

PARKS CANADA AGENCY

SPECIFICATIONS

UPPER NICHOLSONS
EARTH DAM REHABILITATION

MERRICKVILLE-WOLFORD, ON

ISSUED FOR TENDER

PROJECT NO. 20034960
PROJECT FILE NO. 630288

2016-09-12

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SPECIFICATIONS ISSUED FOR
TENDER

UPPER NICHOLSONS
EARTH DAM REHABILITATION
MERRICKVILLE-WOLFORD, ON

SIGNED:



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Structural Engineer
SNC-Lavalin Inc.



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SNC-Lavalin Inc.

A handwritten signature in black ink, appearing to read "Adam Boland".

Adam Boland, CET
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<u>Section</u>	<u>Title</u>	<u>Pages</u>
<u>Division 01 - General Requirements</u>		
01 11 00	GENERAL INSTRUCTIONS	8
01 14 00	WORK RESTRICTIONS	3
01 29 00	MEASUREMENT AND PAYMENT	4
01 29 83	PAYMENT PROCEDURES: TESTING LABORATORY	2
01 32 16.07	CONSTRUCTION PROGRESS SCHEDULES - BAR (GANTT) CHART	3
01 33 00	SUBMITTAL PROCEDURES	6
01 35 29.06	HEALTH AND SAFETY REQUIREMENTS	12
01 35 43	ENVIRONMENTAL PROCEDURES	18
01 35 45	ENVIRONMENTAL PROTECTION REFULING VEHICLES	3
01 45 00	QUALITY CONTROL	3
01 51 00	TEMPORARY UTILITIES	3
01 52 00	CONSTRUCTION FACILITIES	4
01 56 00	TEMPORARY BARRIERS AND ENCLOSURES	2
01 61 00	COMMON PRODUCT REQUIREMENTS	5
01 71 00	EXAMINATION AND PREPARATION	2
01 74 11	CLEANING	2
01 74 21	CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL	4
01 77 00	CLOSEOUT PROCEDURES	2
01 78 00	CLOSEOUT SUBMITTALS	4
<u>Division 04 - Masonry</u>		
04 03 43	HISTORIC-DISMANTLING STONE MASONRY	9
04 05 00	COMMON WORK RESULTS FOR MASONRY	10
04 05 12	MASONRY MORTAR AND GROUT	7
04 05 19	MASONRY ANCHORAGE AND REINFORCING	5
04 43 19	SUPPLY NEW STONES	6
<u>Division 31 - Earthwork</u>		
31 05 16	AGGREGATE MATERIALS	5
31 11 00	CLEARING & GRUBBING	4
31 14 13	SOIL STRIPPING AND STOCKPILING	3
31 23 33.01	EXCAVATING, TRENCHING AND BACKFILLING	10
31 24 13	EMBANKMENTS	5
31 32 19.01	GEOTEXTILES	5
31 32 19.13	GEOGRID SOIL STABILIZATION	4
31 37 00	RIP RAP	2
<u>Division 32 - Exterior Improvements</u>		
32 11 23	AGGREGATE BASE COURSES	4
32 91 19.13	TOPSOIL PLACEMENT AND GRADING	5
32 92 19.16	HYDRAULIC SEEDING	7
32 92 23	SODDING	6
<u>Division 35 - Waterway and Marine</u>		
35 20 25	DEWATERINTG	7
35 42 19	PRESERVATION OF WATER COURSES AND WETLANDS	6

Appendix A: Geotechnical Report
Appendix B: Basic Impact Analysis

Drawing List

Civil

C1 - LEGEND, SITE LOCATION AND GENERAL NOTES
C2 - UPPER NICHOLSONS - EXISTING CONDITIONS, SITE ACCESS AND REMOVALS
C3 - WEST EMBANKMENT - EXISTING CONDITIONS, SITE ACCESS AND REMOVALS
C4 - UPPER NICHOLSONS - WALL BACKFILL REPLACEMENT SITE PLAN
C5 - WEST EMBANKMENT - SITE PLAN
C6 - CONSTRUCTION DETAILS
C7 - SECTIONS

Structural

S1 - SITE PLAN
S2 - EXISTING CONDITIONS - STA. 0+115 TO 0+000
S3 - EXISTING CONDITIONS - STA. 0+230 TO 0+115
S4 - EXISTING CONDITIONS - STA. 0+300.8 TO 0+230
S5 - PLAN - NEW STONE MASONRY WALL
S6 - ELEVATION - NEW STONE MASONRY WALL
S7 - SECTIONS, DETAILS & NOTES

END OF SECTION

PART 1 - GENERAL

- 1.1 PRECEDENCE .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Specification.
- 1.2 DESCRIPTION OF WORK .1 The work under this Contract covers the furnishing of all labour, materials and equipment required to re-construct and elevate an existing earth embankment, dismantle, clean and re-construct an existing masonry wall facing on a concrete retaining wall, and remove and replace existing retaining wall backfill. The work will occur at two locations in the vicinity of the Upper Nicholsons Lock Station, located in Merrickville-Walford, Ontario. the project includes but is not limited to the following:
- .1 Site erosion and sedimentation measures including silt fencing, fibre filtration tubes, filter bags, turbidity curtains, hay/straw bales vegetative stabilization and other measures as required, maintained for the duration of the project.
 - .2 Temporary site access and facilities including staging area, access roads and cofferdam/access embankment.
 - .3 Dewatering procedures to allow for all work "in the dry", and preservation of existing watercourses.
 - .4 Tree clearing, grubbing, selective vegetation removal, and soil stripping, including stockpiling of re-usable topsoil.
 - .5 Excavation and embankment of in-situ material within project sites, and off-site disposal of surplus and unsuitable materials.
 - .6 Supply and compaction of Engineered Fill as backfill and embankment, including geosynthetic reinforcement and separation.
 - .7 Supply and compaction of granular base.
 - .8 Surface treatment and protection, including topsoil (stockpiled and imported), hydraulic seeding, sodding and rip rap.
 - .9 Existing masonry wall dismantling.
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2016-09-12

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- 1.2 DESCRIPTION OF WORK
(Cont'd)
- .1 (Cont'd)
.10 Masonry stone, grout and mortar re-construction to mimic existing wall, complete with installation of new, partial length anchored lumber fender rail.
.11 Supply and installation of new masonry stones as required to fill gaps.
- 1.3 CODES
- .1 Meet or exceed requirements of: Contract documents, Specified standards, codes and referenced documents.
.2 Conform to the latest revision of any referenced standard as re-affirmed or revised to the date of specification. Standards or codes not dated shall be deemed editions in force on the date of tender advertisement.
- 1.4 DOCUMENTS REQUIRED
- .1 Maintain at job site, one copy of each of the following:
.1 Contract Drawings;
.2 Specifications;
.3 Addenda;
.4 Reviewed shop drawings;
.5 List of outstanding shop drawings;
.6 Change orders;
.7 Other modifications to Contract;
.8 Field test reports;
.9 Copy of approved work schedule;
.10 Health and safety plan and other safety related documents.
.11 Other documents specified;
.12 Manufacturer's installation and application instructions; and
.13 All testing results.
- 1.5 WORK SCHEDULE
- .1 Provide within 5 working days after Contract Award, construction schedule showing anticipated progress stages and final completion of work within time period required by Contract Documents and as specified herein.
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1.5 WORK SCHEDULE
(Cont'd)

- .2 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of the Departmental Representative.
- .3 All work at the Upper Nicholsons masonry wall and adjacent backfill shall be completed during the non-navigation period and decreased water levels for the canal system from late October to mid May. Activity completion dates as follows:
 - .1 Canal masonry wall reconstruction: March 1, 2017.
 - .2 Cofferdam and other "in-water" measures to be removed: March 7, 2017.
 - .3 All work, including site restoration and removal of temporary facilities: May 6, 2017.

1.6 CONTRACTOR'S
USE OF SITE

- .1 Contractor's use of site for trailers storage and preparatory work shall be limited to an area within limits defined by project layout. Any additional areas required shall be approved by the Departmental Representative prior to use.
- .2 Maintain the site in a tidy condition free from the accumulation of waste products and debris. Upon substantial performance of the work, remove surplus products, tools, machinery and equipment from the site. Completion of clean-up is required for total performance of the work.
- .3 Provide any and all traffic control services required for the project.
- .4 Obtain all necessary permits to perform work and to comply with all permit requirements and conditions.
- .5 Maintain work during construction. Undertake continuous maintenance each day. Maintain roadway and structures in a safe and tidy condition.

2016-09-12

1.7 PROJECT
MEETINGS

- .1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
- .2 The Departmental Representative shall make available, with adequate notice, meeting facilities for regular project meetings.
- .3 Attend project meetings as specified. Arrange for and ensure applicable project sub-trades attend meetings as required.

1.8 SETTING OUT OF
WORK

- .1 Employ a certified surveyor to mark out work. All surface modifications are restricted to the identified construction limits.
- .2 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .3 Provide devices needed to lay out and construct work.
- .4 Supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.
- .5 Provide coordinates, elevations and dimensions from site as required by the Departmental Representative.

1.9 EXISTING
SERVICES

- .1 Where Work involves breaking into or connecting to existing services, carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.
- .2 Work that involves temporary disruption of services will be scheduled through the Departmental Representative. Give Departmental Representative minimum 72 hours notice of any disruption of services.
- .3 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

1.9 EXISTING

SERVICES

(Cont'd)

- .4 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .5 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .6 Record locations of maintained re-routed and abandoned service lines.
- .7 Confirm all inverts and critical elevations in the field prior to construction.

1.10 ADDITIONAL
DRAWINGS

- .1 Departmental Representative may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in the Contract Documents.

1.11 CONSTRUCTION
SAFETY MEASURES

- .1 The Contractor must submit a Safety Plan prior to the pre-construction meeting.

1.12 EXCAVATION

- .1 Prior to commencing any excavation, check for and become aware of all buried utilities and submit findings for review and approval by Departmental Representative.

1.13 STANDARD HOURS

- .1 The Contractor must maintain existing site hours for the work unless otherwise authorized by Departmental Representative.

1.14 SITE
CONDITIONS

- .1 For subsurface information, refer to geotechnical report prepared by DBA Engineering (Ref No. 15-2150-11), included in Appendix A.
- .2 Promptly notify Departmental Representative if subsurface conditions differ materially from those indicated in Contract Documents or a reasonable assumption of probable conditions based thereon.

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- 1.14 SITE CONDITIONS (Cont'd) .3 Contractor shall visit the canal and embankment and review existing site conditions prior to starting the Work.
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- 1.15 EXISTING SURVEY .1 Topographic survey used in the preparation of these contract documents was performed by Annis, O'Sullivan, Vollebekk Ltd. between September 1 and September 28, 2005 (Job No. 15522-15). Refer to contract drawings for further information.
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- 1.16 WORK WITHIN HISTORIC SITE BOUNDARIES .1 The Work is within a National Historic Site. It is essential that all lands remain as undisturbed as possible. Use standards and methods beyond those for normal construction in order to protect the environment and ensure aesthetics of the Work. Strictly adhere to contract limits and take every precaution to minimize environmental damage and disruption to vegetation, wildlife habitat, and structures or existing services, both on construction and storage sites.
- .1 If damage occurs during construction, bear the expense to immediately restore such damaged areas to the satisfaction of the Departmental Representative.
 - .2 If restoration fails to satisfy specified requirements, the Departmental Representative may complete repairs at the Contractor's expense.
 - .3 Ensure no damage will be done to aerial or underground electrical/communications cables.
 - .4 Submit all sources of aggregate and asphalt cement to Departmental Representative at least two weeks prior to start of the Work.
 - .5 Follow Provincial requirements regarding: Pit and Quarry guidelines; and Environmental Construction Practice Specifications.
 - .6 Make arrangements with authorities or owners of private properties for quarrying and transporting materials and machinery over properties and roads. Obtain associated permits and pay associated fees.
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- 1.17 NOISE .1 Fit all construction equipment with standard noise suppression devices. Maintain devices in accordance with manufacturer's requirements. Use smaller, less-disturbing equipment where possible.
- .2 Limit scheduling of Work activities on site in accordance with Section 01 14 10, Scheduling and Management of Work.
- 1.18 AIR QUALITY .1 Implement an anti-idling policy for trucks and machinery.
- .2 Submit dust control measures to Departmental Representative prior to starting Work. Apply dust control measures during periods of dust generation.
- 1.19 RELICS
ANTIQUES AND
WILDLIFE HABITAT .1 Protect relics, antiquities, wildlife habitat, items of historical or scientific interest such as cornerstones and contents, animal nesting sites, commemorative plaques, inscribed tablets, and similar objects found during course of work.
- .2 Give immediate notice to Departmental Representative and await Departmental Representative's written instructions before proceeding with work in this area.
- .3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.
- 1.20 NATIONAL PARKS
ACT .1 For projects within boundaries of National Historic Sites, perform work in accordance with National Parks Act.
- 1.21 PERMITS/
AUTHORITIES .1 Obtain and pay for permits from authorities as required for the Work. Comply with pertinent regulations of authorities having jurisdiction over the Work. Provide copies of permits to Departmental Representative prior to starting the Work.
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PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- 1.2 ACCESS AND EGRESS .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including coffer dams and access embankments, stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.
.1 For design of any temporary structures, submit design and supporting data at least 2 weeks prior to beginning work.
.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- 1.3 USE OF SITE AND FACILITIES .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
.2 Maintain existing services to building and provide for personnel and vehicle access.
.3 Where security is reduced by work provide temporary means to maintain security.
- 1.4 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING SITE .1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- 1.5 EXISTING SERVICES .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
.2 Provide for personnel, pedestrian and vehicular traffic.
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2016-09-12

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- 1.5 EXISTING SERVICES (Cont'd) .3 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- 1.6 WORK PERIODS .1 All work at the Upper Nicholsons masonry wall and adjacent backfill shall be completed during the non-navigation period and decreased water levels for the canal system from late October to mid May. Activity completion dates as follows:
.1 Canal masonry wall reconstruction: March 1, 2017.
.2 Cofferdam and other "in-water" measuresto be removed: March 7, 2017.
.3 All work, including site restoration and removal of temporary facilities: May 6, 2017.
- 1.7 SPECIAL REQUIREMENTS .1 Access to the Upper Nicholsons masonry wall by heavy and construction vehicles shall be limited to use of the Contractor designed and constructed cofferdam and access embankment.
.1 Design, construction and inspection of temporary access/cofferdam to Section 31 23 33.01 - Excavating, Trenching and Backfilling.
.2 Transportation of any major equipment and material from and to the masonry wall and surrounding area will not be possible during navigation season.
.3 Contractor to maintain existing travelled way across two bridges at all times.
.1 Existing single-lane bridges to masonrywall site have height and weight restrictions as follows:
.1 Wooden swing bridge (from County Road 23): 2.4 m and 10 tonnes.
.2 Steel bridge (from County Road 2):2.4 m and 5 tonnes.
.4 Carry out noise generating Work Monday to Friday from 0700 hours to 2200 hours, and on Saturday, Sunday or statutory or public holiday, not before 0900 hours.
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PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 GENERAL
REQUIREMENTS

- .1 The form of Tender includes one lump sum priced item, and several unit priced items.
- .2 The Total Tendered price shall be the sum of the lump sum item plus the amounts calculated from the unit priced items based on the approximate quantities identified for each of the unit priced items.
- .3 The Contractor in submitting their Tender for the project understands that they will only be entitled to payment under the unit priced items when prior written authorization has been received from the Departmental Representative for utilization and then only to the extent of the work authorized by the Departmental Representative.
- .4 The quantities listed in the Form of Tender are approximate only and are for the purpose of tendering. Payment to the Contractor will be based on actual quantities of work completed in accordance with the drawings and specifications.
- .5 The submitted tender prices will be inclusive of all costs for the complete supply and installation of all materials, labour and equipment required to complete the work. No separate payment will be made for any engineering design testing, inspections and approvals required by Contractor.
- .6 Payment shall be calculated as follows:
 - .1 The quantity for each pay item on which actual work has been performed shall be measured.
 - .2 For the lump sum item, multiply the percent complete by the value of the lump sum item.
 - .3 For each Unit Price item, this quantity shall be multiplied by the applicable Unit Price as provided in the Tender Form.
- .7 All measurement shall be along a horizontal plane unless otherwise indicated.

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- 1.2 LUMP SUM ITEM .1 No separate measurement for payment shall be made for any work completed under this item.
- .2 The work of the lump sum item shall include all work which is required for completion of the project, exclusive of those covered by the unit priced items.
- .3 All and any items not specifically included in the unit price items are considered incidental to the work and are to be included in the lump sum portion of the work.
- 1.3 UNIT PRICE ITEMS .1 Clearing and Grubbing:
- .1 Unit of Measurement: hectare (ha).
- .2 This item includes: cutting and disposal of all trees, brush, stumps, roots,downed timber, and embedded logs from areas indicated.
- .2 Soil Stripping and Stockpiling:
- .1 Unit of Measurement: cubic metre (m³).
- .2 This item includes: excavation and removal of all rootmat, humus, and topsoil from areas indicated, complete with stockpiling on-site and re-use or disposal of surplus or unsuitable material.
- .3 Mass Excavation and Embankment - Common:
- .1 Unit of Measurement: cubic metre (m³).
- .2 Method of Measurement: average and area method between cross sections taken after grubbing or topsoil removal and to lines and elevations indicated.
- .3 This item includes: excavation, placement and compaction to lines and elevations indicated, and disposal of surplus or unsuitable material.
- .4 Engineered Fill:
- .1 Unit of Measurement: metric tonne (t).
- .2 Method of Measurement: scale tickets signed by Departmental Representative.
- .3 This item includes: supply, placement and compaction of fill as indicated.
- .5 Granular Base Course:
- .1 Unit of Measurement: metric tonne (t).
- .2 Method of Measurement: scale tickets signed by Departmental Representative.
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- 1.3 UNIT PRICE .5 (Cont'd)
ITEMS .3 This item includes: supply, placement
(Cont'd) and compaction of gravel as indicated.
-
- .6 Hand Placed Rip Rap:
.1 Unit of Measurement: metric tonne (t).
.2 Method of Measurement: scale tickets
signed by Departmental Representative.
.3 This item includes: supply, placement
and compaction of rip rap as indicated.
- .7 Geotextile:
.1 Unit of Measurement: square metre (m²).
.2 Method of Measurement: slope measure of
indicated area.
.3 This item includes: supply, placement,
anchorage, and connection or overlap.
- .8 Geogrid:
.1 Unit of Measurement: square metre (m²).
.2 Method of Measurement: slope measure of
indicated area.
.3 This item includes: supply, placement,
anchorage, and connection or overlap.
- .9 New Masonry Stone:
.1 Unit of Measurement: cubic metre (m³).
.2 Method of Measurement: finished stone
dimensions prior to placement.
.3 This item includes: transportation and
storage of new stones. Written
authorization of the Departmental
Representative required for the procurement
of new masonry stone. Installation,
including mortar and anchorage, for salvaged
and new stones is included under the Lump
Sum item.
- .10 Topsoil and Hydraulic Seeding:
.1 Unit of Measurement: square metre (m²).
.2 Method of Measurement: slope measure of
indicated area at mean depth.
.3 This item includes: re-use of
stockpiled topsoil and supply of new,
placing of topsoil, lime, fertilizer,
tackifier, mulch, erosion control agent,
seed, and maintenance.
-

1.3 UNIT PRICE
ITEMS
(Cont'd)

- .11 Topsoil and Sodding:
 - .1 Unit of Measurement: square metre (m²).
 - .2 Method of Measurement: slope measure of indicated area at mean depth.
 - .3 This item includes: re-use of stockpiled topsoil and supply of new, placing of topsoil, lime and fertilizer, sod, required accessories, and maintenance.
- .12 Lumber Fender Rail:
 - .1 Unit of Measurement: metre (m).
 - .2 Method of Measurement: along top face of rail.
 - .3 This item includes: supply and installation, including anchorage and all accessories.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various sections.
- 1.2 APPOINTMENT AND PAYMENT .1 Departmental Representative will appoint and pay for services of testing laboratory except as follows:
.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
.2 Inspection and testing performed exclusively for Contractor's convenience.
.3 Testing, adjustment and balancing of equipment and systems.
.4 Mill tests and certificates of compliance.
.5 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
.6 Additional tests specified in the following paragraph.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.
- 1.3 CONTRACTOR'S RESPONSIBILITIES .1 Provide labour, equipment and facilities to:
.1 Provide access to Work to be inspected and tested.
.2 Facilitate inspections and tests.
.3 Make good Work disturbed by inspection and test.
.4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Departmental Representative sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
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- 1.3 CONTRACTOR'S RESPONSIBILITIES (Cont'd)
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
 - .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 DEFINITIONS
- .1 Activity: An element of Work performed during course of Project. An activity normally has an expected duration, an expected cost and expected resource requirements. Activities can be subdivided into tasks.
 - .2 Bar Chart (GANTT Chart). A graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
 - .3 Baseline: Original approved plan (for Project, work package, or activity), plus or minus approved scope changes.
 - .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
 - .5 Duration: Number of work periods (not including holidays or other nonworking periods) required to complete an activity or other Project element. Usually expressed as workdays or workweeks.
 - .6 Master Plan: A summary-level schedule that identifies major activities and key milestones.
 - .7 Milestone: A significant event in Project, usually completion of major deliverable.
 - .8 Project Schedule: The planned dates for performing activities and the planned dates for meeting milestones. A dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
-

1.1 DEFINITIONS
(Cont'd)

- .9 Project Planning, Monitoring and Control System: Overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Submit to Departmental Representative within 5 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .2 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 PROJECT MILESTONES

- .1 Project milestones to form targets for Project Schedule.
.1 Work to achieve substantial completion within 26 weeks of Contract Start Date.

1.5 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.
-

- 1.6 PROJECT SCHEDULE
- .1 Develop detailed Project Schedule derived from Master Plan.
 - .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.
 - .6 Backfill/Embankment.
 - .7 Masonry.

- 1.7 PROJECT SCHEDULE REPORTING
- .1 Update Project Schedule every 2 weeks reflecting activity changes and completions, as well as activities in progress.
 - .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

- 1.8 PROJECT MEETINGS
- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

PART 2 - PRODUCTS

- 2.1 NOT USED
- .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED
- .1 Not used.

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 11 00 -General Instructions.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are coordinated.

1.2 ADMINISTRATIVE
(Cont'd)

- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.
- .11 Make any changes in submissions which Departmental Representative may require consistent with Contract Documents and resubmit as directed by Departmental Representative.
- .12 Notify Departmental Representative, in writing, when resubmitting of any revisions other than those requested by Departmental Representative.

1.3 SHOP DRAWINGS
AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work that are specific to project requirements.
- .2 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 coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow 5 working days for Departmental Representative's review of each submission.

1.3 SHOP DRAWINGS
AND PRODUCT DATA
(Cont'd)

- .4 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.
 - .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of any revisions other than those requested.
 - .6 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.
 - .7 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication;
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances;
 - .3 Setting or erection details;
 - .4 Capacities;
 - .5 Performance characteristics;
 - .6 Standards;
 - .7 Operating weight;
 - .8 Relationship to adjacent work.
 - .8 After Departmental Representative's review, distribute copies.
-

1.3 SHOP DRAWINGS
AND PRODUCT DATA
(Cont'd)

- .9 Submit 1 PDF digital file or 6 prints of shop drawings for each requirement requested in the Specification sections and as Departmental Representative may reasonably request.
- .10 Submit 1 PDF digital file or 6 copies 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.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.4 SAMPLES

- .1 Samples: examples of materials, equipment quality, finishes, workmanship.
- .2 Submit for review samples 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.

-
- 1.4 SAMPLES
(Cont'd)
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
 - .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
 - .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.
- 1.5 PROGRESS
PHOTOGRAPHS
- .1 Submit electronic and hard copy of colour digital photographs in "jpg" format.
 - .2 Identification: name and number of project and date of exposure indicated.
 - .3 Number of view points: locations of view points determined by Departmental Representative, or as specified elsewhere in this specification.
 - .4 Frequency: monthly, at completion of excavation/embankment and before buried component concealment, or as specified elsewhere in this specification.
- 1.6 CERTIFICATES
AND TRANSCRIPTS
- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
 - .2 Submit transcription of insurance immediately after award of Contract.
- 1.7 WORK SCHEDULE
- .1 Provide within 5 working days after contract award, schedule showing anticipated progress stages and final completion of work within time period required by Contract Documents.
 - .2 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 01 33 00 - Submittal procedures.
- 1.2 REFERENCES .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Province of Ontario
.1 Occupational Health and Safety Act, and regulations for construction projects, R.S.) (1990, c.0.1., as amended and O. Reg. 213/91 as amended)- updated (2005).
- 1.3 SUBMITTALS .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
.1 Results of site specific safety hazard assessment.
.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit Material Safety Data Sheets (MSDS) to Departmental Representative.
-

1.3 SUBMITTALS
(Cont'd)

- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 7 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's full responsibility for construction Health and Safety.
- .9 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.
- .11 Submit other data, information and documentation upon request as stipulated elsewhere in this section.

1.4 FILING OF
NOTICE

- .1 File Notice of Project and other Notices with provincial authorities prior to commencement of Work.
- .2 Upon request, Departmental Representative will provide name and mailing address of provincial department to whom the Notice of Project shall be sent.

1.5 HAZARD
ASSESSMENT

- .1 Implement and carry out a health and safety hazard assessment program as part of the work. Program to include:
 - .1 Initial hazard assessment carried out immediately upon notification of contract award prior to commencement of Work.
-

1.5 HAZARD
ASSESSMENT
(Cont'd)

- .1 (Cont'd)
- .2 Ongoing hazard assessments performed during the progress of work identifying new or potential health risks and safety hazards not previously known. As a minimum, hazard assessments shall be carried out when:
 - .1 New sub-trade work, new subcontractor(s) or new workers arrive at the site to commence another portion of the work.
 - .2 The scope of the work has been changed by Change Order.
 - .3 Potential hazard or weakness in current health and safety practices are identified by Departmental Representative or by an authorized safety representative.
- .3 Hazard assessments to be project and site specific, based on review of contract documents, site and weather conditions.
- .4 Each hazard assessment to be made in writing. Keep copies of assessments on site for duration of work. Upon request, make available to Departmental Representative for inspection.

1.6 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work. Have Contractor's Site Superintendent in attendance. Departmental Representative will advise of time and location.
- .2 Provide site safety orientation session to all workers and other authorized persons prior to granting them access to work site. Brief persons on site conditions and on the minimum site safety rules in force at the site.
- .3 Conduct site-specific occupational health and safety meetings during the entire work as follows:
 - .1 Formal meetings on a minimum monthly basis.
 - .2 Informal "tool box" meetings on a regular basis from a predetermined schedule.

- 1.6 MEETINGS
(Cont'd)
- .4 Keep workers informed of anticipated hazards, on safety practices and procedures to be followed and of other pertinent safety information related to:
 - .1 Progress of work;
 - .2 New sub-trades arriving on site, and;
 - .3 Changes in site and project conditions.
 - .5 Record and post minutes of meeting. Make copies available to Departmental Representative upon request.
- 1.7 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 Health and Safety Plan shall contain the following three (3) parts:
 - .1 Part 1: List of individual health risks and safety hazards identified by hazard assessments.
 - .2 Part 2: List of specific measures to control or mitigate each hazard and risk identified in part one of Plan. Describe the engineering controls, personnel protective equipment and safe work practices to be implemented and followed when performing work related to each identified hazard or risk.
 - .3 Part 3: Emergency Measures and Communications Procedures as follows:
 - .1 Emergency Measures: on-site operating procedures, evacuation measures and emergency response to be implemented in the occurrence of an incident. Procedures to be specific and relevant to identified hazards. Measures to complement and be integrated with the facility and tenants Emergency Response Plans in place at site. Obtain information on existing emergency and evacuation plans from Departmental Representative and incorporate appropriate data.
 - .2 Communication Procedures:
-

1.7 GENERAL
REQUIREMENTS
(Cont'd)

- .2 (Cont'd)
- .3 (Cont'd)

.1 List of names and telephone numbers of designated officials, to be contacted should an incident or emergency situation occur, including the following.

.1 General Contractor and all Subcontractors. Federal and Provincial Departments and local emergency resources organizations, as resources organizations, as applicable laws and regulations.

.2 Officials from Parks Canada Agency. Departmental Representative will provide list of names to be included.

.2 Procedures implemented at site to communicate and share information between workers, subcontractors, and General Contractor on work activities and in particular those which might endanger workers and Facility employees.

.3 List of critical construction activities to be communicated with the Facility Manager and designated tenant representatives which could affect facility and tenant operations, or pose a risk to the health and safety of their employees and to the general public. Develop list in consultation with the Departmental Representative.

- .3 Prepare Health and Safety Plan in a three column format, addressing the three parts specified above, as follows:

Column 1	Column 2	Column 3
Identified	Control Measures	Emergency
Hazard	Implemented	Measures and
		Communications
		Procedures _____

1.7 GENERAL REQUIREMENTS
(Cont'd)

- .4 Develop Health and Safety Plan in collaboration with all subcontractors. Address all work and activities of subcontractors as they arrive on site. Immediately update Plan and submit to Departmental Representative.
- .5 Implement, maintain and enforce compliance with requirements of the Health and Safety Plan until final completion of work and demobilization from site.
- .6 As work progresses, review and update Plan addressing additional health risks and safety hazards identified by on-going hazard assessments.
- .7 Submit revised versions of Plan to Departmental Representative.
- .8 Post a typed written copy, including all updates of the Health and Safety Plan in a common visible location at work site.
- .9 Submission of the Health and Safety Plan, and updates to the Departmental Representative is for review and information purposes only. Its submission shall not be construed to imply approval by Departmental Representative, be interpreted as a warranty of being complete, accurate and legislate compliant and shall not relieve the Contractor of his legal obligations for the provision Health and Safety of the Construction Project.
- .10 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

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 environment to extent that they may be affected by conduct of Work.
-

- 1.8 RESPONSIBILITY (Cont'd) .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- 1.9 COMPLIANCE REQUIREMENTS
- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c.0.1 and Ontario regulations for construction projects, O. Reg. 213/91.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations made under part II of the Canada Labour Code.
- .3 Observe and enforce construction safety measures required by:
- .1 2010 National Building Code of Canada, Part 8;
 - .2 Provincial Worker's compensation Board;
 - .3 Municipal Statutes and ordinances.
- .4 In event of conflict between any provisions of above authorities the most stringent provision shall apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
- .5 A copy of the Canada Labour Code Part II may be obtained by contacting:
- Canadian Government Publishing
Public Works & Government Services Canada
Ottawa, ON, K1A 0S9
Tel: (819) 956-4800 or 1-800-635-7943
- 1.10 UNFORESEEN HAZARDS .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction. Advise Departmental Representative verbally and in writing.
-

- 1.11 HEALTH AND SAFETY CO-COORDINATOR
- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-coordinator. Health and Safety Co-ordinator must:
 - .1 Have minimum 2 years' site-related working experience specific to activities.
 - .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.
- 1.12 POSTING OF DOCUMENTS
- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.
 - .2 Post all permits on site. Submit copies to Departmental Representative.
- 1.13 CORRECTION OF NON-COMPLIANCE
- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
 - .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
 - .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.
- 1.14 BLASTING
- .1 Blasting or other use of explosives is not permitted without prior written instructions from Departmental Representative.
-

- 1.15 POWDER ACTUATED DEVICES .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.
- 1.16 WORK STOPPAGE .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- 1.17 SITE CONTROL AND ACCESS .1 Control work site and entry points. Grant and allow entry to only workers and other persons so authorized. Immediately stop unauthorized persons from circulating within construction areas and remove from site.
- .2 Implement procedures for granting permission to enter into work site to all persons who require access. Procedures to include the provision of a site safety orientation session.
- .3 Delineate and isolate construction areas from other areas of site by use of appropriate means. Erect barricades, fences, hoarding and temporary lighting as required.
- .4 Erect signage at entry points and at other strategic locations around site, clearly identifying construction area(s) as being "off limits" to unauthorized persons. Signage must be professionally made in both official languages or by use of well-understood graphic symbols.
- .5 Secure site at night time or provide security guard(s) as deemed necessary to protect site against entry.
- .6 Ensure persons granted access are fitted and wear appropriate personnel protective equipment (PPE). Be responsible for the provision of such PPE to persons who require access to conduct work or perform inspections.
- 1.18 PROTECTION .1 Provide temporary facilities for protection and safe passage of public pedestrians and vehicular traffic around adjacent work site.
-

- 1.18 PROTECTION
(Cont'd)
- .2 Provide safety barricades, lights and signage on work site as required to provide a safe working environment for workers.
 - .3 Carry out work placing emphasis on health and safety of public, site personnel and protection of the environment.
 - .4 Should unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.
- 1.19 PERMITS
- .1 Obtain permits, licenses and compliance certificates, at appropriate times and frequency as stipulated by authorities having jurisdiction.
 - .2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Departmental Representative in writing and obtain Departmental Representative's approval to proceed prior to carrying out that portion of the work.
- 1.20 MINIMUM SITE SAFETY RULES
- .1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements at the work site and obeyed by all persons granted access:
 - .1 Wear personal protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat and safety footwear. Wear eye protection where appropriate.
 - .2 Immediately report unsafe activities, conditions, near-miss accidents, injuries and damages.
 - .3 Maintain site in tidy condition.
 - .4 Obey warning signs and safety tags.
 - .2 Brief workers on site safety rules, and on the disciplinary measures to be taken for violation or non-compliance of such rules. Post such information on site.
-

- 1.21 TOOLS AND EQUIPMENT SAFETY
- .1 Implement and follow a scheduled tool and equipment inspection/maintenance program at work site. Regularly check tools, equipment and machinery for safe operation and perform maintenance at pre-established time and frequency intervals as recommended by manufacturer. Include subcontractors equipment as part of the inspection process.
 - .2 Use standardized checklists to ensure established safety checks are stringently followed.
 - .3 Immediately tag and remove items found faulty or defective off site.
 - .4 Maintain written documentation on each inspection. Make available to Departmental Representative upon request.
- 1.22 HAZARDOUS PRODUCTS
- .1 Comply with requirements of Workplace Hazardous Materials Information Systems (WHMIS).
 - .2 Keep MSDS data sheets on site. Provide copies of all data sheets to Departmental Representative upon receipt of materials on site.
 - .3 Put all MSDS data sheets on site, in a common area, visible to workers.
- 1.23 PROJECT / SITE CONDITIONS
- .1 The following are known or potential project related safety hazards at site:
 - .1 Overhead Power Lines.
 - .2 Working adjacent waterways.
 - .3 Excavations and Trenches.
 - .4 Environment (Extreme weather, wildlife).
 - .5 Working at heights.
 - .6 Working below water line in diverted waterway.
 - .2 Obtain from Departmental Representative, copy of MSDS Data sheets of existing hazardous materials stored on site or being used by Facility and Tenant personnel in the course of their operations.
-

1.23 PROJECT / SITE .3 Above lists shall not be construed as being
CONDITIONS
(Cont'd) complete and inclusive of safety and health
hazards encountered as a result of
Contractor's operations during the course of
work. Include above items into the hazard
assessment program specified herein.

1.24 ACCIDENT .1 Investigate and report incidents and
REPORTING accidents as outlined in Provincial
Occupational Safety and Health Act and
Regulations.

.2 Investigate and immediately report to
Departmental Representative incidents and
accidents which results, or has the
potential of resulting in:
.1 Injuries requiring medical aid.
.2 Property damage in excess of \$5,000.00.
.3 Required notification to Workers
Compensation Board or other regulatory
agencies as stipulated by applicable
regulations.

.3 Medical aid in above clause shall have the
same meaning as the term "medical aid
injury" as defined in the Canadian
Dictionary of Safety Terms - 1987 issue,
from the Canadian Society of Safety
Engineers (C.S.S.E.) as follows:
.1 Medical Aid Injury: any minor injury
for which medical treatment was provided and
the cost of which is covered by Workers'
Compensation Board of the province in which
the injury was incurred.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

PART 1 - GENERAL

1.1 DESCRIPTION

- .1 This Section describes requirements for the protection of the environment that apply to the Work. These requirements apply to all Sections of this Specification, without limiting the conditions and approvals imposed by statute.
- .2 Control work to provide effective environmental, waterway, and fish habitat protection. Departmental Representative will monitor environmental protection measures and will identify whenever such protection is found to be ineffective. Change protective measures or work procedures as directed by Departmental Representative to ensure environmental, waterway and fish habitat protection.

1.2 SITE CONDITIONS

- .1 For site-specific ecologic/habitat information, potential impacts and mitigation measures, refer to the Basic Impact Analysis prepared by Parks Canada Agency (August 2016), included in Appendix B.
 - .1 In the case of disagreement between mitigation measures presented in the analysis and the provisions of this specification, the more stringent shall apply.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.
 - .1 Environmental Protection Plan to present comprehensive overview of known or potential environmental issues to be addressed during construction.
 - .2 Environmental Protection Plan to be prepared in accordance with requirements of Federal, Provincial and Municipal laws and regulations.
 - .3 Address topics at level of detail commensurate with environmental issue and required
-

construction tasks.

- .4 Environmental Protection Plan to include:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Description of environment protection personnel training program.
 - .5 Erosion, sediment and dust control plan which identifies type and location of erosion, sediment and dust controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion, sediment and dust control plan, Federal, Provincial, and Municipal laws and regulations.
 - .1 Erosion and Sedimentation Control measures provided in the contract drawings are the minimum requirement. Provide any changes or additional measures as required due to Contractor's schedule and Work Plan.
 - .6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .1 Engage the services of a qualified, professional engineer registered in the Province of Ontario to design and inspect temporary cofferdams and access embankments.
 - .7 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Work area plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
 - .8 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .9 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
 - .10 Air pollution control plan detailing
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provisions to assure that dust, debris, materials, and trash, do not become air borne and are contained on project site.

.11 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.12 Waste water management plan that identifies methods and procedures for management and discharge of waste waters which are directly derived from construction activities, such as dewatering of lock, concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water and water used in flushing of lines.

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

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

- .5 Product Data: Submit manufacturer's instructions, printed product literature, data sheets and WHMIS MSDS sheets

1.4 EXPLOSIVES

- .1 Use of explosives is not prohibited.

1.5 FIRES

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

1.6 DEFINITIONS

- .1 Deleterious Material: substance that, if added to a waterway, could degrade water quality or impact fish, fish habitat and aquatic wildlife. This includes, but is not limited to:
- .1 Concrete dust.
 - .2 Soils (clay, silt, sand).
 - .3 Oil, diesel, or gasoline.
 - .4 Chipped or fresh concrete and admixtures.
 - .5 Alkali water resulting from fresh concrete or cementitious grout .

- .6 Salt.
- .7 Solvent.

- .2 Dripline: location on the ground surface directly beneath a theoretical line described by the tips of the outermost branches of the trees.
- .3 Barrier: fence consisting of approved material, supported by steel posts and being a minimum of 1.8m high, without breaks or unsupported sections

1.7 TURBIDITY CONTROL AND DRAINAGE WATER

- .1 Control turbidity of water released during work.
 - .1 Do not pump water directly into waterway. Send discharge to silt bag or other filtration measure before being released into waterway.
 - .2 Water quality downstream of construction site and/or released to watercourses not to exceed background turbidity readings of 8 nephelometric turbidity units (NTU) or change of 25 mg/l for suspended solids. Dispose of water so that it does not create a safety or health hazard, or cause damage to the environment, to adjacent property or cause erosion.
 - .3 Provide marine grade turbidity curtain across areas where sediments can enter waterway. Turbidity curtain to be anchored or weighted down along its length to form continuous seal on canal bed with adequate flotation at water surface to prevent over spills of turbid water.
 - .4 Mechanical filtration of turbid water is also acceptable.
 - .5 In event of significant silting or escape of debris caused by construction activities, contractor to immediately stop work, notify Departmental Representative and take appropriate measures to confine work and install additional turbidity curtains.
- .2 Control disposal or runoff of water containing other harmful substances in accordance with local authority requirements.
- .3 Sediment, debris and erosion control measures to be inspected daily to ensure that they are functioning properly and are maintained and upgraded as required.
- .4 If sediment, debris or erosion control measures

2016-09-12

are not functioning properly, no further work permitted until problem has been rectified.

- .5 Sediment, debris and erosion control measures to be left in place until disturbed areas within work area have been stabilized and sediments in water have settled. Removal permitted only after written approval from Departmental Representative.

1.8 WORK ADJACENT TO
WATERWAYS

- .1 Do not release deleterious materials into waterway.
- .2 Do not use salt as deicer or sand for traction within 30 m of canal.
 - .1 Where ice is safety concern, use environmentally acceptable deicing or traction materials approved by Departmental Representative.
 - .2 No deicer or traction materials to be allowed to enter waterway.
- .3 Ensure equipment and temporary access structures such as scaffolding placed in waterbodies are free of earth material, and excess, loose or leaking fuel, lubricants, coolant and other deleterious material that could enter waterway.
- .4 Do not use waterway beds for borrow material.
- .5 Do not dump excavated fill, waste material or debris in waterways.
- .6 Stockpiles of excavated or fill materials to be stored and stabilized no closer than 30 m from waterway. Runoff from excavated or fill material to be contained from entering waterway.

1.9 AQUATIC LIFE
PROTECTION

- .1 Restrict in-water works to approved timing windows (no in-water works permitted between March 31 and July 01).
 - .2 Amphibians, reptiles or fish that could become or have become trapped within cofferdam area, between upper and lower stoplog gains of navigation lock, to be captured and transferred "live" immediately upstream or downstream of lock.
 - .1 Work program will be overseen by Departmental
-

Representative to ensure proper capture and handling of aquatic life.

1.10 EROSION, SEDIMENT
AND DUST PROTECTION

- .1 Prior to starting work that will create dust or debris, such as improvements to access, concrete sawing, removal, excavation or backfilling, install effective mitigation techniques for erosion, sediment, dust and debris control in accordance with Federal, Provincial and Municipal laws and regulations. Maintain these protective measures at all times, including during shut down periods.
- .2 Maintain effective surface drainage and direct runoff away from work areas and into adequately vegetated areas.
- .3 Provide one metre high silt fence barrier or fiber filtration tubes in areas where, due to construction activities, silt or debris may leave the work area enter the adjacent lands, canal or waterway. This includes, but is not limited to, barrier installed around staging and work areas, and on canal bed (or ice surface) parallel to canal wing walls.
- .4 Maintain standby supply of pre-fabricated silt fence barrier, or an equivalent ready-to-install sediment control device.
- .5 Excavation to cease during periods of heavy rainfall, unless runoff is contained from entering waterway.
- .6 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

1.11 PLANT AND TREE
PROTECTION

- .1 Protect trees and plants on site and adjacent properties.
 - .2 Limit clearing, grubbing, and tree-branch removal to areas of work or access indicated on approved shop drawings.
 - .3 Provide barriers around trees which may be affected by work, including staging areas.
 - .1 Locate barrier 1 metre beyond Dripline.
 - .2 Barrier to consist of protective wood framework covered with plastic construction fence
-

material, extending from grade level to a height of 2 metres.

.3 Maintain barriers in good repair throughout duration Work.

.4 Remove barriers upon completion of Work.

.4 Protect roots of designated trees to drip line to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.5 Damage to trees due to Contractor' s operations:

.1 Broken branches 25 mm or greater in diameter: cut back cleanly at break, or to within 10 mm of their base, if substantial portion of branch is damaged Departmental Representative will direct.

.2 Exposed roots 25 mm or larger: cut back cleanly to soil surface within five calendar days of exposure.

.3 Damaged bark: neatly trim back to uninjured bark, without causing further injury, within five calendar days of damage.

.5 Reduce soil displacement and compaction by using heavy machinery in designated areas and on existing vehicle paths.

.6 Replace damaged lawn to pre-construction state with topsoil and sod.

.7 Avoid using heavy machinery on saturated ground.

.8 Use equipment of low bearing weight and low pressure tires wherever possible.

1.12 OPERATION AND
MAINTENANCE OF EQUIPMENT

.1 Do not operate heavy equipment in waterway, except when operated from barge or after dewatering completed.

.2 Clean equipment prior to entering waterway in designated area at least 30 m from waterway.

.3 Provide and use drip trays to prevent discharge of oil, grease, antifreeze, or other materials into ground or waterways .

.4 Equipment and heavy machinery to meet or exceed applicable emission requirements.

- .5 Leave machinery running only while in actual use, except where extreme temperatures prohibit shutting machinery down.
- .6 Vehicle and equipment maintenance and refueling to be conducted over impermeable/absorptive material situated at a designated area that is located at least 30 m away from nearest waterway.
- .7 In case of fuel heaters to be located nearer than 15 m from canal, use large drip pan to contain possible leakage from heater or refueling operations. Absorptive material to be placed at bottom of drip pan for added measure.

1.13 REMOVED MATERIALS

- .1 Unless otherwise specified, materials designated for removal become Contractor's property. Remove these from site.

1.14 HAZARDOUS MATERIALS

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.
- .3 Store Hazardous Materials in secure areas on impermeable pads, provide berms if necessary.

1.15 NOTIFICATION

- .1 Monitor compliance with the accepted Environmental Protection Plan, logging compliance and noncompliance issues. Present the log to the Departmental Representative for review.
 - .2 Notwithstanding the Contractor's monitoring of compliance, the Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's
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Environmental Protection plan.

- .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 will 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.

1.16 CLEAN UP

- .1 Clean up work area continuously as work progresses.
 - .2 At end of each work period, and more often if ordered by Departmental Representative, remove debris from site, neatly stack material for use, and clean up generally.
 - .3 Permit no amount of debris, trash or garbage to accumulate on-site.
 - .4 Do not bury rubbish on site.
 - .5 Separate and recycle materials that can be recycled.
 - .6 Dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner by taking them to special designated waste facility. Do not dump these into waterways, storm or sanitary sewers.
 - .7 Ensure emptied containers are sealed and stored safely for disposal away from children.
 - .8 Spills:
 - .1 Have environmental emergency response plan in place, spill kit and other materials readily available on-site to respond quickly if spills occur.
 - .2 Report spills immediately to Departmental Representative and Ontario Ministry of Environment Spills Action Centre (Telephone No.
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2016-09-12

1-800-268-6060).

.3 Secure source of spill to stop flow of spill and isolate area of spill.

.4 Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material, or absorbent pads.

.5 Clean-up, remove and dispose of contaminated materials in accordance with MSDS or as directed by Ontario Ministry of Environment.

.6 Be responsible for costs of cleaning up spills to satisfaction of Departmental Representative.

.9 Remove scaffolding, temporary protection and surplus materials, tools, plant, rubbish and debris and dispose of them in an approved manner off Parks Canada property at following times:

.1 By April 25, 2017 for items in Rideau Canal/River.

.2 At completion date of work for all other areas.

.10 Clean areas under contract to condition at least equal to that previously existing and to approval of Departmental Representative.

1.17 CLEANING OF CONCRETE EQUIPMENT

.1 Departmental Representative will designate cleaning area for equipment and tools to limit water use and control runoff.

.2 Cleaning area to be no closer than 30 m from waterway to prevent contamination.

.3 Where no safe cleaning area is available, Contractor to provide settling pond for area where equipment to be cleaned.

.4 Alkali water, such as concrete wash water, to be collected and disposed off-site in accordance with federal, provincial, and local authority requirements .

.5 Use only trigger operated spray nozzles for water hoses.

1.18 DISPOSAL OF WASTE MATERIALS

.1 Waste subject to Ontario Environmental Protection Act to be transported with valid "Certificate of Approval for a Waste Management System" to site approved by Ontario Ministry of the Environment to accept that waste.

2016-09-12

- .2 Obtain and submit Waste Generator Numbers, permits, manifests, and other paperwork necessary to comply.

1.19 NOISE CONTROL

- .1 Minimize noise levels from construction activities by using proper muffling devices, in addition to appropriate timing and location of these activities to reduce or -minimize effect of noise on nearby residents, recreationists, and wildlife.
 - .1 Carry out noise generating Work Monday to Friday from 0700 hours to 2200 hours, and on Saturday, Sunday or statutory or public holiday, not before 0900 hours.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each phase.
- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.2 MITIGATION MEASURES

- .1 Fish / Fish Habitat:
 - .1 Restrict in-water works to approved timing windows (no in-water works permitted between March 31 and July 01).

- .2 Implement protection measures to control releases of sediment and spills and leaks from equipment.
 - .3 Should conditions at the work site indicate that there are unforeseen negative impacts to fish or their habitat, all work shall cease until the problem has been corrected and/or DFO are consulted.
 - .4 To prevent fish from being killed by the placement of rock in watercourses measures should be taken to move fish away from the immediate area before dumping the rock. Methods could include
 - .1 The combination of noise and bubbles from an air compressor could be utilized for a sufficient amount of time to direct fish away from the area where rock will be dumped;
 - .2 Place both turbidity curtains side by side across the canal, then pull one away pushing fish away from corridor;
 - .3 Capture fish stranded behind turbidity curtains and release in safe area.
 - .5 Fish trapped in area to be dewatered must be captured alive and relocated outside areas to be dewatered before commencement of pumping.
 - .6 Implement mitigation measures in accordance with Fisheries and Oceans Canada recommendations, "Measures to avoid causing harm to fish and fish habitat".
 - .2 Aquatic Species (Species At Risk Act (SARA)):
 - .1 Distribute descriptions and illustrations of Species at Risk (SAR) so that sub-contractors/workers on the Project can readily identify them. SAR list will be provided by Parks Canada. Incorporate procedures into environmental protection plan. Should a SAR be encountered, cease work and contact Departmental Representative for advice regarding mitigation measure to be implemented to avoid destruction, injury, or interference with the species, its residence and/or its habitat.
 - .3 Migratory Birds/Birds (MBCA):
 - .1 Minimize disturbance to onsite vegetation, including vegetation surrounding the construction staging area. Construction must be in compliance with the Migratory Birds Convention Act guidelines for tree clearing. The Act states that vegetation clearing will be undertaken outside of the breeding season. Clearing of vegetation in this
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region should be avoided from March 25 to August 28.

.2 Migratory birds, their nests and eggs are protected under the Migratory Birds Convention Act, 1994 (MBCA). Project works or activities, such as construction access, site grubbing, vegetation clearing and construction activities, are potentially destructive or disruptive activities to birds, their nests or eggs and should be avoided at key locations or during key periods, including the breeding periods and periods of high usage such as migration and/or feeding. These locations and periods vary by region and by species. Minimize the risk of detrimental effects to migratory birds by developing and implementing appropriate preventive and migrative measures to minimize the risk of incidental take and to help maintain sustainable populations of migratory birds. General information about incidental take, avoidance and how to work during the core periods of migratory bird breeding can be found at

<http://www.ec.gc.ca/paom-itmb/default.aspx?lang=En&n=1B16EAFB-1>. To comply with the Migratory Bird Convention Act, if activities are proposed to occur between March 25 to August 28 in any given year, a bird survey and nest search should be undertaken before the construction activities to ensure no nesting birds are located in the area. Should a nest be encountered, the area should be clearly staked or flagged and a 50 m buffer established around the nest to avoid disturbance of the area.

.4 Air Quality:

.1 Use soil removal methods and best practices to avoid generating airborne dust and particulates, including hand held tools.

.2 Undertake misting, create localized wind barriers, use tarps to cover loads, or implement other methods particularly during dry, dusty conditions to avoid generating airborne or surface dust and particulates. Provide dust control on access roads. Do not dump material in high wind conditions.

.3 Maintain trucks, boats and equipment in good condition, equipped with emission controls as applicable, and operated within regulatory requirements, including meeting local authority's emission requirements. Keep equipment and vehicles clean and free of deleterious material.

- .4 Avoid unnecessary idling of vehicles and equipment.

 - .5 Historical, Archaeological and Cultural Resources:
 - .1 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 PCA.
 - .2 Should historic objects be uncovered during the work, stop work immediately and notify the Departmental Representative. Do not resume work until such time as directed by the Departmental Representative.

 - .6 Soil:
 - .1 To minimize land disturbance, the construction envelope will be clearly demarcated and kept as small as possible.
 - .2 Stockpiled material to be located away from watercourse and covered to prevent its erosion and transport. Ensure silt fences encompass stockpile areas.
 - .3 Do not stockpile on high-risk areas with unstable slopes; keep site clearing to a minimum to maintain vegetative cover and windbreaks.
 - .4 Avoid stockpiling during dry and windy periods and limit size of stockpiles to avoid anaerobic conditions.
 - .5 Install and maintain erosion control measures such as silt fence, fibre filtration tubes, filter bags, straw bale or rock flow checks, temporary berms and grading, and erosion prevention mats/covers. Maintain these measures until the site has stabilized. Keep stockpile of erosion control material on site so repairs can be undertaken immediately.
 - .6 Avoid activity during wet weather conditions and ensure that a consistent access route is used and maintained throughout vegetation clearing.
 - .7 Install a tarpaulin on stockpiles and haulage trucks as appropriate.
 - .8 Backfill and compact excavation as soon as possible and minimize vehicle traffic on exposed soils.
 - .9 Materials and equipment used for the Project shall be operated and stored in a manner that prevents a deleterious substance from being released to the ground.
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- .7 Surface Water:
- .1 Refuel equipment off slopes, and minimum of 30 m away from waterbodies/aquatic habitats. Refuel heavy equipment in staging area designated for refueling with spill mitigating measures in place. Refuel machinery and follow spill avoidance procedures as specified above in Soil section.
 - .2 Store oils, lubricants, fuels and chemicals in secure areas on impermeable pads, 30 m away from a waterbody, and provide containment berms as necessary.
 - .3 Securely contain and remove contaminated soils or other contaminated materials offsite to a licensed facility.
 - .4 An emergency spill kit shall be kept at the site and deployed immediately should a spill occur. In the case of a spill contact the Departmental Representative and the Ontario Spill Action 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.
 - .5 Maintain effective surface drainage, ensure work does not promote flood hazards or create undesired obstructions to drainage into natural water bodies.
 - .6 Install sediment and erosion control structures and measures before construction and inspect devices daily.
 - .7 Remove accumulated sediments before removing erosion control devices.
 - .8 Direct runoff and overland flows into adequately vegetated areas, away from waterbodies, working areas and areas of exposed soils.
 - .9 Turbidity curtains shall be installed before rock fill placement in the bed of the Canal and in any watercourse, and maintained in place until the end of construction and removal of the placed material. Locations include, but are not limited to, installation upstream of the temporary access road/cofferdam, immediately downstream of the waste weir, and downstream of the Upper Nicholsons lock station. A temporary turbidity curtain shall be installed downstream of the cofferdam during its construction, and removed following dewatering. The turbidity curtains to be marine grade, anchored and weighted along length to form a continuous barrier with adequate flotation at water surface. Inspect daily and maintain turbidity curtains until the end of construction.
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.10 Inspect all erosion and sediment control measures daily and leave them in place until construction site has stabilized. In the event the sediment and erosion control measures are not functioning, the supervisor shall order the work stopped. No further work shall be carried out until the sediment control plan is adjusted to address the sediment problem.

.11 Silt fences and/or fibre filtration tubes should also be installed around the perimeters of work areas to prevent sediment and other deleterious substances from entering the water (Rideau River and Canal) and other forest habitats.

.12 Minimize runoff from stockpiles created through misting and wetting. Stockpiled or excavated materials should be stored well away from water and surrounded by sediment control measures to prevent runoff from entering waterbodies.

.13 Upon completion of work, debris on the canal bed and on existing ground shall be completely removed and areas restored to their original condition.

.14 Do not operate heavy equipment in waterway except when operated from a barge. Any small tools and equipment operating in waterbodies must be cleaned prior to entering the water and inspected daily for leaks. Equipment should never be left in water overnight. Do not skid construction material across area and inspect daily for leaks.

.15 Use and discharge of chemicals and cleaning agents is prohibited near aquatic habitats. Do not dump excavated fill, waste material or debris into waterways.

.16 Ensure painting and staining are done upland well above the upper controlled water elevation level. Ensure all equipment and temporary access structures such as scaffolding placed in watercourses are free of earth material, fuel, lubricants, coolant and other deleterious material that could enter the watercourses.

.17 Attach drop cloths to scaffolding to prevent deleterious materials, paints, timbers, concrete, solvents, etc. from entering the water.

.18 All concrete, sealants or other compounds used for this project shall be utilized according to the appropriate Product Technical Data Sheet, stating guidelines and methods for proper use, and provided by the manufacturer of the product. Refer to following web link for additional guidelines for working with concrete around water:

<http://www.env.gov.bc.ca/wld/BMP/concretehtml>.

.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 or lime-containing construction materials (concrete) sediments, debris, concrete, concrete fines, wash or contact water do not deposit, directly or indirectly, into or about any watercourse. Concrete materials cast in place must remain inside formed structures. Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment. All concrete wash water will be disposed of offsite in a location where it will not enter subsurface drains, water bodies or storm drains. 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 or stormwater system. 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. Isolate and hold any water that contacts uncured or partly cured concrete until the pH is between 6.5 and 8.0 pH. Use only non-toxic biodegradable form stripping agents.

.20 Materials and equipment used for the Project shall be operated and stored in a manner that prevents deleterious substance from entering the water.

Prevent spillage of stored chemicals, gasoline, fuel, or other petroleum products into a waterway.

.8 Terrestrial Habitat and Species:

.1 Minimize damage and removal of vegetation to the extent possible by establishing staging areas and site access routes away from existing trees/naturalized vegetation to the extent possible.

.2 Schedule work so that tree trunks are (Cont'd) removed prior to hibernation period. If unavoidable prior to cutting of trees, rap their trunks repeatedly with a stick (or similar object) to awaken hibernating mammals.

.3 Exposed soils shall be stabilized and re-vegetated as soon as possible.

.4 Vegetation selected for removal or protection will be identified and specific protection barriers will be installed where required before construction.

.5 Investigate the area for the presence of animal dens before commencing work.

.6 Direct surface runoff away from work areas and into adequately vegetated areas.

.7 Maintain an adequate supply of clean up material on site.

.8 During stump removal, monitor the immediate work and stop work as required to allow herpetofauna to escape the work area. Relocate herpetofauna away from the construction area to a similar habitat within the confines of the Upper Nicholsons Lockstation.

END OF SECTION

PART 1 - GENERAL

1.1 REFUELING

- .1 Refueling of equipment to be performed in locations as directed by Departmental Representative.
 - .2 Do not refuel equipment within 30 metres of any watercourse or storm water catch basin unless protection against spills is in place and location is approved by Departmental Representative.
 - .3 Use petroleum containers approved for products with no spill fill spouts for dispensing fuels. The sure pour nozzle to have self closing valve, prevent any flow of fuel until the nozzle is inserted into the receiving container. On removal from the receiving container the slide valve closes to eliminate any fuel spill. Nozzle to be equipped with its own automatic vent eliminating the need for the user to open or close air inlets on the pouring container.
 - .4 Nozzle to support the weight of the pouring container. Nozzles to automatically stop the flow when the receiving container becomes full. The nozzle to be such that it reduces evaporative losses of volatile organic compounds during the fuel transfer.
 - .5 All spills of hydrocarbon based products such as gasoline, kerosene, naphtha, lubricating oils, engine oils, greases and de-icing fluids or antifreeze **no** matter how large or small to be reported to Departmental Representative and the Park Canada's Environmental Protection Officer (EPO).
 - .6 Oil changes or equipment repairs in the field or on Parks Canada land are not permitted.
 - .7 Refueling to be performed on level surfaces, PCC Portland cement concrete or HMA surfaces when approved by the Departmental Representative unless otherwise directed.
 - .8 Contractor to have drip pans sized for amounts of product to be recovered and customized to fit
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under pieces of equipment to perform routine maintenance to equipment while maintaining equipment on property. Drip Pans to be used whenever leaving equipment on site or parking overnight when not in use.

- .9 Parking of equipment on site to be on level ground in locations away from watercourses and as approved by Departmental Representative. Equipment with leaks or poor mechanical repair to be removed from site when so ordered by Departmental Representative.

1.2 SPILL CONTROL
KIT

- .1 Contractor to have at the work site a spill control kit consisting of the following minimum types of equipment:
 - .1 a spaded shovel;
 - .2 a stable broom;
 - .3 a broad nosed shovel;
 - .4 a container(s) suitable, compatible to and of sufficient size to contain petroleum products being used with equipment;
 - .5 Absorbents;
 - .6 rags;
 - .7 metal container for soiled rags;
 - .8 Booms when working next to a watercourse that will traverse the width of the watercourse by two times; and
 - .9 Spill control kit to be inspected and approved by both the Contractor and the Departmental Representative prior to Work commencing. Spill control kits to be available to Contractor employees at all areas where Work of the Contract is being performed and at all times during the course of the Contract.
 - .10 Contractor employees to be trained in the use of the spill control kit and the equipment they contain.

1.3 SPILLS

- .1 Disposal of spilled materials to be off Parks Canada property and at approved locations for materials to be disposed of.
- .2 When parking of equipment on site, the equipment is to be secured from entry, inspected for leaks and the ground protected from leaks.

- .3 Contractor to protect all wells, catch basins, drywells, drains and watercourses from contamination in event of a spill.
- .4 All equipment to be used for the Work of the Contract to be inspected by the Departmental Representative for leaks. Equipment not in good repair to be removed/repared when directed by Departmental Representative.
- .5 Spills in excess of 74 litres to be reported immediately to Departmental Representative, the Park's Environmental Protection Officer (EPO) and the Ministry of Environment Spills Action Centre (Telephone No. 1-800-268-6060).
- .6 Contractor to immediately remove as much or all of the contaminated soils as possible, from any spills created from Work of the Contractor.
- .7 Contaminated soils/materials to be placed in containers compatible to the contaminants.
- .8 Any remaining clean-up to be performed at no extra cost to Parks Canada. Clean-up to be to the Departmental Representative's satisfaction.

PART 1 - GENERAL

1.1 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.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 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.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

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- 1.2 INDEPENDENT INSPECTION AGENCIES (Cont'd) .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.
- 1.3 ACCESS TO WORK .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.
- 1.4 PROCEDURES .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site.
- 1.5 REJECTED WORK .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
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1.5 REJECTED WORK .3 If in opinion of Departmental Representative
(Cont'd) it is not expedient to correct defective
Work or Work not performed in accordance
with Contract Documents, Departmental
Representative may deduct from Contract
Price difference in value between Work
performed and that called for by Contract
Documents, amount of which shall be
determined by Departmental Representative.

1.6 REPORTS .1 Submit 1 PDF copy or 4 copies of inspection
and test reports to Departmental
Representative.
.2 Provide copies to Subcontractor of work
being inspected or tested.

1.7 MILL TESTS .1 Submit mill test certificates as required of
specification Sections.

1.8 TESTS AND MIX
DESIGN .1 Furnish test results and mix designs may be
requested.
.2 The cost of tests and mix designs beyond
those called for in Contract Documents or
beyond those required by law of Place of
Work shall be appraised by Departmental
Representative and may be authorized as
recoverable.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 INSTALLATION AND REMOVAL
- .1 Provide temporary utilities controls in order to execute work expeditiously.
 - .2 Remove from site all such work after use or as directed by Departmental Representative.
- 1.2 DEWATERING
- .1 Provide temporary drainage to keep excavations and site free from standing water.
 - .2 Ensure discharge is not contaminated with sediment, oil, etc.
- 1.3 TEMPORARY HEATING AND VENTILATION
- .1 Pay for costs of temporary heat, and pumping used during construction, including costs of supply, installation, fuel, operation, maintenance, and removal of equipment, if applicable.
 - .2 Maintain strict supervision of operation of temporary heating and pumping equipment:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .3 Provide temporary heating and hoarding 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.
 - .4 Hoard, heat and provide protection for curing concrete in accordance with Section 04 05 12 - Masonry Mortar and Grout.
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1.3 TEMPORARY HEATING AND VENTILATION
(Cont'd)

.5 Allow Departmental Representative to Inspect methods for fire safety.

1.4 TEMPORARY POWER AND LIGHT

.1 Departmental Representative will not provide or pay for temporary power during construction for temporary lighting and operating of power tools.

.2 Arrange for connection with appropriate utility company. Pay all costs for supply, installation, maintenance and removal.

.3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.

.4 Provide and maintain temporary lighting throughout project.

.5 Coordinate with all Parks Canada Staff.

.6 Supply and install temporary facilities for power to approval of local power supply authorities.

.7 Provide and pay for temporary power and lights for use of Departmental Representative site office.

1.5 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax and data hook up, line(s) and equipment as necessary for own use.

1.6 FIRE PROTECTION

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

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

1.7 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

- 1.7 SANITARY FACILITIES (Cont'd) .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
- 1.8 STORAGE SHEDS .1 Provide adequate weathertight sheds with raised floors, for storage of materials, tools and equipment which are subject to damage by weather.
- 1.9 ACCESS .1 Provide and maintain adequate access to project site.
- .2 Build and maintain temporary roads where indicated and provide snow removal during period of work.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .4 All surface modifications are restricted to the identified construction corridors. Accurate delineation of these corridors by field survey prior to commencement of construction is required.
- .5 All vehicle traffic is restricted to existing roadways or as indicated in project plans. A field visit will be scheduled with the Contractor for locational confirmation and all areas of proposed construction will be marked in the field with orange flagging tape prior to commencement of work.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1-GP-189M-2000, Primer, Alkyd, Wood, Exterior.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN3-A23.1-/A23.2-09 (R2014) Concrete Materials and Methods for Concrete Construction/ Method of Test for Concrete.
 - .2 CSA-0121-CSA 0121-08 (R2013), Douglas Fir Plywood.
 - .3 CAN/CSA-Z321-96 (R2006), Signs and Symbols for the Occupational Environment.

1.2 INSTALLATION
AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.
- .3 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .4 Indicate use of supplemental or other staging area.

1.3 SCAFFOLDING

- .1 Provide and maintain scaffolding, ladders and temporary stairs.

1.4 HOISTING

- .1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists cranes shall be operated by qualified operator.

1.5 SITE
STORAGE/LOADING

- .1 Contractor's use of site storage and loading shall be limited to an area within limits of traffic diversion. Any conditional areas required shall be approved by Departmental Representative prior to use.
- .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.6 CONSTRUCTION
PARKING

- .1 Parking will be limited to Contractor vehicles and equipment required to carry out work only, provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.
- .3 Build and maintain temporary roads where indicated or directed by Departmental Representative and provide snow removal during period of Work.
- .4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.7 SECURITY

- .1 Departmental Representative shall provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays, if applicable.

1.8 OFFICES

- .1 Provide office space for own use as required. Locate office on site to satisfaction of Departmental Representative.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors may provide their own offices as necessary. Location of these offices to be to the satisfaction of the Departmental Representative.

2016-09-12

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- 1.9 EQUIPMENT TOOL AND MATERIALS STORAGE
- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
 - .2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.
- 1.10 SANITARY FACILITIES
- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
 - .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
- 1.11 CONSTRUCTION SIGNAGE
- .1 No other signs or advertisements, other than warning signs, are permitted on site.
 - .2 Signs and notices for safety and instruction shall be in both official languages Graphic symbols shall conform to CAN3-Z321.
 - .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.
- 1.12 CLEAN-UP
- .1 Clean continuously as work progresses.
 - .2 Remove construction debris, waste materials, packaging material from work site daily.
 - .3 Clean dirt or mud tracked onto paved or surfaced roadways.
 - .4 Store materials resulting from demolition activities that are salvageable.
 - .5 Stack stored new or salvaged material not in construction facilities.

PART 2 - PRODUCTS

- 2.1 NOT USED
- .1 Not Used.
-

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 01 51 00 - Temporary Utilities.
 - .2 Section 01 52 00 - Construction Facilities.
- 1.2 REFERENCES
- .1 Public Works Government Services Canada (PWGSC) Standard Acquisition clauses and conditions (SACC) - ID: R0202D, Title: General Conditions 'c', in effect as of May 14, 2004.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.189M-2000, Primer, Alkyd, Wood, Exterior.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .3 Canadian Standards Association (CSA International)
 - .1 CSA-O121-MO121-08 (R2013), Douglas Fir Plywood.
- 1.3 INSTALLATION AND REMOVAL
- .1 Provide temporary controls in order to execute Work expeditiously.
 - .2 Remove from site all such work after use.
- 1.4 GUARD RAILS AND BARRICADES
- .1 Provide secure, rigid guard rails and barricades around deep excavations.
 - .2 Provide as required by governing authorities.
- 1.5 ACCESS TO SITE
- .1 Provide and maintain access roads, as may be required for access to Work.
- 1.6 PUBLIC TRAFFIC FLOW
- .1 Provide and maintain competent Traffic Control Persons, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.
- 1.7 FIRE ROUTES
- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.
-

- 1.8 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.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 REFERENCE
STANDARDS

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.2 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

1.2 QUALITY
(Cont'd)

- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout project site.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions.

1.3 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE,
HANDLING AND
PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
 - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
 - .3 Store products subject to damage from weather in weatherproof enclosures.
 - .4 Store cementitious products clear of earth or concrete floors and away from walls.
-

2016-09-12

1.4 STORAGE,
HANDLING AND
PROTECTION
(Cont'd)

- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .7 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

1.6 MANUFACTURER'S
INSTRUCTIONS

- .1 Unless otherwise indicated in 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 Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

-
- 1.7 QUALITY OF WORK .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.
- 1.8 CO-ORDINATION .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- 1.9 REMEDIAL WORK .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.
- 1.10 EXISTING UTILITIES .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Identification of existing survey control points and property limits as indicated.
- 1.2 QUALIFICATION OF SURVEYOR .1 Qualified registered land surveyor, licensed to practice in Province of Ontario, acceptable to Departmental Representative.
- 1.3 SURVEY REFERENCE POINTS .1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .2 Make no changes or relocations without prior written notice to Departmental Representative.
- .3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .4 Require surveyor to replace control points in accordance with original survey control.
- 1.4 SURVEY REQUIREMENTS .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement.
- .4 Stake slopes.
- .5 Establish pipe invert elevations and location of any exposed pipe not being removed under this contract.
- .6 Record elevation and location of all existing and installed end caps of abandoned underground services.
-

- 1.5 EXISTING SERVICES .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- 1.6 RECORDS .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of site works, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.
- 1.7 SUBMITTALS .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform with Contract Documents.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 PROJECT
CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Departmental Representative or other Contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Provide and use clearly marked separate bins for recycling.
- .6 Remove waste material and debris from site and deposit in waste container at end of each working day.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Dispose of waste materials, and debris off site at approved facilities.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Departmental Representative or other Contractors.

- | | | |
|--|----|--|
| <u>1.2 FINAL CLEANING
(Cont'd)</u> | .5 | Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site. |
| | .6 | Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris. |
| | .7 | Sweep and wash clean paved areas. |

PART 2 - PRODUCTS

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

PART 3 - EXECUTION

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

PART 1 - GENERAL

1.1 DEFINITIONS

- .1 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .2 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .3 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .4 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .5 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .6 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .7 Separate Condition: Refers to waste sorted into individual types.
- .8 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.2 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Material Source Separation Plan.
-

- 1.3 SUBMITTALS
- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- 1.4 WASTE REDUCTION WORKPLAN (WRW)
- .1 Prepare Waste Reduction Work plan.
 - .2 Structure WRW to prioritize actions and follow as first priority Reuse, then followed by Recycle.
 - .3 Describe management of waste.
 - .4 Post workplan or summary where workers at site are able to review its content.
- 1.5 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)
- .1 Prepare MSSP and have ready for use prior to project start-up. The DWA with related weight bills and/or receipt must be submitted on a monthly basis with the Contractor's monthly Progress claim.
 - .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
 - .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
 - .4 Provide containers to deposit reusable and recyclable materials.
 - .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
 - .6 Locate separated materials in areas which minimize material damage.
 - .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility.
-

- 1.6 STORAGE, HANDLING AND PROTECTION
- .1 Store, materials to be reused, recycled and salvaged in locations as specified in MSSP.
 - .2 Unless specified otherwise, materials for removal become Contractor's property.
 - .3 Protect, stockpile, store and catalogue salvaged items.
 - .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
 - .5 Protect structural components not removed for demolition from movement or damage.
 - .6 Support affected structures. If safety of road is endangered, cease operations and immediately notify Departmental Representative.
 - .7 Protect surface drainage and electrical from damage and blockage.
 - .8 Separate and store materials produced during dismantling of structures in designated areas.
 - .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.
- 1.7 DISPOSAL OF WASTES
- .1 Do not bury rubbish or waste materials.
 - .2 Do not dispose of waste, volatile materials, mineral spirits, or oil into waterways, storm, or sanitary sewers.
 - .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total weight generated.

- 1.7 DISPOSAL OF WASTES (Cont'd)
- .3 (Cont'd)
 - .4 Weight reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.
- 1.8 USE OF SITE AND FACILITIES
- .1 Execute work with least possible interference or disturbance to normal use of premises.
- 1.9 SCHEDULING
- .1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.
- PART 2 - PRODUCTS
- 2.1 NOT USED
- .1 Not Used.
- PART 3 - EXECUTION
- 3.1 APPLICATION
- .1 Do Work in compliance with WRW.
 - .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- 3.2 CLEANING
- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
 - .2 Clean-up work area as work progresses.
 - .3 Source separate materials to be reused/recycled into specified sort areas.

PART 1 - GENERAL

1.1 INSPECTION AND
DECLARATION

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Systems have been tested and are fully operational.
 - .4 Operation of systems have been demonstrated to Departmental Representative.
 - .5 Work is complete and ready for Final Inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative, and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 If requested, furnish evidence as to type, source and quality of products provided.
- .5 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .6 Pay costs of transportation.

1.2 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.

2016-09-12

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- 1.2 FORMAT
(Cont'd)
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dxf or dwg and pdf format on diskettes or CD.
- 1.3 CONTENTS - EACH VOLUME
- .1 Table of Contents: provide title of project;
.1 date of submission; names,
.2 addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;
.3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
.1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- 1.4 AS-BUILTS AND SAMPLES
- .1 Maintain at the site for Departmental Representative one record copy of:
.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.
-

1.4 AS-BUILTS AND
SAMPLES
(Cont'd)

- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.5 RECORDING
ACTUAL SITE
CONDITIONS

- .1 Record information on set of opaque drawings, provided by Departmental Representative.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .2 Field changes of dimension and detail.
 - .3 Changes made by change orders.
 - .4 Details not on original Contract Drawings.
 - .5 References to related shop drawings and modifications.
- .4 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.

2016-09-12

- 1.5 RECORDING
ACTUAL SITE
CONDITIONS
(Cont'd) .5 Other Documents: maintain manufacturer's
certifications, inspection certifications,
field test records, required by individual
specifications sections.
- 1.6 FINAL SURVEY .1 Submit final site survey certificate,
certifying that elevations and locations of
completed Work are in conformance, or
non-conformance with Contract Documents.
- 1.7 WARRANTIES AND
BONDS .1 Separate each warranty or bond with index
tab sheets keyed to Table of Contents
listing.
- .2 List subcontractor, supplier, and
manufacturer, with name, address, and
telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in
duplicate by subcontractors, suppliers, and
manufacturers, within ten days after
completion of the applicable item of work.
- .4 Except for items put into use with
Departmental Representative's permission,
leave date of beginning of time of warranty
until the Date of Substantial Performance is
determined.
- .5 Verify that documents are in proper form,
contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time
specified for submittal.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Division 01 - General Requirements.
- .2 Section 04 05 00 - Common Work Results for Masonry.
- .3 Section 04 05 12 - Masonry Mortar and Grout.
- .4 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .5 Section 04 43 19 - Supply New Stones.

1.2 ADMINISTRATIVE
REQUIREMENTS

- .1 Conduct a pre-dismantling meeting with Departmental Representative to verify project requirements, equipment, procedures and assigned storage areas.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit method of dismantling, cleaning and storage of existing stone masonry prior to start of stone removal to Departmental Representative for approval.
 - .3 Shop Drawings:
 - .1 Submit drawings for recording typical existing conditions to facilitate reinstallation of salvaged stones. Indicate typical coursing heights, stone and mortar dimensions and details, overall masonry dimensions, bearing conditions, and existing concrete retaining wall dimensions and details.
 - .2 Submit drawings for shoring and bracing and temporary framing work.
 - .4 Site Quality Control:
 - .1 Provide up-to-date copies of salvaged and new stone locations and coursing recording system chart or card index, when requested by Departmental Representative.
-

.2 Coordinate with work by other trades and as indicated in the contract documents.

1.4 CLOSEOUT SUBMITTALS .1

Submit in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Maintenance Data: submit maintenance data for incorporation into manual. Include:
- .1 Photographical record of existing stonework to be dismantled, salvaged and rebuilt.
 - .2 Photographical record of existing concrete retaining wall and bearing surfaces, after stonework has been dismantled and removed.
 - .3 Drawings of current typical existing conditions, including existing stone masonry, concrete retaining wall, and bearing surfaces.

1.5 QUALITY ASSURANCE .1

Qualifications: unless stricter requirements are indicated on the drawings:

- .1 Masonry Contractor:
 - .1 Work of this Section: executed by contractor specializing in historic stone conservation work, using similar stone dismantling techniques and with minimum 10 year record of successful performance.
- .2 Foreperson:
 - .1 Provide competent trade foreperson specializing in type of work required.
 - .2 Experience in deconstruction of historic stone masonry with minimum 10 year record of successful performance. Must be present on site throughout Work.
- .3 Dismantlers:
 - .1 Experience: minimum 5 year record of successful masonry dismantling.

- .2 Mock-up:
- .1 Provide mock-up in accordance with Section 01 45 00 - Quality Control and 04 05 00 - Common Work Results for Masonry.
 - .2 Mock-up to demonstrate dismantling of existing stone masonry walls and installations of salvaged and new stones, mortar, anchorage, and other typical masonry work as indicated on the drawings.
-

.3 Unless directed otherwise by Departmental Representative, size of mock-up to be 1800 mm high (full height of wall) x 1000 mm long and match wall thickness as indicated on drawings. Additional mock-ups may be required in locations and sizes as directed by Departmental Representative.

.4 Notify Departmental Representative minimum of 72 hours prior to construction of mock-up.

.5 Perform mock-up under supervision of Departmental Representative to demonstrate a full understanding of specified procedures and techniques is achieved before work commences.

.6 Stone and masonry installations are not to proceed prior to written approval of mock-up. Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with new installations. Dismantling operations of existing stone masonry may occur prior to approval of mock-up, unless directed otherwise by Departmental Representative.

.7 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

.8 If mock-up is rejected, remove and reinstall or repair mock-up as directed by Departmental Representative.

.9 If ambient temperatures are below 5 degrees C, provide heat and hoard mock-up as per 1.7 - AMBIENT CONDITIONS.

1.6 DELIVERY, STORAGE
AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Protect and store stones to facilitate their resetting.

.1 Store dismantled masonry units, protected from exposure to water, elements, and potential mechanical damage, fully covered under polyethylene.

.2 Coordinate stone storage with work by other trades.

- .3 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 AMBIENT CONDITIONS

- .1 Where ambient temperatures are below 5 degrees C, provide heat and hoard sections of stone masonry walls for stone masonry and mortar installation operations.
- .1 Hoarding sections to be no more than 10 m in length per work crew and include entire height of wall.
- .2 Heat inside hoarding section to minimum 10 degrees C and maximum 25 degrees C for minimum 72 hours prior to, during, and minimum 72 hours after stone masonry and mortar installation operations.
- .2 Do not pressure wash stone masonry and mortar at temperatures below 5 degrees C.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Examine masonry, staging and storage areas and notify Departmental Representative in writing of conditions detrimental to acceptable and timely completion of Work.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with dismantling, storage and installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .4 Report in writing to Departmental Representative areas of deteriorated stone,

concrete, or unacceptable bearing conditions not identified in the documents. Obtain Departmental Representative's approval and instructions for repair or reinforcement of stone, concrete or bearing surface before proceeding.

.5 Stop work in that area and report to Departmental Representative immediately evidence of hazardous materials or conditions.

.6 Record typical existing conditions, including masonry dimensions and coursing to facilitate re-installation of salvaged stones.

.7 Coordinate with work by other trades.

3.2 PREPARATION

- .1 Deteriorated stones are to be removed and replaced with new.
- .2 Stones that require reshaping in-place are to be done using low impact methods.
- .3 Obtain Departmental Representative's approval for alternative methodology and tools to be employed before commencing the work.
- .4 Clean stone surface of dust and stone chips.

3.3 PROTECTION

- .1 Prevent damage to adjacent existing structures, including the concrete retaining wall and surrounding trees, landscaping, natural features, bench marks, and utility lines which are to remain.
- .2 Make good damage incurred.
- .3 Protect surrounding components from damage during work.
- .4 Obtain Departmental Representative's approval for repair methodology.

3.4 SPECIAL TECHNIQUES

- .1 Identify typical stone masonry and coursing and other elements on a photographic record.
 - .2 Before dismantling stones, indicate typical dimensions of stone and mortar joints on a drawing.
-

- .3 Temporary Tracking and Recording:
 - .1 Tracking relocated stones and other masonry units:
 - .1 Use numbering, marking, and positioning system when necessary.
 - .2 Mark/Identify:
 - .1 Salvaged stones, new stones and other elements or components to show identity and position.
 - .2 Wood platforms or other equipment used to transport and store stones.
 - .3 Work and storage areas.
 - .4 Locations from which stones are removed on drawings, photographs and charts.
 - .3 Stone location recording system.
 - .1 Prepare chart to:
 - .1 Help locate stones or units when necessary.
 - .2 To manage availability of platforms.
 - .3 To manage work and storage areas.
 - .2 Keep chart index up-to-date and, if required, produce copy every day.
 - .3 Prepare chart and drawing to contain relevant information, including location, size, shape, coursing, joint and bed dimensions.
 - .4 Ensure that temporary marking will remain in use resistant to weather, handling and cleaning until final marking of stones.
 - .5 Remove all 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.

3.5 TEMPORARY SHORING

- .1 Construct shoring and cradling, and other temporary framing work needed to support structure, or parts of it, during removal operations and in anticipation of resetting, according to approved shop drawings.
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3.6 METHOD FOR
LOOSENING STONES

- .1 Use approved methods to loosen stones which will cause no damage either to stones or to other elements.
- .2 Prior to removing a stone approved for replacement or re-installation, rout out existing mortar joints around the stone.
- .3 Remove mortar from top, bottom and side joints, with the back surface of the joint square and of an even depth.
- .4 Use only hand held tools with mallet or pneumatic driven percussion at low stroke speed.
- .5 Obtain Departmental Representative's approval for use of power tools before commencing work.
- .6 Ensure that adjacent stones are not used as lever points in removal of stone.
- .7 Loosen wet masonry when temperature is above freezing.

3.7 DISMANTLING AND
MOVING STONES

- .1 Avoid damaging edges of stone when removing mortar and freeing up.
 - .2 Remove loose mortar using hand tools.
 - .3 Use wood wedges where required to remove, dislocate or position stone.
 - .1 Use flat pry bars protected with impact absorbing protection (burlap, cardboard).
 - .4 Use regularly inspected nylon hoisting belts. Use minimum 2 belts per stone.
 - .5 Protect stone from damage when hoisting and lifting from position.
 - .1 Use separators or wood shims to isolate units from hoisting belts.
 - .6 Where damage occurs to stone, report to Departmental Representative and repair stone or supply new stone as approved by Departmental Representative.
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- .7 Make good damage incurred at no additional cost to Contract.
- .8 Obtain review and approval of repaired damage by Departmental Representative.

3.8 HANDLING

- .1 Usage of drill-in chemical or mechanical anchors or devices for handling stone is not permitted.
- .2 Place detached stones on wood surfaces during handling. Prevent contact with metal.
- .3 When stones are lowered to ground, place directly on wooden platform used for transport or storage.
- .4 Transport and keep stones on wooden platforms.
- .5 Ensure that sharp edges of stones do not come into contact with hard objects.

3.9 TEMPORARY STORAGE STAGING AREA

- .1 Place stones in designated area of site for cleaning, detailed inspection and for final marking, before storage.
- .2 Make stones accessible and retrievable when required.

3.10 CLEANING

- .1 Do cleaning operations at above freezing temperature.
 - .1 After cleaning, protect wet stones against freezing until dry.
 - .2 Clean stones by wet scrubbing with vegetable fibre brush unless otherwise instructed by Departmental Representative.
 - .1 Use high pressure water jet as approved by Departmental Representative.
 - .2 Remove excess mortar with hand tools.
 - .3 Do not use chemical cleaning methods.
 - .4 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
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- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .6 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.11 FINAL MARKING

- .1 Do final marking after cleaning, on surface that supports good adhesion and legibility and will not be visible after resetting.
- .2 Do marking in colour and legible from distance of 1 m.
- .3 Ensure that marking product used will not affect mortar to stone adhesion when resetting.
- .4 Ensure marking product used will survive storage until resetting of stone.

3.12 PRELIMINARY WORK
BEFORE RESETTING

- .1 Coordinate with other sections of Division 04.

3.13 FINAL STORAGE

- .1 When stones are placed under shelter:
 - .1 Design and ventilate shelter to keep condensation from forming on surfaces of stone.
- .2 Lay out storage so that each stone will have its numbered face visible, and be accessible or removable without having to move adjacent stones.
- .3 Show layout of stones to be stored on record drawing.
- .4 Store stone masonry on a wooden pallet or in a wood box.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Division 01 - General Requirements.
- .2 Section 04 03 43 - Historic - Dismantling Stone Masonry.
- .3 Section 04 05 12 - Masonry Mortar and Grout.
- .4 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .5 Section 04 43 19 - Supply New Stones.

1.2 REFERENCES

- .1 CSA Group:
 - .1 CAN/CSA-A165 Series-14, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
 - .2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA-A371-14, Masonry Construction for Buildings.
- .2 International Masonry Industry All-Weather Council (IMIAC)
 - .1 Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.3 ADMINISTRATIVE
REQUIREMENTS

- .1 Pre-installation meetings: comply with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart. Conduct pre-installation meeting one week prior to commencing work of this Section and on-site installations 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 Co-ordinate with other building subtrades.
 - .6 Review manufacturer's installation instructions.
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- .7 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.
- .8 Review warranty requirements.
- .2 Sequencing: sequence with other work in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart. Comply with manufacturer's written recommendations for sequencing construction operations.
- .3 Scheduling: schedule with other work in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS
 - .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for stone masonry, mortar, anchorage, accessories, timber rub rail, etc. and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .3 Shop Drawings:
 - .1 Submit drawings of proposed coursing and layout for stone installation, including salvaged and new stones. Include mortar, anchorage, accessories, timber rub rail and details.
 - .2 Submit shop drawings detailing temporary bracing required, designed to resist wind pressure and lateral forces during installation.
 - .4 Samples:
 - .1 Unless directed otherwise by Departmental Representative, provide samples as follows:
 - .1 4 stone samples each of salvaged and new stone as specified in Section 04 03 43 - Historic - Dismantling Stone Masonry and

Section 04 43 19 - Supply New Stones.
Samples may be included in the mock-up, as specified in Part 1 - Quality Assurance.

.2 2 cured samples each of existing and proposed mortar, illustrating existing typical mortar colour and proposed new mortar colour range, as specified in Section 04 05 12 - Masonry Mortar and Grout.

.3 2 samples each of masonry anchorage and accessories, as indicated on the drawings and specified in Section 04 05 19 - Masonry Anchorage and Reinforcing.

.3 Samples: used for testing and when accepted become standard for material used.

- .5 Certificates: submit manufacturer's product certificates certifying materials comply with specified requirements.
- .6 Test and Evaluation Reports:
.1 Submit certified test reports in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
.2 Test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.
.3 Submit data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.
- .7 Installer Instructions: provide installation instructions, including storage, handling, safety and cleaning.
- .8 Regional Materials: submit evidence that project incorporates salvaged stone masonry to maximum possible percentage and new stone masonry from regional sources. Show cost and distance from project to furthest site of extraction or manufacture, and cost of materials for project.
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1.5 CLOSEOUT
SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals. Include manufacturer's instructions for care, cleaning and maintenance of masonry work.
- .2 Maintenance Data: submit maintenance data for incorporation into manual. Include:
 - .1 Photographical record of stone masonry in the final as-built condition.
 - .2 As-built drawings of typical final conditions, including typical locations of salvaged and new stone masonry, coursing, joints, anchorage, accessories, timber rub rail and details of existing concrete retaining wall, and bearing surfaces.

1.6 QUALITY ASSURANCE

- .1 Mock-up:
 - .1 Provide mock-up in accordance with Section 01 45 00 - Quality Control.
 - .2 Mock-up to demonstrate installations of salvaged and new stones, mortar, anchorage, and other typical masonry work as indicated on the drawings.
 - .3 Unless directed otherwise by Departmental Representative, size of mock-up to be 1800 mm high (full height of wall) x 1000 mm long and match wall thickness as indicated on drawings. Additional mock-ups may be required in locations and sizes as directed by Departmental Representative.
 - .4 Notify Departmental Representative minimum of 72 hours prior to construction of mock-up.
 - .5 Perform mock-up under supervision of Departmental Representative to demonstrate a full understanding of specified procedures and techniques is achieved before work commences.
 - .6 Stone and masonry installations are not to proceed prior to written approval of mock-up. Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with new installations.
 - .7 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
 - .8 If mock-up is rejected, remove and reinstall or repair mock-up as directed by Departmental Representative.
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.9 Continue work only upon receipt of written approval of mock-up by Departmental Representative.

.10 If ambient temperatures are below 5 degrees C, provide heat and hoard mock-up as per Part 1 - SITE CONDITIONS.

1.7 DELIVERY, STORAGE
AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect material from nicks, scratches, blemishes or damage.
.3 Keep materials dry until use except where wetting of masonry is specified.
.4 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
.5 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 SITE CONDITIONS

.1 Ambient Conditions/Weather Requirements: to CAN/CSA-A371 and to IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

.1 Cold weather requirements: to CAN/CSA-A371 with following additional requirements.

.1 Where ambient temperatures are below 5 degrees C, provide heat and hoard sections of stone masonry walls for stone masonry and mortar installation operations.

2016-09-12

- .1 Hoarding sections to be no more than 10 m in length per work crew and include entire height of wall.
- .2 Heat inside hoarding sections to minimum 10 degrees C and maximum 30 degrees C for minimum 72 hours prior to, during and minimum 72 hours after installation of mortar and stone masonry.
- .2 Do not install mortar or stone masonry at temperatures below 10 degrees C or above 30 degrees C.
- .3 Do not pressure wash stone masonry and mortar at temperatures below 5 degrees C.
- .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 maximum of 3 days after installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Masonry materials specified in related Sections:
 - .1 Section 04 03 43 - Historic - Dismantling Stone Masonry.
 - .2 Section 04 05 12 - Masonry Mortar and Grout.
 - .3 Section 04 05 19 - Masonry Anchorage and Reinforcing.
 - .4 Section 04 43 19 - Supply New Stones.
- .2 Salvaged stone masonry: from existing stone wall and from surrounding vicinity of existing wall.
- .3 New stone masonry: where approved by Departmental Representative, to be similar in physical properties and appearance of existing and locally sourced.

- .4 Timber rub rail: rough sawn treated eastern hemlock and as indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLERS

- .1 Experienced and qualified masons to carry out erection, assembly and installation of masonry work.

3.2 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section.
.1 Co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Examine locations to receive new stone masonry units. Verify size and that location is square and plumb or is similar to adjacent stone masonry, 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 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of stone masonry.
.2 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 and co-ordinate with Section 01 71 00 - Examination and Preparation.
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- .2 Establish and protect lines, levels, and coursing to match as closely as possible with existing.
- .3 Protect adjacent materials from damage and disfiguration.
- .4 Sort, prepare, place and install salvaged stone masonry and, where approved, new stone masonry. Any cutting of stone for fitting into existing stone masonry is included in this work.
- .5 Remove and salvage existing wooden ladders, or supply new ladders, as directed by Departmental Representative.

3.4 INSTALLATION

- .1 Do 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 and respecting alignments of existing joints.
- .3 Layout coursing and bond to achieve similar coursing heights from existing stone masonry, and continuity of bond above and below with minimum of cutting.

3.5 CONSTRUCTION

- .1 Exposed masonry:
 - .1 Remove stone masonry and mortar, in accordance with CAN/CSA-A165, in exposed masonry and salvage units for re-installation or, where approved, replace with new undamaged units.
 - .2 Where existing stone masonry units are discovered by the Contractor to be missing, search for stone masonry in surrounding vicinity, including on canal bottom.
 - .3 Salvage and clean stone masonry for reinstallation as approved by Departmental Representative.
- .2 Jointing:
 - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to

2016-09-12

provide smooth, joints true to line, compressed, uniform joints with profile to match existing.

- .3 Cutting:
 - .1 Cut units to fit into recesses of existing stone masonry.
- .4 Interface with other work:
 - .1 Make good existing work. Use materials to match existing.
- .5 Coordinate with other Sections of Division 04 and with the drawings.
- .6 Timber rub rail: install timber rub rail, complete with anchorage, as indicated on the drawings.
- .7 Install salvaged or new wood ladders, as directed by Departmental Representative.

3.6 SITE TOLERANCE

- .1 Tolerances in notes to CAN/CSA-A371 apply.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection:
 - .1 Perform field inspection and testing in accordance with Section 01 45 00 - Quality Control].
 - .2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.
- .2 Manufacturer's Services:
 - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, and protection of its product[s], and submit written reports in acceptable format to verify compliance of work with Contract.
 - .2 Obtain reports within 3 days of review and submit immediately to Departmental Representative.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

- .1 Moisture Protection:
 - .1 Keep masonry dry using waterproof, non staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed. Coordinate with Part 1 - SITE CONDITIONAL and as approved by Departmental Representative.
 - .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.
 - .3 Air Temperature Protection: protect completed masonry as recommended in Part 1 - SITE CONDITIONS.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Division 01 - General Requirements.
- .2 Section 04 03 43 - Historic - Dismantling Stone Masonry.
- .3 Section 04 05 00 - Common Work Results for Masonry.
- .4 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .5 Section 04 43 19 - Supply New Stones.

1.2 REFERENCES

- .1 CSA Group
 - .1 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.
 - .2 CAN/CSA-A371-14, Masonry Construction for Buildings.
 - .3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .2 International Masonry Industry All-Weather Council (IMIAC)
 - .1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry mortar and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC's for mortar, parging, colour additives and admixtures. Expressed as grams per litre (g/L).
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- .3 Samples:
 - .1 Samples: submit unit samples in accordance with Section 04 05 00 - Common Work Results for Masonry, supplemented as follows:
 - .1 Submit samples and confirmation of source and product data sheet, prior to mixing or preparation of mortars, to Departmental Representative.
- .4 Manufacturers' Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry._
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect masonry mortar from damage.
-

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE CONDITIONS

.1 Ambient Conditions/Weather Requirements: to CAN/CSA-A371 and International Masonry Industry All-Weather Council (IMIAC) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

.1 Where ambient temperatures are below 5 degrees C, provide heat and hoard sections of stone masonry walls for stone masonry and mortar installation operations.

.1 Hoarding sections to be no more than 10 m in length per work crew and include entire height of wall.

.2 Heat inside hoarding sections to minimum 10 degrees C and maximum 30 degrees C for minimum 72 hours prior to, during and minimum 72 hours after installation of mortar and stone masonry.

.2 Do not install mortar or stone masonry at temperatures below 10 degrees C or above 30 degrees C.

.3 Do not pressure wash stone masonry and mortar at temperatures below 5 degrees C.

.4 Coordinate further requirements for materials and surrounding air temperature to manufacturers recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Cement:

.1 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA-A179, Type S with integral water repellents.

.1 Use low VOC products.

- .3 Aggregate: supplied by one supplier.
 - .1 Fine Aggregate: to CAN/CSA-A179.
 - .2 Course Aggregate: to CAN/CSA-A179.
- .4 Water: clean and potable.
- .5 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

2.2 ADMIXTURES

- .1 Water Repellent Agents: pre-blended powder.
 - .1 Use low VOC products.
- .2 Air Entrainment Agents: not permitted.
- .3 Anti-Freeze Compounds: use of calcium chloride or chloride based compounds are not permitted.

2.3 MORTOR MIXES

- .1 Pointing Mortar: CAN/CSA-A179, Type S using property specification with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
- .2 Stain Resistant Pointing Mortar: one part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate to 2 percent of Portland cement by weight.
- .3 Mortar for exterior retaining wall stone masonry: type S based on property specifications, CAN/CSA-A179.

2.4 MORTOR MIXING

- .1 Mix mortar ingredients in accordance with CAN/CSA-A179 in quantities needed for immediate use.
 - .2 Maintain sand uniformly damp immediately before mixing process.
 - .3 Add mortar admixtures in accordance with manufacturer's instructions. Provide uniformity of mix.
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- .4 Do not use air entraining compounds.
- .5 Do not use anti-freeze compounds containing calcium chloride or chloride based compounds.
- .6 Use a batch type mixer in accordance with CAN/CSA-A179.
- .7 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 no more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.
- .8 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.
- .9 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 10 degrees C.

2.5 MIX TESTS

- .1 Testing Mortar Mix:
 - .1 Test mortar to requirements of Section 01 45 00 - Quality Control, and in accordance with CAN/CSA-A179, for mortar based on property specification. Test prior to construction and during construction for:
 - .1 Compressive strength.
 - .2 Consistency.
 - .3 Mortar aggregate ratio.
 - .4 Sand/cement ratio.
 - .5 Water content and water/cement ratio.
 - .6 Air content.
 - .7 Splitting tensile strength.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Apply bonding agent to existing concrete surfaces.

3.3 CONSTRUCTION

- .1 Do masonry mortar work in accordance with CAN/CSA-A179 except where specified otherwise.

3.4 MIXING

- .1 All pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes. Mixing by hand must be pre-approved by the Departmental Representative.
- .2 Clean all mixing boards and mechanical mixing machine between batches.
- .3 Mortar must be weaker than the units it is binding.
- .4 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

3.5 MORTOR PLACEMENT

- .1 Install mortar or premixed mortar to manufacturer's instructions and to requirements of CAN/CSA-A179.
- .2 Remove excess mortar.

3.6 FIELD QUALITY CONTROL

- .1 Site Tests, Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry supplemented as follows:

.1 Test and evaluate mortar prior to construction and during construction in accordance with CAN/CSA-A179.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

- .1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Division 01 - General Requirements.
- .2 Section 04 03 43 - Historic - Dismantling Stone Masonry.
- .3 Section 04 05 00 - Common Work Results for Masonry.
- .4 Section 04 05 12 - Masonry Mortar and Grout.
- .5 Section 04 43 19 - Supply New Stones.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A276/A276M-16a, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM A580/A580M-15, Standard Specification for Stainless Steel Wire.
- .2 CSA Group
 - .1 CSA A23.1/A23.2-09(R2014), Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA-A370-14, Connectors for Masonry.
 - .4 CAN/CSA-A371-14, Masonry Construction for Buildings.
 - .5 CSA-S304.1-04(R2010), Design of Masonry Structures.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for anchorage and include product characteristics, performance criteria, physical size, finish and limitations.
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- .3 Shop Drawings:
.1 Submit drawings detailing anchorage details and placement drawings
.2 On placement drawings, indicate sizes, spacing, location and quantities of anchorages and connectors.
- .4 Samples:
.1 Submit 2 samples of: tie and anchor assembly, including wire ties, drop-in anchor, threaded rod, eye nut, and miscellaneous items as indicated on drawings.
- .5 Manufacturers' Instructions: submit manufacturer's installation instructions.
- 1.4 QUALITY ASSURANCE
- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Mock-ups:
.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry.
- 1.5 SITE MEASUREMENTS
- .1 Make site measurements necessary to ensure proper fit of members.
- 1.6 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory
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2016-09-12

packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect anchorage materials from nicks, scratches, blemishes, defects and damage.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Anchors, ties and miscellaneous items to be manufactured as per drawings and in accordance with manufacturer's written instructions.
- .2 Anchors: stainless steel system, comprising:
 - .1 Drop-in anchor, internally threaded stainless steel. Acceptable products include:
 - .1 'HDI-SS Drop-in Anchor' by Hilti.
 - .2 'Steel Dropin' by Powers Fasteners.
 - .3 'Drop-In Anchor' by UCAN.
 - .2 Threaded rod, stainless steel.
 - .3 Eye nut, shoulder pattern, threaded, stainless steel.
 - .4 Drop-in anchor, rod and eye nut to be compatible.
- .3 Ties: stainless steel.

2.2 SOURCE QUALITY CONTROL

- .1 Provide Departmental Representative with certified copy of mill test report of ties and anchors, showing physical and chemical analysis, prior to commencing work.
- .2 Inform Departmental Representative of proposed source of material to be supplied.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for anchorage materials installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 PREPARATION .1 Direct and coordinate placement of metal anchors for masonry supplied to other Sections.
- 3.3 INSTALLATION .1 Install masonry ties and anchors in accordance with drawings and manufacturer's instructions.
- .2 Prior to placing mortar, obtain Departmental Representative's approval of placement of ties and anchors.
 - .3 Supply and install additional ties and anchors to masonry as directed by Departmental Representative.
- 3.4 BONDING AND TYING .1 Bond/tie masonry walls to backing using metal ties and anchors as indicated on drawings.
- 3.5 TIES AND ANCHORS .1 Supply and install metal ties, anchors and miscellaneous items as indicated on drawings.
- 3.6 FIELD BENDING .1 Field bend wire ties as indicated on drawings and to suit field conditions.
-

- .2 Field bend without heat, applying a slow and steady pressure.
- .3 Replace wire ties which develop cracks or splits.

3.7 FIELD QUALITY CONTROL

- .1 Site inspections in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Obtain Departmental Representative approval of placement of ties and anchors, prior to placing mortar.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Division 01 - General Requirements.
- .2 Section 04 03 43 - Historic - Dismantling Stone Masonry.
- .3 Section 04 05 00 - Common Work Results for Masonry.
- .4 Section 04 05 12 - Masonry Mortar and Grout.
- .5 Section 04 05 19 - Masonry Anchorage and Reinforcing.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C 568/C 568M-15, Standard Specification for Limestone Dimension Stone.
- .2 CSA Group
 - .1 CAN/CSA-A371-14, Masonry Construction for Buildings.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for stone masonry and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Shop Drawings:
 - .1 Submit drawings indicating sizes, locations and sections of stone veneer, arrangements of joints and bonding.
 - .2 Each section of stone indicated on shop drawings must bear corresponding number marked on its back or bed.
 - .4 Samples:
 - .1 Submit samples of new stone masonry with appearance, finishes, profiles, etc. to match
-

existing for review and acceptance of Departmental Representative.

.2 Samples will be of sufficient size to demonstrate all finishes and profiles and shall be clearly marked as to location of quarry of origin and the supplier(s). Samples which are approved may be incorporated in the work provided that they match all dimensions of stone schedules as being replaced. The surface shall be finished to match the un-deteriorated finish of each type of stone and in no case shall the finish be rougher than the stones of this type in good condition elsewhere.

.3 Acceptability of the source of stone will also be determined by the weathered colour of the stone samples. Samples should include weathered examples and a possible visit to the quarry may be required for acceptance. In general, the weathered colour should match the predominant stone colour of the overall structure. The colour of the new stone should not be close in colour to the extreme ends of the range of stone colours present in the structure.

1.4 QUALITY ASSURANCE

.1

Mock-ups: _

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control and requirements of Section 04 05 00 - Common Work Results for Masonry.

1.5 DELIVERY, STORAGE AND HANDLING

.1

Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2

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

.3

Storage and Handling Requirements:

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

.2 Store and protect stone masonry from defects and damage.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE CONDITIONS

.1 Ambient Conditions/Weather Requirements: to CAN/CSA-A371 and International Masonry Industry All-Weather Council (IMIAC) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

.1 Where ambient temperatures are below 5 degrees C, provide heat and hoard sections of stone masonry walls.

.1 Hoarding sections to be no more than 10m in length per work crew and include entire height of wall.

.2 Heat inside hoarding sections to minimum 10 degrees C and maximum 30 degrees C for minimum 72 hours prior to, during and minimum 72 hours after installation of mortar and stone masonry.

.2 Do not install mortar or stone masonry at temperatures below 10 degrees C or above 30 degrees C.

.3 Do not pressure wash stone masonry and mortar at temperatures below 5 degrees C.

.2 Field Measurements:

.1 Make site measurements necessary to ensure proper fit of members.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Limestone: to ASTM C 568/C 568M, category II - Medium Density or III - High Density, colour and texture to match approved sample and to existing stone masonry.

.1 New stone masonry to be locally sourced.

.2 Minor variations in colour and texture between adjacent stones shall be reviewed and accepted by Departmental Representative.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for stone masonry installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 During inspection with Departmental Representative, determine approximate locations, quantities, and sizes and extent of new stone masonry.
 - .3 Inform Departmental Representative unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Protect adjacent finished materials from damage due to masonry work.
- .2 Stone shape and quarry bed preparation are to match.
- .3 Make joints to be similar in thickness with existing joints and as indicated on the drawings.
- .4 Back-check stone contacting existing concrete or other stone masonry. Allow minimum of 25 mm clearance between back of stone and concrete members. Shape beds of stone to fit existing conditions.

3.3 INSTALLATION

- .1 Construction in accordance with CAN/CSA-A371.
 - .2 Clean stone exposed surfaces by washing with stiff fibre brush and water.
 - .3 Set stones plumb, true, level in full bed of mortar with vertical joints slushed full except where otherwise specified. Keep edges and faces aligned to respect indicated tolerances.
-

- .4 Support stone in proper alignment until mortar has set. Fill voids with pointing mortar.
- .5 Tool joints after initial set has occurred.
- .6 Rake out joints to 25 mm depth or as indicated on drawings and make ready for pointing with pointing mortar. Sponge stone face along joints and remove droppings and splashed mortar immediately. Coordinate with drawings and with existing conditions.
- .7 Pointing: remove dirt and loose mortar from joints by using pressure air stream and hand tools.
 - .1 Wet joints for mortar pointing.
 - .2 Point joints with pointing mortar in stages as required for depth as indicated on drawings and as per manufacturer's recommendations. Rub smooth with plastic tool to slightly joint profile to match as closely as possible with existing.

3.4 TOLERANCES

- .1 To CAN/CSA-A371.

3.5 FIELD QUALITY CONTROL

- .1 Site Tests Inspection: in accordance with Section 04 05 00 - Common Work Results for Masonry.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 At end of each working day, brush off loose mortar from stone face.
 - .3 At completion, wash stonework with stiff-fibre brushes and clean water.
 - .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
-

- 3.7 PROTECTION .1 Brace and protect stone masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
 - .2 Section 31 24 13 - Embankments.
 - .3 Section 32 11 23 - Aggregate Base Courses.
- 1.2 REFERENCES
- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
 - .2 Reference Documents
 - .1 Ontario Provincial Standards (OPS) for Roads and Public Works, Ministry of Transportation (MTO), latest edition.
- 1.3 SOURCE APPROVAL
- .1 Source of materials to be incorporated into work or stockpiled requires approval.
 - .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least two weeks prior to commencing production.
 - .3 If, in opinion of Departmental Representative, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
 - .4 Advise Departmental Representative 2 weeks in advance of any change in material source to allow sampling, testing and approval.
 - .5 The Contractor will pay all costs associated with sampling, testing and approval of any material source change made after approval of initial source.
-

- 1.3 SOURCE APPROVAL (Cont'd) .6 Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.
- 1.4 ACTION AND INFORMATION SUBMITTALS .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
.1 Allow continual sampling by Departmental Representative during production.
.2 Provide Departmental Representative with access to source and processed material for sampling.
.3 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D 4791-05.
.1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
.1 Natural sand.
.2 Manufactured sand.
.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

2.1 MATERIALS

(Cont'd)

- .4 Coarse aggregates satisfying requirements of applicable section to be crushed rock:
- .1 Gravel or crushed gravel will not be acceptable.
 - .2 River or beach gravels will not be acceptable.
 - .3 Salt water submerged deposits will not be acceptable.

2.2 SOURCE APPROVAL
AND QUALITY CONTROL

- .1 Source(s) of materials to be incorporated into work or stockpiled requires approval by Departmental Representative.
- .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling within 20 days of contract award.
- .3 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .4 Advise Departmental Representative 2 weeks in advance of any change in material source to allow sampling, testing and approval.
- .5 The Contractor will pay all costs associated with sampling, testing, and approval of any material source change made after approval of the initial source.
- .6 Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Topsoil stripping:
- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

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- 3.1 PREPARATION (Cont'd)
- .1 (Cont'd)
 - .2 Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds and grasses and removed from site.
 - .3 Strip topsoil to depths as directed by Departmental Representative. Avoid mixing topsoil with subsoil.
 - .4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.
 - .2 Processing:
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.
 - .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.
 - .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
 - .3 Handling:
 - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
 - .4 Stockpiling:
 - .1 Stockpile aggregates on site in locations as indicated or approved unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
 - .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
 - .3 Stockpile sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
 - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
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- 3.1 PREPARATION .4 (Cont'd)
- (Cont'd)
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 h of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
- .1 Max 1.5 m for coarse aggregate and base course materials.
- .2 Max 1.5 m for fine aggregate and sub-base materials.
- .3 Max 1.5 m for other materials.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.
-
- 3.2 CLEANING .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 As directed by the Departmental Representative leave any unused aggregates in neat compact stockpiles or dispose of off-site at an approved facility.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 31 23 33.01 - Excavation, Trenching and Backfilling.
 - .2 Section 31 14 13 - Soil Stripping and Stockpiling.
- 1.2 REFERENCES
- .1 Ontario Provincial Standards (OPS) for Roads and Public Works, Ministry of Transportation (MTO), latest edition.
- 1.3 DEFINITIONS
- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
 - .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
 - .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
 - .4 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments to not less than specified depth below existing ground surface.
 - .5 Select vegetation removal consists of complete removal of targeted individual plants, including their root systems, to not less than a specified depth below existing ground surface.
- 1.4 QUALITY ASSURANCE
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 STORAGE AND
PROTECTION

- .1 Prevent damage to trees, landscaping, natural features, utility lines, site appurtenances, water courses, which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.6 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate waste materials for disposal in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove other cleared and grubbed material off-site, to site as indicated and approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.

PART 3 - EXECUTION

3.1 TEMPORARY
EROSION AND
SEDIMENTATION
CONTROL

- .1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .3 Use control measures as specified in Section 01 35 43 - Environmental Procedures.

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative items designated to remain.

2016-09-12

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- 3.2 PREPARATION
(Cont'd)
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .3 Notify utility authorities before starting clearing and grubbing.
 - .4 Keep roads and walks free of dirt and debris.
- 3.3 CLEARING
- .1 Clearing includes trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal.
 - .2 Clear as indicated by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
 - .3 Cut off branches and cut down trees overhanging area cleared as directed by Departmental Representative.
 - .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.
- 3.4 ISOLATED TREES
- .1 Cut off isolated trees as indicated or as directed by Departmental Representative at height of not more than 300 mm above ground surface.
 - .2 Grub out isolated tree stumps.
- 3.5 SELECTIVE VEGETATION REMOVAL
- .1 Completely remove select vegetation as indicated by Departmental Representative, including root systems, to not less than 200mm depth below existing ground surface.
 - .2 Remove select vegetation by non-chemical means and dispose of off-site by composting.
 - .3 Reinststate disturbed areas to match existing.
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2016-09-12

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- 3.6 UNDERBRUSH CLEARING .1 Clear underbrush from areas as indicated.
- 3.7 GRUBBING .1 Remove and dispose of roots larger than 75 mm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m³.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.
- 3.8 REMOVAL AND DISPOSAL .1 Remove cleared and grubbed materials off site.
- .2 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.
- 3.9 FINISHED SURFACE .1 Leave ground surface in condition suitable for immediate grading operations to approval of Departmental Representative.
- 3.10 CLEANING .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 RELATED SECTIONS .1 Section 31 11 00 - Clearing and Grubbing.

1.2 REFERENCES .1 Reference Documents
.1 Ontario Provincial Standards (OPS) for Roads and Public Works, Ministry of Transportation (MTO), latest edition.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL .1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
.2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal when approved by Departmental Representative.
.3 Use control measures as specified in Section 01 35 43 - Environmental Procedures.

3.2 STRIPPING OF TOPSOIL .1 Ensure that procedures are conducted in accordance with applicable Provincial and Federal requirements.
.2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
.3 Handle topsoil only when it is dry and warm.
.4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal composting.

2016-09-12

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- 3.2 STRIPPING OF
TOPSOIL
(Cont'd)
-
- .5 Remove brush from targeted area by non-chemical means and dispose of through mulching.
- .6 Strip topsoil to depths as indicated as directed by Departmental Representative.
.1 Avoid mixing topsoil with subsoil.
- .7 Pile topsoil in berms or stockpiles in locations as directed by Departmental Representative.
.1 Stockpile height not to exceed 2 m.
- .8 Dispose of unused or surplus topsoil offsite.
- .9 Protect stockpiles from contamination and compaction.
- .10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.
- 3.3 PREPARATION OF
GRADE
-
- .1 Rough grade in accordance with requirements of Section 31 23 33.01 - Excavating, Trenching and Backfilling and Section 31 24 13 - Embankments
- .2 Verify that grades are correct.
.1 Grade area only when soil is dry to lessen soil compaction.
.2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.
- 3.4 PLACING OF
TOPSOIL
-
- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Place topsoil in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedures.
-

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11
- Cleaning.
- .2 On completion and verification of
performance of installation, remove surplus
materials, excess materials, rubbish, tools
and equipment.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 31 05 16 - Aggregate Materials.
 - .2 Section 31 32 19.01 - Geotextiles.
 - .3 Section 32 11 23 - Aggregate Base Courses.
- 1.2 REFERENCES
- .1 Examine soils report attached as Appendix A (DBA Eng - Geotechnical Investigation Report, Ref# 15-2150-11).
 - .2 Ontario Provincial Standard Specification (OPSS).
 - .1 OPSS.MUNI 1010, Material Specification for Aggregates - Base, Sub-base, Select Subgrade and Backfill Material (November, 2013).
 - .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 117-13, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 422-63(2007)e1, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D 698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D 4318-10e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .5 Reference Documents
 - .1 Ontario Provincial Standards (OPS) for Roads and Public Works, Ministry of Transportation (MTO), latest edition.
- 1.3 DEFINITIONS
- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

1.3 DEFINITIONS
(Cont'd)

- .1 (Cont'd)
 - .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan and frozen materials.
- .2 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .6 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318-10, and gradation within limits specified when tested to ASTM D 422-63(2007) and ASTM C 136-06: Sieve sizes to CAN/CGSB-8.2-M88.
 - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

1.5 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 For design of any temporary structures submit design and supporting data at least 2 weeks prior to beginning Work.
- .3 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which work isto be carried out to design and inspect shoring, coffer dams, temporary access, bracing and underpinning required for Work.
- .4 Contractor's Engineer shall make, check and sign all calculations; check, seal and sign all drawings; inspect temporary structures and systems; and verify their adequacy and safety.
- .5 Keep design and supporting data on site.

1.6 EXISTING CONDITIONS

- .1 Existing buried utilities and structures:
 - .1 Before commencing work obtain all required digging permits from local utilities, and verify and establish location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Prior to beginning excavation Work, notify applicable owner or authorities to clearly mark such locations to prevent disturbance during Work.
 - .6 Confirm locations of buried utilities by hand digging or careful test excavations in presence of Departmental Representative. Hand dig all cables one metre either side of cable prior to machine excavation.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
-

- 1.6 EXISTING CONDITIONS
(Cont'd)
- .1 (Cont'd)
- .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or otherwise disturbing utilities or structures.
- .9 Record location of maintained, re-routed and abandoned underground lines.
- .2 Existing buildings and surface features:
- .1 Conduct, with Departmental Representative, condition survey of existing buildings, fencing, service poles, wires, lighting fixtures, pavement, survey benchmarks and monuments, and all other surface features which may be affected by Work.
- .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
- .3 Protect existing asphalt and concrete pavements which may be affected by Work from damage while work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
- .3 For subsurface information, refer to geotechnical report prepared by DBA Engineering (Ref No. 15-2150-11) included in Appendix A.
- .1 Although not included in report, the existing material found on the canal is expected to be a layer of sediment and miscellaneous debris underlain by bedrock.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Engineered Fill: Granular B - Type II
OPSS.MUNI 1010.
- .2 Select backfill material: from excavations or other sources, approved by the Departmental Representative for use intended, unfrozen and free from rocks larger than 80 mm, cinders, ashes, sods, organics, peat, refuse or other deleterious materials.
-

2.1 MATERIALS .3 Geotextiles: to Section 31 32 19.01 -
(Cont'd) Geotextiles.

PART 3 - EXECUTION

3.1 SITE .1 Remove obstructions, ice and snow, from
PREPARATION surfaces to be excavated within limits
indicated.

3.2 STOCKPILING .1 Stockpile fill materials in areas designated
by Departmental Representative.
.1 Stockpile granular materials in manner
to prevent segregation.
.2 Protect fill materials from contamination.
.3 Implement sufficient erosion and sediment
control measures to prevent sediment release
off construction boundaries and into water
bodies.

3.3 COFFERDAMS, .1 Maintain sides and slopes of excavations in
SHORING, BRACING safe condition by appropriate methods and in
AND UNDERPINNING accordance with Section 01 35 29.06 - Health
and Safety Requirements.
.2 Obtain permit from authority having
jurisdiction for any temporary diversion of
water course.
.3 During backfill operation:
.1 Unless otherwise indicated or directed
by Departmental Representative, remove
sheeting and shoring from excavations.
.2 Do not remove bracing until backfilling
has reached respective levels of such
bracing.
.3 Pull sheeting in increments that will
ensure compacted backfill is maintained at
elevation at least 500 mm above toe of
sheeting.
.4 When sheeting is required to remain in
place, cut off tops at elevations as
indicated.
.5 Upon completion of substructure
construction:

3.3 COFFERDAMS, SHORING, BRACING AND UNDERPINNING (Cont'd) .5 (Cont'd)
.1 Remove cofferdams, shoring and bracing.
.2 Remove excess materials from site and restore watercourses as directed Departmental Representative.

3.4 DEWATERING AND HEAVE PREVENTION .1 Keep excavations free of water while Work is in progress.
.2 Submit for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
.4 Protect open excavations against flooding and damage due to surface run-off.
.5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved runoff areas and in manner not detrimental to public and private property, existing facilities, or portion of Work completed or under construction.
.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.
.7 Control water from dewatering operations in accordance with OPSS 518.

3.5 EXCAVATION .1 Excavate to lines, grades, elevations and dimensions as indicated.
.2 Excavation must not interfere with normal 45 degree spray of bearing capacity of adjacent foundations.

3.5 EXCAVATION
(Cont'd)

- .3 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
 - .4 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than what can be completed in two (2) working days.
 - .5 Hoard excavations as required to present exposure to precipitation and/or freezing conditions. Frozen soil shall be replaced prior to backfilling at no cost to owner.
 - .6 Keep excavated and stockpiled materials safe distance away from edge of trench.
 - .7 Restrict vehicle operations directly adjacent to open trenches.
 - .8 Dispose of surplus and unsuitable excavated material at approved location off site. Comply with applicable provincial and municipal regulations.
 - .9 Do not obstruct flow of surface drainage or natural watercourses, except where permitted.
 - .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
 - .11 Notify Departmental Representative when bottom of excavation is reached and/or appears unsuitable and proceed as directed by Departmental Representative.
 - .12 Obtain Departmental Representative's approval of completed excavation.
 - .13 If encountered, remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
 - .1 Replace excavated material with compacted Engineered Fill compacted to no less than 98% Standard Proctor maximum dry density.
-

3.5 EXCAVATION
(Cont'd)

- .14 Correct unauthorized over-excavation as follows:
 - .1 Fill under areas with Engineered Fill compacted to not less than 98% of Standard Proctor Maximum Dry Density.
- .15 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.
- .16 Install geotextiles in accordance with Section 31 32 19.01 - Geotextiles.

3.6 FILL TYPES AND
COMPACTION

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698.
 - .1 Adjacent Retaining Wall: Engineered Fill, placed in uniform layers not exceeding 200m compacted thickness up to grades indicated to allow for surface treatment. Compact to no less than 98% maximum dry density.

3.7 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Inspection, testing, approval, and recording location of underground utilities.
 - .3 Removal of shoring and bracing; backfilling of voids with satisfactory material.
 - .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
 - .3 Do not use backfill material which is frozen or contains ice, snow or debris.
 - .4 Place backfill material in uniform layers. Compact each layer before placing succeeding layer.
-

- 3.8 RESTORATION
- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
 - .2 Replace topsoil, seed or sod and fertilize as indicated.
 - .3 Clean and reinstate areas affected by Work as directed by Departmental Representative.
 - .4 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 31 11 00 - Clearing and Grubbing.
- .2 Section 31 14 13 - Soil Stripping and Stockpiling.
- .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .4 Section 31 32 19.01 - Geotextiles.
- .5 Section 31 32 19.13 - Geogrid Soil Stabilization.
- .6 Section 32 11 23 - Aggregate Base Courses.
- .7 Section 32 91 19.13 - Topsoil Placement and Grading.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM D 698-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³) (600 kN-m/m³).
- .2 Ontario Provincial Standard Specifications (OPSS).
 - .1 OPSS PROV.501, Construction Specification for Compacting (November 2014).
 - .2 OPSS MUNI.1010, Material Specification for Aggregates - Base, Sub-base, Select Subgrade and Backfill Material (November 2013).
- .3 Reference Documents
 - .1 Ontario Provincial Standards (OPS) for Roads and Public Works, Ministry of Transportation (MTO), latest edition.

1.3 DEFINITIONS

- .1 Rock Excavation: excavation of:
-

1.3 DEFINITIONS
(Cont'd)

- .1 (Cont'd)
- .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpillar D9L or equivalent to be considered integral with parent mass.
- .2 Boulder or rock fragments measuring in volume one (1) cubic metre or more.
- .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.
- .3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the work.
- .4 Stripping: excavation of organic material covering original ground.
- .5 Embankment: material derived from usable excavation or imported borrow material and placed above original ground or stripped surface up to top of subgrade.
- .6 Engineered Fill: granular materials (specified as Granular Sub-base and/or Granular Base) supplied, placed and compacted in thin layers to high compaction densities.
- .7 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
- .8 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.
- .9 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Embankment materials require approval by Departmental Representative.

-
- 2.1 MATERIALS
(Cont'd)
- .2 Embankment Materials:
.1 Engineered Fill: Granular B - Type II in accordance with OPSS, Volume 2, Specification No. 1010.
.2 Select Backfill Material: from excavations or other sources, approved by the Departmental Representative for use intended, unfrozen and free from rocks larger than 80mm, cinders, ashes, sods, organics, peat, refuse or other deleterious materials.

PART 3 - EXECUTION

- 3.1 COMPACTION
EQUIPMENT
- .1 Compaction equipment must be equivalent of one 12 tonne vibratory packer capable of obtaining required densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.
- .2 Operate compaction equipment continuously in each embankment when placing material.
- 3.2 WATER
DISTRIBUTORS
- .1 Apply water with equipment capable of uniform distribution.
- 3.3 STRIPPING OF
TOPSOIL
- .1 Strip topsoil in accordance with Section 31 14 13 - Soil Stripping and Stockpiling.
- 3.4 EXCAVATING
- .1 General:
.1 Excavate to lines, grades, elevations and dimensions as indicated and as directed by Departmental Representative
- .2 Drainage:
.1 Maintain profiles, crowns and cross slopes to provide good surface drainage.
.2 Provide ditches as work progresses to provide drainage.
.3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.
-

3.5 EMBANKMENTS

- .1 Do not place material which is frozen nor place material on frozen surfaces except protect and heat materials as required.
- .2 Maintain crowned or sloped surface during construction to ensure ready run-off of surface water.
- .3 Drain low areas before placing materials.
 - .1 Place and compact to full width in layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.
- .4 Grade area leaving surface as smooth as possible. Install geosynthetic materials at depth indicated in embankment and in accordance with Section 31 32 19.01 - Geotextiles and Section 31 32 19.13 - Geogrid Soil Stabilization.

3.6 COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
 - .2 Deposit, spread, and level, embankment material in layers 200 mm maximum thickness after compaction.
 - .1 Compact each layer of embankment until compaction equipment achieves no further significant consolidation.
 - .2 Ensure required compaction for each layer before placing any material for next layer.
 - .3 Use specialized compaction equipment supplemented by routing, hauling, and levelling equipment over each layer of fill.
 - .4 Obtain written approval from Departmental Representative before using specialized compaction equipment such as tamping rollers, vibratory rollers, or other alternate compaction equipment that produces the required results
 - .5 Compact each layer to minimum 98% Standard Proctor maximum dry density, ASTM D 698.
-

3.6 COMPACTION
(Cont'd)

- .5 (Cont'd)
- .1 As indicated, compact selected areas using only static effort. Static compaction of materials shall be measured by way of a Control Strip, conducted in accordance with OPSS.PROV 501. Achieve maximum average dry density.
- .6 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

3.7 FINISHING

- .1 Finish slopes, ditch bottoms and borrow pits true to lines, grades and drawings where applicable.
- .2 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.
- .3 Hand finish slopes that cannot be finished satisfactorily by machine.
- .4 Round top of backslope 1.5 m both sides of top of slope.
- .5 Run tractor tracks over slopes exceeding 3 m in height to leave tracks parallel to centreline of roadway.
- .6 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

3.8 PROTECTION

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Departmental Representative.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
 - .2 Section 31 24 13 - Embankments.
 - .3 Section 31 32 19.13 - Geogrid Soil Stabilization.
- 1.2 REFERENCES
- .1 ASTM International:
 - .1 ASTM A 123/A 123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM D 4491-99a(2014)E1, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .3 ASTM D 4716-14, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .4 ASTM D 4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - .5 ASTM D4632-15a, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - .6 ASTM D6241-14, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Projects Using a 50mm Probe.
 - .7 ASTM D 4533-15, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - .8 ASTM D 4355-14, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
 - .2 CSA International:
 - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
 - .2 Product Data:
-

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .2 (Cont'd)
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit following samples 4 weeks prior to beginning Work as requested by Departmental Representative.
 - .1 Minimum length of 2 m of roll width of geotextile.
 - .2 Methods of joining.
- .4 Test and Evaluation Reports:
 - .1 Submit copies of mill test data and certificate at least 4 weeks prior to start of Work.

1.4 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 6 00 - Common Product Requirements and with manufacturer's written instructions.
- .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 and protect geotextiles from direct sunlight and UV rays.
 - .3 Replace defective or damaged materials with new.
- .3 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials.

PART 2 - PRODUCTS

2.1 MATERIAL

- .1 Geotextile: woven non-woven synthetic fibre fabric, supplied in rolls.
 - .1 Width: 4.57m minimum.
 - .2 Length: 91.4m minimum.
 - .3 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.

2.1 MATERIAL
(Cont'd)

- .2 Physical and Hydraulic properties:
 - .1 Non-Woven Geotextile A:
 - .1 Grab Tensile Strength: to ASTM D4632, minimum 578 N.
 - .2 Grab Elongation: to ASTM D4632, minimum 50%.
 - .3 CBR Puncture: to ASTM D6241, minimum 1126N.
 - .4 Trapezoid Tear: to ASTM D4533, minimum 178N.
 - .5 Apparent Opening Size (AOS): to ASTM D4751, minimum 0.212mm, maximum 0.250 mm.
 - .6 Permittivity: to ASTM D4491, minimum 1.4 s^{-1} .
 - .7 Water Flow Rate: to ASTM D4491, minimum 4480 l/min/m².
 - .8 UV Resistance (@ 500hrs): to ASTM D4355, minimum 70%.
 - .2 Non Woven Geotextile B:
 - .1 Grab Tensile Strength: to ASTM D4632, minimum 356 N.
 - .2 Grab Elongation: to ASTM D4632, minimum 50%.
 - .3 CBR Puncture: to ASTM D6241, minimum 704 N.
 - .4 Trapezoid Tear: to ASTM D4533, minimum 111 N.
 - .5 Apparent Opening Size (AOS): to ASTM D4751, minimum 0.212mm, maximum 0.250 mm.
 - .6 Permittivity: to ASTM D4491, minimum 2.0 s^{-1} .
 - .7 Water Flow Rate: to ASTM D4491, minimum 5900 l/min/m².
 - .8 UV Resistance (@ 500hrs): to ASTM D4355, minimum 70%.
- .3 Securing pins and washers: to CSA G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to ASTM A 123/A 123M.
- .4 Factory seams: sewn in accordance with manufacturer's recommendations.
- .5 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface in orientation and manner to suit installation particulars at locations indicated.
 - .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
 - .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
 - .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
 - .5 Pin successive strips of geotextile with securing pins at 600mm interval at mid point of lap as required on slopes.
 - .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
 - .7 After installation, cover with overlying layer within 4 hours of placement.
 - .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
-

- 3.2 INSTALLATION (Cont'd) .9 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling 31 24 13 - Embankments.
- 3.3 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling.
- 3.4 PROTECTION .1 Vehicular traffic not permitted directly on geotextile.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 31 24 13 - Embankments.
 - .2 Section 31 32 19.01 - Geotextiles.
- 1.2 REFERENCES
- .1 ASTM International:
 - .1 ASTM D 1248-12, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
 - .2 ASTM D 4101-14, Standard Specification for Polypropylene Injection and Extrusion Materials.
 - .3 ASTM D 4218-15, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique.
 - .4 ASTM D 5262-07 (2012), Standard Test Method for Evaluating the Unconfined Tension Creep Behaviour of Geosynthetics.
 - .5 ASTM D 6637-15, Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.
 - .2 Drexel University - Geosynthetic Research Institute (GRI)
 - .1 GRI GG2-87(R2005), Geogrid Junction Strength.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 submittal Procedures.
 - .2 Samples:
 - .1 Submit samples 4 weeks prior to beginning work as requested by the Departmental Representative.
 - .1 One 3 m length from full roll width of geogrid material.
 - .3 Certificates:
 - .1 Submit copies of mill test data and certificate 4 weeks prior to start of Work.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
-

1.4 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .2 During delivery and storage, protect geogrids from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.
- .3 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials.

PART 2 - PRODUCTS

2.1 MATERIAL

- .1 Geogrid: open grid polymer having biaxial orientation, free of striations, roughness, pinholes, blisters, undispersed raw materials or any sign of contamination by foreign matter.
 - .1 Roll width: 3.6 m minimum.
 - .2 Roll length: 50 m minimum.
 - .3 Aperture size:
 - .1 Machine direction: 39 mm.
 - .2 Cross machine direction: 39 mm.
 - .4 Polymer: polypropylene: to ASTM D 4101 with inhibitors added to resist deterioration by ultra-violet and heat exposure.
- .2 Geogrid physical properties:
 - .1 Peak tensile strength: to ASTM D 6637.
 - .1 Machine direction: minimum 19.0 kN/m.
 - .2 Cross machine direction: minimum 19.0 kN/m.
 - .2 Tensile secant modulus at 2% elongation: to ASTM D 6637, minimum 8.0 kN/m.
 - .3 Rigid geogrid junction strength and efficiency: to GRI GG2.
 - .1 Strength: minimum 19.0 kN/m.
 - .4 Carbon black content: to ASTM D 4218, minimum 1%.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for soil stabilization installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
 - .4 Ensure previously placed geotextile is installed in accordance with Section 31 32 19.01 - Geotextiles.
- 3.2 INSTALLATION
- .1 Place geogrid material by unrolling onto graded surface in manner and locations indicated and retain in position in accordance with manufacturer's written recommendations.
 - .2 Place geogrid on sloping surfaces in one continuous length from toe of slope to upper extent of geogrid.
 - .3 Overlap each successive strip of geogrid 600 mm over previously laid strip.
 - .4 Join successive strips of geogrid by tying as recommended by manufacturer.
 - .5 Protect geogrid from displacement, damage or deterioration before and during placement of overlay soil layers.
 - .6 After installation, cover with overlay layer within 10 days of placement.
 - .7 Replace damaged or deteriorated geogrid to approval of Departmental Representative.
 - .8 Place and compact soil layers in accordance with Section 31 24 13 - Roadway Embankments.
-

- 3.3 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.4 PROTECTION
- .1 Vehicular traffic not permitted directly on geogrid.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 31 24 13 - Embankments.
 - .2 Section 31 32 19.01 - Geotextiles.
- 1.2 REFERENCES
- .1 Ontario Provincial Standard Specifications (OPSS PROV.1004, Material Specification for Aggregates - Miscellaneous (November 2012)).
 - .2 Reference Documents
 - .1 Ontario Provincial Standards (OPS) for Roads and Public Works, Ministry of Transportation (MTO), latest edition.
- 1.3 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate and recycle waste materials as approved by Departmental Representative.
 - .2 Divert left over aggregate materials from landfill to local facility for reuse as approved by Departmental Representative.
 - .3 Divert left over geotextiles to local plastic recycling facility program as approved by Departmental Representative.

PART 2 - PRODUCTS

- 2.1 STONE
- .1 Hard, dense with relative density not less than 2.65, durable quarry stone, free from seams, cracks or other structural defects, to meet following size distribution for use intended:
 - .1 Hand Placed Rip-Rap: R-10 Rip Rap in accordance with OPSS.PROV.1004.
- 2.2 GEOTEXTILE FILTER
- .1 Geotextile: in accordance with Section 31 32 19.01 - Geotextiles.

PART 3 - EXECUTION

- 3.1 PLACING
- .1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
-

3.1 PLACING

(Cont'd)

- .2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface in accordance with Section 31 32 19.01 - Geotextiles and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
- .4 Place rip-rap to thickness and details as indicated.
- .5 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .6 Hand placing:
 - .1 Use larger stones for lower courses and as headers for subsequent courses.
 - .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
 - .3 Finish surface evenly, free of large openings and neat in appearance.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 31 05 16 - Aggregate Materials.
 - .2 Section 31 24 13 - Embankments.
- 1.2 REFERENCES
- .1 Ontario Provincial Standard Specifications (OPSS).
 - .1 OPSS PROV.5.1, Construction Specification for Compacting (November 2014).
 - .2 OPSS.MUNI.1010, Material Specification for Aggregates - Base, Sub-base, Select Subgrade and Backfill Material (November 2013).
 - .2 ASTM International:
 - .1 ASTM C 117-13, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D 698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D 1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .6 ASTM D 4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .4 Ontario Provincial Standards (OPS) for Roads and public Works, Ministry of Transportation (MTO), latest edition.
-

1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 31 05 16 - Aggregate Materials and with manufacturer's written instructions.

.2 Storage and Handling Requirements:
.1 Stockpile minimum 50% of total aggregate required prior to beginning operation.
.2 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.3 Replace defective or damaged materials with new.
.4 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Granular Base Course: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
.1 Granular A, in accordance with OPSS.MUNI.1010.

PART 3 - EXECUTION

3.1 PLACEMENT AND INSTALLATION .1 Place granular base after sub-grade surface is inspected and approved in writing by Departmental Representative.

.2 Placing:
.1 Construct granular base to depth and grade in areas indicated.

3.1 PLACEMENT AND
INSTALLATION
(Cont'd)

- .2 (Cont'd)
- .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
 - .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .1 Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
- .1 Ensure compaction equipment is capable of obtaining required material densities.
 - .2 Efficiency of equipment shall be proved at no extra cost and written approval must be received from Departmental Representative before use.
 - .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compacting:
- .1 Compact to density not less than 100% maximum dry density to ASTM D 698.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

- 3.1 PLACEMENT AND INSTALLATION (Cont'd) .4 (Cont'd)
.6 As indicated, compact select areas using only static effort. Static compaction of materials shall be measured by way of a Control Strip, conducted in accordance with OPSS.PROV 501. Achieve maximum average dry density.
- 3.2 SITE TOLERANCES .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.
- 3.3 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
.2 Divert unused granular material from landfill to local quarry facility approved by Departmental Representative.
- 3.4 PROTECTION .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 31 14 13 - Soil Stripping and Stockpiling.
 - .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
 - .3 Section 31 24 13 - Embankments.
 - .4 Section 32 92 19.16 - Hydraulic Seeding.
 - .5 Section 32 92 23 - Sodding.
- 1.2 REFERENