobilize from site by May 4, 2018. No extensions of time are possible. Remove all material and equipment from site. No storage over the summer is allowed.

.4 Sequence of Work – Phase 2

.1 Contractor may remobilize to site after October 9, 2018.

.2 Install stop logs in stop log gains. Include for dewatering the lock.

.3 Complete all work, including masonry work inside log gains, removal of stop logs, landscaping and deficiencies by May 3, 2019. No extensions of time are possible.

1.2 PROJECT COORDINATION

.1 Coordination

.1 Coordinate work between sub-trades and own forces to ensure that the complete scope of work detailed in the Contract Documents is completed.

.2 Coordinate progress of the Work, progress schedules, submittals, use of site, temporary utilities, construction facilities, with the Departmental Representative.

.3 Execute the Work to cause minimum interference to adjacent locks, waterway and canal wall structure. Public boat traffic is to take priority over Contractor. Lock will only be operational during business hours. Do not operate the lock under any circumstances.

.4 Take reasonable measures to control noise during construction.

.5 Working hours other than normal business hours shall be subject to the approval of the Departmental Representative. Coordinate work with the Departmental Representative.

.6 Maintain one copy of each of the following at the job site for reference purposes:

.1 Drawings

.2 Specifications

.3 Addenda (if applicable)

.4 Change Orders

.5 Reviewed Shop Drawings

.6 Reports from Independent Inspection/Testing Agencies

.7 Health and Safety Standards

.8 Schedule

.9 Basic Impact Analysis (BIA)

.10 Environmental Management Plan (EMP)

.11 Historic Canal Regulations Permit

.2 Hours of Operation

.1 Work can only be performed in accordance with local by-laws for Smiths Falls, unless specifically authorized by Departmental Representative. Work can be performed on Saturdays between 9:00am and 5:00pm. No work permitted during Sundays and Statutory Holidays unless approved in advance by the Departmental Representative.

.3 Noise Control

.1 Adhere to local noise by-laws; notify residents of planned activities that may cause disturbance.

.2 Take all necessary precautions to reduce impact noise transmitting through structure which may have environmental implications to area wildlife.

.4 Health and Safety

.1 Refer to Section 01 35 30 Health and Safety Requirements.

.5 Hazardous Materials Abatement and Protection Requirements

.1 Provide all measures and procedures for hazardous materials abatement in accordance with the Departmental Representative's recommendations.

.2 Be responsible for disposing of all hazardous materials, including all effluent, in conformance with Ministry of Environment and Ministry of Labour guidelines, PCA Environmental Standards and Guidelines for Ontario Waterways (ESG) and EMP.

.3 Provide all equipment required to clean the Work and access stage/platform in conformance with all applicable statutes and guidelines.

.6 Taxes

.1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

.7 Fees, Permits and Certificates

.1 Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.3 CUTTING AND PATCHING

.1 Approvals

.1 Submit written request in advance of cutting or alteration which affects:
- .1 Structural integrity of any element of the Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Departmental Representative or separate contractor.

.2 Inspection

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of work.

.3 Inspect and record photographically, condition of existing landscaping prior to commencement work on site and submit a detailed list of noted defects to the Departmental Representative. On completion of project, ensure the site is returned to a condition which is the same or better than existing condition, prior to start of project.

.4 Inspect and become familiar with all perimeter conditions of cofferdam, prior to submitting design and shop drawings for approval.

.5 Beginning of cutting or patching and installation of cofferdams, means acceptance of existing conditions.

.3 Execution

.1 Execute cutting, fitting, and patching including excavation and fill to complete the Work.
.2 Remove and replace defective and non-conforming work.
.3 Execute Work to avoid damage to other work.
.4 Prepare proper surfaces to receive patching and finishing.
.5 Restore work with new products in accordance with Contract Documents.
.6 Refinish work to match adjacent finishes, unless otherwise noted.

.4 Protection

.1 Provide adequate protection to the public and property.

.2 Protect existing vegetation, shoreline and waterway from any damages resulting from performing work on this Contract. Incurred damages to be repaired, without cost to the Departmental Representative.

.3 Protect new work from damages from any cause. All finished surfaces must be protected so that no marks or scratches mar the finished surfaces prior to acceptance of work.

.4 Protect and be responsible for all new finished and unfinished work which is exposed and susceptible to vandalism or theft.

.5 Where security has been reduced by work of this Contract, provide temporary means to maintain security.

1.4 EXAMINATION

.1 The Drawings are, in part, diagrammatic and are intended to convey the scope of work and indicate general and approximate locations and arrangement of the Work.

.2 Obtain more accurate information from measurements made at the site in conjunction with the Drawings and become familiar with all site conditions before proceeding with the Work. Notify the Departmental Representative immediately, should any discrepancy be discovered. No allowances will be made later for any expense incurred by the Contractor through their failure to make this examination.

1.5 PROJECT MEETINGS

.1 Administrative

.1 The Departmental Representative will schedule and administer biweekly project progress meetings. More frequent meetings will be scheduled, in the event the schedule is not being adhered to.

.2 The Departmental Representative will prepare a template for agenda and minutes.

.3 The Departmental Representative will record minutes. Include significant proceedings and decisions. Identify “Action By” parties.

.4 The Departmental Representative will reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants and affected parties not in attendance.

.5 Record the minutes, when the Departmental Representative is not present. Include significant proceedings and decisions. Identify "Action By" parties.

1.6 SUBMITTALS

.1 Administrative

.1 Submit to Departmental Representative submittals listed for review, refer to Section 01 33 00 Submittal Procedures.

.2 Do not proceed with Work affected by the submittal until review is complete.

.3 Verify field measurements and coordinate affected adjacent Work.

.4 Prior to beginning work, submit to the Departmental Representative for approval, proposed pedestrian and vehicular control measures, signing, site security, sediment and erosion control measures. Do not proceed until written approval is given, EMP is approved and a permit under the Historic Canal Regulations is granted. Modify procedures when required by the Departmental Representative and at no cost to the Departmental Representative.

.5 Health and Safety Plan: Submit Health and Safety Plan within 10 working days of award of Contract.

.6 Environmental Management Plan: Submit within 10 working days of award of Contract.

.7 Keep record of all HST paid on Labour and Materials. Submit information to Departmental Representative monthly.

.8 Contract Price Breakdown

.1 Provide a complete Contract price breakdown by construction element within five (5) working days from receipt of the Contract or Letter of Intent. The breakdown must be representative of the full contract price as identified in the Contract or Letter of Intent.

.2 Shop Drawing and Product Data

.1 Refer to Section 01 33 00 - Submittal Procedures.

.3 Samples

.1 Samples: examples of materials, equipment, quality, finishes, workmanship. Refer to Section 01 33 00 – Submittal Procedures.

.2 Submit for review, samples as requested in respective specification Sections.

.3 Deliver samples prepaid to Departmental Representative's business address.

.4 Reviewed and accepted samples will become standard of workmanship and material quality, against which installed work will be verified.

.4 Photographs

.1 Submit to the Departmental Representative, colour digital photography in jpg format, fine resolution, detailing the as found condition of the masonry prior to start of construction.

.2 Submit progress photographs to Departmental Representative bi-weekly at progress meeting.

.5 Record Drawings

.1 Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by the Departmental Representative.

.2 Identify drawings as "Project Record Copy." Maintain in new condition and make available for inspection on site by the Departmental Representative.

.3 On completion of Work and prior to final inspection, submit record documents to the Departmental Representative.

1.7 SCHEDULE

.1 Schedules Required

.1 Construction Progress Schedule, in Gantt Chart format. Indicate Critical Path on Schedule. Summarize work activities into work packages and highlight key milestones to satisfaction of Departmental Representative. Incorporate items into schedule, as requested by Departmental Representative.

.2 Monthly Cash Flow Document: Submit to Departmental Representative, a breakdown on the Contract Amount in detail as directed by the Departmental Representative and aggregating the total amount of the Contract Price, so as to facilitate evaluation of application for payment.

.2 Submission

.1 Submit initial schedules within 5 working days after award of Contract, indicating the timing of the work, including the sequence of all operations involved therein, in order to meet the completion date. Work on site cannot commence until schedule is approved.

.2 Submit updated Project Schedule at minimum two days prior to the site meeting, or at shorter intervals as changes to schedule dictate.

.3 Submit initial Cash Flow Document within 10 working days after award of Contract. Progress Claims cannot be authorized until this document has been approved by the Departmental Representative.

1.8 SITE INSTRUCTION

.1 When a clarification or modification of the work is required which does not require an adjustment of the contract price or contract time, the Departmental Representative will issue a Site Instruction.

.2 Upon receipt of a Site Instruction, proceed promptly with the work.

1.9 QUALITY CONTROL

.1 Provide sufficient, safe and proper facilities at all times for review of the Work by the Departmental Representative.

.2 Independent Inspection Agencies

.1 Independent Inspection/Testing Agencies will be engaged by the Departmental Representative for the purpose of inspecting and/or testing portions of Work and regularly inspecting the EMP requirements, as identified in the Specifications. Cost of such services will be borne by the Departmental Representative.

.2 Provide equipment, samples of materials, design mix, tools, storage, safe access and assistance as required for executing inspection and testing by the appointed agencies.

.3 Cost of reinspection of unacceptable work to be borne by Contractor.

.3 Reports

.1 Submit one copy of inspection and test reports promptly to the Departmental Representative.

1.10 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

.1 Installation/Removal

.1 Provide construction facilities and temporary controls in order to execute the work expeditiously.

.2 Prior to substantial performance, remove from site all such work.

.3 Make good any damage to, or disturbance of existing property caused by such work.

.2 Site Office

.1 Position temporary site office/trailer at location designated by Departmental Representative.

.2 Maintain facility in clean and tidy condition.

.3 Keep access doors closed at all times.

.4 Provide heating. Arrange Hydro hook-up under separate meter.

.3 Site Storage/Loading

.1 Do not load or permit to be loaded, any part of the Work with a weight or force that will endanger the safety of the Work.

.2 Space on site is limited to the boundaries set out by the Departmental Representative. Keep storage requirements to a minimum. Interior storage is not available.

.3 Store products, materials, equipment in locations indicated by the Departmental Representative. All construction material and equipment must be stored inside the fenced area.

.4 Maintain equipment to avoid leakage of fuels and liquids. Ensure measures are in place to minimize impacts of accidental spills. Keep an emergency spill kit at the site and deploy immediately, should a spill occur. In the case of a spill contact Departmental Representative and notify Ontario Spill Action Center immediately at 1-800-268-6060. All provincial and federal regulations are to be adhered to. Maintain an adequate supply of clean up materials on-site. Include this information in the EMP, following the guidelines of the ESG.

.5 Store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads.

.6 Conduct refuelling and maintenance of equipment off slopes and away from water bodies on impermeable pads or buried liners to allow full containment of spills at a recommended distance of 30 meters from any watercourse.

.7 Do not discharge chemical and cleaning agents in or near aquatic habitats. Dispose of all such substances at a facility licensed to receive them.

.4 Sanitary Facilities

.1 Provide sufficient sanitary facilities for construction personnel in accordance with local health authorities. The Departmental Representative will designate a location for the contractor to place the facility.

.2 Maintain the facilities in clean and sanitary condition.

.3 Provide hand sanitation station.

.4 Do not use public washrooms.

.5 Water Supply

.1 Provide a supply of potable water to facilitate the Work.

.2 Running water is not available on site.

.6 Temporary Power

.1 Provide and pay for temporary power as required during construction.

.2 There is no power source on site. Provide a generator as required to complete the work.

.7 Communication Facilities

.1 Provide Site Superintendent with a cell phone, to ensure he/she can contact or be contacted by the Departmental Representative at all times during working hours.

.2 Provide a means of communication on site in the form of a computer with printer or tablet, in order to facilitate the dispatch of Construction Review Reports and Site Instructions directly to the site office.

.8 Project Cleanliness

.1 Maintain the Work in tidy condition, free from the accumulation of waste products and debris.

.2 Remove waste material and debris from the site and deposit in waste container at the end of each working day. Do not burn waste materials on site.

.9 Dust Control

.1 Take every precaution to control dust.

.2 Keep the surface area damp to minimize dust where removals are in progress.

.10 No Smoking Environment

.1 Comply with existing no smoking laws.

.11 Security

.1 Submit a list of all workers on site.

.12 Parking

.1 There is substantial parking available on site. Allow for parking for up to two Parks Canada service vehicles at all times.

.13 Loading/Unloading and Garbage Container

.1 Do not use the Departmental Representative's garbage container to store or dispose of contract waste.

.2 Provide garbage container, sufficient to accommodate contract waste. Locate where directed by Departmental Representative in Laydown Area.

1.11 MATERIAL AND EQUIPMENT

.1 Product and Material Quality

.1 Unless otherwise specified in the Contract Documents, products provided shall be new. Products which are not specified, will be of a quality consistent with those specified, and their use acceptable to the Departmental Representative.

.2 Storage, Handling and Protection

.1 Do not unreasonably encumber site with materials or equipment. Move stored materials or equipment when directed by the Departmental Representative.

.2 Handle and store Products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.3 Store packaged or bundled Products in original and undamaged condition with manufacturer's seals and labels intact.

.4 Store loose granular materials on solid flat surfaces, in a well drained area. Prevent mixing with foreign matter.

.5 Store products subject to damage from weather in weatherproof enclosures.

.6 Obtain and pay for use of additional storage or work areas if needed for operations.

.7 Provide trailer for duration of project to be used as meeting room and lunch room for workers. The trailer can be located as noted on Drawings.

.8 Store products in a heated facility, trailer or container to maintain manufacturer's temperature requirements.

.3 Manufacturer's Instructions

.1 Unless otherwise indicated in the specifications, install or erect Products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify the Departmental Representative in writing, of conflicts between the specifications and manufacturer's instructions, so that the Departmental Representative may establish the course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in Contract Price.

.4 Workmanship

.1 Ensure workmanship is of the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the

Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Departmental Representative, whose decision is final.

1.12 PROJECT CLOSEOUT

.1 Final Cleaning

.1 Remove stains, dirt and smudges from finished surfaces.

.2 Clean exposed, finished surfaces in accordance with respective material manufacturers' recommendations.

.3 Broom clean and wash pathways and surfaces affected by the work.

.4 When work is substantially performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris.

.5 Restore landscaping and vegetation to as found condition. Re-sod damaged areas, including re-watering until grass has been cut twice. Replace all damaged shrubs, with shrubs of equal or better quality.

.2 Documents

.1 Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers, and manufacturers.

.2 Submit material prior to final Application for Payment.

.3 Submit operation and maintenance data, record (as-built) drawings.

.4 Provide guarantees, warranties, and bonds where requested, fully executed and notarized.

.5 Departmental Representative will issue a final Change Order, reflecting approved adjustments to Contract Price for agreed measured quantities for all unit rate items.

.3 Inspection/Takeover Procedures

.1 Prior to application for certificate of Substantial Performance, the Contractor and all Sub-Contractors shall carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete, defects are corrected and the site is in clean condition. Notify the Departmental Representative in writing, of satisfactory completion of the Work and request an inspection.

.2 During the Departmental Representative inspection, a list of deficiencies and defects will be tabulated. Correct same.

.3 When the Departmental Representative considers deficiencies and defects have been corrected and it appears requirements of the Contract have been substantially performed, make application for certificate of Substantial Performance.

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 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

- .1 Submit Preliminary Schedule within 5 working days of Contract award.
- .2 Submit Cash Flow Documents, Health and Safety Plan and Environmental Management Plan (EMP) within 10 working days of Contract award. Issuance of an Historic Canals Regulation Permit is contingent upon receipt of an acceptable EMP. Mobilization to site will not be permitted without an approved Historic Canals Regulation Permit.
- .3 Submit Cofferdam Shop Drawings within 15 working days of Contract award.
- .4 Submit all other required submittals within the first 30 days of Contract award.

.2 Prepare submittals log, listing all shop drawings, samples and product data sheet submittals required as part of the contract. List status of each submittal, from submission to final approval. Submit updated submittals log at each progress meeting.

.3 Do not proceed with Work affected by submittal until review is complete.

.4 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.5 Where items or information is not produced in SI Metric units converted values are acceptable.

.6 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.8 Verify field measurements are coordinated with affected adjacent Work.

.9 Coordinate each submission with requirements of work and contract documents. Individual shop drawings will not be reviewed until all related drawings are available.

.10 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.11 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review, unless Departmental Representative gives written acceptance of specified deviations.

.12 Keep one reviewed copy of each submission on site.

.13 Arrange and pay for all deliveries and pick-ups to and from the office of the Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 A list of all required shop drawings will be provided to the Contractor at the start of the Project. This list will be used to monitor the status of Submittals.

.2 Provide shop drawings to the Departmental Representative to review in orderly sequence and sufficiently in advance, so as to cause no delay in the Work.

.3 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.

.4 Prepare shop drawings using a computer aided drafting program.

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Submit drawings stamped and signed by a Professional Engineer registered or licensed in Province of Ontario, where requested.

.7 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.

.8 Allow five (5) days for Departmental Representative's review of each submission.

.9 Make changes to shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.10 Accompany submissions with transmittal letter, 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.

.11 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Contractor
  - .2 Subcontractor.
  - .3 Supplier.
  - .4 Manufacturer.
  - .5 Separate detailer when pertinent.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Identification of product or material.

.6 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 Relationship to adjacent work.

.7 Where Departmental Representative's drawings are used as the base for the shop drawings, delete the Departmental Representative's title block and stamp. Failure to do so will mean that the drawings will be returned without review.

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

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

.14 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.

.15 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 1 year of date of contract award for project.

.16 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.

.17 Submit one electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

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

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

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

.21 Delete information not applicable to project.

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

.23 If upon upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.24 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that the Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

.1 A list of all required samples will be provided to the Contractor at the start of the Project. This list will be used to monitor the status of Submittals.

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

.3 Deliver samples prepaid to Departmental Representative's business address.

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

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

.6 Adjustments made to 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.

.7 Make changes to samples which Departmental Representative may require, consistent with Contract Documents.

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

1.4 MOCK-UPS

.1 Construct field samples and mock-ups at locations acceptable to the Departmental Representative.

.2 Construct each mock-up complete, including work of all trades required to finish work.

.3 Reviewed mock-ups will become standard of workmanship and material quality, against which installed work will be verified.

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic digital photography in jpg format, fine resolution, as directed by Departmental Representative.

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

.3 Submit photographs of as-found condition prior to commencement of the project.

.4 Submit progress photographs to Departmental Representative, bi-weekly at progress meeting, to document advancement of project.

1.6 PERMITS, CERTIFICATES AND TRANSCRIPTS

.1 As per the Historic Canal Regulations applicable to lands administered by the Rideau Canal National Historic Site of Canada, a Permit signed by Parks Canada's Ontario Waterways Director will be required to authorize the project work prior to commencement of project activities on site.

.2 Immediately after award of Contract, submit Workers' Compensation Board status.

.3 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 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Health and Safety Regulations.

.2 Province of Ontario

.1 Occupational Health and Safety Act and Regulations 213/91 for Construction Projects, latest edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Complete Parks Canada site-specific Health and Safety Plan Template and submit within 10 working days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Complete and submit Parks Canada Form, attestation and proof of compliance with occupational Health and Safety.

.3 Contractor may use own plan format, provided it includes at minimum, the contents of Parks Canada Plan template.

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

.5 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.6 Submit copies of incident and accident reports.

.7 Submit Material Safety Data Sheets (MSDS) to Departmental Representative.

.8 Personnel training requirements including as follows:

.1 Names of personnel and alternates responsible for site safety and health, hazards present on site, and use of personal protective equipment.

.9 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 2 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 2 days after receipt of comments from Departmental Representative.

.10 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.

.11 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.

.12 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.

1.3 SAFETY ASSESSMENT

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

1.4 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

- .1 Wild Parsnip (noxious weed)
  - .1 Protective clothing, rubber gloves and eye protection is advised.
  - .2 Remove protective clothing carefully to reduce risk of skin coming into contact with sap, which may be on clothing.
  - .3 Launder non-disposable clothing immediately to prevent distribution of sap.
  - .4 If skin comes into contact with sap, thoroughly wash with soap and water.
  - .5 Avoid further exposure of the affected skin to UV/sunlight.
  - .6 If a rash occurs, seek medical attention.
  - .7 If eyes are exposed to direct contact with the sap, immediately flush with water and seek immediate medical attention.
- .2 Fall Hazards
  - .1 Lock walls are considered a fall hazard. Ensure workers are aware of safety regulations.
- .3 Work Near Water
  - .1 Adhere to the regulations of Occupational Health and Safety Act and Regulations 213/91 for Construction Projects.
  - .2 Ensure all workers are well informed of the risks of working in the vicinity of a weir.
  - .3 Provide all personnel working on, in or around water with appropriate water safety devices, including the use of life jackets.
  - .4 Ensure an alarm system is in place, in the event that a worker falls in the water.
- .4 Work Behind Cofferdam
  - .1 Provide means to control flooding of work area.
  - .2 Ensure warning system is in place in case emergency evacuation is required.
  - .3 Provide a means of rapid exit, by way of ramp or walkway. Do not allow this exit to become blocked at any time.
- .5 Work Upstream of Cofferdam
  - .1 Avoid diving in conditions where pressure differential may exist.
  - .2 Divers to test for suction, using standard DAG test before all diving operations.

.6 Working around Motorized Watercraft

.1 The lock and waterway are actively used by recreational boaters.

.7 Winter Work

.1 Working on the floor of the lock chamber during sub-zero temperatures may cause ice build-up on the soles of work boots. Be alert to ice hazards generated by extreme temperatures.

.2 Ensure access paths to area of work are maintained in a safe condition, by spreading gravel as required to prevent fall hazard.

.3 Ensure workers are aware of the potential hazards of cold weather work and have adequate insulated clothing to withstand a cold environment.

.8 Thin Ice

.1 Ice thickness on the waterway varies and may be thin approaching the lock.

1.5 MEETINGS

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

.2 Schedule and administer weekly Health and Safety Toolbox Meetings with workers. Submit minutes of meetings to Departmental Representative at Progress Meetings.

1.6 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any 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.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials and regarding the labelling and provision of MSDS data sheets.

1.8 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 surrounding 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, and local statutes, regulations and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Health and Safety Act and Regulations for Construction Projects.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 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 identified health and safety issues.

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

1.11 UNFORSEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, suspend work and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of the Province of Ontario. Advise Departmental Representative verbally and in writing.

1.12 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have minimum 2 years' site-related working experience.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to, and be under direction of site supervisor.

.2 Provide the name of this individual to the Departmental Representative.

.3 Ensure at least one of the site personnel is trained in CPR, in the event it is required.

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 the Province of Ontario and in consultation with the Departmental Representative.

1.14 WORK STOPPAGE

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

.2 Assign responsibility and obligation to Health and Safety Officer to stop or start work when, at Health and Safety Officer’s Discretion, it is necessary or advisable for reasons of Health and 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 MEASUREMENT AND PAYMENT

.1 No measurement for payment will be made for the work of implementing the environmental protection measures indicated on the drawings, specifications, environmental assessment, or as required by applicable legislation and, including water control through the site. Include all costs for the implementation of environmental measures in the "Environmental Measures" lump sum price. Refer to Environmental Standards Guidelines (ESG) for Parks Canada expectations.

.2 Prior to the first application for progress payment, submit a breakdown of the lump sum price for the various environmental measures called for. Once approved, this will be used as the basis for progress payments.

1.2 RELATED REQUIREMENTS

.1 Section 32 92 23 – Sodding.

1.3 REFERENCES

.1 Definitions

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

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

.2 Reference Standards

.1 Canadian Council of Ministers for the Environment (CCME).

.2 This Section 01 35 43 – Environmental Procedures, to be read in conjunction with Environmental Standards and Guidelines Document – Ontario Waterways (ESG), appended to these Specifications.

1.4 ENVIRONMENTAL ASSESSMENT

.1 Adhere to the environmental protection measures and mitigation measures outlined in the Parks Canada Basic Impact Analysis report, attached in the Bid Documents, as well as the measures called for elsewhere in Project Drawings and these Specifications.

1.5 ARCHAEOLOGICAL ASSESSMENT

.1 Adhere to the requirements outlined in the Parks Canada Archaeological Overview Assessment attached in the Bid Documents and corresponding measures called for elsewhere in the Project Drawings and Specifications.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Management Plan for review and approval by Departmental Representative.

.3 Environmental Management Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction and the methods of mitigation as well as how compliance will be measured.

.4 For required permits, refer to Section 01 33 00 – Submittal Procedures.

.5 Address topics at level of detail commensurate with environmental issue and required construction tasks. Refer to ESG – Table 3: EMP Component Plans and Key Requirements, for recommendations necessary to address the full range of anticipated Project effects.

.6 Environmental Management Plan to be prepared by a qualified Professional, in accordance with ESG standards.

.7 Include in Environmental Management Plan:

- .1 Names of persons responsible for ensuring adherence to Environmental Management Plan.
- .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
- .3 Names and qualifications of person responsible for training site personnel.
- .4 Descriptions of environmental protection personnel training program.
- .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material and fuel storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
- .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
  - .1 Plans to include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
- .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

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

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

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off the project site.

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

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

.14 Historical, archaeological, cultural resources, biological resources and wetlands plans may be required for this project where the ground surface is to be disturbed. If it becomes necessary, the plans will define procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands. Should any suspected species at risk be encountered or if there is potential to negatively impact species at risk, or wild life in general, contact PCA Environmental Assessment staff at 613-283-5170, for guidelines on how to proceed.

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

.16 Plan which demonstrates procedures for avoiding disturbance/harm to wildlife.

1.7 PROJECT SPECIFIC MEASURES

.1 No in-water works permitted between March 15 – June 30 in any given year.

.2 Throughout dewatering, ensure that the dewatered portion of the Work is cleared of all stranded fish. Use nets and/or traps to catch fish. Handle fish to prevent their injury and place in buckets with ample fresh water at lake temperature until released. Release alive as soon as possible upstream of dewatered work area.

.3 Implement required measures to keep work site dry. Pump construction waste water from work site, upstream of check dam into a silt trap prior to release into natural environment. Do not pump water directly into the waterway. Send all discharge to a settling pond or filtration area before being released into the waterway. Refer to ESG for waste water management. Water quality downstream of construction activities and/or released to watercourses not to exceed background turbidity readings of 8 nephelometric turbidity units (NTU), or a change of 25 mg/L for suspended solids. Refer to CCME

guidelines for the protection of aquatic life. Prior to dewatering, submit a Dewatering Plan for approval by the Departmental Representative.

.4 Ensure all debris from demolition, raking and mortar/grout residue is collected and removed from the site. Develop catchment system and/or work method to ensure all debris is captured and removed from site. Ensure no release of deleterious material from demolition into downstream water courses or other areas adjacent to work site.

.5 Remove green algae from lock walls prior to start of work. Ensure stone is in clean condition before raking out of joints.

.6 Zebra Mussels

.1 Remove and dispose of zebra mussels found in area of work, in accordance with "Invasive Species Management" section in ESG.

.2 Upon completion of project, clean tools, cofferdams and all other equipment used in the execution of the project to remove any attached zebra mussels.

.3 Maintain equipment in a dry condition for at least 21 days before placing into another water body.

1.8 FIRES

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

1.9 DISPOSAL OF WASTE

.1 Do not bury rubbish and waste materials on site. Do not dump excavated fill, waste material or debris in water bodies.

.2 Do not dispose of waste of volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

.3 Remove all hazardous waste to an appropriate waste management facility for disposal.

1.10 DRAINAGE, SEDIMENT CONTROL AND AQUATIC PROTECTION

.1 Develop and submit erosion and sediment control plan as part of the Environmental Management Plan that identifies type and location of erosion and sediment controls. Adhere to ESG requirements. Plan to include monitoring and reporting requirements to assure that control measures are installed properly and functioning.

.2 Develop a contingency plan (eg. Extra pumps/equipment) in the event of extreme precipitation events or spring flooding at the place of Work. Refer to ESG, Table 3 – EMP Component Plans and Key Requirements: Dewatering and Wastewater.

.3 Provide temporary drainage and pumping required to keep excavations and site free from water ponding.

.4 All erosion and sediment control methods, including those identified on the drawings, will be installed according to the erosion and sediment control plan, prior to commencement of any project activities and must remain in place until all work has been completed and disturbed areas have been stabilized. Removal will be permitted only after written approval from the Departmental Representative.

.5 Sediment, debris and erosion control measures must be inspected twice weekly and before and after rainfall events, to ensure that they are functioning properly and are maintained and upgraded as required. Remove accumulated sediment required and dispose off site.

.6 In the event that sediment and erosion control measures are not functioning, the Departmental Representative will order the work stopped. Do not carry out further work until the sediment control plan is adjusted to address the sediment problem.

.7 Provide sediment control measures in accordance with the ESG and to the approval of the Departmental Representative, in all areas where, due to construction activities, silt or debris may enter the canal or water. This includes, but is not limited to: a filtration barrier installed around staging, stockpiles and work areas; access routes where ground is disturbed and locations indicated on drawings.

.8 Place only washed stone, free of particulate in the water.

.9 Use of earth or granular material with sand and fines for any required cofferdam construction is not acceptable. Washed gravel with 6 mm minimum aggregate size can be used as cofferdam material, contained within meter bags with waterproof liners. If using sandbags, sand must be washed and free of fines.

.10 Quickly address and seal any leaks discovered in cofferdam. If leaks persist, create a clean water collection area, to be pumped back to the upstream or downstream receiving waters.

.11 Upon completion of work, completely remove all debris from work area and stream bed. Restore the area to its original state.

.12 Treat any water containing a high level of silt or sediment by discharging to settling basins, vegetated areas or sediment traps prior to release to streams. Mechanical filtration ie filterpress or chemical – flocculation may be acceptable to the Departmental Representative. Confirm if this is an option and refer to ESG-14-C for the Treatment of Discharge Waters. Water quality downstream of construction activities and turbidity curtain should not exceed recommended CCME guidelines on water quality for the protection of aquatic life. Particularly no change from background turbidity readings of 8 nephelometric turbidity units (NTU), or a change of 25 mg/L for suspended solids, at any one time for a duration of 24 h in all waters during clear flows or in clear waters. Information on CCME guidelines can be obtained online at: http://ceqgrcqe.ccme.ca/download/en/217/. If NTU readings are found to be non-compliant, total suspended solids (TSS) may be sampled for laboratory analysis.

.13 Provide sediment traps and bags across all areas where sediment can enter the watercourse. This includes, but is not limited to, a sediment trap located as indicated on drawing. Refer to ESG-2-Pre for specific regulations.

.14 In the event of a significant silting or debris caused by construction activities, take appropriate measures to contain and mitigate the problem including the installation of additional downstream turbidity curtains. Investigate the source of the problem and eliminate the activities leading to the issues.

.15 Implement additional mitigation measures in accordance with any regulatory requirements and recommendations stipulated by authorities under the Fisheries Act and Historic Canal Regulation Permit.

.16 Maintain a standby supply of pre-fabricated silt fence barrier, or an equivalent ready-to-install sediment control device, and a standby supply of erosion controls, to the approval of the Departmental Representative.

.17 Cease demolition and excavation during periods of heavy rainfall.

.18 Ensure all equipment and temporary access structures such as scaffolding placed in water bodies is free of earth material, and excess loose or leaking fuel, lubricants, coolant and other deleterious material that could enter the water body.

.19 As concrete leachate is alkaline and highly toxic to fish and other aquatic life, ensure that all works involving the use of concrete, cement, mortars and other Portland cement of lime-containing materials (concrete) will not deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse. Concrete materials cast in place must remain inside formed structures. Concrete waste water must be removed from site. Refer to ESG-5-C – Concrete Pour Operations and Grouting and strictly follow the defined guidelines.

.20 Use trigger operated spray nozzles for water hoses, when cleaning concrete equipment.

.21 Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment and other tools and equipment.

.22 Dispose of all concrete wash water in a location where it will not enter subsurface drains, water bodies or storm drains.

.23 Prevent any water that contacts uncured or partly cured concrete during activities like exposed aggregate wash-off, wet curing, or equipment washing from directly or indirectly entering any watercourse.

.24 Maintain complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 48 hours if ambient air temperature is above 0ºC and for a minimum of 72 hours if ambient temperature is below 0ºC.

.25 In accordance with the ESG, isolate and hold any water that contacts uncured or partly cured concrete, until the pH is between 6.5 and 9.0 pH units, and the turbidity levels are acceptable. Employ CO_2 treatment as outlined in ESG-5-C – Concrete Pour Operations and Grouting.

1.11 PERMIT TO TRANSPORT

.1 Transport all waste described as subject to Ontario Regulation 347 as amended of the Environmental Protection Act, with a valid "Certificate of Approval for a Waste Management System" to a site approved by the Ontario Ministry of the Environment, to accept that waste.

1.12 WORK ADJACENT TO WATERWAYS

.1 Prior to commencement of work, install sediment and erosion control measures, such as turbidity curtains, straw bale flow checks, silt fences, drainage swales or other methods necessary to prevent silt or sediment from entering the watercourse.

.2 Operate construction equipment on land only.

.3 Keep waterways free of excavated fill, waste material and debris.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid logs or construction materials across waterways.

.6 In-water work is not permitted after March 14, to protect fish spawning habitat.

1.13 NOISE CONTROL

.1 In all cases, comply with local noise by-laws, including the by-laws related to noise and construction. Do not idle equipment.

.2 Minimize the noise levels from construction activities by using proper muffling devices, in addition to appropriate timing and location of these activities to reduce or minimize the effect of noise on nearby residents, recreationists and wildlife.

1.14 SPILL CONTAINMENT

.1 Comply with the requirements of ESG-13-C – Refueling and Spill Management.

.2 Ensure a spill containment kit is on site and available at all times. Provide training to site personnel in the use of the kit.

.3 During all operations, such as refueling, complete the operations within a secondary environment system capable of preventing release of spills or leaks into the environment.

.4 Store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads; provide berms and secondary containment systems as necessary.

.5 Conduct all vehicle/equipment maintenance and refuelling over impermeable surfaces situated at a designated area that is located at least 30 metres away from the nearest water body.

.6 Clean any equipment which operates in water bodies, prior to entering the water and inspect daily for leaks; never leave equipment in the water outside of working hours.

.7 Provide drip trays to prevent the discharge of oil, grease, antifreeze or any other deleterious materials into the ground, for any equipment, including pumps, machinery and compressors.

1.15 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.3 Prevent extraneous materials from contaminating air and waterways beyond removal/application area, by providing temporary enclosures or other suitable methods acceptable to the Departmental Representative.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Spills of deleterious substances

.1 Immediately contain, limit spread and clean up in accordance with Provincial regulatory requirements. Refer to ESG-13-C – Refueling and Spill Management for requirements.

.2 Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal.

.3 Report IMMEDIATELY to the Ontario Spill Action Centre:1-800-268-6060 and to the Departmental Representative.

.4 Further information on dangerous goods emergency clean-up and precautions, including a list of companies performing this work, can be obtained from the Transport Canada 24-hour number (613) 996-6666 collect.

.5 Be responsible for all costs of cleaning up any spills, to the satisfaction of the Departmental Representative.

.6 Dispose of contaminated material off site to a licenced facility.

.7 Ensure an environmental emergency response plan is in place and a spill kit is readily available. Note location of spill kit on the Site Plan.

.8 Should conditions at the work site indicate that there are unforeseen negative impacts to fish or their habitat, cease all work until the problem has been corrected and/or appropriate guidance has been obtained from Parks Canada.

.6 Leave machinery running only when in actual use, except where extreme temperatures prohibit shutting machinery down.

.7 Remove concrete debris and dust generated as a result of various concrete/stone work, in such a way that will ensure material does not enter the waterway. Remove unused aggregate, concrete rubble and stone rubble material and restore to original state, upon completion of work.

1.16 MISCELLANEOUS

.1 Do not use explosives. Sandblasting is not permitted on the site.

.2 Restore habitat where necessary; completely remove all debris from bed (including unused aggregate/concrete rubble) and restore area to original condition. Wash down all debris from lock area; collect/pump and treat the water.

.3 Investigate the area for any nests or dens prior to clearing and avoid disturbing any active nests or dens. Minimize operation of machinery in areas where migratory birds are breeding.

.4 Protect trees and plants on site and adjacent properties as indicated.

.5 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes and encase with protective wood framework from grade level to height of 2 m.

.6 Protect roots of designated trees to drip line (outer perimeter of branches) to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.7 Minimize stripping of topsoil and vegetation.

.8 Reduce soil displacement and compaction by using equipment of low bearing weight and low psi tires, wherever possible. Reinstate damaged areas with native plants/seeds only. Seed mix to be approved by Departmental Representative.

.9 Avoid activity during wet weather conditions (rainfall amounts greater than 20mm predicted), and ensure that a consistent access route is used and maintained throughout the vegetation clearing.

.10 Restrict tree removal to areas indicated by Departmental Representative.

.11 Relics and antiquities such as cornerstones and their contents, commemorative plaques, the remains and evidence of ancient persons and peoples, and other objects of historic value and worth will remain the property of the Department. When found, protect such articles and request direction from the Departmental Representative.

1.17 HISTORICAL/ARCHAEOLOGICAL CONTROL

.1 Submit historical, archaeological, cultural and biological resources plan to Departmental Representative for approval.

.2 Contents of Plan:

.1 Procedures for identifying and protecting historical, archaeological, cultural and biological resources known to be on project site.

.2 Procedures to be followed if historical, archaeological, cultural and biological resources, not previously known to be on project site or in the area, are discovered during the work.

.3 Procedures to assure protection of known or discovered resources.

.4 Procedures for communication between Contractor's personnel and Departmental Representative.

.3 Minimum Procedures:

.1 Obtain diagrams and maps of previously disturbed areas and areas of concern from Departmental Representative.

.2 Use previously disturbed areas (eg. lawns, parking lots) immediately adjacent to the locks, to mitigate possible impact of heavy equipment and/or of staging area(s).

.3 Confine heavy machinery to a minimal area, to mitigate impact on potential archaeological structures.

.4 Develop proposed approach to cofferdam that has a minimal impact on potential underwater archaeological resources and submit to Departmental Representative for approval.

.5 After installation of the cofferdam and completion of dewatering process, allow 2 days for Departmental Representative to enter dewatered area to inspect water bed, prior to commencing work.

.6 Avoid use of heavy equipment on water bed.

.7 If significant features (eg. structural remains an/or high artifact concentration) are encountered, stop work in immediate area, take photographs and notify Departmental Representative. Departmental Representative will contact Parks Canada Terrestrial Archaeology section for advice. A Parks Canada assessment of significance of the resources will determine required mitigation of the chance find.

.8 All excavation work may be monitored by Archeologists, who may stop excavations as artifacts or remnants are uncovered. Proceed as directed by Departmental Representative.

1.18 NOTIFICATION

.1 Monitor compliance with the accepted environmental plan, logging compliance and non-compliance issues. Present the log to the Departmental Representative for review.

.2 While the Contractor remains responsible for compliance review, the Departmental Representative may notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Management Plan.

.1 The BIA and the Contractor's approved EMP will form the basis for a permit, under the Historic Canal Regulations. Non-compliance with required mitigation may lead to violations of the permit.

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

.1 Take action only after receipt of written approval by Departmental Representative.

.4 Departmental Representative may issue stop order of work until satisfactory corrective action has been taken.

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

.6 Cooperate with the authorities having jurisdiction and correct any non-compliant issues.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CLEANING

.1 Clean up work area as work progresses. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment from the site.

.3 Landscaping on site must be returned to its former condition. Regrade and resod damaged areas as per Section 32 92 23 – Sodding.

END OF SECTION

Basic Impact Analysis

Poonamalie Lock 32, Heritage Stone Masonry Rehabilitation

Rideau Canal, Smiths Falls, ON

July 2017

1. PROJECT TITLE & LOCATION

Poonamalie Lock 32, Weir Heritage Stone Masonry Rehabilitation. Poonamalie Lock station is located south west of Smiths Falls, with access just off of County Road 15 at 22 Poonamalie Road

GPS Coordinates: N44˚ 53.569' W76˚ 03.349'

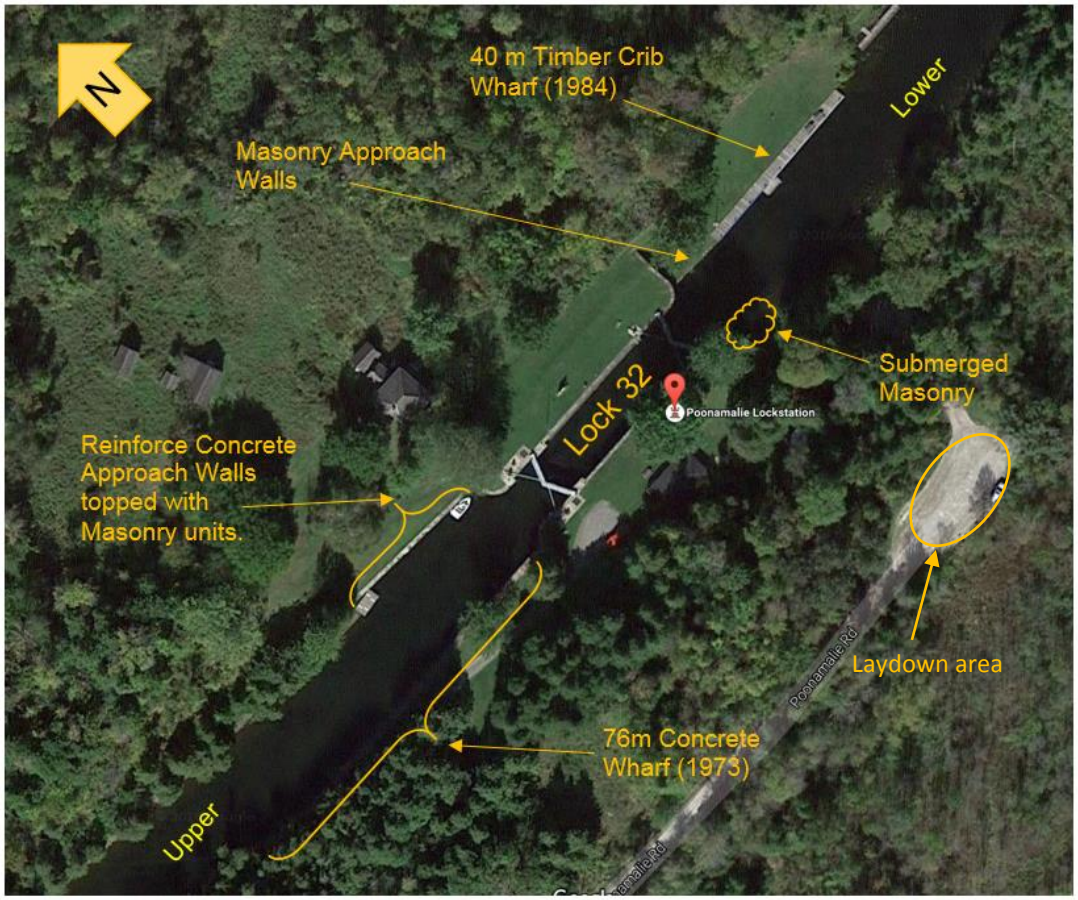

Figure 1. Map of Poonamalie Lockstation (ESRI, 2016).

2. PROPONENT INFORMATION

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3. PROPOSED PROJECT DATES

Planned commencement: 2016-07-02
Planned completion: 2018-05-01

4. INTERNAL PROJECT FILE # 30029880

5. PROJECT DESCRIPTION

Poonamalie lock 32 is a single lock located on the Rideau Canal, just west of Smiths Falls, Ontario. The lock chamber is composed of two original masonry walls, which have been repaired with concrete parging in the past. The capstones and skyward surfaces are generally stone, except at the winches, which are bolted to concrete.

The upstream and downstream wing walls are also original masonry. On the downstream side, the northwest wall is composed of a low masonry wall, located just beyond the masonry wing wall. A timber crib wharf is located beyond the low masonry wall. There is submerged masonry located at the downstream northeast wall. Other than the submerged masonry, there is no other structure beyond the wing wall at this location. On the upstream side, the southwest wall is a combination masonry and concrete wall. The capstone and the first course is stone masonry and the lower portion of the wall is concrete with faux-joint tooling. The southeast wall is a concrete wharf with stone capstones and a stone skyward surface.

The work on site is scheduled to begin October 9, 2017 and continue until May 5, 2018, however no in-water work can be completed after March 15, 2018 due to Fisheries Restrictions.

After mobilizing on site, the Contractor's priority will be the construction of the cofferdams and winter enclosure over the lock. A cofferdam is needed both upstream and downstream, as the masonry approach walls extend past the stop logs. A single cofferdam in conjunction with the stop logs is not an option as the masonry beyond the stop logs would not be repointed and repaired.
The lock will need to be cleaned of zebra mussels, algae and debris prior to the start of the masonry work.

Masonry repairs will proceed following the installation of the temporary works. Heating will be required to provide and maintain a temperature above 10 degrees Celsius at all times within the enclosure, for the duration of the masonry work and until fresh mortar has been adequately cured.

Sawcutting and raking out the joints will begin immediately. Sawcutting is necessary in order to break the surface tension of the hard Portland mortar. Hand chipping will damage the stone arris. Raking out must remove all debonded and deteriorated joints to the point where good mortar is located. Once the rake out is complete, backpointing can begin and the stones will be assessed for repairs or replacement. The Dutchman repairs will be cut once the backpointing is complete to ensure the stone is secure in the wall. Finishpointing will only start once the Dutchman repairs have been completed to ensure a uniform joint color and finish.

On the upstream east approach wall the area behind the wall will be excavated to a depth of 1.8 m to receive repointing treatment. The area will be backfilled and restored.

Once masonry work is complete and mortar has cured, the enclosure will be removed, followed by removal of the cofferdam and stop logs, and general clean up. The final step is to repair landscaping to its as found condition.

6. VALUED COMPONENTS LIKELY TO BE AFFECTED

Physical Environment

Physiography, Geology, Soil, and Groundwater

According to Chapman and Putnam (1984), the BIA Study Area is in a physiographic region known as the Napanee Plain, which is characterized as a flat-to-undulating limestone plain (Gull River and Bobcaygeon Formations) and has had most of the overburden removed through glacier activity. The Napanee Plain is underlain by sandstones and dolostones of the Beckmantown Group and covers an area approximately 1,800 square kilometres (km^2). A layer of soil several centimeters thick covers much of the region, except in depressions where deposits of glacial till and clay may be found. According to the geotechnical investigation report prepared by LRL (2006), the maps provided by the Department of Energy, Mines and Resources Canada indicated the BIA Study Area would be located within the organic deposits with local till veneer outcrops less than 1 m thick resting over dolomite bedrock (LRL, 2006).
According to the geotechnical investigation (LRL, 2006), groundwater levels below the Earth Dam were reported to be on average approximately 123.1 masl or 1.40 metres below ground surface (mbgs) in August 2006.

Climate and Air Quality

The climate of the Mixedwood Plains Ecozone, in which the BIA Study Area is located, is characterized by warm to hot summers and cool winters. The Great Lakes and Saint Lawrence River have a significant moderating effect in this ecozone, which is in a major North American storm belt. Warm air fronts from the Gulf of Mexico and U.S. South and Midwest often collide with cold polar air masses, providing abundant precipitation in some areas. Locally, winters tend to be snowy and wind-chilled, while summers are humid and longer than elsewhere in Canada. Annually, the area receives approximately 758.2 millimetres (mm) of rain and 223.5 mm of snow (data for Ottawa International Airport), and the temperatures average around 21 degrees Celsius (°C) in July and -10.8°C in January (Environment Canada, 2014).

The following is summarized primarily from the “Air Quality in Ontario 2011 Report” (Ontario Ministry of the Environment [MOE], 2011), with specific data from the closest site to the BIA Study Area (ID 51002) located at 960 Carling Avenue in Ottawa, Ontario, which is approximately 70 km north of the project area. The primary indicator used for air quality in the Province of Ontario is the Air Quality Index (AQI), which is a calculated index developed by the MOE. The AQI provides a standardized measure of air quality across the province and a scientific basis to issue ‘smog alerts’. The AQI is based on the following pollutants that adversely affect human health and the environment: ozone, $PM_{2.5}$ (air particles less than 2.5 micrometres in diameter), nitrogen dioxide, carbon monoxide, sulphur dioxide, and total reduced sulphur compounds. Table 2-2 summarizes the AQIs for 2011 for Ottawa. In total, Ottawa had zero days in which the AQI exceeded 49 for at least 1 hour

Surface Water

The Study Area lies within the Rideau River watershed and is immediately south of the Rideau River along the banks of the Poonamalie Cut. The Earth Dam, which runs in an east-west direction along the length of the BIA Study Area, creates a localized drainage divide, and therefore, runoff drains both north towards the Rideau River and south into the Poonamalie Cut. Minnow Creek, which is in the west of the lock station, connects Rideau River to the Poonamalie Cut and is controlled by the Minnow Creek Waste Weir. The Poonamalie Cut is flooded every year in May for navigational and recreational purposes and

dewatered in early October at the end of the navigational season. East of the lock station remains back watered from the Rideau River.

Large wetland areas are present along both the Rideau River and Poonamalie Cut adjacent to the study area. The marsh south of the BIA Study Area connects to a large and Provincially Significant Wetland, Baccus Marsh, which also is an Area of Natural and Scientific Interest.

Biological Environment

Ecozone and Ecoregion

Overall, the study area is within the northern portion of the Mixedwood Plains Ecozone and the Lake Simcoe-Rideau Ecoregion of Ontario. This ecozone has the highest population density (people) in Canada (35 percent) and in Ontario (92 percent) (Ontario Biodiversity Council, 2011). The landscape has changed over the past hundreds of years from forest, wetlands, prairies, and alvars to being dominated by agriculture and settlement. However, this ecozone still contains the most diverse flora and fauna in Canada (Ontario Biodiversity Council, 2011).

Vegetation

The vegetation in this ecoregion is relatively diverse. Upland forest types include hardwood forests dominated by Sugar Maple, American Beech, White Ash, Eastern Hemlock (Crins et al., 2009). Lowland forests include rich floodplain forests, containing Green Ash, Silver Maple, Red Maple, Eastern White Cedar, Yellow Birch, Balsam Fir, and Black Ash (Crins et al., 2009). According to the Screening Level EA completed in 2006 (PCA, 2007), vegetation found in the BIA Study Area includes:

- Eastern White Cedar (*Thuja occidentalis*)
- Dogwood (*Cornus* sp.)
- Sugar Maple (*Acer saccharum*)
- Ash (*Fraxinus* sp.)
- Birch (*Betula* sp.)
- Current (*Ribes* sp.)
- Cattail (*Typha* sp.)
- Staghorn Sumac (*Rhus typhina*)
- Buckthorn (*Rhamnus* sp.)
- Goldenrod (*Solidago* sp.)
- Aster (*Symphiotrichum* sp.)
- Queen's Anne Lace (*Daucus carota*)
- Orchard Grass (*Dactylis glomerata*)

Wildlife

The fauna in this ecoregion is amongst the most diverse in Canada. Characteristic mammals in the region include the White-tailed Deer, Raccoon, Striped Skunk, and the Woodchuck (Crins et al., 2009). Wetland habitats are home to many bird species, including the Wood Duck, Great Blue Heron, and Wilson's Snipe (Crins et al., 2009). Upland forests in this ecoregion support many bird species, including the Hairy Woodpecker, Wood Thrush, Scarlet Tanager, and Rose-breasted Grosbeak (Crins et al., 2009).

Mammals

According to the Screening Level EA completed in 2006 (PCA, 2007), common mammal species found in the BIA Study Area include:

- Beaver (*Castor canadensis*);
- Eastern Chipmunk (*Tarmius striatus*);
- Red Squirrel (*Tamiasciurus hudsonicus*);
- Eastern Gray Squirrel (*Sciurus carolinensis*).

Birds

According to the Screening Level EA completed in 2006 (PCA, 2007), a survey of habitats in the BIA Study Area identified the following birds:

- Alder Flycatcher (*Empidonax alnorum*);
- American Crow (*Corvus brachyrhynchos*);
- American Goldfinch (*Carduelis tristis*);
- American Robin (*Turdus migratorius*);
- Baltimore Oriole (*Icterus galbula*);
- Belted Kingfisher (*Ceryle alcyon*);
- Black-and-white Warbler (*Mniotilta varia*);
- Blackburnian Warbler (*Dendroica fusca*);
- Black-capped Chickadee (*Poecile atricapillus*);
- Blue Jay (*Cyanocitta cristata*);
- Brown-headed Cowbird (*Molothrus ater*);
- Brown Thrasher (*Toxostoma rufum*);
- Cedar Waxwings (*Bombycilla cedrorum*);
- Common Yellowthroat (*Geothlypis trichas*);
- Eastern Phoebe (*Sayornis phoebe*);
- Gray Catbird (*Dumetella carolinensis*);
- Great Blue Heron (*Ardea herodius*);
- Great Crested Flycatcher (*Myiarchus nuttingi*);
- Hairy Woodpecker (*Picoides villosus*);
- House Wren (*Troglodytes aedon*);
- Least Flycatcher (*Empidonax minimus*);
- Mallard (*Anas platyrhynchos*);
- Mourning Dove (*Zenaida macroura*);
- Nashville Warbler (*Vermivora ruficappila*);
- Northern Cardinal (*Cardinalis cardinalis*);
- Northern Flicker (*Colaptes auratus*);
- Ospreys (*Pandion haliaetus*);
- Pied-billed Grebe (*Podilymbus podiceps*);
- Pileated Woodpecker (*Dryocopus pileatus*);
- Red-eyed Vireo (*Vireo olivaceus*);
- Red-winged Blackbird (*Agelaius phoeniceus*);
- Rose-breasted Grosbeak (*Pheucticus ludovicianus*);
- Ruffed Grouse (*Bonasa umbellus*);
- Scarlet Tanager (*Piranga olivacea*);
- Song Sparrow (*Melospiza melodia*);
- Spotted Sandpiper (*Actitus macularia*);
- Swamp Sparrow (*Melospiza georgiana*);
- Tree Swallow (*Tachycineta bicolor*);
- Yellow Warbler (*Dendroica petechia*);
- Yellow-bellied Sapsucker (*Sphyrapicus varius*);
- Yellow-rumped Warbler (*Dendroica coronate*);
- Veery (*Catharus fuscescens*);
- White-breasted Nuthatch (*Sitta carolinensis*);
- Wood Duck (*Aix sponsa*).

Fish and Fish Habitat

A variety of aquatic plants are found in the Rideau River (Canadian Museum of Nature, 2001). The most common species include fragrant water lily (*Nymphaea odorata*), Common waterweed (*Elodea Canadensis*), Northern Water Milfoil (*Myriophyllum sibiricum*) and Eurasian Water Milfoil (*Myriophyllum spicatum*) (Canadian Museum of Nature, 2001).

The Rideau River has a diverse coolwater fish community. During fish community sampling as part of the Rideau River biodiversity project conducted in 1999-2000, thirty-five fish species were identified within the river (Canadian Museum of Nature, 2001), twenty-two species in the section from Smiths Falls to Burritts Rapids, which includes Poonamalie Lockstation. Species found in this reach include:

- Northern Pike (*Esox lucius*)
- Largemouth Bass (*Micropterus salmoides*)
- Smallmouth Bass (*Micropterus dolomieu*)
- Common Carp (*Cyprinus carpio*)
- Yellow Perch (*Perca flavescens*)
- Greater Redhorse (*Moxostoma valenciennesi*)
- Silver Redhorse (*Moxostoma anisurum*)
- Brown Bullhead (*Ameiurus nebulosus*)
- Black Crappie (*Pomoxis nigromaculatus*)
- Central Mudminnow (*Umbra limi*)
- Brassy Minnow (*Hybognathus hakinsoni*)
- Golden Shiner (*Notemigonus crysoleucas*)
- Blacknose Shiner (*Notropis heterolepis*)
- Mimic Shiner (*Notropis volucellus*)
- Bluntnose Minnow (*Pimephales notatus*)
- Banded Killifish (*Fundulus diaphanus*)
- Brook Silverside (*Labidesthes sicculus*)
- Rock Bass (*Ambloplites rupestris*)
- Pumpkinseed (*Lepomis gibbosus*)
- Bluegill (*Lepomis macrochirus*)
- Tessellated Darter (*Etheostoma olmstedi*)
- Logperch (*Percina caprodes*)

Habitat surrounding the lockstation likely provides spawning, nursery, rearing, migration and feeding habitat for a variety of bait and sport fish species; however, the habitat is not rare or limited in the Rideau system. Habitat upstream and downstream of the lock is within the cut canal and can be considered flat habitat. No critical habitat for at risk fish has been identified adjacent to the Poonamalie Lockstation.

Freshwater mussels found in the Smiths Falls to Burritts Rapids reach include:

- Eastern Elliptio (*Elliptio complanata*)
- Eastern Lampmussel (*Lampsilis radiata*)
- Floater (*Pyganodon sp.*)
- Fluted Shell (*Lasmigona costata*)
- Black Sandshell (*Ligumia recta*)
- Elktoe (*Alasmidonta marginata*)

Herpetiles

Reptiles and amphibians found in this ecoregion include American Bullfrog, Northern Leopard Frog, Spring Peeper, Red-spotted Newt, Snapping Turtle, Eastern Gartersnake, and Common Watersnake (Crins et al., 2009). During multiple site visits in 2005 by resource conservation staff (PCA, 2007), many herpetiles were observed on or near the Earth Dam, including:

- American Bullfrog (Lithobates catesbeianus);
- Green Frog (Lithobates clamitans);
- Gray Treefrog (Hyla versicolor);
- Northern Leopard Frog (*Lithobates pipiens*).

There were also several species of turtles observed during site visits in 2005 (PCA, 2007):

- Blanding's Turtle (*Emydoidea blandingii*);
- Midland Painted Turtle (*Chrysemys picta marginata*);
- Snapping Turtle (*Chelydra serpentina*);
- Eastern Musk Turtle (*Sternotherus odratus*).

Snake habitat in the BIA Study Area may include the following (PCA, 2007):

- Eastern Gartersnake (*Thamnophis* sirtalis sirtalis);
- Gray Ratsnake (*Pantherophis spiloides*);
- Milksnake (*Lampropeltis triangulum*);
- Dekay's Brownsnake (*Storeria dekayi*);
- Red-bellied Snake (*Storeria occipitomaculata*);

- Northern Watersnake (*Nerodia sipedon sipedon*).

Species at Risk

Species at Risk (SAR) are plant or animal species in which individuals or populations are considered *Extirpated, Endangered, Threatened*, or *Special Concern* in Ontario and Canada. The designation for each species is determined by the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC; Government of Canada, 2014). The federal *Species at Risk Act*, *2003* (*SARA*) provides full protection for wildlife species listed under Schedule 1. Schedule 1 species are those that have had their status reports reviewed by an official panel and are currently accepted with COSEWIC designation. *SARA* applies on federal lands only. The federal government's responsibility for listed aquatic species and birds is also covered by the *Fisheries Act* (DFO, 1985) and the *Migratory Birds Convention Act* (*MBCA*, 1994), respectively, which means that protection and prohibitions apply to these species wherever they are found in Canada.

A search was conducted for SAR listed by *SARA* and/or COSEWIC that are potentially located near the BIA Study Area. The species listed in Table 3 were identified based on observations at or near the BIA Study Area listed on the OMNR Natural Heritage Information Centre (NHIC) database in combination with discussion with the Kemptville Ministry of Natural Resources office. The BIA Study Area was located in Region 22 and 10 km2 square 18VQ17. NHIC gives provincial (or Subnational) ranks (i.e., SRanks such as S1) for each species. This ranking is used by NHIC to set protection priorities for rare species and natural communities. Table 2-3 notes which species have been observed more recently in the area. If any SAR at noticed in the BIA Study Area, cease work and contact PCA Environmental Officer Hillary knack, hillary.knack@pc.gc.ca, 613-283-7199 ext. 284) for advice regarding mitigation measure to be implemented to avoid destruction, injury, or interference with the species, its residence and/or its habitat. Species that have a high likelihood of occurring in the BIA Study Area in Table 2-3 have specific mitigation measures in Section 2.5.

Species	Preferred Habitat	NHIC	SARA	COSEWIC	Likelihood of occurrence
Bridle Shiner	The minnow occurs in quiet areas of streams and occasionally in lakes. It is usually found where there is an abundance of aquatic vegetation, where it feeds and spawns. It is tolerant to brackish water but is not acid tolerant, which will likely prevent its spread to acid sensitive areas on the Canadian Shield. It has been found in moderately turbid water but is thought to prefer clear water. Increased clarity of the water caused by the introduced Zebra Mussel (*Dreissena polymorpha*) may have had a positive effect on populations in the upper St. Lawrence River.	No Status	SC	SC	High potential for species to occur within the BIA Study Area (Thompson, Shaun/OMNR, 2014).
Bald Eagle	Bald eagles nest in a variety of habitats and forest types, almost always near a major lake or river where they do most of their hunting. They usually nest in large trees such as pine and poplar.	S2N, S4B	No Status	NAR	Low potential for species to occur within the DIA Study Area. Two sightings occurred in 2007 (OMNR, 2014a) in the area. Bald eagles are in the area but no nests are around the Poonamalie Cut (Thompson, Shaun/OMNR, 2014).

Black Tern	Black terns are found scattered throughout the province, but breed mainly in the marshes along the edges of the Great Lakes. They build floating nests in loose colonies in shallow marshes, especially in cattails. In winter, they migrate to the coast of northern South America.	S3B	No Status	NAR	Low potential. Black terns may occur on the southern side of the Poonamalie Cut in the cattail marshes just outside the DIA Study Area (Thompson, Shaun/OMNR, 2014). Black terns have been observed in the area in 1990 and 2001 but not in the DIA Study Area (OMNR, 2014a).
Bobolink	Historically, Bobolinks lived in North American tall grass prairie and other open meadows. With the clearing of native prairies, Bobolinks moved to living in hayfields. Bobolinks often build their small nests on the ground in dense grasses. S4B No Status THR No potential for species to occur	S4B	No Status	THR	No potential for species to occur within the DIA Study Area. Bobolinks have been observed north of the DIA Study Area (OMNR, 2014a) but their habitat does not occur within the DIA Study Area (Thompson, Shaun/OMNR, 2014).
Least Bittern	The Least Bittern breeds strictly in marshes dominated by emergent vegetation surrounded by areas of open water. Most breeding grounds are dominated by cattails, but also occur in areas with other robust emergent plants and in shrubby swamps. The nests are almost always found within 10 m of open water. Wintering habitat is less specific, and appears to be met by a wide variety of wetlands—emergent marshes, and brackish and saline swamps. Habitat use during migration is poorly known, but is thought to be similar to their breeding and wintering habitat.	SB4	THR	THR	Low potential. Least bitterns may occur in the cattail marshes on the southern side of the Poonamalie Cut, which is outside the BIA Study Area Thompson, Shaun/OMNR, 2014). Least Bitterns have been observed in the area in 1984 but not in the BIA Study Area (OMNR, 2014a).
Blanding's Turtle	The Blanding's Turtle is a primarily aquatic species. In the summer, it is found in several types of freshwater environments, including lakes, permanent or temporary pools, slowflowing streams, marshes and swamps. In general, the species prefers shallow water that is rich in nutrients, organic soil and dense vegetation. Adults are generally found in open or partially vegetated sites, whereas juveniles are more reclusive by nature and prefer areas that contain thick aquatic vegetation including sphagnum, water lilies and algae. They stay along the edge of the water. The Blanding's Turtle also needs terrestrial environments.	S3	THR	THR	High potential for species to occur within the BIA Study Area (Thompson, Shaun/OMNR, 2014). The last sighting of a Blanding's turtle in Poonamalie area was in 2006. The turtle was coming out of a boggy ditch with reeds and bulrushes (Duplain, 2006), along the side of Poonamalie road, within 1 km of the lockstation.
Eastern Musk Turtle	Musk Turtles require shallow water with little or no current and soft earth to bury into when they hibernate. They are sometimes associated with highly vegetated bay areas or wetlands. Nesting habitat is variable, but it must be close to the water and exposed to	S3	THR	SC	High potential for species to occur within the BIA Study Area (Thompson, Shaun/OMNR, 2014). An eastern musk turtle was caught during a turtle survey north of the BIA

	direct sunlight. Eggs are laid in late June and early July, variably on open ground, in shallow excavations in rotting wood, or in shallow gravel and rock crevices. The microhabitat the eastern musk turtle was observed at Poonamalie Dam was a muddy, weedy, stagnant area and the nearest bank was a mature forest (Duplain, 2006).				Study Area along the Rideau River approximately 500 m downstream from the Main Dam (Duplain, 2006). Likely occurrences will be in the marsh areas including the layby (now a cattail marsh) along the south side of the Poonamalie Cut.
Northern Map Turtle	Has been recorded previously in the area. The Northern Map Turtle inhabits both lakes and rivers, showing a preference for slow moving currents, muddy bottoms, and abundant aquatic vegetation.	SC	SC	SC	Likely to occur within the site
Snapping Turtle	The preferred habitat of the species is characterized by slow-moving water with a soft mud bottom and dense aquatic vegetation. Established populations are most often located in ponds, sloughs, shallow bays or river edges, and slow streams, or areas combining several of these wetland habitats.	S3	SC	SC	High potential for species to occur within the BIA Study Area (Thompson, Shaun/OMNR, 2014). There have been several sightings of snapping turtles at Poonamalie during multiple site visits in 2005 by resource conservation staff (PCA, 2007) and an observation in 2010 in the BIA Study Area (OMNR, 2014a). Turtle nesting site and remnants of eggs were found on the Earth Dam in 2006 (PCA, 2007).
Gray Ratsnake (Great Lakes/St. Lawrence population)	Found mainly in Frontenac, Lanark, and Leeds and Grenville counties. The Gray Ratsnake inhabit a wide variety of habitats, with a preference for a mosaic of forest and open habitats, such as fields (abandoned farmland) and rocky outcrops. In winter, they hibernate underground in communal hibernation sites, which are generally located on south-facing relatively rocky slopes. During summer, snakes seek refuge in snags, in hollow logs, in rock crevices, and under rocks to shed and to escape from extreme heat and predators. They must also find suitable sites to warm themselves in the sun. Females nest in the decaying material inside snags, stumps, logs, or compost piles, where the conditions are humid and the temperature is in the 30ºC range.	S3	THR	THR	Low potential for species to occur within the BIA Study Area. The gray ratsnake has not been spotted in the area since 1958 (OMNR, 2014a). The gray ratsnake has been observed in the general area but not within 10 km of the Poonamalie Dam (Thompson, Shaun/OMNR, 2014).
Five-Lined Skink (Great Lakes/St. Lawrence population)	The five-lined skink populations are found on the southern edge of the Canadian Shield, from Georgian Bay to Leeds and Greenville County in south-central Ontario. They favour large rocky outcrops found within fields or mixed coniferous and deciduous forests. Young lizards are frequently found on open,	S3	SC	SC	High potential for the species to occur within the BIA Study Area (Szeto, Harry/PCA. 2014a). The last sighting of five-lined skinks was in 2005 along the Earth Dam by staff of the Rideau

	well-drained, rocky areas where they seek shelter beneath rocks. The availability of suitable microhabitats is extremely important for shelter as they continually take refuge during their short foraging excursions. Objects that can provide protection from extreme temperatures and dehydration are an essential habitat element. As they are prone to dehydration, their habitat must include a permanent water body.				Canal Natural Historic Site of Canada (PCA, 2007).
Butternut	Butternut is mainly encountered as a minor component of deciduous stands, but large pure populations exist on certain flood plains. It grows best in rich, moist, and well-drained soils often found along streams. It may also be found on well drained gravel sites, especially those made up of limestone. It is also found, though seldomly, on dry, rocky, and sterile soils. In Ontario, the Butternut generally grows alone or in small groups in deciduous forests, commonly associated with trees such as Linden, Black Cherry, Beech, Black Walnut, Elm, Hemlock, Hickory, Oak, Red Maple, Sugar Maple, Yellow Poplar, White Ash and Yellow Birch.	S3	END	END	High potential for species to occur within the BIA Study Area. *Juglans cinerea* is known to occur along the berm and associated work site (Thompson, Shaun/OMNR, 2014). According to OMNR (2014a), it was last observed in 1967 in the general area but outside the BIA Study Area.
Flooded Jellyskin	The Flooded Jellyskin will grow only on periodically inundated surfaces; it is usually found on the bark of trees, along the banks of ponds and waterways, and in swampy forests that flood every spring. This lichen grows almost exclusively on the bark of deciduous trees such as ashes, Red Maples, Silver Maples and American Elms, and it is always found below the high-water mark.	S3	THR	THR	Low potential for species to occur within the BIA Study Area. All known populations are documented and the closest population to the BIA Study Area is 30 km

The desktop study of SAR within the BIA Study Area indicated six SAR with high potential to occur within the BIA Study Area: Bridle Shiner, Blanding's Turtle, Eastern Musk Turtle, Snapping Turtle, Five-lined Skink and Butternut. Three of the listed SAR have been seen within the BIA Study Area in the last 10 years: Blanding's Turtle, Snapping Turtle and Five-lined Skink.

Cultural Resources

Poonamalie lockstation is located on a canal off of the Rideau Canal. The site was constructed in 1830, and contains a clay earthen dam that extends westward towards the mouth of the canal. This segment is a part of the original canal construction of the site, and was completed in 1832. Running along the north side of the Clay Dam is a waste weir, which is located 375 meters from the lock station. A defensible stone lockmaster's house was built in 1838-1842.

This location had the first set of rapids at the head of the Rideau River. The rapids were 240 yards (220 m) in length, descending in that distance 8 feet, 5 inches (2.6 m), and with a depth of water over the site where it was proposed to construct a dam of 1 foot, 3 inches (0.4 m). The lock was known

interchangeably as First Rapids and Poonamalie until the late 1850s, when Poonamalie became more common. The lock was built in a section with stiff clay and boulders. The sills and part of the breastwork were made of cement, but the floor was made of wood, hemlock planks placed upon large sleepers, also made of hemlock. The lock's construction is typical of the Rideau Canal; the walls, wing walls, upper and lower gate monoliths and coping are made of masonry. The lock walls are made up of sandstone. The top of the lock stood 4 feet, 8 inches (1.4 m) above the normal water level to guard against spring flooding. The lock was built with a lift of 6 feet, 4 inches (1.9 m). The lock underwent extensive repairs in 1907-08 and in 1913 the wooden floor of the lock was redone in concrete.

There have been a number of repairs done on the lock site, but there is a concerted effort to maintain the appearance of the materials used in the construction of the lock. In 1973, the timber wharf on the upper south side was replaced with a reinforced concrete wharf of 76 meters. In 1974, there was a lock restoration project carried out during the fall and winter, due to deterioration of the masonry at and below the waterline. Since this period, there have been only minor preventative repairs. Between 1984 and 1985, the wharf on the lower north side was replaced with a 40 meter timber crib wharf.

These assets are fundamental cultural resources of the Canal system and integral to the Rideau's unique historical environment.

Archaeology

Poonamalie lockstation was constructed at the first set of rapids on the Rideau River, approximately 5 km upstream of Smiths Falls. Originally spelt Poonamallee and named after Poovirundavalli, a British garrison town in India, today the lockstation contains a masonry lock, defensible lockmaster's house and a concrete overflow dam (Watson 2017:28; Passfield 1982:102).

South side of lock:
There has been limited terrestrial archaeological investigations conducted at Poonamalie south of the lock. In 2009, archaeological work was conducted in advance of a power line installation. The power line was installed using a small backhoe. The backhoe uncovered portions of a foundation adjacent to the lock office. The foundations are most likely associated with the 1908-1967 store house at this location. Historical documentation shows numerous other buildings in the area of the lock office, mainly to the south and east.

North side of lock:
Archaeological work was conducted in 1984-1985 around the Lock Master's house, numerous sheds, and the barn. None of these historic buildings are within the project zone as the "extent of construction" is limited to a short buffer along the canal's edge.

Historic features that may be impacted by this work include the non-extant Store House (1867–1908), the former Lock Labourer's garden and possible privy. Any remnants of the Store House would be located within the earthen dam that borders the canal, and the garden and privy were situated south of the lock (See PCA for AOA showing Figures 1 and 2). These areas are considered to be archaeologically sensitive and are indicated in red on Figure 6 of the AOA attached (appendix 5).

7. EFFECTS ANALYSIS

The scope of the BIA is to assess the Project as described in the Scope of Project and in accordance with PCA's Scope of Work and CEAA 2012. This assessment includes the timing and activities associated with site preparation, removal of vegetation, coffer dam construction, restoration of lock masonry and restoration/cleanup of the site. Spatially, the BIA Study Area includes property owned by PCA (Figure 1). This environmental effects evaluation considers the full range of Project/environment interactions and the environmental factors that could be affected by the Project and the significance of related effects after mitigation. The environmental effects of the Project included at a minimum those described under subsection 5(1) and 5(2) of CEAA 2012.

Physiography, Geology, Soil, and Groundwater

The use of heavy machinery increases the risk of soil contamination if there is a spill or leak of a hazardous material (i.e. fuels, hydraulic fluids); however, this risk will be minimized through the implementation of appropriate mitigation measures.

Project activities will result in soil being disturbed and/or exposed to erosion processes including wind and surface water runoff. Potential contamination of soil in BIA Study Area through spills of deleterious substances from machinery, chemicals stored within or adjacent to the BIA Study Area and/or vehicles

Construction activities will results in temporary disturbance and/or exposure of soil however impacts can be limited through the implementation of mitigation measures. There is the potential for accidental spills to occur during the Project however spills can be avoided through the application of best management practices and mitigation measures and should a spill occur the application of appropriate clean up related mitigation measures will minimize impacts to the environment.

Climate and Air Quality

The short-term use of machinery/equipment will generate exhaust and smoke emissions that could affect air quality. Minor, temporary air emissions associated with dust and particulate during construction/masonry repair. Such effects are likely to be confined to the Project Study Area and can be limited through the application of mitigation measures.

Surface Water

Reduced water quality and clarity because of increased erosion, sedimentation, transport of debris or from point or nonpoint sources of pollution (e.g. discharge of waters, leaks and accidental spills, contaminated groundwater inputs, inputs of contaminants from construction activities and from surface runoff.

There is the potential for accidental spills to occur or debris to be released during the Project however these can be avoided through the application of best management practices and mitigation measures and should a spill occur the application of appropriate clean up related mitigation measures will minimize impacts to the environment. These can be avoided through the application of best management practices and mitigation measures and should a spill occur the application of appropriate clean up related mitigation measures will minimize impacts to the environment. Turbidity monitoring is also recommended to monitor turbidity levels in the Poonamalie Cut.

Terrestrial Vegetation

Project activities will require minor removal of terrestrial vegetation. The vegetation removed includes a few cedar trees to access the coffer dam area and potentially minor impacts to shrubs and grasses. No species at risk vegetation is located in the immediate project area. Additional vegetation at this location may be removed for the creation of a staging area species noted in this area were poison ivy and virgina creeper. The vegetation removal requriements will be detailed in the contractors EMP to ensure that SAR and Breeding Bird mitigation is adhered to.Vegetation loss will be short-term in nature, since the area will be re-colonized by vegetation after construction. A tree planting/ vegeation plan will developed to replace vegetation removed for the project.

Some environmental effects will persist after mitigation measures are implemented. This will result in minor small-scale habitat loss for birds and mammals. Rehabilitation will help the area naturalize more quickly, and provide some cover for wildlife.

Aquatic Resources and Fish and Fish Habitat

The potential environmental effects of project activities on fish and fish habitat include interference with biological time periods (i.e., migration or spawning), the addition of suspended solids to the water column through erosion and sedimentation, potential stranding of fish during dewatering and direct mortality of fish. The dewatered work area will be altered during construction but it will be restored to pre-construction conditions before being re-watered.

Erosion and sedimentation events may occur as a result of project activities, potentially increasing the amount of suspended solids in the water column. Such events can cause increased sediment loads potentially harming fish by altering foraging behaviour and causing physical damage to gills and scales. Increased sediment loads can also smother benthic invertebrates (a primary food source for many fish species) and cover/infill course spawning habitat as silt settles.

Spills of fuels or hydraulic fluid from construction equipment could negatively impact surface water quality.

Despite the potential effects of project activities, with the proper implementation of mitigation measures to protect against sedimentation, to protect against spills, and to ensure work does not occur during sensitive timing windows, it is not anticipated that there will be residual negative impacts to aquatic resources.

Wildlife

Birds

Migratory birds, their nests and eggs are protected under the Migratory Birds Convention Act (1994). Project works that are potentially disruptive activities to nesting birds, such as vegetation clearing, should be avoided during the nesting period. The Poonamalie Lockstation project site is located within Environment Canada nesting zone C2. For open habitats within this zone, the nesting period may begin as early as the end of March and last as long as until the end of August. However, the majority of nesting takes place between early May and late July. This project will commence Thanksgiving in October and continue through the fall and winter. No vegetation clearing should occur before August 28th. If vegetation clearing must take place between the start of project and August 28th, an avian biologist must conduct a

nest survey to identify active migratory bird nests in the area to be cleared. If active nests are found, a buffer must be established and vegetation cannot be cleared within the buffered area until the nest is no longer in use.

Removal of vegetation at the lockstation will result in habitat loss for migratory birds; however, the habitat loss is short-term (vegetation will grow back naturally or through the tree replanting program) and negligible when looking at the amount of vegetation within the entire study area. Construction activity/disturbance also has the potential to displace foraging birds from around the project site, but the displacement will be temporary in duration and will cover a very small footprint.

Other Wildlife

Project activities will take place outside of reptile and amphibian nesting season. However, reptiles and amphibians may still be found on site as they migrate to overwintering habitat in the case of turtles, or as they forage in the case of snakes. Mitigation measures that will be employed to reduce the risk of turtles from entering the site will also work to reduce the risk of snakes from entering the site. Foraging opportunities for wildlife will be limited by the disturbance on site during construction, but the disturbance will be temporary and the habitat type being disturbed is widespread on the landscape outside the area of disturbance.

With the proper implementation of mitigation measures, there should be no residual negative impact to wildlife.

Species at Risk

As identified in Table 1, a number of species at risk have the potential to be present in the project area. For species that do not have critical habitat identified through a recovery strategy, either the planned works will not impact their habitat of individuals, for example the bat species, or mitigation measures will be employed to protect individuals and their habitat.

The Species at Risk Act (SARA) provides protection to all species at risk listed under Schedule 1 of the Act. Under SARA, critical habitat is defined as “the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in the recovery strategy or in an action plan for the species”. Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species’ critical habitat to the extent possible, as well as examples of activities that are likely to result in its destruction. As outlined in Table 1, the project area lies in zones of critical habitat identified in the recovery strategy of one threatened species; the Eastern Musk Turtle and has the potential off other individual species being present within the project area. The effects on individual species and their habitats have been listed below:

Eastern Musk Turtle

The proposed recovery strategy for the Eastern Musk Turtle (Environment Canada, 2016) describes Eastern Musk Turtle habitat as stagnant or slow-moving shallow wetlands that are connected to larger permanent waterbodies or shallow bays of lakes and rivers. In Canada, Eastern Musk Turtles have been found in different types of waterbodies, such as lakes, ponds, marshes, rivers and streams; however, Eastern Musk Turtle seems to require water with abundant emergent, floating, and submerged aquatic vegetation that provides surface cover, which may be important for foraging, adult and juvenile refuge, and thermoregulation. Furthermore, they are often found in areas with a soft substrate such as sand or

organic mud where they can readily bury themselves, and also areas with gravel bottoms (Environment Canada, 2016). The Rideau River, from Lower Rideau Lake, west of Poonamalie Lockstation, to a section of river between Edmonds Locksation and Kilmarnock Lockstation has been mapped as potential critical habitat. Eastern Musk Turtles are known to inhabit the Rideau River in the general area of Edmonds (two were observed at the Parks Canada Woods Mill building in Smiths Falls in May 2016). Also, the aquatic habitat at the downstream portion of the Poonamalie Lockstation exhibits the biophysical attributes of foraging/ thermoregulation/mating and commuting/dispersal critical habitat as defined in the recovery strategy, and the terrestrial habitat exhibits the biophysical attributes of commuting critical habitat (COSEWIC, 2016). The upstream area is seasonally drained and therefor habitat quality is significantly reduced.

The impact to Eastern Musk Turtle will be caused by the placement of a cofferdam downstream of the lock. The cofferdam will cover approximately 120 m^2 of Eastern Musk Turtle habitat. Compared to the 1082 ha of continuous riverine habitat that has been identified in the recovery strategy (1 ha = 10000 m^2), the amount of habitat that will be temporarily unavailable due to the cofferdam is neglible. A full assessment can be found in Appendix 2.

Blanding's Turtle

Suitable Blanding's Turtle overwintering habitat typically includes permanent bogs, fens, marshes, ponds, channels or other habitats with free (unfrozen) shallow water. Blanding's Turtles studied in Algonquin Provincial park overwintered in wetlands with free water depths of 7 cm - 50 cm. This species may also hibernate within graminoid shallow marsh areas of larger marsh complexes by burying into substrates in areas of pooled water. Blanding's Turtle's may also overwinter in seasonal pools or small excavated areas with standing water (MNR, 2014).

Impacts to Blanding's Turtle may be caused by the placement of a temporary cofferdams around the downstream lock walls in the dewatered area, restricting access to potential over-wintering habitat (the upstream is dewatered annually). The amount of habitat that will be temporarily unavailable due to the cofferdams is negligible/non-existent.

Northern Map Turtle

As described in the Management Plan: overwintering sites for the Northern Map Turtle are typically deep, oxygen-rich lake or river bottoms that are sheltered from ice, with sand or gravel substrate and varied bottom features, such as exposed ledges, boulders, and tree trunks (Flaherty 1982; Bonin 1998; Graham et al. 2000; Ultsch 2006; Carrière 2007). Graham et al. (2000) describe the overwintering site at their study area as having very slow current; however, the presence of current has been observed at other overwintering sites (Bernier and Rouleau 2010). Northern Map Turtles have been recorded hibernating at depths between 0.3 m and 11.3 m (Bernier and Rouleau 2010; Harrison 2011; Rouleau and Bernier 2011). This species requires an oxygen-rich environment for over-wintering as they are relatively intolerant of anoxic environments (Ultsch 2006).

Northern Map Turtles prefer to nest in open locations receiving full sun, generally occurs within 3 to 35 m of the water's edge on a variety of habitat types, including (but not limited to) sand beaches and dunes, gravel piers and old quarries, rocky outcrops with thin soil deposits, as well as maintained sites.

Impacts to Map Turtle may be caused by restricting access to overwintering habitat, however the amount of habitat that will be temporarily unavailable due to the cofferdams is negligible/non-existent. There is potential for there to be overwintering nests in the project area. The lock area does not exhibit good aquatic habitat for turtles and individuals can be relocated outside the project dewatering area. The project is being completed in the fall and winter so there would be no likely interaction with active nesting Impacts to Northern Map Turtle that may be caused by the use of the parking area as laydown areas. There is potential for there to be overwintering nests in the project area however hatching would likely occur after the project is complete.

Snapping Turtle

As described in the Management Plan, Snapping Turtles overwintering habitat includes lotic, lentic and mud environments (Brown and Brooks, 1994; Paterson et al., 2012). Within these habitats, the turtles appear to prefer the following characteristics for their hibernacula: water shallow enough to let the turtle reach the surface to breathe, but deep enough so the water will not freeze to the bottom; a location that is likely to freeze over later in the season and thaw earlier in the spring; a thick layer of mud in which the turtle can bury itself; and additional submerged cover, such as a floating mat of vegetation, roots, stumps, branches or logs, a muskrat dwelling or an overhanging bank (Meeks and Ultsch, 1990).

The eggs are generally laid on sand or gravel banks near the water, in locations where vegetation is absent or sparse. Although a wide range of other sites that are easy to dig into are also used, including beaver and muskrat lodges, roadsides, artificial dam and railway embankments, cracks in rocky banks, sawdust piles, disturbed soil, gardens, lawns, forest clearings and farm fields, nesting success at these sites is unknown (Obbard and Brooks, 1980; Congdon et al., 2008; Ernst and Lovich, 2009).

The lock area does not exhibit good aquatic habitat for Snapping turtle and individuals can be relocated outside the project dewatering area. The project is being completed in the fall and winter so there would be no likely interaction with nesting Impacts to Snapping Turtle that may be caused by the use of the parking area as laydown areas. There is potential for there to be overwintering nests in the project area however hatching would likely occur after the project is complete.

Bridle Shiner

The minnow occurs in quiet areas of streams and occasionally in lakes. It is usually found where there is an abundance of aquatic vegetation, where it feeds and spawns. It is tolerant to brackish water but is not acid tolerant, which will likely prevent its spread to acid sensitive areas on the Canadian Shield. It has been found in moderately turbid water but is thought to prefer clear water. Increased clarity of the water caused by the introduced Zebra Mussel (*Dreissena polymorpha*) may have had a positive effect on populations in the upper St. Lawrence River.

The upper reach of the lock is dewatered each fall and does not exhibit good aquatic habitat for Bridle Shiner (little aquatic vegetation). The lower reach does contain better habitat and there will be a minor temporary loss due to the placement of the coffer dam and dewatering. There is abundant habitat in the area and there will little effect on the species. Individuals trapped in the work area will be relocated outside the project dewatering area. The project is being completed in the fall and winter so there would be no interaction with spawning activities.

Least Bittern

The Least Bittern breeds strictly in marshes dominated by emergent vegetation surrounded by areas of open water. Most breeding grounds are dominated by cattails, but also occur in areas with other robust emergent plants and in shrubby swamps. The nests are almost always found within 10 m of open water. Wintering habitat is less specific, and appears to be met by a wide variety of wetlands—emergent marshes, and brackish and saline swamps. Habitat use during migration is poorly known, but is thought to be similar to their breeding and wintering habitat.

While there are reported breeding sites near the project area, Least Bittern Habitat is not present in the direct project area. In addition the work will be conducted during the fall and winter when the species is not present. Construction will be complete prior to the breeding season.

Grey Ratsnake

Found mainly in Frontenac, Lanark, and Leeds and Grenville counties. The Gray Ratsnake inhabit a wide variety of habitats, with a preference for a mosaic of forest and open habitats, such as fields (abandoned farmland) and rocky outcrops. In winter, they hibernate underground in communal hibernation sites, which are generally located on south-facing relatively rocky slopes. During summer, snakes seek refuge in snags, in hollow logs, in rock crevices, and under rocks to shed and to escape from extreme heat and predators. They must also find suitable sites to warm themselves in the sun. Females nest in the decaying material inside snags, stumps, logs, or compost piles, where the conditions are humid and the temperature is in the 30ºC range.

It is not likely, that the species will be in the area since the last reported sighting was greater than 10km away. In addition there is not a lot of suitable habitat present. The work will occur when the species would be hibernating and there isn't a suitable hibernaculum in the direct project area. There will be mitigation for snake and turtle exlusion from the construction area.

Five-Lined Skink (Great Lakes/St. Lawrence population)

The five-lined skink populations are found on the southern edge of the Canadian Shield, from Georgian Bay to Leeds and Greenville County in south-central Ontario. They favour large rocky outcrops found within fields or mixed coniferous and deciduous forests. Young lizards are frequently found on open, well-drained, rocky areas where they seek shelter beneath rocks. The availability of suitable microhabitats is extremely important for shelter as they continually take refuge during their short foraging excursions. Objects that can provide protection from extreme temperatures and dehydration are an essential habitat element. As they are prone to dehydration, their habitat must include a permanent water body.

There are confirmed sitings in the vicinity of the project area so mitigation will be important to protect the species. If encountered the work will stop until the animal escapes the work area. Overwintering habitat is not likely within the work area as it is reported that the species needs to be below the frost line but above the high water mark. Habitat within the work are does not meet this attribute.

Butternut

Butternut is mainly encountered as a minor component of deciduous stands, but large pure populations exist on certain flood plains. It grows best in rich, moist, and well-drained soils often found along streams. It may also be found on well drained gravel sites, especially those made up of limestone. It is also found, though seldomly, on dry, rocky, and sterile soils. In Ontario, the Butternut generally grows alone or in small groups in deciduous forests, commonly associated with trees such as Linden, Black Cherry, Beech, Black Walnut, Elm, Hemlock, Hickory, Oak, Red Maple, Sugar Maple, Yellow Poplar, White Ash and Yellow Birch.

A site visit was conducted and the likely area that trees that are to be removed for the project are eastern white cedar, no Butternut were noted within the tree removal area. The contractor will require a vegetation removal plan that will be reviewed by PCA to ensure Butternut are not being affected.

Conclusion

Activities undertaken in relation to the project shall be in compliance with the federal Species at Risk Act and the Ontario Endangered Species Act, S.O. 2007, c. 6. According to that legislation, if work can be conducted in a manner that avoids adverse effects on protected species and habitats, an authorization under the ESA is not required. Parks Canada intends to fully protect SAR species and project mitigation will result in no negative effects on these species. In addition the contractor will be required to have a SAR/ESA training plan for the workers on site.

Cultural Resources

The heritage value of the Poonamalie Lock and landscape and associated cultural resources of national historic significance is justified by their:

- Associative and physical connection with the construction and early operation of the Canal;
- Contribution to the unique historical environment of the Canal system;
- Visual and historic associations with heritage communities along the Canal system such as Chaffey's Lock, Newboro, Merrickville, Burritt's Rapids and Ottawa;
- Role as landmarks and providing a sense of continuity along the Canal system;
- Surviving historic layout and configuration including their open spaces and circulation patterns;
- Surviving historic views both within and beyond the station boundaries; and,
- Contextual and heritage settings for the stations‟ buildings and engineering works.

Engineering works of national significance on the Rideau Canal are also valued for their:

- integral role in the continuing operation of the navigation system;
- surviving physical attributes of form, material and function;
- manual mode of operation; and
- contribution to knowledge relating to early 19th century engineering and construction techniques.

The heritage value ascribed to cultural resources, guides conservation efforts and investments. Under the Cultural Resource Management (CRM) Policy, conservation of heritage value must be a primary consideration in any intervention directed at a cultural resource. Therefore, the primary recommended conservation approach based on the Standards and Guidelines for the Conservation of Historic Places in Canada is preservation with an emphasis on minimal intervention. Preservation involves protecting, maintaining and stabilizing the existing form, material and integrity of an historic place or individual component, while protecting its heritage value. Preservation can include both short-term and interim measures to protect or stabilize the place, as well as long-term actions to stave off deterioration or prevent damage. Minimal intervention in the context of heritage conservation is defined as the approach that allows functional goals to be met with the least physical intervention.

Although the Poonamalie Lock 32 and Landscape are considered to be cultural resources of national significance, it is not anticipated that the project of rehabilitating the lock will negatively impact the site if appropriate mitigation measures are employed. In principle, the proposed interventions are recommended as they conform to the "minimal intervention" approach of the Standards and Guidelines.

As such, the primary treatment is that of preservation and Standards 1-9 are applicable along with the relevant Guidelines on Cultural Landscapes (Section 4.1), Engineering Structures (Section 4.4) and Materials (Section 4.5). These guidelines are to be reviewed and applied by the contractor.

Archaeology

Project activities could adversely impact archaeological resources that exist below the ground surface at Poonamalie lockstation. An Archaeological Overview Assessment (AOA) was completed by Parks Canada's Archaeology Section to evaluate the archaeological potential of the Project Area identified and determine if an Archaeological Impact Assessment and/or mitigation measures are required (see AOA for full document. Mitigation is contained in Appendix 3). The AOA determined that Project activities could impact potential archaeological resources pertaining to the construction and/or operation of the waterway.

Areas in front of and to the east of the lock office have been proposed as staging areas for the construction work. These areas are acceptable for staging. Additionally, a fenced construction yard will also be required. This construction yard is proposed to be located in the car park, northeast of the locks. The use of the car park as a construction yard is acceptable.

The remaining Project activities may adversely impact archaeological resources that exist below the surface, including evidence of the construction and/or operation of the waterway and its associated historic buildings. Mitigation, including ceasing work should artifacts be found will reduce/eliminate adverse effects

8. MITIGATION MEASURES

See Appendix 3 for Mitigation Measures.

9. PUBLIC/STAKEHOLDER ENGAGEMENT & ABORIGINAL CONSULTATION

9 a) Indicate whether public/stakeholder engagement was undertaken in relation to potential adverse effects of the proposed project:

☒ No

☐ Yes (describe the process to involve relevant parties and indicate how comments were taken into consideration).

9 b) Indicate whether Aboriginal consultation was undertaken in relation to potential adverse effects of the proposed project:

☒ No

☐ Yes (describe the process to involve relevant parties and how the results were taken into consideration).

The proposed works are simply the maintenance and rehabilitation of existing assets. There will be no substantial alteration to the assets or change in water management. For this reason public and Indigenous consultation was not conducted.

10. SIGNIFICANCE OF RESIDUAL ADVERSE EFFECTS

No residual adverse effects are anticipated with the proper implementation of mitigation measures.

11. SURVEILLANCE

☐ Surveillance is not required

☒ Surveillance is required (provide details such as the proposed schedule and the focus of inspections)

An Environmental Assessment Officer will visit the site regularly during construction to ensure that mitigation measures are in place, working as anticipated and are effective at preventing adverse effects to natural and cultural heritage features.

12. FOLLOW-UP MONITORING

Follow-up monitoring is:

☒ not required

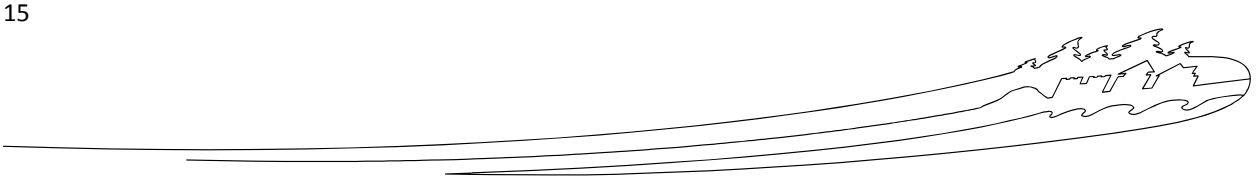
☐ legally required (e.g. under the *Species at Risk Act* or *Fisheries Act)*

☐ required in accordance with the *Parks Canada Cultural Resource Management Policy*

13. SARA NOTIFICATION

Notification is:

☒ not required



☐ required under the *Species at Risk Act* (outline the nature of and response to any notification).

14. EXPERTS CONSULTED

Include Parks Canada experts. Add as many entries as necessary for the project.

Department/Agency/Institution: Parks Canada Agency	Date of Response: July 19, 2017
Expert's Name & Contact Information: Barbara Leskovec	Title: Federal Infrastructure Investments Archaeologist
Expertise Requested: Archaeological assessment of the work area at Edmonds	
Response: Planned work area has been previously disturbed so archaeological potential is low. No go zones are identified and Work to halt if archaeological artifacts are encountered.	

Department/Agency/Institution: Parks Canada Agency	Date of Response: July 19, 2017
Expert's Name & Contact Information: Nathalie Desrosiers	Title: Policy Advisor, Cultural Resources Management
Expertise Requested: Cultural resource impact assessment	
Response: Response incorporated into the BIA.	

15. DECISION

Taking into account implementation of mitigation measures outlined in the analysis, the project is:

☒ not likely to cause significant adverse environmental effects.

☐ likely to cause significant adverse environmental effects.

16. RECOMMENDATION AND APPROVAL

(Add additional blocks as required)

Prepared by (EIA Author): Shaun McIntosh, Environmental Assessment Officer	Date: 2017-07-21
Signature:	
Recommended by: Valerie Minelga, Environmental Assessment Scientist	Date: 2017-07-21
Signature:	
Approved by (Director of Ontario Waterways): Jewel Cunningham, Director, Ontario Waterways	Date: YYYY-MM-DD
Signature:	

17. ATTACHMENTS

Appendix 1 - Environmental Impact Analysis Tool: Effects Identification Matrix
Appendix 2 - Critical Habitat Destruction Analysis for Edmonds Lock 25, Weir and Overflow Dam Heritage Stone Masonry Rehabilitation
Appendix 3 – Mitigation Measures
Appendix 4 – Site Photos

18. NATIONAL IMPACT ASSESSMENT TRACKING SYSTEM

☒ Project registered in tracking system

☐ Not yet registered *(CEAA 2012 requires PCA submit a report to Parliament annually. EIAs must be entered in the tracking system* ***by the end of April*** *to enable reporting*.

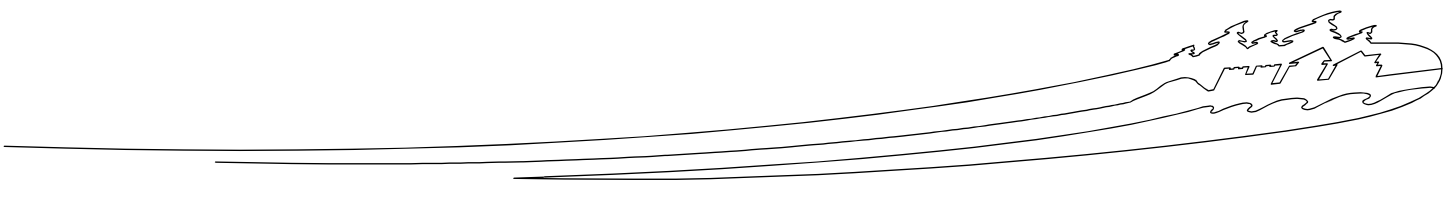
Appendix 1 - Environmental Impact Analysis Tools: Effects Identification Matrix

Section A *focuses on direct effects of the project and* ***Section B*** *on indirect effects that are caused by changes to the environment.*

A. Direct Effects										
			Valued components potentially directly affected by the proposed project							
			Natural Resources					Cultural Resources		
			Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora (specify, including SAR)	Fauna (specify, including SAR)	Poonamalie Lockstation Landscape	Poonamalie Cultural Resources of National Significance (Lock),
	Phase	Examples of Associated Activities							
Project Components	Preparation / Construction / Operation / Decommissioning	Supply and storage of materials	☐	☐	☒	☐	☐	☐	☐
		Burning	☐	☐	☐	☐	☐	☐	☐
		Clearing	☐	☒	☐	☒	☒	☒	☐
		Demolition	☒	☐	☐	☐	☐	☐	☒
		Disposal of waste	☐	☐	☒	☐	☐	☐	☐
		Blasting/ Drilling	☐	☐	☐	☐	☐	☐	☐
		Dredging	☐	☐	☐	☐	☐	☐	☐
		Drainage	☐	☐	☐	☐	☐	☐	☐
		Excavation	☐	☒	☒	☐	☐	☒	☐
		Grading	☐	☒	☐	☐	☐	☒	☐
		Backfilling	☐	☐	☐	☐	☐	☐	☐
		Use of machinery	☒	☒	☒	☐	☐	☐	☐
		Transport of materials/ equipment	☐	☐	☐	☐	☐	☐	☐
		Building of fire breaks	☐	☐	☐	☐	☐	☐	☐
		Use of Chemicals	☐	☐	☐	☐	☐	☐	☐
		Set up of temporary facilities	☐	☐	☐	☐	☐	☐	☐
		Other…	☐	☐	☐	☐	☐	☐	☐

A. Direct effects continued										
			Valued components potentially affected by the proposed project							
			Natural Resources					Cultural Resources		
			Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora (specify, including SAR)	Fauna (specify, including SAR)	Poonamalie Lockstation Landscape	Poonamalie Cultural Resources of National Significance (Lock)
	Phase	**Examples of Associated Activities**							
Project Components	Preparation / Construction / Operation / Decommissioning	Waste disposal	☐	☒	☒	☐	☒	☐	☐
		Wastewater disposal	☐	☒	☒	☐	☐	☐	☐
		Maintenance	☐	☐	☐	☐	☐	☐	☐
		Use	☐	☐	☐	☐	☐	☐	☐
		Use/Removal of temporary facilities	☐	☐	☐	☐	☐	☐	☐
		Use of Chemicals	☐	☐	☐	☐	☐	☐	☐
		Active fire stage	☐	☐	☐	☐	☐	☐	☐
		Prescribed burn cleanup	☐	☐	☐	☐	☐	☐	☐
		Planting	☐	☐	☐	☐	☐	☐	☐
		Culling	☐	☐	☐	☐	☐	☐	☐
		Vehicle Traffic	☐	☐	☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐	☐	☐

B. Indirect Effects (all phases)							
		Impacts as a result of changes to the environment					
		With respect to non-Aboriginal peoples:	With respect to Aboriginal peoples:		With respect to visitor experience		
		Health and socio-economic conditions	Health & socio-economic conditions	Current use of lands and resources for traditional purposes	Access & services	Recreation & accommod'n opportunities	Safety
Phase	**Natural resource components affected by the project**						
Preparation /construction operation/implementation/decommissioning	Could impacts to <u>air</u> lead to adverse effects on…	☐	☐	☐	☐	☒	☐
	Could impacts to <u>soils and landforms</u> lead to adverse effects on…	☐	☐	☐	☐	☐	☐
	Could impacts to <u>water</u> (e.g. surface, ground water and water crossings) lead to adverse effects on…	☐	☐	☐	☐	☒	☐
	Could impacts to <u>flora</u> (including SAR) lead to adverse effects on…	☐	☐	☐	☐	☐	☐
	Could impacts to <u>fauna</u> (including SAR) lead to adverse effects on…	☐	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐	☐



Appendix 2 Critical Habitat Destruction Analysis for Poonamalie Lock 32, Heritage Stone Masonry Rehabilitation

Part A - General Information					
Date	**Where this activity will occur:**	**SAR implicated by this activity:**	**Project**	**Author**	**Collaborators**
June 2017 Rideau Canal NHS Poonamalie Lockstation		Eastern Musk Turtle (*Sternotherus odoratus*) Threatened Schedule 1	Poonamalie Lock 32, Weir and Overflow Dam Heritage Stone Masonry Rehabilitation	C. Strand V. Minelga	

Part B – Determining whether the proposed activitiy(ies) affects critical habitat

1. For the implicated SAR listed in Part A, does the proposed activity(ies) affect habitat within a bounding polygon of critical habitat identified in a recovery strategy or action plan?

☐ **No.** The proposed activity(ies) will not affect habitat within a bounding polygon of critical habitat. Critical habitat is not affected. No need to continue with analysis. **Check the first box in Part D and attach this analysis form to your assessment document.**

☒ **Yes.** The proposed activity(ies) will affect habitat within a bounding polygon of critical habitat for one or more SAR. **Continue to Question 2.**

2. Does the habitat meet the biophysical attributes of critical habitat for the implicated SAR listed in Part A, as described in the recovery strategy or action plan for the species?

- A site survey may be required to determine the biophysical attributes of the affected habitat.

☒ **No.** The habitat does not meet the biophysical attributes of critical habitat for any of the implicated SAR; the affected habitat is not critical habitat. No need to continue with analysis. **Check the first box in Part D and attach this analysis form to your assessment document.**

☒ **Yes.** The habitat meets the biophysical attributes of critical habitat. The affected habitat IS critical habitat for one or more SAR. **For each affected SAR describe the biophysical attributes that are affected and continue to Part C of this analysis when completing the *Residual Adverse Effects* section of your assessment.**

Eastern Musk Turtle

The proposed recovery strategy for the Eastern Musk Turtle (Environment Canada, 2016) describes Eastern Musk Turtle habitat as stagnant or slow-moving shallow wetlands that are connected to larger permanent waterbodies or shallow bays of lakes and rivers. In Canada, Eastern Musk Turtles have been found in different types of waterbodies, such as lakes, ponds, marshes, rivers and streams; however, Eastern Musk Turtle seems to require water with abundant emergent, floating, and submerged aquatic vegetation that provides surface cover, which may be important for foraging, adult and juvenile refuge, and thermoregulation. Furthermore, they are often found in areas with a soft substrate such as sand or organic mud where they can readily bury themselves, and also areas with gravel bottoms (Environment Canada, 2016). The Rideau River, from Lower Rideau Lake, west of Poonamalie Lockstation, to a section of river

between Edmonds Locksation and Kilmarnock Lockstation has been mapped as potential critical habitat. Eastern Musk Turtles are known to inhabit the Rideau River in the general area of Edmonds (two were observed at the Parks Canada Woods Mill building in Smiths Falls in May 2016). Also, the aquatic habitat at Edmonds Lockstation exhibits the biophysical attributes of foraging/thermoregulation/mating and communting/dispersal critical habitat as defined in the recovery strategy, and the terrestrial habitat exhibits the biophyscial attributes of commuting critical habtiat (COSEWIC, 2016). Therefore, Poonamalie lockstation contains both aquatic and terrestrial critical habitat for the Eastern Musk Turtle.

Photo 1. Dewatered cut immediately upstream of Poonamalie Lockstation (May 2016).

Photo 2. Wetland with emergent, floating and submerged vegetation, downstream of the lockstation

☐ **Uncertain.** The habitat may meet the biophysical attributes of critical habitat. The affected habitat MAY BE critical habitat for one or more SAR. **For each affected SAR describe the biophysical attributes that may be affected and continue to Part C of this analysis when completing the *Residual Adverse Effects* section of your assessment.**

Part C – Determining whether the proposed activity(ies) is/are likely to <u>destroy</u> critical habitat

3. For each implicated SAR, what is the *ecologically relevant area* (ERA) for assessing destruction of critical habitat for the species?

<u>Eastern Musk Turtle</u>

The ecological relevant area (ERA) for assessing destruction for Eastern Musk Turtle habitat is three (3) linear kilometres of aquatic habitat (1.5 km upstream and 1.5 km downstream) from Poonamalie Lockstation. Critical habitat mapping identified in the recovery strategy identifies a continuous stretch of Eastern Musk Turtle habitat from from Lower Rideau Lake, west of Poonamalie Lockstation, to a section of river between Edmonds Locksation and Kilmarnock Lockstation, a linear distance of approximately 16 km and an area of 1082 ha. At certain times of year the habitat below the weir and dam is unavailable to turtles because of dewatering within the cut (upstream of the lock only).

4. For each implicated SAR, what percentage/amount of critical habitat within the ERA is affected by the proposed activity(ies)?

Eastern Musk Turtle

The impact to Eastern Musk Turtle will be caused by the placement of a cofferdam downstream of the Poonamalie Lockstation. The cofferdam will cover approximately 120 m^2 of Eastern Musk Turtle habitat. Compared to the 1082 ha of continuous riverine habitat that has been identified in the recovery strategy (1 ha = 10000 m^2), the amount of habitat that will be temporarily unavailable due to cofferdams and permanently lost due to anchors for the safety boom is negligible.

5. What are the components of the species' life process(es) that the affected critical habitat supports?

Eastern Musk Turtle

- ☐ Nesting/oviposition/birth
- ☒ Foraging/Feeding
- ☒ Movement
- ☐ Mating
- ☐ Hibernation/over-wintering
- ☐ Thermoregulation/basking
- ☐ Summer Inactivity
- ☐ Other

6. Does the project impact the ability of critical habitat in the ERA to support those life processes listed in Question 5?

Eastern Musk Turtle

The project does not impact the ability of critical habitat in the ERA to support the life processes listed in Question 5. Using the 3 linear kilometer home range of an Eastern Musk Turtle, the habitat that will be impacted by the cofferdams is abundant in the area.

Appendix 3: Mitigation Measures

General

1. Inform the Departmental Representative and PCA's Environmental Authority (Environmental Officer, Trent-Severn Waterway in Peterborough) of any changes to project plans and/or scheduling. Any changes not assessed under this Basic Impact Analysis will require approval from PCA and may require further mitigation measures.
2. Project commencement only upon submission and Parks Canada acceptance of an Environmental Management Plan (EMP) that outlines all the measures to be implemented by the contractor on the project site to eliminate or reduce environmental effects. The EMP will be submitted in writing, at least five (5) working days prior to commencing work. The Contractor's plan will be required to be submitted to the Departmental Representative and Parks Canada's Environmental Authority (EA), reviewed and accepted by Parks Canada prior to the commencement of work and mobilization to site.
3. It is required that the qualified environmental professional(s) prepare the EMP or its component plans in accordance with PCA's Environmental Standards and Guidelines - Ontario Waterways (2017). The EMP will detail frequency of monitoring and list high-risk construction activities where a qualified environmental professional must be onsite. The EMP will include a list of key project activities and identify the actual and potential environmental impacts associated with each activity.
4. Parks Canada's Environmental Authority (Environmental Officer, Trent-Severn Waterway) will outline all the following mitigation measures in a construction start-up meeting with the contractor, to ensure awareness and understanding of these measures.
5. Ensure that all on-site personnel are aware of, and comply with, these mitigation measures.
6. Should conditions at the work site indicate that there are negative impacts to fish, fish habitat, wildlife, cultural or visitor experience resources, all works shall cease until the problem has been corrected and Parks Canada's Environmental Authority staff have been consulted. The Parks Canada has the right to require that work be altered or ceased immediately.
7. As per the Historic Canal Regulations applicable to lands administered by the Rideau Canal National Historic Site of Canada, a permit signed by Parks Canada's Ontario Waterways Director will be required to authorize the project work prior to commencement of project activities and mobilization to site (to be facilitated by Parks Canada).
8. All machinery and equipment shall be clean, free of leaks, in optimal working condition.

9. Use well-maintained heavy equipment and machinery, preferably fitted with fully functional emission control systems/muffler/exhaust baffles, engine covers, etc.; machines shall not be left to unnecessarily idle in order to avoid emissions.

10. Maintain equipment to avoid leakage of fuels and liquids. Ensure measures are in place to minimize impacts of accidental spills.

11. Operate machinery from stable location;

12. Only the working end of machinery shall directly enter the water. The working end of machinery will be clean and maintained free of leaks. Complete the in-water activity as quickly as possible to minimize the time equipment is in the water; do not leave equipment in water during breaks in work activity.

13. Spill control and emergency plans will be in place prior to initiation of construction; an emergency spill kit shall be kept on-site and employed immediately should a spill occur.

14. In the event of a spill, Parks Canada and the Ontario Spill Action Centre (1-800-268-6060) shall be notified immediately; remediation will be conducted immediately to contain and clean up in accordance with **federal regulatory requirements <u>AND</u> to the satisfaction of Parks Canada**; documentation of remediation, testing and results will be provided to Parks Canada.

15. Store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads.

16. Refuelling of equipment and maintenance shall be conducted off slopes and away from water bodies on impermeable pads to allow full containment of spills.

17. A designated re-fueling depot will minimize the potential for extensive impacts at the site due to accidental releases of substances; proper spill management equipment shall be in place for fueling.

18. Drip trays shall be placed under fuel-powered equipment.

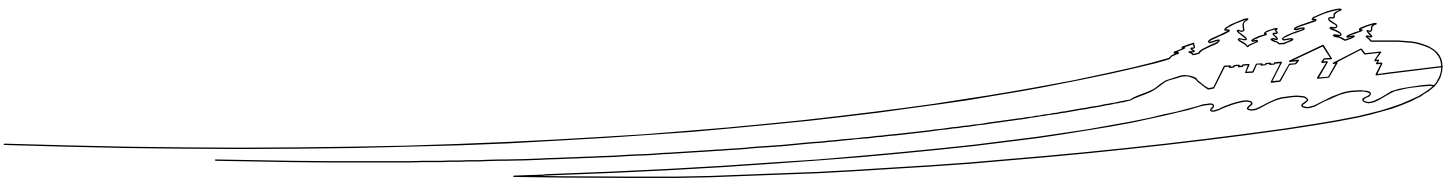
19. There shall be no discharge of chemicals and cleaning agents in or near aquatic habitats; all such substances shall be disposed of at a facility licensed to receive them.

20. No tools, equipment, temporary structures or parts thereof, used or maintained for the purpose of this project, shall be permitted to remain at the site after completion of the project.

<u>Sediment and erosion control</u>

21. Mandatory submission – **and acceptance by Parks Canada** – of an Erosion and Sediment Control Plan, prepared by a qualified individual, as stand-alone or part of the EMP, demonstrating:

    - A focus on erosion control primarily and sediment control secondary;
    - Erosion and sediment controls will be tailored to the type of sediment found onsite (e.g. if clay is present, additional controls are necessary).
    - The area to be controlled. In addition to the construction site, it is necessary to identify adjacent areas that could be negatively impacted by construction activities;



- Drainage areas and patterns based on pre-construction topography and construction design;
- The EMP will have as a principal to reduce the amount of sediment laden water produced. A focus on separating offsite and infiltrating water into the construction site from construction activities and sediment sources.
- How clean storm run-on will be diverted around the site and away from exposed areas;
- How sediment-laden run-off will be directed to detention or retention facilities on-site. Large drainage areas can produce a significant amount of run-off, resulting in a need for large detention or retention structures;
- Channels that are designed and constructed to the necessary design discharge;
- Temporary and permanent erosion control needs for all drainage channels;
- Consideration of project schedule in selecting, designing and laying out environmental controls;
- Consideration of seasonal requirements (for longer-term projects); select and design controls and practices for controlling erosion and sedimentation including shutdown periods.

22. Erosion and sediment control measures shall be implemented prior to work and maintained during the work phase, to prevent entry of sediment into the water where site access or other activities cause exposed soil. The following principles should be considered:

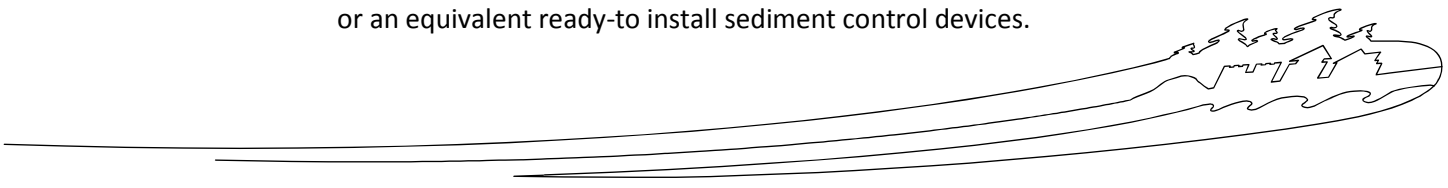
- Diversions to limit run-on water;
- Reduction of erosional forces by surface water velocity reduction;
- Reduction of sediment development through sediment collection or anchoring;
- Sedimentation of mobilized sediments;
- Filtration of sediment-carrying flows;
- Collection of captured or contained sediments;
- Treatment of pH (hydronium and hydroxide).

23. The size of particles present in the sediment is a key consideration for selecting the appropriate sediment treatment option(s):

- If the sediment consists primarily of gravel or sand, which are relatively large particles, a single treatment using a more basic technology, such as a sediment trap or sediment bag, may be adequate.
- If the sediment consists of silt and/or clay, which are relatively small particles, the effluent will most likely need a more advanced technology, such as a filter press or chemical treatment with anionic flocculent and a filtration method.
- If the sediment consists of a large spectrum of particle sizes, the water may need primary treatment to remove larger particles, followed by secondary treatment to remove finer particles.

24. Filter material will consider the grain size characteristics of the concrete sediment and shall be designed around the principals of maintaining sufficient hydraulic flow and prevention of particle movement through the material.

25. Eliminating unnecessary sources of sediment to the dewatering area will improve dewatering outcomes. This can be achieved by ensuring surface water flow is prevented from entering the project site.
26. All erosion and sediment control measures shall be inspected daily to ensure they are functioning properly and are maintained and/or upgraded as required to prevent entry of sediment into the water.
27. If erosion and sediment control measures are not functioning properly, no further work shall occur until the sediment and/or erosion problem is addressed to the satisfaction of Parks Canada.
28. All disturbed areas of the work site shall be stabilized immediately and re-vegetated as soon as conditions allow. All exposed areas should be covered with erosion control blankets or other measures to keep the soil in place and prevent erosion until vegetated in the spring.
29. Sediment and erosion control measures shall be left in place until all areas of the work site have been stabilized.
30. Upon completion of the work all debris shall be completely removed and the area restored to its original state or better. Repair all damages to property due to project activities.
31. Sediment control measures and exclusion fencing must be removed in a way that prevents the escape or re-suspension of sediments.
32. A turbidity curtain will be used during installation and removal of the cofferdams. It will be maintained in the water around all working areas during construction to contain and control the suspension of fines. If water levels/conditions do not permit the flotation of a turbidity curtain, other measures as approved will be implemented.
33. Turbidity curtains should be placed according to OPSD specifications as close to the coffer dam as possible to minimize area of potential impact of sedimentation.
34. Turbidity curtains should not be used as a primary or secondary settling area for dewatering activities. Supplementary sediment and erosion control measures should be installed prior to construction activities and should be added upon/reinforced as necessary.
35. The contractor will provide a marine grade turbidity curtain across all areas where sediments can enter the watercourse. Turbidity curtains are to be anchored or weighted down along its length to form a continuous seal on the river bed with adequate flotation at water surface to prevent over spills of turbid water.
36. Flow dissipaters and/or filter bags, or equivalent, shall be placed at water discharge points to prevent erosion and sediment release.
37. Silt or debris that has accumulated around the temporary cofferdams shall be removed prior to their withdrawal. All cofferdam material will be removed from the watercourse upon decommissioning.
38. Fine materials such as limestone-based aggregates, unwashed rocks or materials that have the possibility of being suspended or transported downstream will not be used.
39. No acid-generating rock (containing sulphides) will be used.
40. In the event of a significant silting or debris caused by construction activities, the contractor will take appropriate measures to contain and mitigate the problem including the installation of additional downstream turbidity curtains.
41. The contractor will maintain a standby supply of pre-fabricated sediment fence barriers, or an equivalent ready-to install sediment control devices.



42. Avoid activities that could lead to erosion during excessively wet weather conditions; monitor forecasts for heavy rainfall watches & warnings.

43. Environmental protection measures shall be checked after each extreme weather event.

44. Any stockpiled materials shall be stored and stabilized a safe distance away from any watercourse, drainage course or swales to prevent erosion and subsequent entry into the water body OR removed from the site, in accordance with all federal, municipal and provincial regulations.

Fish & fish habitat

45. Although this project is planned to take place in the fall; if it is delayed for any reason, no in-water work can occur between March 15th and July 15th of any year to protect fish populations during their spawning and nursery periods. Should work be required within this window, additional permissions and mitigation measures may be required based on site-specific characteristics.

46. Dewatering, demolition and construction is staged such that clean is pumped back to the system and turbid water is managed through a waste water system.

47. All work is to be completed in the dry. A de-watering Plan shall be submitted, as part of an EMP, to Parks Canada for review and acceptance prior to any dewatering.

48. Design and construct coffer dams to minimize sediment inputs to the water course; coffer dams shall not be composed of loose aggregate/granular material.

49. Limestone based aggregates will not be used.

50. No acid-generating rock (containing sulphides) will be used.

51. All debris on bed (including unused aggregate/concrete rubble) shall be completely removed and area restored to original state upon completion of work.

52. Any deviation from the restricted period, must be approved by Parks Canada. The contractor must be able to demonstrate that environmental mitigation is sufficient, such that downstream fish species and water quality will not be impacted, in order for such work to occur.

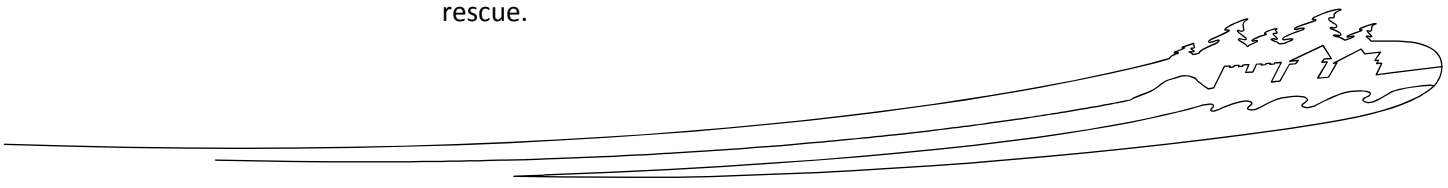
53. Sediment control measures shall be implemented during any in-water work to control turbidity levels. Sediment curtains, or other appropriate measures, shall be implemented prior to any in-water work that may result in sedimentation. These shall remain in place until all suspended sediments have settled.

54. Sediment/turbidity curtains shall be deployed in a manner – e.g. moved in a direction from close to shore/structures outward – that prevent entrapment of fish inside the curtain.

55. Ensure that there is a fish screen that complies with DFO *Freshwater Intake End-of-Pipe Fish Screen* Guideline when pumping in fish-bearing water to prevent impingement or entrainment of fish.

56. Fish shall be removed from the work area prior to complete dewatering and released alive downstream into the river.

- Parks Canada's Environmental Authority shall be advised 24 hours prior to fish rescue.



- Minimize the length of time fish are out of the water.
- Use appropriate equipment to remove any stranded fish in the dewatered area. As water levels drop in the work area monitor the deeper pool areas where fish are congregating. If safe to do so, Seine nets or Dip nets can be operated by field staff to remove the fish.
- Contact PCA EA staff should there be any issues with fish removal.
- Any fish found within the dewatered coffer dam areas will be documented by species, counted and removed and placed downstream if found in the downstream coffer dam and upstream if found upstream.
- Round gobies or other invasive species found during dewatering activities shall be euthanized and not returned to the water system; this shall be reported to Parks Canada.

57. Monitor water quality for unacceptable suspended sediment levels during in water activities.

58. CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life will form the baseline for water and streambed quality monitoring and assessment.

59. At the discharge point into the watercourse – i.e. the interface between the work site and the natural waterbody – a maximum increase of 8 NTU caused by suspended sediment from background levels for a short-term exposure (< 24-h period). Maximum average increase of 2 NTU from background levels for a longer term exposure. If elevated turbidity is observed Parks Canada will stop work and assess potential impact to the aquatic environment. Additional mitigation measures may be required.

60. For compliance/enforcement purposes, TSS samples may be taken at the discharge point into the watercourse. A Maximum increase of suspended sediment concentrations by more than 25 mg/L over background levels during any short-term exposure period (e.g., 24-h). For longer term exposure (e.g., > 24 h), average suspended sediment concentrations shall not be increased by more than 5 mg/L over background levels. If elevated turbidity beyond 25 mg/L from background levels is observed during in-water activity, Parks Canada will assess potential impact to the aquatic environment. Additional mitigation measures may be required.

61. Only clean material free of fine particulate matter shall be placed in or near water where it has been previously planned and authorized.

62. Should conditions at the work site indicate that there are negative impacts to fish or their habitat, all work shall cease until the problem has been corrected and Parks Canada EA staff has been consulted.

<u>Concrete</u>

63. Concrete leachate is alkaline and highly toxic to fish and aquatic life. Measures must be taken to prevent any incidence of concrete or concrete leachate from entering the watercourse. Maintain complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 48 hours if ambient air temperature is above 0°C and for a minimum of 72 hours if ambient air temperature is below 0°C or until significantly cured to allow the pH to reach neutral levels.

64. At the discharge point into the watercourse, pH will be maintained between 6.5 and 9.0. Water with pH > 9 cannot be released directly back into the

watercourse, but must be treated prior to release. Water with a pH ≥ 12.5 is considered toxic and treated as a hazardous waste under Ontario Regulation 347 of the Environmental Protection Act and wastewater in this condition must be removed from the site.

65. Additional Environmental Mitigation Measures For Placement Of Tremie Concrete:

- Ensure concrete forms are tight and no flow is occurring.
- Isolate area with curtain or impermeable material specified for concrete particulates; ensure fish exclusion is followed.
- Isolated area should be the minimum size required to complete task.
- For tremie pours, CO_2 system must be installed and operating along the entire length of the isolated area; the tank shall be used to release carbon dioxide gas into an affected area to neutralize pH levels. Ensure sufficiently sized tanks for the concrete volumes used.
- Workers shall be trained in the use of the system.
- Use of neutralizing acids is not permitted unless the system is designed and implemented by a qualified professional.
- pH monitoring shall be conducted inside and outside the containment area.

66. Ensure that all works involving the use of concrete will not deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse;

67. In the event of a release of concrete or grout, Parks Canada and the Ontario Spill Action Centre (1-800-268-6060) shall be notified; remediation will be conducted immediately contain and clean up in accordance with **federal regulatory requirements AND to the satisfaction of Parks Canada**; documentation of remediation, testing and results will be provided to Parks Canada.

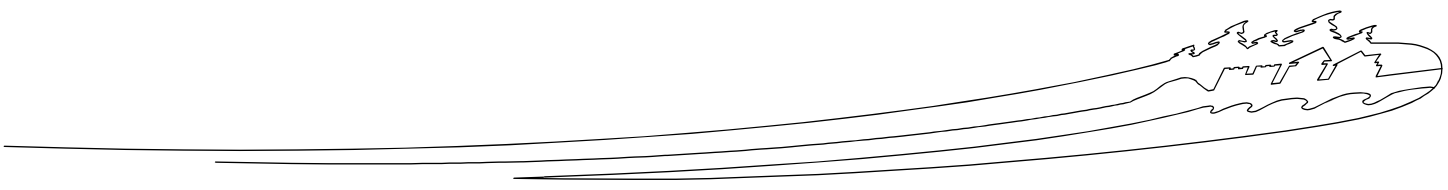
68. Wash equipment away from water and provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment;

69. Filter fabric material will consider the grain size characteristics of concrete sediment and shall be designed around the principals of maintaining sufficient hydraulic flow and prevention of particle movement through the material.

70. Concrete debris shall be placed into an enclosed container daily, or more frequently if required.

Aquatic Invasive Species

71. To reduce the risk of introducing invasive species, all equipment must be thoroughly cleaned prior to coming to the site. Any machinery that appears to have not been cleaned will not be permitted on site. For additional information or guidance on how to properly clean equipment, see the Clean Equipment Protocol for Industry developed by the Ontario Invasive Plant Council and found here: http://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/Clean- Equipment-Protocol_June2016_D3_WEB-1.pdf



72. Any equipment or vehicles which are to be used in water, should be thoroughly cleaned before and after use of any visible mud, vegetation, mussels, etc.:

- Vessels/equipment should be drained of standing water.
- Vessels/equipment should ideally be cleaned with hot water (>50 °C) at high pressure water (>250 psi).
- Vessels/equipment should be dried for 2 – 7 days in sunlight before transported between waterbodies.
- Cleaning of vessels/equipment should be conducted away from waterbodies at a recommended distance of at least 30 m from the shoreline.

73. Mud, dirt and vegetation should be cleaned from clothing and footwear prior to entering the work site, and prior to leaving the work site.

74. Should an invasive species be encountered (or at least suspected) not identified in this BIA, a photo and report of the specimen should be sent to Parks Canada's EA staff and the Invading Species Hotline at 1-800-563-7711 or online at EDDMapS Ontario, https://www.eddmaps.org/ontario/.

75. Conduct a site assessment for invasive plant infestations prior to carrying out field activities.

76. Use weed-free material (i.e. sand, gravel, etc.) for erosion control and stabilization.

77. Use weed-free seed and confirm that seed mix to be used for revegetation purposes does not (potentially) contain invasive plants.

78. Seed purchased commercially should have a label that states the following:

- Species;
- Purity: Most seed should be no less than 75% pure and preferably over 85% pure. The rest is inert matter, weed seed, or other seed;
- Weed seed content: The tag should state NO invasive plants are present. Only certified weed-free seed should be used; and
- Germination of desired seed: Germination generally should not be less than 50% for most species, although some shrubs and forbs will have lower percentages.

79. Move only weed/contaminate-free materials into non-infested areas. Moving materials from one infested location to another within a particular zone may not cause contamination, but moving materials from infested to non-infested areas could lead to the introduction and spread of invasive plants.

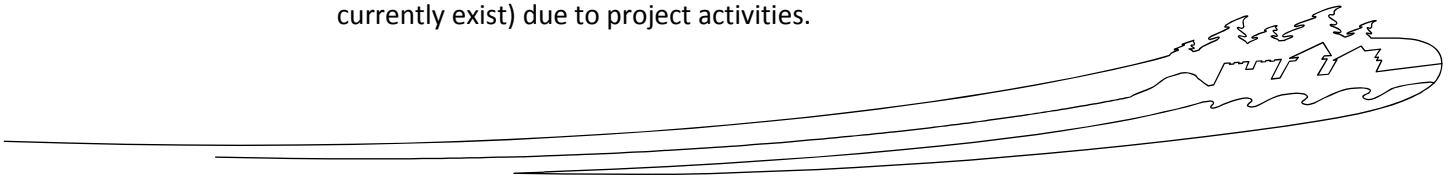
80. If removal of invasive species occurs, individuals will be disposed of appropriately, offsite to ensure no further propagation.

81. Workers should familiarize themselves with invasive species identified in this BIA that are potentially present within the work sit areas.

82. Any invasive fish species captured will be euthanized and not returned to the system and reported to Parks Canada.

Water Quality

83. Ontario Drinking Water Quality Guidelines cannot be exceeded (beyond parameters that currently exist) due to project activities.



Vegetation removal

84. All disturbed areas of the work site shall be stabilized immediately with erosion protection. All exposed areas should be covered with erosion control blankets or other measures such as mulch to keep the soil in place and prevent erosion until vegetated in the spring.

85. Trees, shrubs and vegetation which are to remain throughout construction should be properly identified and delineated.

86. Where practical, the branches of the large trees should be trimmed back as the first option rather than cutting the entire tree.

87. When feasible, alter riparian vegetation by hand. If machinery must be used, operate machinery on land and in a manner that minimizes disturbance to the banks of the water body.

88. Should any vegetation require chipping/mulching, the after product will be stored onsite for the duration of the project to supplement erosion and sediment control methods when required.

89. Grubbing should not be conducted unless a suitable planting plan and Erosion and Sediment Controls are in place. Discuss with EA officer for suitable plans.

90. Prune limbs close to the tree trunk. For a clean cut, make a shallow undercut first, then follow with the top cut. This prevents the limb from peeling bark off the tree as it falls. Do not use an axe for pruning.

91. If over half of a tree needs pruning, in most circumstances it will be best to cut it down instead of pruning. Cut trees off at ground level and do not leave pointed stumps.

92. Native species are to be used for tree planting and/or ground cover with mulch to prevent erosion and to help seeds germinate.

93. If there is insufficient time (at least four weeks) in the growing season remaining for the seeds to germinate, or at risk of germinating and being damaged by frost, the site shall be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring. Frost can occur as early as August 31st and late as June 25th.

94. Root systems of trees identified to remain should be properly delineated and fenced off, so as to protect the root systems from being crushed and impacted by machinery.

95. In the event that the installation of root-protectant fencing is not possible and/or ideal, alternative measures, as approved by PCA, must then be implemented. Such measures must provide a sufficient amount of soil compaction prevention with regards to the highest level of activity to occur within the immediate area of protection.

- For areas of light-to-medium levels of traffic activity, a geotextile cloth shall be placed over the area of protection and covered with an 8 inch (at minimum) thick layer of mulch material.
  - Pins or staples must be used to secure the geotextile material to the ground.
- For areas of medium-to-high levels of traffic activity, a geotextile cloth shall be placed over the area of protection and covered with an 8 inch (at minimum) thick layer of mulch material. The mulch material shall then by covered with 3/4 inch sheets of plywood.

- The plywood will break down over time, and shall be replaced periodically to retain its effectiveness.
- ¾ inch laminated large sheets of plywood are recommended for use.
- Overtime, mulch material can degrade, move, or wash away. Mulch must be replenished as necessary in order to maintain a layer of 8 inch thickness at all times.
- Mulch material should not be permitted to pile against the trunk(s) or root flare(s) the tree(s), as this may lead to unwanted bark rot and oxygen deprivation, subsequently leading to the death of the tree(s).

96. Alternative methodology for soil-compaction prevention may be utilized (ex. blast mats), as reviewed and approved by PCA.

97. The success of all vegetative plantings shall be assessed through visual site inspections conducted at least once each spring and each fall for the first two growing seasons following planting. If at any time during the monitoring period any plantings are found dead or failing, mitigation measures shall be implemented to reduce the risk of future failure and the plants shall be replaced and monitored accordingly.

98. Native grasses, shrubs, etc. should be planted to match existing species growing on the sites.

Birds

99. Site clearing/commencement of construction should be planned to occur outside of sensitive nesting times - April 1 to August 31. If this is not feasible, then the site must be inspected by a biologist prior to clearing, to check for the presence of nests.

Species at Risk

100. The EMP must detail procedures (e.g. exclusion fencing) for preventing turtle entry/nesting within disturbed project gravels/soils during all stages of project activity;

101. The EMP must demonstrate procedures for avoiding disturbance/harm to wildlife and nesting birds.

102. Species at risk training shall be provided to all employees before they begin work on site (materials can be part of the Environmental Protection Plan). Employees must be able to identify potential species at risk and know the proper procedures to follow when they encounter a species at risk.

103. Temporary reptile fencing, such as polythene/ woven geotextile secured with timber stakes, or material of a similar nature/function, shall be installed completely around gravel stockpiles and exposed soils to prevent turtle nesting in the project area.

104. Synthetic plastic Erosion Control Blankets/Mats should not be utilized, particularly during nesting season, as they pose as an entrapment hazard to turtles. Fibre-based bio-degradable Erosion Control Blankets/Mats are only to be utilized.

105. Should any suspected species at risk – snakes or turtles and/or eggs be encountered during construction - project staging, implementation or demobilization - work would halt immediately and Parks Environmental Assessment Staff would be notified. Stop work immediately and contact EA staff on how to proceed. Additional measures to

avoid impacts may be required before work can restart. Stand back and allow the animal to leave the site.

106. Minimize the disturbed area; clearly mark the work space.

107. Park on roads or disturbed areas only.

108. Proper ESC measures, monitoring and reporting will mitigate potential impacts to channel darter in downstream habitats

Noise /Air

109. Adhere to local noise by-laws. Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods.

110. Monitor and mitigate public complaints by keeping a record of complaints and addressing any issues raised by the public.

111. All on-site vehicles are expected to have a Drive Clean Emissions Report in compliance with O. Reg. 361/98: Motor Vehicles under the Environmental Protection Act, R.S.O. 1990, c. E.19. EA Officers may stop a vehicle if they believe the vehicle is emitting excessive exhaust smoke or suspect that emission control equipment has been tampered with or removed.

112. Use well-maintained heavy equipment and machinery, fitted with fully functional emission control systems/muffler/exhaust baffles, engine covers, etc.

113. Machines shall not be left to unnecessarily idle in order to avoid emissions.

Cultural Resources

114. Allow PCA to conduct a heritage recording of the lock and landscape prior to construction.

115. Any modification to the proposed scope of work and/or conservation measures must be submitted to the CRM Advisor for review and approval for compliance with the Standards and Guidelines.

116. If an opportunity arises to address or correct past repairs that are no longer considered best conservation practice or that seriously impact heritage value, CRM advice should be sought to determine whether it makes sense to address this as a part of this project.

117. When removing work for the purposes of replacement or repair, it is possible to uncover unanticipated materials or construction that may have historic significance or provide important evidence of previous construction techniques or materials. If unanticipated material or construction is discovered during work, the project lead should stop the work, take photos, and consult with CRM immediately for advice on how to proceed.

118. All removals are to be done in conformance with the drawings and specification documents.

119. When temporary structures and machinery are installed on a site, the contractor must safeguard / protect the character-defining elements of the site (including landscape features). The contractor should bear in mind that at National Historic Sites, the recommended practice is to employ a minimal intervention approach, as defined in the Standards and Guidelines.

120. If, in the course of work, a cultural resource or character-defining element is damaged, the project lead should take photos and consult with CRM immediately for advice on how to proceed.

121. Any removals where profiles, sizes, or stone finishes are to be replicated, the material being removed must be documented and templated accurately.

122. If unrecorded cultural or archaeological resources (i.e. structural remains and/or artifact concentrations) or any other cultural resource be encountered, work shall cease until the item can be reviewed by a PCA or PCA appointed archaeologist, the situation reviewed and direction for mitigation measures is provided to the Environmental Assessment Coordinator and Project Manager. Ensure that all exposed underwater cultural materials are kept submerged and/or wet while waiting for direction.

Archaeological Resources

The following mitigation measures are required to minimize the project's impacts on these resources (See AOA for full description of the resources):

123. No excavation is permitted in the aarchaeologically sensitive areas outlined in red on Figure 6.

124. All parking, staging and access roads will be restricted to present-day roadways, parking lots and previously disturbed areas. If this is not possible, the use of protective covering such as geotextile protective mats with a wood chip lift or granular "A" gravel is required. All protective covering must be removed following construction and the area restored to pre-construction state. Excavation is not permitted during installation or removal of protective covering.

125. Should vegetation clearing be required, excavation or grubbing of the ground surface is not permitted.

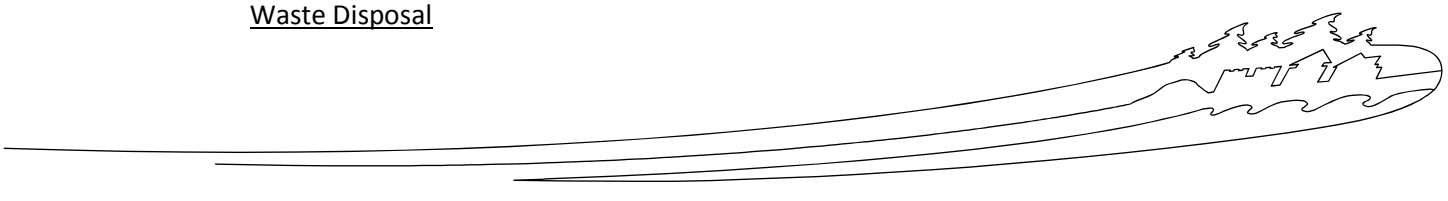
126. Coffer dams will need to be installed both upstream and downstream from the lock. Similar coffer dams were used during the 1985 construction work. Photos from that construction period show extensive on-land disturbance caused by the creation of the coffer dams. As such, all shoreline areas impacted by the installation of the coffer dams should be limited to these previously disturbed construction areas.

127. The earth dams are to be "protected from rutting and other damage" during this project. The north earth dam, which could contain remnants of the Store House, is within an archaeologically sensitive area. As such, the north earth dam should be protected by geotextiles overlaid with gravel if it is used for access.

128. If archaeological resources (e.g. structural features or artifact concentrations) are encountered during construction activities, work will cease in the immediate area and the Parks Canada Project Manager informed. The Project Manager should then contact Parks Canada's Terrestrial Archaeology section for advice and assessment of significance, and if necessary, any further mitigation measures.

129. Once the wing walls are exposed through excavations ranging between 0.6 and 1.8 m below surface, photo-document the wing walls and limits of excavation for PCA Terrestrial Archaeology's records.

Waste Disposal



130. Recyclable material and waste shall be removed from the site, in accordance with all federal, provincial and municipal regulations, to disposal facilities licensed to receive them;

131. Waste generated will be disposed according to regulations (i.e., O. Reg. 102/94 and O. Reg. 558/00, R.R.O. 1990, 347).

Lock Commissioning

132. Ensure that all construction debris is removed from the lock prior to rewatering. This may involve sweeping and hosing down the bottom of the lock. All wash water is to be collected and treated.

133. If elevated turbidity beyond 8 NTU from background levels for a short-term exposure (e.g., 24-h period) is observed Parks Canada will assess potential impact to the aquatic environment. A determination will be made by Parks Canada as to whether subsequent lock operation is permitted. If not, additional mitigation measures may be required.

134. The area inside of the downstream coffer dams, if necessary, will be cleaned or alternately capped with clean rock, in order to mitigate turbidity from the former construction area as it is re-flooded.

Floods/Extreme or inclement weather/Ice formation

135. Undertake construction under normal weather conditions, to the extent possible, and design the project worksite to withstand variable weather conditions.

136. Apply wet weather restrictions on construction activities to reduce surface run-off from exposed work areas and to minimize the risk of inundation.

137. The work area shall be stabilized against the impacts of high flow/heavy rainfall events at the end of each workday.

138. Work shall be suspended and the work area stabilized when there is a high probability of a rainfall event.

Appendix 4 – Site Photos

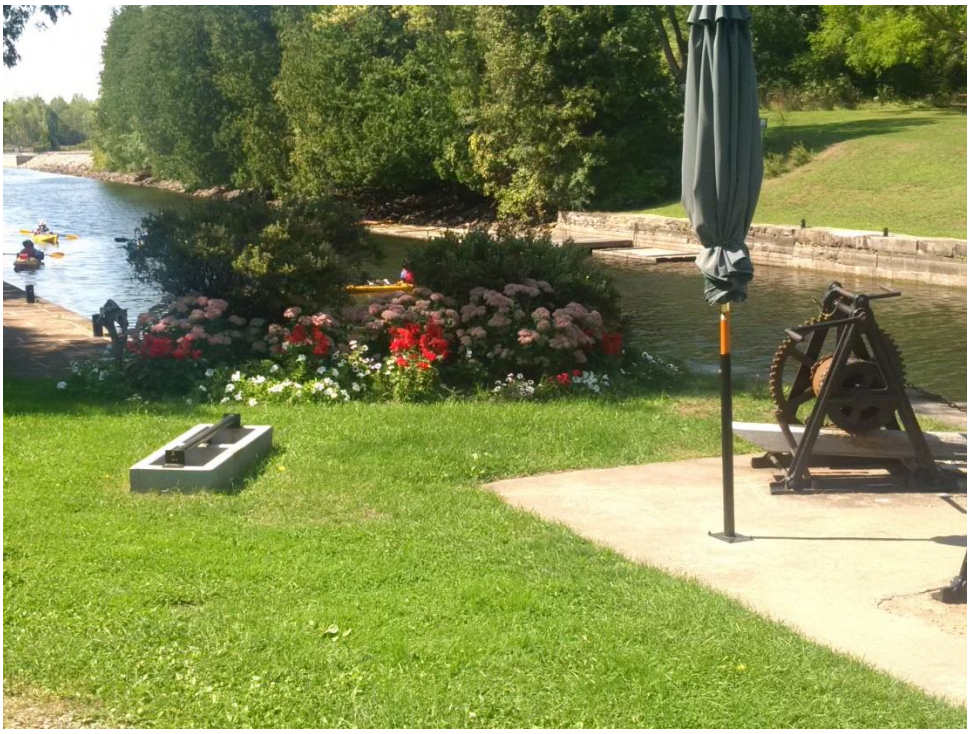


Photo 1. Upstream view from the Poonamalie Lockstation grounds.

Photo 2. View of the lockstation grounds.

Photo 3. View looking upstream from the Poonamalie lockstation towards the earth dam.

Photo 4. View of aquatic habitat immediately downstream of the lockstation.

Appendix 5: AOA Figure 6

Figure 6. Archaeologically sensitive areas highlighted in red. The area south of the lock office, between the car park and the lock office may contain buried remnants of the Lock Labourer's garden and unidentified structure, and the areas north of the lock could contain evidence of the store house and other historical buildings. No excavation is permitted in these areas. If staging or vehicular access is required, protective measures must be implemented in these areas.

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM C185-08, Standard Test Method for Air Content of Hydraulic Cement Mortar.
- .2 ASTM C270-14a, Standard Specification for Mortar for Unit Masonry.
- .3 ASTM C780-14b, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

.2 Canadian Standards Association (CSA)

- .1 CSA A179-14, Mortar and Grout for Unit Masonry.

1.2 TESTING STANDARDS

.1 Conduct required testing in accordance with the following standards:

- .1 Flow and Cube strength: to ASTM C270.
- .2 Vicat Cone test: to ASTM C780.
- .3 Cube strength: to CSA A179, Annex B.
- .4 Flexural bond strength: to CSA A179
- .5 Air content: to ASTM C185.

1.3 INSPECTION

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.

1.5 ACCESS TO WORK

.1 Poonamalie Lockstation 32 is located at the outlet of Lower Rideau Lake, at 22 Poonamalie Road, approximately 4 km west of Smiths Falls, Ontario in the rural township of Rideau Lakes.

.2 Co-ordinate site visits with the Contractor.

1.6 PROCEDURES

.1 Contractor will notify the Testing Agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REPORTS

.1 Submit inspection and test reports to Departmental Representative with copies to Contractor at each stage of testing.

.2 Include note on test report identifying the mortar mix ratio; and the location of mortar use on project (i.e. mortar mix 1:1:6 cement : lime : sand; for northeast approach wing wall on Weir).

.3 Identify the specific mix which is being tested (i.e. backpointing mortar, finishpointing mortar, grout, repair concrete).

Part 2 Products

2.1 EQUIPMENT

.1 Air content apparatus for mortar. A concrete test apparatus must not be used to test the air, as it is unsuitable for this application.

.2 Vicat Cone.

.3 Compressive Strength Testing: use cube moulds specifically for mortar testing, in accordance with CSA A179.

Part 3 Execution

3.1 TESTING

.1 Flexural Bond Strength: Prior to commencing project, arrange with Testing Laboratory to construct a section of sandstone and limestone masonry wall, of sufficient size for the lab to test for flexural bond strength, in accordance with CSA A179, when using the specified mortar.

.2 Prepare mortar cubes on site in accordance with CSA A179 and ASTM C270. Record air temperature and mortar temperature. Ensure mortar cubes set in protected location, at minimum 10°C, for 24 hours minimum.

.3 Record air content in percent.

.4 Conduct Vicat Cone test in accordance with ASTM C780. Record cone penetration in millimetres. Vicat Cone testing is not required for grout samples.

.5 After mortar cubes have set, transport all cubes to the lab for curing. Cure in accordance with ASTM C270 and CSA A179.

3.2 TESTING SCHEDULE

.1 For each mortar test, cast 9 cubes for testing. Break 3 cubes at each test date. Submit report after each testing date.

.2 Test mortar cubes at 7, 28 and 56 days, unless otherwise indicated.

.3 Test grout cubes at 28, 56 and 112 days, unless otherwise indicated.

.4 Conduct 20 mortar tests (50% for backpointing, 50% for finishpointing), and 3 grout tests. Conduct maximum 2 concrete tests on locks, locations to be determined, if required. Consultant will provide table showing quantity and location of tests.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 10 – Common Work Results for Masonry.

1.2 REFERENCES

.1 Definitions

.1 Housing: Enclosure placed around work or around scaffolding and work, to provide either protection for the work taking place, or to provide a micro-climate more suitable to the work than ambient atmospheric conditions, or both.

1.3 PRICE AND PAYMENT PROCEDURES

.1 Provide lump sum price to include all costs for labour, materials and equipment necessary to complete the work of installing and removing insulated housing for the work, as well as for all hook-ups/metering (if required) and heater(s).

.2 Watchperson: No measurement for payment will be made for the work of providing a Watchperson, if required. Include all costs for the provision of a watchperson in the tendered prices for the above lump sum items.

1.4 REGULATORY REQUIREMENTS

.1 Design and construct temporary housing to resist the snow and wind loads (including uplift), in accordance with the 2015 National Building Code.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings

.1 Submit shop drawings for temporary housing. Indicate material specification and all details and information necessary for assembly and erection.

.2 Shop drawings for housing to be stamped and signed by a qualified Professional Engineer registered in the Province of Ontario.

.3 Provide schedule of heater numbers, types, locations and capacities.

.4 Indicate number and location of fire extinguishers associated with heating equipment.

1.6 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.7 TEMPORARY HOUSING

.1 Provide weather tight housing for the portions of the Work which must be protected, heated and/or ventilated during the work.

1.8 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside housing enclosure must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .6 Continue heating operation until all mortar has been adequately cured, or ambient temperature reaches acceptable levels, whichever is first.

.4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

- .1 Conform with applicable Codes and Standards.
- .2 Enforce safe practices.
- .3 Prevent abuse of services.
- .4 Prevent damage to finishes.
- .5 Vent direct-fired combustion units to outside.

.7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

.8 Appoint a Watchperson to be in attendance, when workers are not present, to ensure temperatures are maintained and heating equipment is operating safely.

1.9 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Store heating fuels and gas to the requirements of the Departmental Representative and in accordance with Section 01 35 43 – Environmental Procedures.

Part 2 Products

2.1 MATERIALS

.1 Use only new materials, unless approved otherwise by the Departmental Representative.

.2 Materials must comply with the requirements of the 2015 National Building Code.

Part 3 Execution

3.1 TEMPORARY HOUSING

.1 Install housing enclosure above the lock, extending above all masonry work to be rehabilitated, between the upstream cofferdam and the downstream cofferdam. Location as noted on the Drawings.

.2 Prior to commencing heating, inform Departmental Representative of the intent and obtain approval prior to starting. The Departmental Representative will make periodic inspections of the housing and heating works throughout the duration of construction. Cooperate with and make adjustments/changes as directed.

.3 Maintain housing in satisfactory condition for the duration of construction.

.4 Remove structure on completion of construction and restore areas disturbed during removal.

.5 Remove all anchors from masonry or concrete. Repair stone or mortar as required.

3.2 HEATING EQUIPMENT

.1 Use only heating equipment types acceptable to the Departmental Representative.

.2 Ensure all installation and removals of meters and/or piping is performed by a Fitter/Installer CSA certified for the type of fuel being used. Be responsible to maintain piping and associated heating systems at no additional cost to the Departmental Representative.

.3 Ensure that the heating requirements are met by providing, at optimum efficiency of the equipment, a capacity of 125% of the heat requirement and a sufficient number of standby heaters ready for use at the site.

.4 Heating Fuels

.1 Use electricity, gas, diesel oil or other fuels approved by the Departmental Representative. Note that electricity availability is limited and an outside source will be required. Be responsible for all arrangements and paying of accounts with Hydro, if this is the selected method of heating.

.2 Fuel storage to the requirements of the Fire Commissioner of Canada.

.3 Heating fuel usage quantities will be recorded monthly and the Contractor will be billed at cost. Monthly cost shall equal total consumption times the effective volume times rate for the given month, as dictated by the heating fuel provider.

.5 Provide and maintain temporary fire protection equipment during performance of work, commensurate with fuel source selected.

3.3 REMOVAL OF HEATING AND VENTILATING EQUIPMENT

.1 Upon receipt of Departmental Representative's approval:

.1 Discontinue heating operations.

.2 Remove housing and heating equipment from the site.

3.4 FIELD QUALITY CONTROL

.1 Provide acceptable maximum-minimum thermometers and relative humidity gauges inside the housing and maintain to the satisfaction of the Departmental Representative, and in accordance with Section 04 05 10 – Common Work Results for Masonry. Locate thermometers at lowest and highest levels of scaffold.

.2 Ensure continuity of protection by posting a Watchperson at Contractor's discretion, when work is not in progress.

.3 The Watchperson's qualifications must be sufficient to perform, on heating equipment, such duties as:

.1 Preventative maintenance and refueling, normally performed during any shift.

.2 Emergency repairs of minor complexity.

.3 Place standby items in service.

.4 Record maximum and minimum temperature at each thermometer on a daily basis; twice per day, at 8:30 am and 3:00 pm and reset the thermometers when requested by the Departmental Representative, or at prescribed intervals.

.5 Provide temperature records on a daily basis and certified written records on a weekly basis to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 03 07 – Historic - Masonry Repointing.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA Z797-09 (R2014), Code of Practice for Access Scaffold.

.2 Occupational Health and Safety Act Ontario Regulations 213/91 for Construction Projects, latest edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 REGULATORY REQUIREMENTS

.1 Design and construct scaffolding in accordance with:

.1 CSA Z797.

.2 Occupational Health and Safety Act Ontario Regulations 213/91 for Construction Projects.

Part 2 Products

2.1 SCAFFOLDING

.1 Scaffolding in accordance with CSA Z797

.2 Access ladders and platforms.

2.2 HOISTING

.1 Hoists for moving of workers, materials and equipment.

Part 3 Execution

3.1 SCAFFOLDING ERECTION

.1 Supply and install scaffolding sufficient to carry out the scope of work identified on the drawings.

.2 Set scaffold anchors in horizontal masonry joints only. DRILLING INTO THE FACE STONE IS NOT PERMITTED. Repointing of masonry joints, as scaffold anchors are removed, will be carried out as part of the Masonry Contract.

.3 Erect scaffolding independent of walls.

.4 Provide scaffolding with approved configuration for free access of workers, including side brackets at each lift. Install tie-backs at same level as side brackets. Tie-backs must be installed such that they do not create a tripping or other form of hazard to workers using the scaffold.

.5 Supply and install full width, continuous platform and side brackets, planking, braces, (cross and horizontal), jacks and base plates (with special attention for safety on the adjustable jacks), hangers, guardrails, guardrail posts, coupling pins, safety clips and all clamps for safe installation. Number of fully planked decks required to be determined by Scaffold Design Engineer.

.6 Do not bear any part of the scaffolding, hoist or construction plant directly against the masonry. Provide isolating material, lumber or plywood with additional padding as required, to prevent damage to the existing masonry.

.7 Provide, operate and maintain hoists and equipment required for moving of workers, materials and equipment.

.8 Provide access ladders, securely erected, on both sides of Lock chamber.

.9 Provide safety handrails and fencing as required for safe working conditions.

.10 Prior to use, provide proof of review and approval of scaffolding erection by a Professional Engineer licensed in the Province of Ontario.

.11 Maintain the scaffolding in satisfactory condition for the duration of the work.

.12 Provide security fencing, around scaffolding to prevent access to scaffolding by the public, refer to Section 01 56 00 - Temporary Barrier and Enclosures. Contractor is responsible to maintain security on the scaffold.

3.2 SCAFFOLD DISMANTLING

.1 Prior to removal of scaffold anchors from masonry walls, see Section 04 03 07 – Historic Masonry Repointing for procedure.

.2 After repointing has been allowed to cure for a minimum of seven days, relocate all scaffold anchors into fresh horizontal mortar joints. Rake out and repoint all existing mortar at original scaffold anchor locations as specified.

.3 Work to be reviewed by Departmental Representative prior to removal of scaffold.

.4 When removing scaffolding at completion of project, remove all scaffold anchors from masonry joints and repair mortar joints.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 23 19 – Dewatering.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA O86-14, Engineering Design in Wood.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings

.1 Submit shop drawings for temporary barriers, cofferdam and enclosures. Indicate material specification and all details and information necessary for assembly and erection of fencing and enclosures.

.3 Shop drawings for cofferdam to be stamped and signed by a qualified Professional Engineer registered in the Province of Ontario.

1.4 SITE CONDITIONS

.1 Public Traffic Flow

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

.2 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

.3 Perform work such that public access to the parking lot and boat docking area is not impeded at any time.

Part 2 Products

2.1 MATERIALS

.1 Construction Fence

.1 2300 mm high modular steel construction fence. Provide fence bases that will not present a tripping hazard for the public.

.2 Cofferdam

.1 Refer to Section 31 23 19 – Dewatering.

.3 Weather Enclosure

.1 Design enclosure to withstand wind pressure and snow loading, in accordance with the 2015 Building Code.

Part 3 Execution

3.1 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

.3 Install temporary barriers and enclosures as per manufacturer's recommendations.

3.2 CONSTRUCTION FENCE

.1 Erect and maintain secure construction fence around perimeter of the work area. Fence must be secure at all intersection points with the existing structure.

.2 Install lockable access gate on secure hinges to provide access for all equipment and personnel to the work area. Provide key to Departmental Representative and Parks Canada staff who will require access for the duration of the project.

.3 Install fence in accordance with manufacturer's recommendations.

3.3 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around steep changes in grade, such as at the top of lock walls.

.2 Provide barriers around vegetation, including all trees and shrubs in the work area, designated to remain. Protect from damage by equipment and construction procedures.

3.4 COFFERDAM CONSTRUCTION

.1 Refer to Section 31 23 19 – Dewatering.

3.5 WEATHER ENCLOSURES

.1 Provide weather tight enclosure above the lock, extending from the upstream coffer dam to the downstream cofferdam, in accordance with Section 01 51 23 – Temporary Heating, Cooling and Ventilating.

.2 Construct mortar mixing shelter in accordance with CSA O86.1, of sufficient size to house all mortar materials and mixer in a dry environment.

.1 Maintain public side of enclosure in clean condition.

.2 Install fastening devices in such a way where clamps or wire ends cannot cause damages to the workers.

3.6 ACCESS TO SITE

.1 Provide and maintain access roads, pathway crossings, ramps and construction runways as may be required for access to Work.

3.7 SIGNAGE

.1 Provide common use signs related to traffic control, information, instruction, use of equipment, public safety devices, and other signs as directed by Departmental

Representative in both official languages or by use of commonly understood graphic symbols to approval of Departmental Representative.

.2 Signage for Contractor advertising, beyond emergency contact details, is not allowed on any element of this project. Size of lettering on emergency contact notice to be approved by Departmental Representative, prior to display of such notice.

3.8 FIRE ROUTES

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

3.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred due to lack of improper protection.

3.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with local Waste Management policies.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
- .2 CSA O86-14, Engineering Design in Wood.
- .3 CSA O121-08 (R2013), Douglas Fir Plywood.
- .4 CSA O151-09 (R2014), Canadian Softwood Plywood.
- .5 CSA S269.1-16, Falsework and Formwork.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Store formwork material so that it is not in contact with the ground and protected from water, oil, dirt or other contamination. Support so as to prevent warping or distortion.

.2 Waste Management and Disposal:

- .1 Separate waste materials for recycling in accordance with local Waste Management policies.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

- .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CSA O86 and CSA O151.
- .2 Use new materials throughout except for concrete in unexposed locations, where used material is acceptable. Fabricate forms from sound, undamaged sheets with clean true edges, sealed and factory treated with form sealer. Thicknesses as required to support concrete at rate poured with no bowing of forms between supports. If forms are not new, obtain approval before using.

.2 Grooves, reglets, chamfers and rustification strips: Use White Pine selected for straightness and accurately dressed to size. Provide 1 to 3 draw unless otherwise shown. Provide continuous saw-cut at back of strip. Chamfers at 45° unless noted.

.3 Form ties:

.1 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Maximum spacing 600 mm o.c.

.2 Wire ties and wood spacers not permitted.

.4 Form liner: High density overlay Douglas Fir to CSA O121 or medium density overlay Canadian Softwood Plywood to CSA O151, 2 grade, T and G edge, 16mm thick.

.5 Joint tape for sealing panel joints: Tape must be capable of preventing leakage of concrete in form joints.

.6 Caulking for joints between panels: Use grey urethene catalyst cured non-sag or self-levelling sealant, as applicable.

.7 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, preventing concrete from sticking to forms, non-toxic, biodegradable, low VOC.

.8 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm^2/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.

.2 Fabricate and erect formwork in accordance with CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.

.3 Align form joints and make watertight.

.1 Keep form joints to minimum.

.4 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners and joints, unless specified otherwise.

.5 Provide access openings as required for cleaning and inspection of forms and embedded items, prior to placing concrete and for verifying that forms are being completely filled during pouring of concrete.

.6 Clean and prepare formwork in accordance with CSA A23.1/A23.2, before placing concrete. Apply form release agents to formwork in accordance with manufacturer's instructions, prior to placing accessories and reinforcement.

.7 Re-use formwork and falsework subject to requirements of CSA A23.1. Do not re-use forms if there is any evidence of surface damage or wear which would impair the quality of the concrete surface.

.8 When formwork is to be re-used, apply non staining parting agent in accordance with CSA A23.1.

3.2 REMOVAL

.1 Remove forms without damage to concrete surfaces. Repair all blemishes by patching and sacking.

3.3 QUALITY CONTROL ON SITE

.1 Check elevations, camber and plumbness of formwork continuously during concreting and after, until initial set occurs. Where necessary, make appropriate adjustments promptly. Report all adjustments made after initial set to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM) International

- .1 ASTM A955/A955M-13, Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts.
- .2 ASTM A1022/A1022M-16b, Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement

.2 Canadian Standards Association (CSA)

- .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
- .2 CSA A23.3-14, Design of Concrete Structures.
- .3 CSA G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.

.3 Reinforcing Steel Institute of Canada (RSIC)

- .1 Reinforcing Steel Manual of Standard Practice.

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 for all materials noted in this Section.

1.4 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 in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

.4 Separate and recycle waste materials in accordance with the Waste Reduction Workplan.

Part 2 Products

2.1 MATERIALS

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

.2 Stainless steel reinforcement bars: 300 MPa, Type 304, to ASTM A955/A 955M.

.3 Cold-drawn stainless steel wire ties: to ASTM A1022/A1022M.

.4 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

2.2 FABRICATION

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

.2 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

Part 3 Execution

3.1 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.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1/A23.2.

.2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement, and removal of rust from existing reinforcement.

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

.4 Before placing, remove all loose scale, dirt, oil or other coatings which would destroy or reduce bond. Place reinforcement within the specified tolerances and secure in position by the use of chairs, spacers and hangers. Tie reinforcement securely together using 16 ga. annealed wire to prevent displacement during concrete placing and vibrating. Turn the ends of all ties towards the interior of the concrete. Use stainless tie wire at all locations.

.5 For existing concrete repairs, Departmental Representative will verify exact number of required new bars for each location which requires structural strengthening, before concrete is placed.

.6 Position reinforcing for exposed concrete using snap-on plastic positioners and plastic chairs of the same colour as the concrete. Use concrete chairs for slabs on grade.

.7 Do not splice reinforcement unless indicated on Drawings. Do not cut reinforcement to permit placing of embedded items.

.8 Maintain clean cover for reinforcement in accordance with drawings.

.9 Reset immediately, reinforcing steel displaced during concrete pour.

.10 For concrete placement, see Section 03 30 00 – Cast-in-Place Concrete.

3.3 QUALITY CONTROL ON SITE

.1 Reinforcement must be complete, adequately supported, tied and properly positioned for cover in advance of the time scheduled for casting concrete.

.2 Notify Departmental Representative for inspection of reinforcement prior to enclosing the reinforcement in the forms. Provide adequate time for this inspection to occur.

3.4 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 20 00 – Concrete Reinforcing.

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measure cast-in-place concrete in square metres based on site measurements. Average depth as noted on Drawings. Include all formwork, reinforcing and associated accessories.

1.3 REFERENCES

.1 Abbreviations and Acronyms:

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.

.1 Type GU, GUb and GUL - General use cement.

.2 Reference Standards:

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.2 Canadian Standards Association (CSA)

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA A3000-13, Cementitious Materials Compendium.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Extended Warranties

.1 Submit to the Departmental Representative in an acceptable written form, guarantees against defects arising from faulty workmanship or defective materials for the listed items. Upon written notification, Make Good all defects.

1.5 QUALITY ASSURANCE

.1 Quality Control Plan:

.1 Provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

.2 Mock-up

.1 Construct mock-up in accordance with Section 01 33 00 – Submittal Procedures.

.2 The first pour for each repair type will be considered the mock-up unless otherwise stated.

.3 Construct mock-up of one repair, where directed by Departmental Representative.

.4 Construct mock-up under supervision of Departmental Representative to demonstrate a full understanding of specified procedures, techniques and formulations are achieved before work commences.

.5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.6 STORAGE AND HANDLING

.1 Storage

.1 Concrete materials: to CSA A23.1.

.2 Concrete admixtures: in accordance with manufacturer's directions.

.2 Waste Management and Disposal

.1 Packaging Waste Management: remove for recycling in accordance with local Waste Management laws.

.2 Remove excess concrete from site.

.3 Designate a cleaning area for tools to limit water use and prevent runoff. As this is an environmentally sensitive site, collect run-off from cleaning area and dispose safely off site.

.4 Carefully coordinate the specified concrete work with weather conditions.

.5 Ensure emptied containers are sealed and stored safely for disposal away from children.

.6 Prevent plasticizers, water-reducing agents and air-entraining agents from entering the waterway. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

.7 Choose least harmful, appropriate cleaning method which will perform adequately.

1.7 SITE CONDITIONS

.1 Existing Conditions

.1 Visit the site to determine available access, storage and working areas. Determine any interference from existing services.

.2 Use of accelerating or set retarding admixtures during hot or cold weather concrete placing is subject to the Departmental Representatives' approval.

.3 Notify the Departmental Representative in accordance with the requirements of the General Conditions of the Contract, if during the execution of the work, subsurface conditions are found to differ materially from those indicated in the Contract Documents or geotechnical report.

.4 Keep construction traffic and loads on the adjacent landscaping to a minimum.

Part 2 Products

2.1 MATERIALS

.1 Portland Cement: to CAN/CSA A3000, Type GU.

.2 Supplementary cementing materials: to CAN/CSA A3000.

.3 Water: to CSA A23.1.

.4 Aggregates: to CSA A23.1/A23.2. Coarse aggregates to be normal density. Aggregate to be suitable for NBC type N concrete. Normal size 20 mm unless noted on Drawings. Obtain coarse and fine aggregate for exposed concrete from the same sources and select from uniformly of colour. Stockpile supplies for project.

.5 Admixtures:

.1 Air entraining admixture: to CSA A23.1.

.2 Chemical admixture: to CSA A23.1. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.6 Bonding adhesive: Cement-based epoxy-modified three-component anti corrosive coating and bonding slurry. As an alternative, a two component, multi-purpose high modulus, epoxy bonding agent can be used.

.7 Polymer modified mortar:

.1 Polymer modified mortar shall be latex based, prepackaged, suited for the proposed application

.2 For repairs exceeding a thickness of 50mm, extend polymer modified mortar using clean 10mm aggregate in accordance with manufacturer’s instructions.

2.2 MIXES

.1 Proportion normal density concrete in accordance with CSA A23.1, Alternative 1, to give following properties for all concrete.

.2 Cement:

.1 Type GU Portland cement, Class C1 for all concrete repairs as per CSA A23.1.

.2 Minimum compressive strength at 28 days: 35 MPa.

Part 3 Execution

3.1 CO-OPERATION

.1 Provide casual labour to the independent inspection and testing agency's field personnel for the purpose of obtaining and handling sample materials. Provide free access to all portions of work and co-operate with the Testing Agency.

.2 Cooperate with all engaged on the work.

3.2 PROTECTION OF EXISTING STRUCTURE

.1 Take precautions necessary to protect the existing structure from damage. Be responsible for damage or claims for damage.

3.3 ALTERATIONS TO EXISTING STRUCTURE

.1 Undertake cutting, repairs, patching and removal of existing concrete.

.2 Provide connections between new and existing construction. Make cuts with the proper saws and bits when a clean line is required.

.3 Install all temporary supports which may be required.

.4 Supply and install formwork, concrete, reinforcing and accessories.

.5 Where existing concrete structure is damaged during removals, the existing concrete must be repaired to the Departmental Representative's specifications, at no cost to the Departmental Representative.

3.4 PREPARATION

.1 Obtain Departmental Representative's written approval before placing concrete.

.1 Provide 24 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.

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

.5 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.6 Protect previous Work from staining.

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

.8 Do not place load upon new concrete until authorized by Departmental Representative.

3.5 INSTALLATION/APPLICATION

.1 Cast-in-place concrete work to CSA A23.1/A23.2.

.2 Concrete Placement:

.1 Clean all forms of debris and deleterious materials before placing concrete. Remove all contaminants which lessen bond of concrete to reinforcement prior to placing concrete.

.2 Adjust reinforcement immediately before concrete is placed to ensure that all bars are secured in their correct positions. Arrange to have a crew of reinforcing setters on hand as concrete is placed, in order to make any last minute adjustments that are required.

.3 Use form vibrators for thin sections where rodding, spading or the use of internal vibrators is impractical. Attach vibrators firmly to the forms and so spaced that the complete lift of concrete is visibly affected.

.4 Do not place concrete in the rain. Protect exposed surfaces from rain or other adverse weather conditions until final set occurs.

.5 Where concrete is rejected by the Departmental Representative, refer to clause entitled "Field Quality Control".

3.6 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1.

3.7 CURING AND PROTECTION

.1 Provide curing and protection for concrete to CSA A23.1, Clause 7.4.

.2 High performance concrete, with strength of 35 MPa or greater, must be wet cured for a minimum of 7 days. Special attention must be paid to thin concrete sections.

.3 Do not pile, store or transport materials over repaired areas until concrete has been in place for at least 7 days.

.4 Do not use curing compounds that would have detrimental effect on bonding, adhesion, curing, appearance or similar qualities of materials applied to thin concrete surfaces, where finishes are incompatible with curing compound.

.5 Do not use combustion heaters of any kind in the presence of new concrete during construction.

.6 Shrinkage cracking as a result of improper curing will be cause for rejection of the concrete element in question. The concrete must be removed and replaced at no cost to the Departmental Representative.

3.8 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by the Departmental Representative in accordance with CSA A23.1/A23.2.

.2 Departmental Representative will pay for costs of tests.

.3 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.4 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

.5 Notify the Departmental Representative and Testing Laboratory as to the concreting schedule. Provide samples and standard test cylinders.

.6 Provide sufficient concrete quantity to allow appointed Testing Agency Representative to cast four test cylinders at pours selected by the Departmental Representative, for each standard strength test. One cylinder will be tested at 7 days and two at 28 days. One cylinder to be held as reference in case one cylinder at 7 or 28 days, provides negative results. Reference may also be broken at 56 days, at direction of Departmental Representative.

.7 Provide sufficient concrete quantity to allow appointed Testing Agency Representative to test concrete for air entrainment, as directed by the Departmental Representative. The percentage of entrained air will be determined and reported for concrete requiring an air entraining agent.

.8 Concrete Tests:

.1 Standard strength tests are required as requested by the Departmental Representative. Appointed Testing Agency Representative will store cylinders cast for testing, within a hoarded curing enclosure and allow to cure in-situ for a period of 72 hours. 7-day strength test shall not show less than 70% of 28 day strength.

.2 Test in accordance with CSA A23.2.

.3 Make slump tests in accordance with CSA A23.2, with each standard strength test and when so directed by the Departmental Representative.

.4 Ship test cylinders with completed shipping tag attached. Provide identification and sufficient information to correlate the cylinder to the information taken by the testing agency, to complete the report form as per Annex B, CSA A23.2.

.9 Install thermometers for recording temperatures when concrete is placed under cold weather or hot weather conditions.

.10 Ensure that supervisory personnel are on hand when concrete is being cast so that the placing and curing procedures of the specification will be properly observed.

3.9 RESTORATION

.1 Restore areas of existing concrete work affected by the Contract.

3.10 CLEANING

.1 Remove rubbish and surplus materials leaving the work ready for the Trades that follow.

.2 Dispose of waste in accordance with applicable local, Provincial and National regulations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 03 08 – Historic - Mortaring

.2 Section 04 05 10 – Common Work Results for Masonry

.3 Section 04 05 19 – Masonry Anchorage and Reinforcing

1.2 PRICE AND PAYMENT PROCEDURES

.1 Unit Prices

.1 Provide unit rates for each of the masonry repairs identified on the drawings, including grouting work. The unit cost for repair, includes all costs necessary to complete the specific repair, including additional scaffold, where required.

1.3 REFERENCES

.1 Definitions:

.1 Sawcutting: the careful use of a power tool with a fine blade to cut the middle third of the mortar joint, in order to break the surface tension of hard mortar and facilitate the raking out process, without damaging the stone.

.2 Raking: removal of loose/deteriorated mortar to a depth suitable for repointing until sound mortar, but not less than a depth of 30 mm. It is assumed that the outer 75 mm of mortar consists of a very hard cementitious mortar, however, it may extend deeper in some areas.

.3 Backpointing: filling of masonry joints from which mortar has been raked out to a point 30 mm from the stone face.

.4 Finishpointing: filling of masonry joints from which mortar has been raked out for a depth of 30 mm.

.5 Tooling: finishing of masonry joints using tool to provide final contour.

.6 Repair: use of adhesives to re-bond sections of fractured masonry.

.7 Consolidation: strengthening masonry units to prevent deterioration (spalling).

.8 Descaling: the removal of loose portions of the masonry (usually spalled area) through impact with a bush hammer or similar device.

.9 Resurfacing: tooling and polishing of stone surface to renew it’s texture and finish.

.10 Low-pressure water cleaning: water soaking of masonry using less than 350 kPa (50 psi) water pressure, measured at nozzle tip of hose.

.2 Canadian Standards Association (CSA) International

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.

.2 CSA A179-2014, Mortar and Grout for Unit Masonry.

.3 CAN/CSA A371-2014, Masonry Construction for Buildings.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 04 05 10 – Common Work Results for Masonry.

.2 Samples:

.1 Provide labelled samples of materials used on project for approval before work commences.

.3 Test and Evaluation Reports:

.1 Provide laboratory test reports certifying compliance of mortar ingredients with specifications requirements.

.4 Record Drawings:

.1 Upon completion of project, submit the following:

.1 Grout Records: Elevation drawings, recording grout tube numbers, and quantity of grout used in each elevation.

1.5 QUALITY ASSURANCE

.1 Masonry Contractor:

.1 Use single Masonry Contractor for masonry work.

.2 Masonry Contractor must demonstrate at the time of Bid submission, that he/she has 10 years minimum experience with historic stone masonry work on projects of similar size and complexity, to Work of this Contract. This experience must be verified by References.

.3 Masonry Contractor to have good level of understanding of structural behaviour of masonry walls when masonry work involves replacing or repairing stones which are part of structural masonry work.

.2 Masons:

.1 Principal mason to have certificate of qualification with 10 years minimum experience in historic stone masonry work.

.2 Ensure site personnel working on the work of this section, engaged by the Masonry Contractor can pass a hands on test of skills administered by the Departmental Representative where requested. Departmental Representative has right to reject any mason who does not demonstrate appropriate abilities.

.3 Appoint one thoroughly experienced, reliable and competent worker to be in charge of all mortar mixing for the duration of the project. The experience must include mixing mortar for a minimum of three projects similar to this project.

.4 Mortar grouting: grouting activities should be undertaken by workers experienced in manipulation and mortar grouting methods.

.5 Obtain approval from Departmental Representative for changes to qualified personnel.

.6 Mock-ups:

.1 Construct mock-up in accordance with Section 04 05 10 – Common Work Results for Masonry.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Store cementitious materials and aggregates in accordance with CSA A23.1. Keep sand dry, in conformance with CSA A179, Clause 5.3.6. Sand that does not conform will be rejected.
- .3 Keep material dry. Protect from weather, freezing and contamination.
- .4 Ensure that manufacturer's labels and seals are intact upon delivery.
- .5 Remove rejected or contaminated material from site.

.2 Packaging Waste Management: remove for reuse, in accordance with local Waste Management laws.

1.7 AMBIENT CONDITIONS

.1 Maintain masonry temperature between 10 degrees C and 25 degrees C for duration of work.

.2 When ambient temperature is below 5 degrees C:

- .1 Store mortar materials for immediate use within heated enclosure in accordance with Section 04 03 08 – Historic - Mortaring. Allow mortar materials to reach minimum temperature of 5 degrees C before use.
- .2 Heat water to minimum 20 degrees C and maximum 30 degrees C.
  - .1 At time of use, temperature of mortar to be minimum of 15 degrees C and maximum of 30 degrees C.

.3 Maintain sand temperature between 10 degrees C and 30 degrees.

.4 Do not mix cement/lime with water or with aggregate or with water-aggregate mixtures having higher temperature than 30 degrees C.

.5 Maintain mortar mix temperature between 10 degrees C and 30 degrees C.

1.8 SITE CONDITIONS

.1 Existing Conditions

- .1 Report in writing, to Departmental Representative, areas of deteriorated masonry revealed during work. Obtain Departmental Representative’s approval and instructions for repair and replacement of masonry units before proceeding with repair work.

.2 Protection

- .1 At end of each working day, cover unprotected work with waterproof membranes. Extend membranes to 0.5 m beyond the perimeter of the work area and install securely to prevent finished work from drying out too rapidly.
- .2 Protect adjacent finished work against damage which may be caused by on-going work.

.3 All methods of enclosure and protection to be approved by the Departmental Representative.

.4 Protect newly laid mortar from excessive exposure to rain and full sunlight until the surface is thumb-print hardened.

.5 Provide and maintain protection for masonry walls at all times when work is suspended, to prevent water from entering partially repointed masonry.

.6 Protection to consist of non-staining 6 mil polyethylene sheets, or tarpaulins over burlap, secured to prevent lifting in high winds.

Part 2 Products

2.1 MATERIALS

.1 Mortar: in accordance with Section 04 03 08 - Historic - Mortaring.

.2 Proportions: in accordance with Section 04 03 08 - Historic - Mortaring.

.3 Anchorage and Reinforcing: comply with Section 04 05 19 – Masonry Anchorage and Reinforcing.

Part 3 Execution

3.1 GENERAL

.1 Perform work in accordance with CAN/CSA A371. Extent of raking out and repointing is as noted on the Drawings.

.2 Work from the top of wall down, unless noted otherwise, or approved by the Departmental Representative.

.3 Use manual raking tool unless otherwise specified, to remove deteriorated mortar and ensure that no masonry units are chipped/altered/damaged by work to remove mortar. Tools for cutting out must be narrower than the joint.

.4 Tool and compact using jointing tool to force mortar into joint.

.5 For backpointing in deep, narrow joints, fabricate long stainless steel packing tools, to force mortar into the joints and provide compaction.

.6 Finish joints to follow profile of existing joints, except where specified otherwise.

.7 Use suitable approved jointing tool to form compacted tooled joints. Tool length for finishpointing not to exceed 50 mm.

.8 Do not sawcut or rake out mortar joints where ambient temperature is below 5°C in the Springtime or 0°C in the Fall, as the mortar in the joints may be frozen. Any attempt to remove frozen mortar will result in damage to the masonry. Damaged masonry resulting from removal of frozen mortar must be replaced at Contractor’s cost.

3.2 REPOINTING

.1 Raking Joints

.1 Rake out all joints as noted on drawings.

.2 Rake unsound joints free of deteriorated and loose mortar, dirt and other undesirable material.

.3 Cutting out of joints is to be done with hammer and chisel, unless otherwise specified. Take great care so as not to damage masonry units adjacent to joints. Cut away from the arrises to prevent spalling of the masonry. The use of power tools is only permitted, as noted.

.4 Permission to use power tools will be based on the Contractor's ability to comply with the conditions noted below (sub-paragraph 6), as observed in the mock-up.

.5 If these requirements are not complied with, the Contractor will be required to remove all mortar by use of hand tools, at no extra cost to the Departmental Representative.

.6 Where the use of power tools is permitted to remove existing mortar, proceed as follows:

.1 Grind the centre of the joint only, to a maximum width of half of the joint width. Mortar must remain on each side of the cut. The grinders must not touch the stone.

.2 For vertical joints, and discontinuous horizontal joints, stop sawcut 50 to 75mm from end of joint. Do not sawcut stone.

.3 Notify the Departmental Representative to inspect the grinding, prior to removing the remaining mortar.

.4 Remove the remaining mortar with hand tools.

.7 Include removal of all existing excess mortar that may have been applied to stone face due to overpointing. Do not damage arris or finish on stone face.

.8 Include removal of all existing high strength cementitious mortar from the joints, to a minimum depth of 75 mm.

.9 Clean joints to full depth of deteriorated mortar, but in no case to less than 30 mm. Clean out voids and cavities encountered.

.10 Clean surfaces of joints by compressed air, without damaging texture of exposed joints or masonry units.

.11 Flush open joints and voids; clean open joints and voids with low pressure water and if not free draining blow clean with compressed air.

.12 Fine joints (less than 4mm) need not be raked out more than 10mm, in order to reduce the danger of chipping the masonry edges. Cut these joints with power - saw, if necessary. When saw cutting vertical joints, stop sawcut 50 to 75mm from end of joint. Do not saw cut stone. Use flat-bladed quirks and light hammers, hack-saw blades or similar tools to rake out joints.

.13 Leave no standing water.

.14 Damaged stone includes widening of existing joints, nicks, gouges and chipped or scratched surfaces from cutting out tools, resulting from improper workmanship. Stone damaged as a result of careless raking, or saw cutting, shall be replaced at no cost to the Departmental Representative.

.15 Do not rake joints for more than three courses of stone, prior to backpointing, unless approved by the Departmental Representative.

.16 If masonry unseats or bond is broken, remove unit, consolidate the back-up masonry and reset.

.2 Backpointing

.1 Prior to commencing backpointing, notify Departmental Representative to review masonry, make adjustments to stone repair requirements, identify all Dutchman repairs, stone replacement and stone removals.

.2 Where cut out joints are deeper than minimum raking out depths specified above, backpoint joints to bring mortar face to specified depth for raked out joints, in preparation for finishpointing. Where voids exist that conventional backpointing cannot fill, notify Departmental Representative for direction.

.3 Immediately prior to pointing, thoroughly wet joints in order to control absorption.

.4 Allow water to soak into masonry and mortar, leaving no standing water, but remaining wet.

.5 For backpointing, fill all joints full with mortar, compacting firmly into joints to ensure positive adhesion to all inner surfaces. Place mortar in layers, maximum 50 mm thick, minimum 30 mm thick, allowing each layer to set to thumb print hardness before placing next layer. Fill joints to a depth of 400 mm minimum from face of stone. Bring face of mortar in backpointed joint to specified minimum depth for raked out joints, measured from the arris of the masonry unit. Leave ready for final pointing.

.6 Form mortar square to stone face, and leave exposed stone each side of joint clean of mortar prior to mortar setting. Roughen surface of mortar when thumbprint hard.

.7 For deep joints, provide stainless steel packing tools manufactured to permit the mason to compact mortar deep into the joints.

.8 In the event that the vertical joints are too deep to install mortar full depth, install mortar to minimum 400 deep, and install grout tube in order to grout deep voids.

.9 Prevent mortar from being placed or smeared onto face of stone. Avoid mortar staining of masonry faces during backpointing.

.3 Finishpointing

.1 When all required repair and replacement work is complete, carry out finishpointing.

.2 Before finishpointing, wash walls to be finishpointed and allow to dry to damp-dry condition. Ensure that all dust, mortar particles, and other debris is removed from joints and wall surfaces before finishpointing.

.3 Dampen joints and completely fill with mortar. Fill the joints to approximately 1 mm behind arrises. Avoid feathered edges. Pack mortar solidly into voids and joints, to ensure positive adhesion to all inner surfaces.

.4 Where stone units have worn rounded edges, keep pointing back from face of stone, as detailed on drawings. If the width of the mortar joint will exceed 35 mm, stop work and notify the Departmental Representative for direction.

.5 Keep masonry damp while pointing is being performed.

.6 Do no pointing in freezing weather.

.7 Build up pointing in layers not exceeding 30 mm in depth. Allow inner layers to become thumbprint hard before applying subsequent layers. Pack and compress mortar into voids to fit approximately, but no less than 15mm thick. Maintain joint width.

.8 Remove excess mortar from masonry face before it sets. Finish jointing neatly as detailed.

.9 Allow mortar to set so that there is no excess water which will cause run off on stone faces, then tool to match approved mock-up joints. Tool head joints, followed by horizontal joints. Do not overwork the face of the joints. Ensure joints are uniform in appearance. Do not brush joints until they have set to the extent that brushing will not mark the joint surface.

.10 When mortar is thumbprint hard, tool joints behind masonry face with tools specifically crafted to replicate weathered joints.

.11 Retempering of Mortar

.1 Portland cement-hydrated lime mortars should only be retempered once, and should be used within 2 hours of adding water to the mix when the air temperature is less than 25 degrees C. (1½ hours for higher temperatures).

.4 Underwater joints/Joints above waterline with active seepage: Remove all loose material from joints. Repoint using a rapid setting, cement based repair mortar, specifically formulated for underwater use, following manufacturer's instructions. Finish joints as neatly as possible. Installation of this product must be pre-approved by the Departmental Representative, at all locations where it is to be installed. This application is considered to be a last resort.

.5 Curing

.1 Moist cure freshly pointed joints by spraying at intervals and covering with moist burlap enclosure and polyethylene sheeting for minimum of 7 days after finishpointing. Keep wall and burlap misted.

.6 Protection

.1 Protect newly laid mortar from frost, rainfall or rapid drying conditions for 7 days.

3.3 RESETTING

.1 Prepare slot to receive stones. Clean back all loose and deteriorated core to sound material.

.2 Repoint all void joints in back-up masonry. Replace deteriorated masonry as directed by Departmental Representative. Shave back-up masonry as necessary to reset stone.

.3 Build up core where more than 50 mm wide void exists behind stones to be reset. Build up in traditional manner with new stone offsets in mortar. Allow mortar to fully set up.

.4 Install new stainless steel pin anchors as detailed on drawings; two anchors per stone, top and bottom.

.5 Install mortar on face of back-up masonry to form continuous collar joint, just prior to resetting stone.

.6 Arrange dislodged masonry units in same location and orientation as originally set with water soaked hardwood wedges. Reset level, true and square with even mortar joints to exact original thickness.

.7 Insert and compress firm mortar to within 30 mm of finishpointing surface. Allow mortar to set 24 hours.

.8 Pull out wood wedges when dried and shrunken.

.9 Backpoint in layers and leave ready for finishpointing.

3.4 GROUTING

.1 Where it is determined that there are voids in the centre core of the wall, or joints are void to a depth of 400 mm or greater, install specified grout.

.2 Clean out void with water until water runs clear. Ensure ambient temperature is to remain above 5°C for at least 24 hours after voids are cleaned out.

.3 Fill joints and cracks with mortar set back 50 mm from final mortar surface.

.4 Drill grout holes to depth of 1200 mm.

.5 Install grouting tubes in holes, spaced at 600 mm on centre horizontally and vertically in joints, as backpointing proceeds. Number each grout hole and note on Master Elevation drawings.

.6 Pour specified mortar, with casein additive through mortar cup until void is full. Record quantity of grout inserted in each tube, on Master Elevation drawings.

.7 Grout from the bottom of the wall to the top.

.8 Do not exceed lifts of 600mm. Allow grout to set for 24 hours, prior to proceeding.

.9 Remove grout tubes after initial set of grout has occurred. Fill holes with backpointing mortar.

.10 Proceed with finishpointing only after all grouting is complete.

3.5 FIELD QUALITY CONTROL

.1 The Departmental Representative will inspect the quality of the work on a regular basis.

.2 Once the stone masonry is cleaned of mud and debris, notify Departmental Representative prior to sawcutting joints, so that the stone masonry can be recorded photographically. Provide clear access to all points of stone masonry to permit this photography to occur.

.3 Provide Departmental Representative with a minimum of 48 hours of notice for required inspection.

.4 Approval of raked out condition of joints, approval of deep backpointing mortar after it is installed to a depth of 150 mm from the stone face and approval on completion of backpointing, must be received in writing by the contractor before the next procedure can proceed.

.5 Where work proceeds to the next phase, without the approval of the Departmental Representative, all unapproved mortar will be removed at contractor cost.

3.6 SCAFFOLDING ANCHORAGE

.1 As each level of work is completed and cured for a minimum of seven days, remove embedded scaffold anchors.

.2 Reinstall anchors into alternate freshly pointed masonry joints adjacent to existing anchorage location, until scaffold removal is required.

.3 Rake out and repoint joints affected by anchors, as detailed.

.4 Repointed joints must be inspected by Departmental Representative, prior to removal of scaffold deck.

.5 Upon final removal of anchors, repoint the joints where the anchor has been removed. Ensure mortar colour is uniform with previously repointed joints.

3.7 CLEANING

.1 Clean surfaces of mortar droppings, stains and other blemishes resulting from work of this contract as work progresses.

.2 Remove droppings and splashings using clean sponge and water.

.3 Do further cleaning using stiff natural bristle brushes after mortar has attained its initial set and has not fully cured.

.4 Clean masonry with stiff natural bristle brushes and plain water only if mortar has fully cured.

.5 Clean stone surface behind scaffold tie-backs, as they are removed.

.6 Obtain approval of Departmental Representative prior to using other cleaning methods for persistent stains.

.7 After final cleaning, notify Departmental Representative to complete a final inspection of the wall. Repair all noted deficiencies before dismantling scaffolding.

3.8 PROTECTION OF COMPLETED WORK

.1 Protect adjacent finished work against damage which may be caused by on-going work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 03 07 - Historic - Masonry Repointing.

.2 Section 04 05 10 - Common Work Results for Masonry.

1.2 ALTERNATES

.1 Obtain Departmental Representative's approval before changing manufacturer's brands or sources of supply of mortar materials during entire contract or other methods of mixing mortar specified elsewhere in this specification. This criterion will apply for the duration of the contract.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C109/C109M-13, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm Cube Specimens).

.2 ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar.

.3 ASTM C185-08, Standard Test Method for Air Content of Hydraulic Cement Mortar.

.4 ASTM C207-06 (2011), Standard Specification for Hydrated Lime for Masonry Purposes.

.5 ASTM C270-14a, Standard Specification for Mortar for Unit Masonry.

.6 ASTM C780-14b, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

.7 ASTM C940-10a, Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

.8 ASTM C1324-10, Test Method for Examination and Analysis of Hardened Masonry Mortar.

.2 Canadian Standards Association (CSA)

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.

.2 CSA A179-2014, Mortar and Grout for Unit Masonry.

.3 CAN/CSA A3000-2013, Cementitious Materials Compendium.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings

.1 Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.2 Scheduling of Work

.1 Submit work schedule indicating anticipated progress stages within time of final completion shown in bid document.

.2 Take measures necessary to complete work within approved schedule time. Schedule may not be changed without approval of Departmental Representative.

1.5 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 for:

.1 Aggregate. Include identification of aggregate source.

.2 Cement.

.3 Lime.

.4 Premixed products.

.5 Additives.

.3 Samples:

.1 Provide samples in accordance with CSA A179.

.2 Submit two 50 mm x 50 mm size samples of mortar to demonstrate colour and texture.

.3 Submit sample of sand to demonstrate colour and gradation.

.4 Action Submittals:

.1 Submit recordings of temperature and humidity weekly.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Refer to Section 04 03 07 – Historic – Masonry Repointing.

.2 Certificates

.1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Testing Standards

.1 Conduct the required testing in accordance with the following standards:

.1 Flow and cube strength: to ASTM C 270.

.2 Vicat cone test: to ASTM C780.

.3 Cube strength: to CSA A179, Annex B.

.4 Flexural bond strength: to CSA A179.

.4 Test reports:

.1 Submit test results during site work as directed by Departmental Representative as follows:

.1 Sieve analysis: sand, in accordance with CSA A179.

.2 Bulking analysis: sand in condition as delivered to site.

.3 Air content: mortar mix in plastic state.

.4 Vicat cone penetration: mortar mix.

.5 Mortar compressive strength: at 7, 28 and 56 days or otherwise required.

.6 Flexural bond strength: test during mock-up using masonry units on site.

.7 Lime grout compressive strength: at 28, 56 and 112 days, or otherwise required.

.5 Mock-ups:

.1 Construct mock-up in accordance with Section 04 05 10 – Common Work Results for Masonry.

.2 For mortar colour, include five 500 mm long mock-ups of different mortar colours. Departmental Representative to select the colour to be used for the project.

.6 Existing Mortars:

.1 Verification of compliance with proportion specifications: test original mortar material for aggregate to binder ratio to ASTM C1324.

1.7 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 off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store cementitious materials and aggregates in accordance with CSA A23.1/A23.2.

.3 Protect from weather, freezing and contamination.

.4 Remove rejected or contaminated material from site.

.3 Waste Management and Disposal

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with local collection services.

1.8 SITE CONDITIONS

.1 Ambient Conditions:

.1 Execute work to CSA A179.

.2 Provide weather-tight enclosure to store materials and mix mortars, maintain air temperature above 10ºC at all times.

.3 Maintain maximum/minimum thermometers and relative humidity gauges on site and in enclosures.

.1 Maintain a daily record of temperature and humidity.

.2 Locate gauges at upper reaches of enclosure, and within 600 mm of floor level at base of enclosure.

.4 Execute work when ambient temperature is above 5° Celsius. When ambient temperature is below 5° Celsius, cover and heat Work as directed by Departmental Representative.

.5 Prepare and maintain temperature of mortar between 5° Celsius and 30° Celsius until used.

Part 2 Products

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Mortar and grout: to CSA A179.

.3 Water: potable, clean and free from contaminants.

.4 Sand: to CSA A179; Gradation to ASTM C144. Use well graded sand passing 4.75 mm down to 150 micron sieve where joints are greater than 6 mm. Use sand passing 1.18 mm down to 300 micron sieve where 6mm thick joints or less are indicated. In the event that the sand does not meet the gradation requirements, carry out additional sieving to meet requirements or provide alternate sand. Provide dry aggregate to CSA A179, Clause 5.3.6.

.1 Sharp, screened and washed pit sand, free of organic material, with final grading and colour to approval of Departmental Representative.

.5 Colour: inorganic oxide pigments only. Colour of sand to match existing shades and tones.

.6 Portland cement: to CAN/CSA A3000, non-staining, type GU.

.7 Lime:

.1 Hydrated Lime:

.1 Hydrated, high calcium, Type "SA" to ASTM C207.

.8 Casein Additive: Protein polymer to provide fluidity in grout.

.9 Calcium chloride is not to be used for any mortar.

.10 Polymer Latex: organic polymer latex admixture of batadene-styrene type non-emulsifiable bonding admixture.

.11 Underwater Grout/Mortar: proprietary formulation of blended Portland cements, finely processed aggregates and chemical additives designed to produce a rapid set in underwater environments. Compressive strength to ASTM C109. Product to be approved in writing by Departmental Representative.

2.2 MORTAR MIXES

.1 Proportion requirements:

Bedding and pointing mortar for stonework: type N based on proportion specifications. Range of compressive strength: 10.0 MPa to 15.0 MPa at 56 days.

.1 Limestone: 1:1:6 cement: lime: aggregate mix for all joints.

.2 For all joints in walls, add polymer latex admixture as per manufacturer's instructions.

.3 Underwater stone joints and stone joints above waterline with active water seepage: use approved rapid setting underwater grout, mixed to manufacturer's requirements. Compressive strength: 41 MPa. at 28 days.

.2 Vicat Cone Penetration for Stonework: to ASTM C780.

.1 Pointing Mortar: 15-20mm.

.2 Bedding Mortar: 20-30mm.

.3 Allowable air content for all Lime Mortars: 7% to 15%.

.4 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour and not more than 2 hours, then remix with sufficient water to produce mortar of proper consistency for pointing.

.5 Do not add air entraining admixture to mortar mix.

.6 Grout mix

.1 Add casein to the specified mortar mix (1:3:7) at the following ratio: between 0.5 – 2% casein by weight of binder, to increase fluidity of grout.

.2 Range of compressive strength at 112 days is 3.0 MPa to 5.5 MPa.

2.3 ALLOWABLE TOLERANCES

.1 If mortar fails to meet 60% of the specified mortar strength range at 7 days, but meets the 28 day compressive strength requirement, it is acceptable. If mortar fails to meet the 7 day compressive strength requirement, but its strength at 7 days exceeds two thirds of the value required for the 7 day strength, contractor may elect to continue work at his own risk while awaiting the results of the 28 day tests, or to take down the work affected.

.2 The Departmental Representative reserves the right to reject mortar which falls more than 20% outside of the 56-day compressive strength range required, and to have the contractor remove it from the wall.

Part 3 Execution

3.1 GENERAL PREPARATIONS

.1 Traditional Mortar:

- .1 Prepare measuring boxes to ensure accurate proportioning of materials.
- .2 Maintain separate measuring boxes for each component.
- .3 Ensure sand is tested and volume corrected for bulking. To avoid bulking, use dry sand.
- .4 Ensure testing equipment is ready and in working order.
- .5 Apply Vicat cone test to ensure desirable performance of the mortar and record results.

.2 Premixed Mortar:

- .1 Follow manufacturer's written instructions.
- .2 Whole bag has to be prepared. Mortar prepared using a portion of a bag will be rejected.
- .3 Apply Vicat cone test to ensure desirable performance of the mortar and record results.

3.2 BULKING OF SAND

.1 Test sand for bulking:

- .1 At start of work.
- .2 After each new delivery of sand.
- .3 After severe change in weather.

.2 Verify moisture content in sand conforms to CSA A179.

.3 The Departmental Representative reserves the right to reject sand if bulked volumes are excessive.

.4 Test and adjust sand quantities for bulking:

- .1 Obtain sample of sand which accurately reflects average condition of pile of damp sand, as follows:
  - .1 Take 4 shovels full of sand, each from a different level of the pile, and mix thoroughly.
  - .2 Place sand in a conical pile and divide into 4 quarters with a board. Remove 2 opposite quarters from pile, and combine remaining 2 quarters and mix thoroughly.
  - .3 Repeat quartering and mixing procedure until a sample of size required for testing remains.
- .2 Fill a 1-litre capacity jar, about two-thirds full with damp sand to be tested. Drop sand in loosely. Do not pack it in. Level off surface, measure depth of damp sand (D).
  - .1 Carefully empty sand into another container, and half fill first container with water.

.2 Pour back about half of test sample of sand slowly into water so it is entirely saturated. Rod it thoroughly to remove air.

.3 Add rest of sand, rodding again to remove air and level off surface. Measure depth of saturated sand (S), which will be less than depth of damp sand.

.4 Calculate percentage bulking using formula: [(D-S) x 100%]/S = percentage bulking; where D = depth of damp sand, and S = depth of saturated sand.

.3 Increase volume of sand by percentage bulking shown in test.

3.3 MIXING

.1 Prepare measuring boxes to ensure accurate proportioning of mortar ingredients. Each box to contain exact volume proportion for each specific mix ingredient.

.2 Introduce approximately 75% of the total volume of water into the mixer, followed by 50% of the sand and all of the dry hydrated lime and any pigment. Mix for approximately 3 minutes, or until the materials are thoroughly blended and no particles of white lime are apparent in the mix.

.3 Allow to stand for 5 minutes.

.4 Add the full volume of Portland cement, the remainder of the sand and water. Mix for further 3-5 minutes until thoroughly blended and mortar has reached consistency determined by Vicat Cone penetration testing.

.5 Add just sufficient water to obtain workable consistency for setting units. Avoid too wet a mix which stains the face of the work. Vicat Cone penetration may be slightly greater for bedding mixes, but should not exceed maximum value specified by more than 20%.

.6 Mix Characteristics:

.1 Pointing mortar: slightly stiffer than bedding mortar with a consistency such that the mortar can be hand-formed into a stiff ball.

.2 Record amount of water required to reach this consistency and use for subsequent mixes.

.7 Adjust mix proportions based on percentage bulking shown in the test.

.8 Mortar for reconstruction of dismantled masonry, or new construction, can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes.

.9 Mixing by hand for repointing mortars must be pre-approved by Departmental Representative as follows:

.1 Hand mixing must be carried out using high speed, 2500 Rpm drill, with paddle mixer attachment. Mixing to be completed in sufficiently small container so as to allow full contact of the paddle with the mortar during the mixing process, thus ensuring thorough incorporation of ingredients and air entrainment.

.2 Submit masonry tools and container for approval prior to starting pointing work.

.10 Prepare only enough mortar to be used within two hours. Do not re-temper mortar beyond this time.

.11 Follow manufacturer instructions when premixed mortar is used.

.12 Appoint one individual to mix mortar for duration of project. If this individual must be replaced, mortar mixing must cease until replacement individual is trained, and mortar mix is tested.

.13 Ensure mortar does not contain elements detrimental to the original masonry or surrounding materials.

3.4 CONSTRUCTION

.1 Do masonry mortar and grout work in accordance with CSA A179 except where specified otherwise.

3.5 CLEANING

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

.2 Remove droppings and splashings using clean sponge and water.

.3 Clean masonry with low pressure clean water and soft natural bristle brush. For limestone, pressure should be between 276 kPa and 410 kPa. See Section 04 03 07-Historic - Masonry Repointing and Repair.

3.6 PROTECTION OF COMPLETED WORK

.1 Cover completed and partially completed work, not enclosed or sheltered at end of each work day.

.2 Enclose and protect work using wetted burlap.

.3 Cover with waterproof tarps to prevent weather from eroding recently laid material.

.1 Maintain tarps in place for minimum of 1 week after laying.

.2 Ensure that bottoms of tarps permit airflow to reach mortar in joints.

.4 Anchor coverings securely in position.

3.7 FIELD QUALITY CONTROL

.1 Inspection and testing of mortar will be carried out by a Testing Laboratory designated by the Departmental Representative, to CSA A179. The mortar testing company should have the capacity to provide Vicat Cone testing and test the air with a mortar test apparatus. A concrete test apparatus must not be used to test the air, as it is unsuitable for this application.

.2 Departmental Representative will pay for cost of test as specified.

.3 Frequency of mortar testing will be specified by Departmental Representative.

.4 Air content to ASTM C185, and penetration using Vicat Cone to ASTM C780 for mortars used in stonework, must be tested at the same frequency as strength tests to ASTM C109, or more frequently as required by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 03 07 – Historic – Masonry Repointing.

.2 Section 04 03 08 – Historic – Mortaring.

.3 Section 04 03 42 – Historic – Replacement of Stone.

.4 Section 04 05 10 – Common Work Results for Masonry.

1.2 PRICE AND PAYMENT PROCEDURES

.1 Unit Prices

.1 Provide unit prices for each of the repairs identified on the drawings. The unit price for each repair will include all costs necessary to complete the specific repair, including additional shoring and scaffolding, removal and reinstatement of existing stone, core masonry consolidation, all anchorage, mortar and grout work necessary to stabilize adjacent masonry.

.2 Allow for waste required to achieve desired size of Dutchman repairs.

1.3 ALTERNATES

.1 Obtain Departmental Representative's written approval before changing procedures, manufacturer's brands, sources of supply of materials during entire contract.

1.4 REFERENCES

.1 Definitions:

.1 Repair of Stone: mechanical or plastic repair, done to restore original appearance and function of partly deteriorated stones. Repairs include crack repair, Dutchman repair, fracture repairs and descaling.

.2 Filling: material used to rebuild broken or deteriorated part of stone.

.3 Adhesive: material used to fasten broken/fractured stone elements by direct application at fracture interface and/or by application to added reinforcing elements such as dowels.

.4 Mortar: material used to re-bed the stone element being repaired and to repoint adjacent mortar joints.

.2 Reference Standards:

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar.

.2 ASTM A276-15, Standard Specification for Stainless Steel Bars and Shapes.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA A3000-13, Cementitious Materials Compendium.

.2 CSA A179-2014, Mortar and Grout for Unit Masonry.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations. Include:

.1 Application/installation instructions.

.2 Laboratory test reports certifying compliance of products with specification requirements.

.3 Manufacturer's material safety data sheets (MSDS) for safe handling of specified materials and products, in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.3 Samples:

.1 Submit adhesive and mortar samples for testing.

.2 Submit (3) 250 mm x 250 mm x 50 mm stone units, representative of proposed units for work. (This is only necessary, if samples not submitted for replacement stone).

.1 New Stone:

.1 Departmental Representative reserves the right to request results from tests by an independent testing agency to verify mechanical, physical and aesthetic properties of stone, at no additional cost to Contract.

.3 Submit (1) 300 mm x 300 mm x 100 mm stone sample, representing each stone repair type, for review by Departmental Representative. Samples to be completed within six weeks of award of Contract and once approved, to remain in site office for duration of project.

.4 Certificates:

.1 Submit upon request by Departmental Representative purchase orders, invoices, suppliers test certificates and documents to prove materials used in contract meet requirements of specification. Allow free access to sources where materials were procured.

1.6 CLOSEOUT SUBMITTALS

.1 Record Documentation:

.1 Provide marked up set of drawings to provide referencing system identifying locations of stone repairs.

.2 Provide photographic record of dismantle and rebuilt stonework.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Masonry Contractor:

.1 Work of this Section: executed by contractor specializing in historic stone conservation work of this nature, using similar stone repair techniques and with a minimum 10 year record of successful performance.

.2 Foreperson:

.1 Provide competent trade foreperson specializing in type of work required. Must be present on site throughout Work.

.2 Experience: minimum 10 years of experience in conservation work similar to work of this Section. Must be present on site throughout Work.

.3 Masons:

.1 Ensure site personnel working on the work of this section, engaged by the Masonry Contractor, can pass a hands on test of skills administered by Departmental Representative where requested. Departmental Representative has right to reject any mason who does not demonstrate appropriate abilities or experience.

.2 All masons employed on this project throughout course of project must meet above requirements. Where, during course of project, masons leave work force, replacement masons must also meet requirements.

.3 Apprentices with a minimum of one year certification from a recognized Masonry Program, may work under the direction of a mason as noted above.

.2 Mock-ups:

.1 Construct mock-up in accordance with Section 04 05 10 – Common Work Results for Masonry.

.2 Construct mock-up where directed by Departmental Representative.

.3 Prepare one mock-up in wall, and one mock-up in sample stone, as noted under Sub-article 1.5.3.3, for each stone repair type.

.4 Construct the following stone repair mock-ups:

.1 Crack repair

.2 Dutchman repair

.3 In-situ fracture repair

.5 Select location of mock-ups in consultation with Departmental Representative.

.6 Clean mock-up to demonstrate cleaning operations to Departmental Representative.

1.8 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.1 Identification with grade, batch and production date shown on container or packaging.

.2 Store materials in a clean, dry enclosed area and supported free of ground. Maintain a minimum ambient temperature of 10 degrees C in storage area.

.3 Packaging Waste Management: remove for reuse and return in accordance with Waste Management plan.

1.9 SITE CONDITIONS

.1 Ambient Conditions

.1 Maintain a minimum temperature of 10 degrees C during and 48 hours after repair, throughout thickness of stone.

.2 Allow materials to reach minimum temperature of 10 degrees C prior to use.

.3 Provide temporary enclosures to maintain specified temperatures. Take precautions to avoid overheating masonry.

.4 Remove work exposed to lower temperatures as directed by Departmental Representative.

.5 Refer to manufacturer's instructions for environmental requirements of products.

.2 Record and report to Departmental Representative, site conditions non-conforming to those specified before beginning work.

Part 2 Products

2.1 MATERIALS

.1 Use materials from same manufacturer throughout the Work.

.2 Portland cement: to CAN/CSA A3000.

.3 Sand: cleaned and graded in accordance with ASTM C144.

.4 Water: clean and free of deleterious materials such as acid, alkali and organic material in accordance to CSA A179.

.5 Dowels: stainless steel to ASTM A276, Type 304.

.1 Diameter: dependent on size and weight of each new stone insert and as noted on Drawings.

.6 Deformed wire: 2 mm diameter, stainless steel Type 304.

.7 New stone:

.1 Similar mechanical, physical and aesthetic properties to existing stone. See Section 04 03 42 – Historic – Replacement of Stone.

.2 To approval of Departmental Representative.

.8 Hairline Crack Filling: Dispersed Hydrated Lime (DHL) grout and shelter coat, pigmented to match stone colour to approval of Departmental Representative.

2.2 MORTAR MIXES

.1 Mortar: in accordance with Section 04 03 08 - Historic - Mortaring.

2.3 ADHESIVE MIXES

.1 Proprietary stone adhesive:

.1 Specially formulated for repair of broken stone units.

.2 Adhesive mix: NHL 3.5 Hydraulic Lime and Casein. Mix proportions as recommended by manufacturer to obtain specified results.

.1 Submit samples for testing.

Part 3 Execution

3.1 SITE VERIFICATION OF CONDITIONS

.1 Report in writing, to Departmental Representative, areas of deteriorated stone not identified in the documents.

.2 Notify Departmental Representative to inspect the masonry and mark all Dutchman, new stone and stone removals on the masonry, prior to commencing backpointing of joints.

.3 Obtain Departmental Representative's approval and instructions for repair and replacement of masonry units before proceeding with repair work.

.4 Stop work in that area and report to Departmental Representative immediately any evidence of hazardous materials.

3.2 PREPARATION

.1 Obtain Departmental Representative's approval for repair methodology and tools to be employed prior to commencing work.

3.3 SPECIAL TECHNIQUES

.1 Temporary Marking and Recording:

.1 Mark stone, on face, before removal using marking product which can be completely erased when required without damaging masonry unit:

.1 Ball-point pen on diachylon, attached to stone.

.2 Waxless chalk directly on stone.

.3 Waterproof information card, securely tied to stone.

.2 Use numbering, marking, and positioning system shown on drawing or chart specifically prepared for accurate recording of stone location.

.3 Ensure that temporary marking will remain in use: resistant to weather, handling and cleaning until final marking of stones.

.4 Remove markings and adhesive without damaging units:

.1 Brush with vegetable fibre brush: either dry or with water.

.2 Use no solvent, acid or other chemical product.

3.4 PROTECTION

.1 Prevent damage to stone surfaces, mortar joints, and natural features which are to remain. Make good damage incurred.

.2 Protect surrounding components from damage during work.

.3 Take utmost care not to damage historic fabric. Make good damage incurred.

.4 Obtain Departmental Representative's approval for repair technology.

3.5 CRACK REPAIR

.1 Drill 5 mm diameter injection ports as per injection adhesive manufacturer's specifications.

.2 Clean out void with compressed air and potable water until water runs clear. Final flushing to be with 10% ethyl alcohol solution.

.3 Seal joints and cracks to manufacturer's specifications.

.4 Complete injection procedure as per manufacturer's instructions. Keep surface of stone clean of spills. Clean off as work progresses.

.5 Allow adhesive to harden.

.6 Prepare DHL shelter coat using compatible pigments with the DHL grout. Pigment must match stone colour.

.7 Inject shelter coat over crack fills. Apply in thin layers to build up to surface.

3.6 REPAIR OF A FRACTURED STONE

.1 Remove deteriorated portions of stones using low impact removal methods until sound surface is reached.

.2 Remove elements which require minor repair, without losing pieces or worsening damage. Do not damage existing Work.

.3 Drill 13 mm diameter holes, 60 mm long in each section at fracture, maximum spacing at 300 mm on centre. Provide minimum two holes per stone. Clean dust out of holes using acetone and cotton swabs.

.1 Fractures over 300 mm in length: require additional dowels per 200 mm length of fracture.

.4 Align holes on each side of fracture.

.5 Use minimum 2 dowels per fracture, for stones less than 600 mm high and one additional anchor for every 300 mm extra height.

.6 Dampen stone surfaces prior to application of adhesive and ensure humidity, temperature, cleanliness and finish condition of stone is in accordance with adhesive manufacturer's instructions.

.7 Insert 12 mm diameter dowels, 100 mm long, and apply specified adhesive to holes and interface. Allow adhesive to cure in accordance with manufacturer's instructions for 24 hours minimum.

.8 Reinstate consolidated element into work and repoint using specified mortar, in accordance with Section 04 03 07 - Historic - Masonry Repointing. Joint profiles to match existing. If fracture lines up with vertical mortar joints above and below the fractured stone, rotate the stone 180°, if pattern on stone permits, and reinsert.

.9 Repair surface of fracture to match the surrounding stone, as per Article 3.5 – Crack Repair.

.10 Finish surface of fracture to match colour and profile of existing stone.

3.7 REPAIR OF FRACTURED STONE IN-SITU

.1 Drill 11 or 13 mm diameter holes, extend 60 mm beyond fracture, spaced at 300 o/c maximum. Minimum 2 per stone. Minimum length of hole to be 140 mm. Confirm dowel size with Departmental Representative, prior to drilling hole.

.2 Clean dust out of hole with acetone and cotton swabs.

.3 Dampen stone surfaces prior to application of adhesive. Insert 10 or 12 mm diameter stainless steel dowels, 100 mm long and apply anchor setting mortar to holes and joints. Confer with Departmental Representative to determine diameter of dowels. Allow to set for 24 hours minimum.

.4 Drill injection ports and seal fracture as per Article 3.5 – Crack Repair.

.5 Repair fracture as per Article 3.6 – Repair of a Fractured Stone.

.6 Finish surface of fracture to match existing stone.

3.8 REFACING PARTLY DETERIORATED STONE WITH STONE SLAB (DUTCHMAN REPAIR)

.1 Remove decayed stone until sound surface is reached. Cut existing stone to achieve a square void in stone as much as possible, with minimum depth 65 mm.

.2 Where Dutchman size exceeds 40% of the failed stone size, proceed to do full face Dutchman, unless noted otherwise by Departmental Representative. Where there is more than one Dutchman repair required on any single stone, proceed to do full face Dutchman, unless noted otherwise by Departmental Representative.

.3 Select new stone to match surrounding stone of geological type and colour, free from defects and with bedding to match adjacent work. Where possible, salvage from existing weathered stone on site.

.4 Cut new stone insert to exactly fit the cut in existing stone.

.1 Allow for thickness of stone adhesive.

.2 Allow for finished surface slightly projecting from existing masonry face.

.5 Cutting tolerance for new stone: Allow 1 mm maximum joint tolerance on all sides, between the new stone section and the parent stone.

.6 Dowels as mechanical fasteners:

.1 Drill 11mm diameter holes, 60mm long at interface of existing and new stone slabs. Where stone depth on either side of the interface is less than 100mm, length of hole to be 60% of stone thickness.

.2 Fully saturate stone surface, prior to application of adhesive.

.3 Insert 10mm diameter dowels, 100mm long into existing stone and apply specified adhesive to holes and interface. Allow to set for 24 hours minimum.

.4 Where new or existing stone is less than 100 mm thick, length of dowel to be 50% of the thickness of stone on each side of the interface.

.7 Dovetailed grooves as mechanical fasteners:

.1 Cut horizontal dovetailed grooves 12mm deep at interface of existing and new stone slabs. Cut stone shape by hand using tempered chisels ensuring that the edges are not plucked or spalled.

.2 Fully saturate stone surface, prior to application of adhesive.

.3 Apply specified adhesive to dovetailed grooves and interface of existing stone.

.8 Dampen stone surfaces and fill dowel holes and/or dovetailed grooves of new stone slab with specified adhesive. Erect new stone slab into position. Secure stone temporarily to allow adhesive to set. Ensure joint between new and existing stone is filled solid and finished to match existing stone face.

.9 Position face of Dutchman slightly proud and finish to original profile by rubbing back or tooling as required. Resurface new slab insert as required to make patch unobtrusive. Rubbing back marks on existing stone are not permitted.

.10 Repoint with specified mortar. Profile of joints to match existing.

3.9 MORTAR JOINT REPAIR

.1 Do repointing work in accordance with Section 04 03 07 - Historic - Masonry Repointing.

.2 Make good damage incurred to mortar joints.

3.10 CLEANING

.1 Obtain Departmental Representative's approval of cleaning operations before starting cleaning work.

.2 Protect vegetation and adjacent grounds from excessive water accumulation.

.3 Clean stone work surfaces after repairs have been completed and mortar has set.

.4 Clean stone surfaces of grout or mortar residue resulting from work performed without damage to stone or joints.

.5 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

3.11 PROTECTION OF COMPLETED WORK

.1 Protect finished work from impact damage for period of two weeks.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 03 07 - Historic - Masonry Repointing.

.2 Section 04 03 08 – Historic – Mortaring.

.3 Section 04 05 10 – Common Work Results for Masonry.

.4 Section 04 05 19 – Masonry Anchorage and Reinforcing.

1.2 STONE AVAILABILITY

.1 Confirm in writing at time of Bid closing, that sufficient quantity of stone type included in the bid submission is available to complete the requirements of the project.

1.3 PRICE AND PAYMENT PROCEDURES

.1 Provide unit prices for replacement of stone. The unit price for each replacement will include all costs necessary to complete the specific replacement, including additional shoring and scaffolding, removal and disposal of existing stone, consolidation of core, all anchorage, mortar and grout work necessary to stabilize adjacent masonry, and to install the new stone.

.2 For quantity estimation of dressed quoin stones and jamb stones, measure long face only. Allow for waste required to achieve desired size of replacement stone.

.3 Payment for this work will include all costs associated with supplying materials, and executing work as described herein and reflected in the contract.

1.4 REFERENCES

.1 Definitions:

.1 Lewis: instrument inserted at top of stone as means of attachment in raising and lowering. Holds stone by means of keys or wedges fitted to dovetailed recess.

.2 Dogs: metal appliance for securing parts or members together by means of one or more projecting teeth or bent portions, lug, cramp.

.3 Fabricator: company having sufficient capacity to quarry, cut, and deliver stonework on schedule.

.4 Installer: company or person specializing in commercial stone work. Employ skilled stone masons on site to do necessary field cutting as stones are set.

.2 Reference Standards:

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C97/C97M-2009, Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.

.2 ASTM C170/C170M-2009, Standard Test Method for Compressive Strength of Dimension Stone.

.3 ASTM C568-10, Standard Specification for Limestone Dimension Stone.

.4 ASTM C616/C616M-10, Specification for Quartz-Based Dimension Stone.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:

.1 Submit shop drawings for all new stone required, describing method of stone replacement, including removal, shoring and erection. Refer to Drawings for locations.

.2 Drawings to show all details for size, section, bedding, jointing, anchor or tying system and finish of stone. Base dimensions on accurate site measurements.

.3 Samples:

.1 Submit samples of replacement stones for approval, prior to purchase of stone.

.2 Submit samples from original quarry or from quarry supplying replacement stone and samples of the existing stone salvaged on site, as follows:

.1 Two samples: representing full range of colour, pattern and inclusions.

.2 One: sized and dressed to match existing stone units.

.3 Five: 150 mm x 100 mm x 50 mm for compressive strength test to ASTM C170.

.4 One: 150 mm x 150 mm x 12 mm for porosity test to ASTM C97.

.5 Select samples from currently worked bed of quarry and accompanied by quarry certification.

.6 Samples should be representative of the full range of colour, visible markings, and finish to be supplied for the entire project. Indicate quarry bed or direction of bedding on samples.

.7 Submit the following samples to indicate required finishes:

.1 1 – 250 mm x 250 mm x 250 mm: bordered and bush hammered.

.2 1 – 250 mm x 250 mm x 250 mm: bordered, bush hammered and media blasted to a light sand colour.

.8 Submit stone samples to the testing laboratory designated by the Departmental Representative, for conformance with applicable ASTM Standards, prior to fabrication.

1.6 QUALITY ASSURANCE

.1 Allow Departmental Representative access to mason's workshop for inspection of current work-in-progress.

.2 Qualifications:

.1 Execute work by personnel experienced in conservation of historic masonry.

.2 Lead masons engaged by Masonry Contractor to have minimum of 10 years of experience with historic masonry. Remaining mason qualification as per Section 04 03 41 – Historic – Repair of Stone.

.3 Departmental Representative has right to reject masons who do not demonstrate appropriate abilities or experience.

.4 Masons employed on this project throughout course of project must meet above requirements. Where, during course of project, masons leave work force, replacement masons must also meet requirements.

.3 Mock-ups:

.1 Construct mock-up in accordance with Section 04 05 10 – Common Work Results for Masonry.

.2 Prepare mock-up of tooling of stone face, to be approved on site by the Departmental Representative prior to commencement of the stone fabrication.

.3 Allow one week for inspection of mock-up by Departmental Representative, before proceeding with replacement work.

.4 When accepted, mock-up may remain as part of finished work.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver finished stone to site in substantial, purpose made containers, packed to avoid chipping damage or soiling from any means.

.2 Label each container to clearly indicate contents and location on building.

.3 Indicate on each stone quarry bed or direction of bedding and location of stone on building, referenced to shop drawings. Mark stones where not exposed with permanent markers.

.4 Protect and store stones to facilitate their resetting.

.1 Store dismantled masonry units on wood pallets, protected from exposure to water, elements, and potential mechanical damage, fully covered under polyethylene.

.2 Ventilate shelter to keep condensation from forming on internal surfaces.

.3 Lay out storage so that each stone will have its numbered face visible, and be accessible or removable without having to move adjacent stones.

.4 Ensure contact between stones is avoided by placing protective, non-staining material between and around each stone.

.5 Avoid excessive handling, and protect against chipping, damage, soiling or staining.

.6 Damaged stone, and stone that is repaired prior to reaching site, will be rejected.

.7 Packaging Waste Management: remove for reuse, in accordance with Waste Management plan.

Part 2 Products

2.1 MATERIALS

.1 Limestone: to ASTM C568, category III - High Density or better, of uniform colour, texture and strength, free from holes, shakes, cracks or other defects. Buff in colour, to be approved by Departmental Representative.

.2 Obtain new stone from a single quarry source acceptable to Departmental Representative.

.1 Attia Limestone of a similar colour to Kingston limestone (existing stone) is available from Attia Quarry: 6414 County Road, Hwy 169, Township of Ramara, Ontario.

.2 Kingston Limestone, a potentially suitable match for the existing stone is available from Rideauview Contractors, Inverary, Ontario.

.3 St. Marc Limestone (formerly known as Deschambeau Limestone), Greymont (Portneuf) Inc., 595 Boul. Dussault, St. Marc, Québec.

.4 Limberlost Limestone, Bruce Peninsula, Wiarton, Ontario.

.5 Montreal Greystone, Ansa Inc., Montreal, Quebec.

.3 Ensure single quarry source has resources to provide materials of consistent quality and matching existing stone.

.4 Sandstone: to ASTM C616, Type II Quartzitic Sandstone, of uniform colour, texture and strength, free from holes, shakes, cracks or other defects. To be approved by Departmental Representative.

.1 St. Canut Sandstone, similar to existing stone is available from St. Canut Quarry, Mirabel, Quebec.

2.2 STONE BEDDING PLANES

.1 Supply stone to be laid on its natural quarry bed.

.2 Face bedded stone will be rejected.

2.3 STONE FABRICATION

.1 Cut stone to shape and dimensions obtained from accurate measurements and profiles taken from existing stone, and full to square with joints as indicated.

.1 Dress exposed faces true.

.2 Allow for beds and joints to be same as average thickness in location of new replacement stone, but not to exceed 20 mm thick on average, and at right angles to face.

.2 Cut stones for anchors, cramps, dowels and support systems.

.1 Provide Lewis pin and clamp holes in pieces which cannot be manually lifted.

.2 Do not cut holes in exposed surfaces.

.3 Fabrication of Replacement Stone

.1 Record profile of existing stone.

.2 Cut and carve new stone to match existing profile.

.3 Obtain approval of new carved stone by Departmental Representative, prior to installation.

.4 Finish exposed faces and edges of stones to comply with requirements indicated on drawings, for finish and to match approved samples and field-constructed mock-up.

2.4 FABRICATION TOLERANCES

.1 Fabricate dimension stone to the following tolerances:

.1 Unit Length: plus or minus 1.5 mm.

.2 Unit Height: plus or minus 1.5 mm.

.3 Deviation from Square: plus or minus 1.5 mm, with measurement taken using the longest edge as the base.

.4 Deviation from flat surface on any exposed face: plus or minus 1.5 mm.

2.5 EXISTING STONE

.1 Use hard, sound, and clean existing stone salvaged on site only, with Departmental Representative's approval.

2.6 MORTAR

.1 Mortar: in accordance with Section 04 03 08 - Historic - Mortaring.

2.7 ACCESSORIES

.1 Anchors, cramps, dowels: Refer to Section 04 05 19 – Masonry Anchorage and Reinforcing.

Part 3 Execution

3.1 SITE VERIFICATION OF CONDITIONS

.1 Report in writing, to Departmental Representative areas of deteriorated masonry not previously identified.

.2 Obtain Departmental Representative's approval and instructions for repair and replacement of masonry units before proceeding with repair work.

.3 Stop work in that area and report to Departmental Representative immediately, evidence of hazardous materials.

3.2 PREPARATION

.1 Prevent absorption of ground water and water accumulation on stone. Rest stones in their natural bedding during weathering.

.2 Move and lift stone units using means to prevent damage. Submit stone units dropped or impacted to Departmental Representative for inspection and approval. Do not make holes or indentations for Lewises or dogs on face or top side of stone.

.3 Indicate bedding planes of stone units. Duplicate bedding marks on usable pieces of cut stone.

.4 Place safety devices and signs near work area as directed.

.5 Install and remove temporary shoring or other supports as required.

.6 Cover adjacent plant material and fragile surfaces.

.7 Repoint backup masonry, install anchors and install mortar in collar joint as per Section 04 03 07 - Historic-Masonry Repointing.

3.3 EXISTING STONE REMOVAL

.1 Remove existing deteriorated stone after obtaining approval from Departmental Representative.

.2 Record photographically from all aspects, those areas allocated for dismantling, prior to start of work.

.3 Using elevation drawings, accurately number each stone to be removed, and record its position. Numbering must correspond to the shop drawings.

.4 Where existing stone is to be reset, mark stone on face, before removal, using marking product which can be completely erased when required, or label attached to stone, without damaging masonry unit. Method of marking to the approval of the Departmental Representative.

.5 Use approved methods to loosen stones which will cause no damage either to stones or to other elements of the lock walls.

.6 Do not use circular millstone or saw, pneumatic chisel, steel tools exerting concentrated pressure on edge of stone. Obtain Departmental Representative's approval for use of power tools before commencing work.

.7 Loosen wet masonry only when temperature is above freezing point.

.8 Remove loose material from deteriorated stones and clean by wet scrubbing with vegetable fibre brush unless otherwise instructed by Departmental Representative. Do not use high pressure water jet.

.9 Place detached stones on wood surfaces during handling. Prevent contact with metal or vegetation.

.10 Clean dust, mortar and stone fragments from slot.

3.4 RAKING JOINTS

.1 Remove mortar in accordance with Section 04 03 07 – Historic – Masonry Repointing.

3.5 CUTTING/SIZING OF STONE

.1 Use calipers, squares and levels to measure hole for new stone. Allow for mortar joints of 20 mm maximum thickness. Where existing joints are narrower, confirm joint thickness with Departmental Representative prior to cutting stone.

.2 Provide 1:10 slope on top face of stone unit, sloping down to front face.

3.6 MOVING STONES

.1 Use Lewises to lift stones to working level.

.2 Move stones horizontally in wheelbarrows or on sleds.

.3 Move large stones using nylon belts properly spaced to provide a safe and even bearing for the stone.

.4 Slide stones into place on wood ramps.

.5 Protect edges of stone from damage when hoisting and lifting from position. Use wood shims to isolate units from hoisting belts.

.1 Incorporate only undamaged stone in Work.

3.7 INSERTING REPLACEMENT STONE

.1 Clean stone by washing with water and natural fibre brush before laying.

.2 Dampen surfaces of slot and apply bedding mortar.

.3 Lay heavy stones and projecting stones after mortar in courses below has hardened sufficiently to support weight.

.4 Prop and anchor projecting stones until wall above is set.

.5 Set large stones on water soaked softwood wedges, to support stone in proper alignment until mortar has set. Remove wedges when dry, do not break off.

.6 Insert and compress firm mortar to within 30mm of pointing surface. Allow mortar to set 24 hours.

.7 Remove mortar dropping from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses.

.8 Install stainless steel anchors to fix stone face plates as indicated. Provide minimum of two anchors per stone, top and bottom.

.9 Set stones plumb, true, level in full bed of mortar with vertical joints buttered and placed full except where otherwise specified. Completely fill anchor, dowel and lifting holes and voids left by removed edges.

.10 Grout solid all voids behind stone using specified grout.

3.8 FILLING JOINTS/POINTING

.1 Fill joints and point: in accordance with Section 04 03 07 - Historic - Masonry Repointing.

3.9 PROTECTION OF WORK

.1 Cover top of completed and partially completed wall, not enclosed or sheltered, with weatherproof coverings at end of each working day.

.1 Drape cover over wall and extend 0.5 m down both sides.

.2 Anchor securely in position.

.3 Prevent finished work from curing too quickly.

.4 Protect from drying winds. Pay particular attention at corners.

.2 Protect adjacent work from marking or damage due to work.

.3 Protect adjacent finished work against damage which may be caused by on-going work.

.4 Provide temporary bracing of masonry work during erection until permanent structure provides adequate bracing.

3.10 CLEANING

.1 Confirm acceptance of mock-up of cleaning operations, as demonstrated to the Departmental Representative, before starting cleaning work.

.2 Clean stone work surfaces after repairs have been completed and mortar has set.

.3 Clean stone surfaces of adhesive or mortar residue resulting from work performed without damaging stone or joints.

.4 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 03 07 – Historic – Masonry Repointing and Repair.

.2 Section 04 05 19 – Masonry Anchorage and Reinforcing.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA A371-14, Masonry Construction for Buildings.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Conduct pre-installation meeting one week prior to commencing work of this Section, to:

.1 Verify project requirements, including mock-up requirements.
.2 Verify substrate conditions.
.3 Co-ordinate products, installation methods and techniques.
.4 Sequence work of related sections.
.5 Review manufacturer's installation instructions.
.6 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.
.7 Coordinate procedures for identifying all stone repairs/replacement, as early as possible in the project, including cutting out, measuring and ordering replacement stone, so as not to affect schedule.
.8 Review warranty requirements.

1.4 ACTION SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, limitations and colours.
.2 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).

.3 Samples:

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
.2 Provide samples as follows:

.1 One sample of mortar and grout.
.2 One of each type of masonry anchorage proposed for use, supplemented by specific requirements in Section 04 05 19 - Masonry Anchorage and Reinforcing.
.3 One sample of each type of stone to be used to replace existing stone, where stone has not been salvaged from site.

.3 Submit samples for testing to laboratories employing technicians certified/trained in procedures for testing masonry units.

.4 The approved samples denote the standard of material to be used.

.4 Shop Drawings:

.1 Provide drawings stamped and signed by Professional Engineer registered or licensed in the Province of Ontario.

.2 Where existing masonry becomes unsupported during construction, provide shop drawings detailing temporary bracing required, designed to resist lateral forces during installation.

.5 Temporary Bracing:

.1 Submit stamped engineered drawings for temporary bracing.

1.5 INFORMATION SUBMITTALS

.1 Certificates: provide manufacturer's product certificates certifying materials comply with specified performance requirements and physical properties.

.2 Test and Evaluation Reports:

.1 Provide certified test reports in accordance with Section 01 33 00 – Submittal Procedures.

.2 Test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.

.3 Provide data for masonry units, in addition to requirements set out in referenced CSA Standards, indicating initial rates of absorption.

.4 For stone replacement units, submit test reports confirming compressive strength, density and porosity to requirements set out in referenced CSA Standards.

.3 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.

.4 Manufacturer's Reports: provide written reports prepared by manufacturer's on-site personnel to include:

.1 Verification of compliance of work with Contract.

.2 Site visit reports providing detailed review of installation of work, and installed work.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturer: capable of providing field service representation during construction and approving application method.

.2 Installer: who has specialized in installation of work similar to that required for this project.

.3 Masons: company or person specializing in masonry installations with five (5) years documented experience with masonry work similar to this project.

.1 Masons employed on this project must demonstrate ability to reproduce mock-up standards.

.4 The principal stone mason and site superintendent engaged by the Masonry Contractor must have a minimum of ten (10) years of experience with historic masonry conservation similar to this project, and can demonstrate an ability to pass a hands-on test of skills, if so administered by the Departmental Representative. The Departmental Representative has the right to reject either of these individuals, if their qualifications cannot be substantiated, or who does not demonstrate the appropriate abilities or experience on the following tasks:
- .1 Raking joints by hand.
- .2 Cutting stone.
- .3 Dutchman repairs.
- .4 Pinning techniques
- .5 Historical repointing.

.5 All masons employed on this project must meet the above requirements. Where, during the course of the project, masons leave or become unavailable to perform their duties, replacement masons must also possess comparable experience equivalent to the masons being replaced.

.6 Apprentices: Apprentices may work on the project provided their work is under the direct supervision of an experienced mason, at a ratio of no more than two apprentices for one experienced mason.

.2 Mock-ups:

.1 Construct mock-up panel of masonry wall construction, 1200 x 1800 mm showing masonry colours and textures, use of reinforcement, jointing, coursing, mortar, tooling and workmanship.

.2 For repointing, mock-up must include examples of saw-cut joints, raked joints, backpointed joints and finishpointed joints for both horizontal and vertical applications

.3 Mock-up used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.2 For testing to determine compliance with performance requirements.

.4 Construct mock-up where directed by Departmental Representative.

.5 Notify Departmental Representative 48 hours before commencing each mock-up.

.6 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with work.

.7 When accepted by Departmental Representative, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

.8 Start work only upon receipt of written acceptance of mock-up by Departmental Representative.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Only accept materials that have been delivered to site in original, unbroken, undamaged packages. Damaged packages are not to be accepted on site.

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

.3 Storage and Handling Protection:

.1 Keep materials dry until use.

.2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

.4 Packaging Waste Management:

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.8 SITE CONDITIONS

.1 Weather Requirements: to CAN/CSA A371.

.2 Site Environmental Requirements

.1 Cold weather requirements: Supplement Clause 6.7.2 of CAN/CSA A371 with following requirements:

.1 Maintain temperature of mortar between 5 degrees C and 30 degrees C until batch is used or becomes stable.

.2 Maintain ambient temperature between 5 degrees C and 30 degrees C and protect site from wind chill.

.3 Cover mortar less than 7 days old with tarpaulins, when temperature is forecast to fall below 5 degrees C, and insulated tarpaulins when temperature is forecast to fall below 0 degrees C.

.4 Provide heating of masonry work when the average air temperature falls below -4 degrees C.

.5 Maintain mean temperature of masonry above 0 degrees C for a minimum of 28 days, after mortar is installed.

.6 Do not repoint if the temperature is forecast to drop below -4 degrees C in the following 24 hours.

.7 Each unheated section of wall must be preheated in it's enclosure for a minimum period of 72 hours above 10 degrees C, before any mortar is applied.

.2 Hot weather requirements:

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

.3 Spray mortar surface at intervals and keep moist for minimum time required for curing as noted in Section 04 03 07 – Historic – Masonry Repointing.

.4 Provide hot weather protection against direct sunlight and wind, when air temperature exceeds 20 degrees C.

.3 Maintain minimum/maximum thermometers and relative humidity gauges on site and in all enclosures and maintain a daily record of temperature and humidity.

1.9 PERFORMANCE

.1 The following will be considered deficiencies in the work, in addition to any failure to meet other provisions of these specifications:

.1 Mortar shrinkage cracks between units.
.2 Unfilled joints.
.3 Spalling of units or joints.
.4 Poor colour or texture blending of joints or units.
.5 Dusting, efflorescence of joints or units.
.6 Surface discolouration, discolouration, variance of colour or crumbling of mortar.
.7 Failure of anchors of built-in items.
.8 Sloppy fitting, or otherwise poor workmanship in levelling, bedding or jointing of units.
.9 Failure to match adjacent work or failure to match control test area.
.10 Failure to adequately cure the mortar.

Part 2 Products

2.1 MATERIALS

.1 Masonry materials are specified in Related Sections:

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

.1 Examine conditions, substrates and work to receive work of this Section.

.2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.

.3 Verification of Conditions

.1 Verify that:
.1 Field conditions are acceptable and are ready to receive work.

.2 Commencing installation means acceptance of existing substrates.

3.3 PREPARATION

.1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.

.2 Protect adjacent materials from damage and disfiguration.

.3 Provide temporary bracing of masonry work during and after erection, as required.

.4 Bracing must be approved by Departmental Representative.

.5 Winter Heating

.1 When average daily temperature is forecast to fall below -4 degrees C, provide winter heat and maintain 55% relative humidity level within the scaffold/housing enclosure.

.2 The use of open flame to provide heating is strictly forbidden.

3.4 INSTALLATION

.1 Masonry work in accordance with CAN/CSA A371 except where specified otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA A371.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.5 CONSTRUCTION

.1 Jointing:

.1 For joint finishing, see Section 04 03 07 - Historic-Masonry Repointing and Repair.

3.6 SITE TOLERANCES

.1 Conform to Clause 6.2 of CAN/CSA A371, unless otherwise noted.

3.7 FIELD QUALITY CONTROL

.1 Site Tests, Inspection:

.1 Inspection and testing will be carried out by Testing Laboratory designated by Departmental Representative.

.2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.

.3 Departmental Representative will pay costs for testing.

3.8 CLEANING

.1 Perform cleaning after installation and when mortar has fully cured to remove construction dust and accumulated environmental dirt.

.2 Upon completion of installation and verification of performance of installation, remove surplus materials, rubbish, tools and equipment barriers.

.3 Ensure all construction debris is removed from the waterways, both upstream and downstream of the locks.

3.9 PROTECTION

.1 Protect masonry work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 05 10 – Common Work Results for Masonry.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM A276/A276M-15, Specification for Stainless Steel Bars and Shapes.
- .2 ASTM A666-14, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- .3 ASTM A955/A955M-15, Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement.
- .4 ASTM C1242-15, Guide for Design, Selection, and Installation of Dimension Stone Anchors and Attachment System.

.2 Canadian Standards Association (CSA)

- .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction.
- .2 CSA A179-14, Mortar and Grout for Unit Masonry.
- .3 CSA A370-14, Connectors for Masonry.
- .4 CAN/CSA A371-14, Masonry Construction for Buildings.
- .5 CSA S304.1-14, Design of Masonry Structures.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

- .1 Provide manufacturer's printed product literature, specifications and datasheets illustrating specified products to be incorporated into project.
- .2 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 01 35 30 - Health and Safety Requirements.
- .3 Submit product data on helical anchors and stainless steel anchors.

.3 Shop Drawings:

- .1 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide shop drawings detailing bar bending details, anchorage details, lists and placing drawings.
- .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.4 Show details of the anchors, specify required hole size to be cored in the stone, and installation procedures. Indicate material specifications for the steel portion of the anchors.

.4 Manufacturer's Instructions:

.1 Provide manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.4 Mock-ups:

.1 Construct mock-ups in accordance with Section 04 05 10 - Common Work Results for Masonry.

1.5 FIELD MEASUREMENTS

.1 Make field measurements necessary to ensure proper fit of members.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle masonry anchorage and reinforcing materials in original packaging until required for installation.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Waste Management plan.

Part 2 Products

2.1 MATERIALS

.1 Bar reinforcement: Stainless steel to ASTM A276 and ASTM A995M, Grade 420.

.2 Connectors: Stainless steel to CSA A370 and CSA S304.1.

.3 Corrosion protection: to CSA S304.1, stainless steel to CSA S304.1 and CSA A370.

.4 Helical Wall Ties: stainless steel helical anchors to Grade 304, sizes as shown on Drawings. Acceptable Manufacturer:

.1 Helifix
.2 Blok-Lok Spira-lok
.3 Thor Helical

.5 Adhesive Anchors: stainless steel threaded rod anchors, Grade 304, with two part hybrid adhesive system, as used for Hilti type adhesive anchors (HY-70). Supply anchors as per Drawings.

.6 Stone Anchorage: type 304 stainless steel conforming to ASTM A666. Anchors to be supplied as per Drawings.

2.2 FABRICATION

.1 Fabricate reinforcing in accordance with CSA A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Fabricate connectors in accordance with CSA A370.

.3 Obtain Departmental Representative's approval for locations of reinforcement splices other than shown on placing drawings.

.4 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.

.2 Upon request, inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Supply and install masonry connectors and reinforcement in accordance with ASTM C1242, CSA A370, CAN/CSA A371, CSA A23.1 and CSA S304.1 unless indicated otherwise.

.2 Prior to placing concrete, mortar, grout, obtain Departmental Representative's approval of placement of reinforcement and connectors.

.3 Supply and install additional reinforcement to masonry as indicated.

.4 The use of expansion type anchors for temporary or permanent applications in stone masonry is prohibited.

3.3 HELICAL WALL TIES

.1 Install helical wall ties as indicated. Installation as per manufacturer's instructions. Repair mortar joint after installation as per specifications.

.2 Pre-drill hole for anchor. Drill bit diameter to be one size smaller than the required anchor diameter.

.3 Install anchors after backpointing has been approved by the Departmental Representative.

.4 Do not mark face of stone with the drill. Damage as a result of careless use of the drill will be repaired at the Contractor's expense.

.5 Ensure the head of the anchor will be completely covered by finishpointing mortar.

.6 Where helical anchors are installed as the outer leaf of the masonry walls is being constructed, drill helical anchors into the backup masonry units and lay in a bed of mortar joint in outer leaf, as reconstruction of the outer leaf proceeds.

3.4 ADHESIVE ANCHORS

.1 Install adhesive anchors as per manufacturer's instructions.

3.5 ANCHORS

.1 Supply and install stainless steel anchors as indicated.

3.6 FIELD BENDING

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

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

.3 Replace bars and connectors which develop cracks or splits.

3.7 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment and barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM A193/A193M-14a, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service.
- .2 ASTM A276/A276M-15, Specification for Stainless Steel Bars and Shapes.
- .3 ASTM A307-14, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB 1.181-99, Ready Mixed, Organic Zinc Rich Coating.

.3 Canadian Standards Association (CSA)

- .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.
- .2 CSA S16-14, Design of Steel Structures.
- .3 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .4 CSA W59-13, Welded Steel Construction (Metal Arc Welding) (Imperial Version).

.4 Master Painters Institute (MPI)

.5 The Society for Protective Coatings (SSPC)

- .1 SSPC-SP 3, Power Tool Cleaning.

1.2 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. Indicate VOC's for:
  - .1 Finishes, coatings, primers and paints.

.3 Shop Drawings

- .1 Submit shop drawings to include fabrication, connection and erection details.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .3 Submit shop drawings for the following:
  - .1 Lock chamber access ladders.

1.3 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 Leave protective covering in place until final cleaning of site. Provide instructions for removal of protective covering.

.3 Waste Management and Disposal

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21;

.1 Plates, Angles and Channels: Grade 300W.

.2 Steel Sections: Grade 350W.

.2 Welding materials: to CSA W59.

.3 Welding electrodes: to CSA W48 Series.

.4 Stainless steel bolts: to ASTM A193.

.5 Stainless steel angles: to ASTM A276, Grade 304.

.6 Bolts and anchor bolts: to ASTM A307.

.7 Fixed steel ladder: to suit site measurements, painted finish, one piece welded assembly, complete with associated anchorage accessories.

.8 Fasteners: Stainless steel, type and size as specified by the structural engineer responsible for the shop drawings. Exposed fasteners to be finished to match the finish on the item being fastened.

.9 Hot-dip galvanizing: galvanize steel, where indicated to ASTM A123, minimum zinc coating of 705g/m^2.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured, and in compliance with approved shop drawings.

.2 Where possible, fit and shop assemble work, ready for erection.

.3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.4 Complete welded connections prior to galvanizing.

.5 Provide effective drainage holes to prevent accumulation of water in hollow section members.

2.3 FINISHES

.1 Galvanizing: Hot dipped galvanizing for all steel elements, unless detailed otherwise.

.2 Paint for Access Ladders: Alkyd System: MPI EXT 5.1D in accordance with manufacturer's instructions and applied under shop conditions.

.1 Prime Coat: Alkyd anticorrosive metal primer.

.2 Intermediate Coat: Exterior alkyd enamel matching topcoat.

.3 Topcoat: Exterior alkyd enamel semigloss. Colour to be selected by Departmental Representative.

.4 Alternative Systems: Must be approved by Departmental Representative.

2.4 ISOLATION COATING

.1 Separation sheet as recommended by the stainless steel manufacturer.

Part 3 Execution

3.1 ERECTION

.1 Welding work in accordance with CSA W59 unless specified otherwise.

.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 stainless steel threaded anchor bolts and as per manufacturer's instructions.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Make field connections with stainless steel bolts to ASTM A193.

.6 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with specified paint.

.7 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 ACCESS LADDERS

.1 Remove existing access ladders and dispose off site.

.2 Install new access ladders on completion of masonry work, or before start of navigational season, if the Work is phased over two years.

3.3 QUALITY CONTROL

.1 Final inspection will be carried out by Departmental Representative to ensure the finished product is free from scratches and dents and the Work is cleaned to the Owner's satisfaction, prior to acceptance.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction waste and accumulated environmental soiling.

.2 Repair or replace damaged products.

.3 Make good any damage caused by the work of this Section.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 32 92 23 - Sodding

1.2 REFERENCES

.1 American Standards for Testing and Materials (ASTM) International

.1 ASTM D2434-68 (2006), Standard Test Method for Permeability of Granular Soils (Constant Head).

.2 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.2 Environmental Protection Agency (EPA)

.3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation.

.1 OPSS 1010-13, Material Specification for Aggregates – Base, Subbase, Select Subgrade and Backfill Material.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Co-ordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.

.1 Pay costs of relocating services.

.2 Notify Departmental Representative of excavation 48 hrs in advance.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Samples: submit to designated testing agency, 70 kg sample of backfill for granular fill material proposed for use, no later than 1 week before backfilling or filling work.

.3 Site Quality Control Submittals: submit in accordance with Quality Control plan.

.1 Submit testing and inspection results and report as described in PART 3 – FIELD QUALITY CONTROL.

Part 2 Products

2.1 MATERIALS

.1 Site excavated material, graded to remove large rocks and organic debris.

.2 Sodium Bentonite (Geoseal): Soil sealing system, available from Canadian Clay Products Inc., Wilcox, Saskatchewan; Ph. 306-732-2085. Permeability testing to ASTM D2434.

.3 Granular A, B Type I, B Type II to OPSS 1010.

.4 Woven Geotextile liner, minimum grab tensile strength of 445 kN; minimum tear resistance of 200 kN.

Part 3 Execution

3.1 EXAMINATION

.1 Evaluation and Assessment:

.1 Before commencing work verify locations of buried services on and adjacent to site.

3.2 PREPARATION

.1 Temporary erosion and sedimentation control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control drawings, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Protection of in-place conditions:

.1 Protect excavations from freezing.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

.3 Removal:

.1 Carefully remove and relocate all man-made features in area of excavation. Store in protected area. Reinstall in same location on completion of work.

.2 Remove existing concrete apron. Prior to removal record dimensions and depth of existing slab. Provide information to Departmental Representative. Dispose of concrete off site.

.3 Remove brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings. Indicate specifically what vegetation is required to be removed and obtain approval from Departmental Representative prior to removal.

.4 Remove obsolete buried services within 2 m of lock wall.

3.3 EXCAVATION

.1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Province of Ontario regulations.

.2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.

.1 Stockpile topsoil on site for later use.

.3 Excavate as required to carry out work.

.1 Do not disturb soil or rock beyond scope of work as detailed.

.2 Carefully excavate adjacent to rear of block walls, so as not to move or damage the existing masonry.

.3 Clean all mud and debris from back face of exposed masonry.

.4 Notify the Departmental Representative when excavations are complete.

.5 If excavations are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.

.6 Excavation taken below depths shown without the Departmental Representative's written authorization to be filled with Engineered Fill at Contractor's expense.

.7 Complete all masonry conservation at the newly exposed rear of the masonry wall, as detailed.

3.4 FIELD QUALITY CONTROL

.1 Testing of materials and compaction of backfill and granular fill will be carried out by testing laboratory designated by the Departmental Representative.

.2 Not later than 1 week minimum before backfilling or filling, submit to designated testing agency, samples of backfill as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.

.4 Not later than 48 hours before backfilling or filling with approved material, notify the Departmental Representative to allow compaction tests to be carried out by designated testing agency.

3.5 BACKFILLING

.1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.2 Place geotextile in accordance with manufacturer’s instructions.

.3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

.4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.

.1 Fill excavated areas with site excavated fill, compacted as specified.

.2 Sodium Bentonite mix as follows: 5% per volume, based on permeability of 1.2x10-7 cm/s, tested to ASTM D2434. Due to potential variable composition of the soil, if desired outcome is not achieved, adjust mix and test again.

.5 Placing:

.1 Place backfill, fill and base course material in 300 mm lifts. Add Sodium Bentonite to backfill for a minimum width of 600 mm behind back face of stone masonry wall.

.6 Compaction: compact each layer of material to following densities for material to ASTM D698:

.1 To underside of topsoil: 90%.

.2 Base course under concrete pads: 98%.

.7 Under concrete slab:

.1 Use Granular A for base courses, to minimum depth of 300 mm.

.8 Behind retaining wall:

.1 Use Granular Granular A crushed stone or Granular B Type II.

.2 Place in maximum 300 mm loose lifts and compact to at least 95% of SPMDD.

.9 Under seeded and sodded areas: use site excavated material to bottom of topsoil.

.10 Sodding: Refer to Section 32 92 23 – Sodding.

3.6 GRADING

.1 Grade so that water will drain away from walls to disposal areas approved by the Departmental Representative.

.1 Grade to be gradual between finished spot elevations shown on drawings.

3.7 CLEANING

.1 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment.

.2 Waste Management: contractor to submit a waste management and disposal plan for approval by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section specifies requirements for dewatering Work spaces described by drawings and specifications.

.2 Work includes but is not limited to:

- .1 Engaging a Professional Engineer to design:
  - .1 Temporary cofferdams at the lock entrance.
  - .2 Systems used to remove water from Work spaces
  - .3 Sediment control systems and devices such as turbidity curtains, sediment traps, silt control fences, filter bags, settling basins and other treatment facilities.
- .2 Constructing and maintaining the temporary cofferdam at the upstream and downstream lock entrances, according to the Professional Engineer's design, for the duration of the work.
- .3 Implementing dewatering according to the Professional Engineer's design.
- .4 Constructing and maintaining all other dewatering structures for the duration of the work.
- .5 Providing and maintaining all dewatering equipment for the duration of the work.
- .6 Removing water from Work spaces and maintaining these spaces in a dry state for the duration of the work.
- .7 Supplying standby equipment to replace dewatering equipment which malfunctions.
- .8 Removing the temporary cofferdam and all other temporary dewatering structures at end of Work.
- .9 Complying at all times with turbidity provisions and aquatic protection of Section 01 35 43 – Environmental Procedures.
- .10 Complying with Regulatory Requirements.

.3 Except where noted, all Work described in this specification to be done "in the dry".

.4 Install upstream and downstream turbidity curtains, prior to cofferdam installation.

1.2 REGULATORY REQUIREMENTS

.1 Adhere to local, provincial and federal requirements relating to:

- .1 Protection of environment;
- .2 Safety of construction; and
- .3 Protection of workers.

.2 Installation of cofferdams must comply with the regulations and guidelines of the Department of Fisheries and Oceans, in accordance with Fisheries Act and the approved Environmental Management Plan (EMP).

.3 Pumping water out of cofferdam enclosure, as required: to Section 01 35 43 – Environmental Procedures.

.4 No in-water work permitted from March 15 to July 15.

.5 Ensure that area to be dewatered behind cofferdam is clear of fish before being dewatered. Release alive, immediately upstream of cofferdam into upstream lake. Also, clear area of other vertebrae animals in area to be dewatered. Catch and release fish that escape process noted above, as dewatering commences.

.6 Obtain and pay for costs of all required permits.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings of cofferdam and other dewatering systems.

.1 Shop drawings must be sealed and signed by a Professional Engineer, licensed to practice in the Province of Ontario.

.2 Submit design calculations of flow capacity and stability of cofferdams and dewatering systems uses for each stage of construction.

.3 Outline procedure to seal cofferdam on rough bed of canal floor and at side conditions, to prevent leaks.

1.4 QUALITY ASSURANCE

.1 Qualifications of Designer

.1 Designer of cofferdams and other related dewatering structures and systems must be a Professional Engineer, licensed to practice in the Province of Ontario, with considerable expertise and experience in design of similar structures and systems.

.2 Designer must: make, check and sign all calculations; check, seal and sign all drawings; inspect dewatering structures and systems; and verify their adequacy and safety.

.2 Design Criteria

.1 Design cofferdams to ensure maintenance of work spaces in a dry state for duration of work.

.2 River flows will be discharged through the adjacent dam. There are no provisions required to have river flows discharged through the temporary cofferdam or work site.

.3 Allow for inspection of existing perimeter conditions, by diver, prior to design of cofferdam.

.4 Plan and design dewatering system considering:

.1 Access to cofferdams and access to reach any portion of work.

.2 Space required for crews to work in dewatered areas.

.3 Sequence of Work.

.4 Water levels at drawdown, navigation and levels anticipated during construction.

.5 Uneven surface of river bed, and perimeter conditions, at intended locations of cofferdam.

.5 At all times, maintain environmental quality of water to Section 01 35 43 – Environmental Procedures.

.6 Ensure that no phase of Work threatens safe performance of cofferdams.

.7 Provide a minimum of 750 mm freeboard to prevent overtopping of cofferdams from normal high water level.

1.5 SITE CONDITIONS

.1 Water Levels

.1 For upstream water elevations at top of cofferdam, refer to drawings.

.2 For downstream elevations at top of cofferdam, refer to drawings.

.2 Existing Soils

.1 Information on existing soils condition in the area of the locks is available through the Geotechnical Report prepared by Paterson Group.

.3 Environmental and Archeological Dewatering Requirements

.1 Do not pump water that flows/seeps through cofferdam directly into waterways. Send all discharge to sediment traps in order to satisfy discharge requirements. Dispose of water so that it does not create a safety or health hazard; or cause damage to environment, to adjacent property or to any portion of work or cause erosion.

.2 Do not release any silt or other materials into watercourse during construction or removal of cofferdams.

.3 Assume that from November 20th to March 25th, water will be freezing, so work must be executed while dealing with ice on the surface.

1.6 PROTECTION

.1 Protect cofferdams and dewatered work spaces from damage due to floods, rain, ice, snow or other adverse climatic conditions.

Part 2 Products

2.1 MATERIALS

.1 In good condition, approved by Departmental Representative and suitable for their use in the Work.

.2 Do not use materials which may cause environmental damage to waterways or to land at or near site.

.3 Materials and methods proposed for use in cofferdams must comply with the regulations and guidelines of the following:

.1 Federal Department of Fisheries and Oceans.

.4 Earth or granular materials with sand and fines is not acceptable. Where earthen cofferdams are desired, they must be designed to permit overtopping without erosion. Alternate cofferdam types may be better suited to site conditions.

.5 If using sandbags, sand must be washed of fines before placing in water.

.6 Use gravel/rock fill with rubber membrane, caissons, rubber dams, sheet piling, bolted pre-engineered frame-type structures, or other types of cofferdams which do not generate turbidity. These approaches are the methods preferred by the Department of Fisheries and Oceans.

Part 3 Execution

3.1 GENERAL

.1 Evaluate, plan and execute Work in an expert and prudent manner, giving due consideration to:

- .1 Climatic conditions which may occur at work location, during period of doing work in its entirety, including dealing with ice, as noted.
- .2 Safety of personnel and of general public.
- .3 Safety of Work and of adjacent property.
- .4 Safety of removals.
- .5 Environmental requirements.
- .6 Clearance requirements for Work.
- .7 Access restrictions for Work.
- .8 Archaeological restrictions for cofferdam location.
- .9 Changes in water levels.

3.2 COFFERDAM CONSTRUCTION

.1 Install cofferdam to allow sufficient clearance for scaffolding and access for workers.

.2 Ensure water tightness by installation of drainage membrane and waterproof sheeting, taped and sealed.

.3 Secure waterproof membrane at top and bottom with weighted material.

.4 Make adequate provisions to seal cofferdam at edge conditions, based on pre-design survey by Contractor.

.5 Prior to use, provide proof of review and approval of cofferdam erection by a Professional Engineer licensed to practice in the Province of Ontario.

.6 Maintain the cofferdam in satisfactory condition for the duration of the work. Regularly check the perimeter for leakage and take measures to prevent such occurrences.

.7 If flooding occurs after excessive rainfall, provide pump to remove water.

3.3 DEWATERING

.1 Dewater work spaces and maintain them in a fully dewatered state until Work is finished.

.2 Continue dewatering operations, to enable Work to proceed in the dry, for duration of Work.

.3 Repeat entire dewatering procedure as often as may be necessary, if flooding of other damage occurs before completion of Work.

3.4 WATCHKEEPER

.1 Ensure continuity of dewatering by designating a Watchkeeper to make periodic checks at times when Work is not in progress. Watchkeeper's qualifications under this Section are to be sufficient to perform, on dewatering equipment, such duties as:

.1 Preventative maintenance and refueling of generators, normally performed during any shift.

.2 Emergency repairs of minor complexity.

.3 Placing standby items in service.

3.5 EQUIPMENT

.1 General

.1 Provide equipment in safe operating condition and maintain it in a safe operating condition for entire period of use and/or standby for use on Work.

.2 Provide skilled operators for equipment.

.2 Standards and Performance

.1 Provide equipment of such quality and in such quantity as to provide sufficient capability to perform essential functions of Work.

.2 Provide standby replacement for pumps and other essential dewatering equipment which may break down during Work.

.3 Keep this replacement equipment available on site for immediate use.

3.6 COFFERDAM REMOVAL

.1 At approved stages of Work, remove all cofferdams, temporary structures and dewatering systems, to original channel bottom level.

.2 Dispose of all unwanted materials in approved manner on Canal Lands.

.3 Do not dispose of any materials in watercourses of canal.

.4 Maintain sediment controls in place during cofferdam removal.

.5 Cofferdams must be removed and all in-water work complete by March 14, due to Ministry of Natural Resources (MNR) restricted timing window for fish spawnings (March 15 to June 30).

.6 Notify Parks Canada to review site, once cofferdam removal is complete.

3.7 CLEAN-UP AND RECTIFICATION

.1 Clean up work area as work progresses. Leave Work area clean at end of each day.

.2 Provide on-site containers for collection of waste materials and debris.

.3 Ensure the waterway, storm and sanitary sewers remain free of waste and volatile materials disposal.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment from the site.

.5 Broom clean and wash surfaces affected by the work; rake clean other surfaces of grounds.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Samples.

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

.2 Submit:

.1 Sod for each type specified.

.1 Install approved samples in one square metre mock-ups and maintain in accordance with maintenance requirements during establishment period.

.2 Bio-degradable geotextile fabric.

.3 Obtain approval of samples by Departmental Representative.

1.2 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.3 SCHEDULING

.1 Schedule sod laying to coincide with preparation of soil surface. Verify source of sod at lease two months prior to installation and confirm date when sod farm will be open. Include these dates in schedule.

.2 Schedule sod installation when frost is not present in ground.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Waste Management plan.

.2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.

.3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

.1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.

.1 Turf Grass Nursery Sod types:

.1 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivars.

.2 Turf Grass Nursery Sod quality:

.1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.

.2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.

.3 Mowing height limit: 35 to 65 mm.

.4 Soil portion of sod: 6 to 15 mm in thickness.

.2 Sod establishment support:

.1 Geotextile fabric: biodegradable, 25 mm square mesh.

.2 Biodegradable starch pegs: 17 x 8 x 200 mm.

.3 Water:

.1 Contractor to supply.

.4 Fertilizer:

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".

.2 Complete, synthetic, slow release with 65 % of nitrogen content in water-insoluble form. Ensure no runoff of fertilizer to water course.

2.2 SOURCE QUALITY CONTROL

.1 Obtain approval from Departmental Representative of sod at source.

.2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

Part 3 Execution

3.1 PREPARATION

.1 Verify that grades are correct and prepared in accordance with recommendations of sod supplier. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.

.2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.

.3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod, surface to drain naturally.

.4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

3.2 SOD PLACEMENT

.1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.

.2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements. Cut sod into existing surface. Do not layer sod on top of soil i.e. flush interface.

.3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

.1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.

.2 Start laying sod at bottom of slopes. Follow horizontal contour of slope, not vertical placement.

.3 Peg sod on slopes steeper than 3 m horizontal to 1 m vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:

.1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.

.2 Not less than 3-6 pegs per square metre.

3.4 FERTILIZING PROGRAM

.1 Fertilize during establishment and warranty periods to in accordance with sod supplier recommendations.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of installation until acceptance.

.2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.

.3 Cut grass to 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas as directed by Departmental Representative.

.4 Maintain sodded areas weed free 95%.

.5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.6 ACCEPTANCE

.1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:

.1 Sodded areas are properly established.

.2 Sod is free of bare and dead spots.

.3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.

.4 Sodded areas have been cut minimum 2 times prior to acceptance.

.2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.7 MAINTENANCE DURING WARRANTY PERIOD

.1 Perform following operations from time of acceptance until end of warranty period:

.1 Water sodded Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.

.2 Repair and resod dead or bare spots to satisfaction of Departmental Representative.

.3 Cut grass and remove clippings that will smother grass, as directed by Departmental Representative to height as follows:

.1 Turf Grass Nursery Sod:

.1 50 mm during normal growing conditions.

.2 Cut grass at 2 week intervals, or as directed by Departmental Representative, but at intervals so that approximately one third of growth is removed in single cut.

.3 Fertilize areas in accordance with fertilizing program.

.4 Eliminate weeds by mechanical or chemical means, to extent acceptable to Departmental Representative.

3.8 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION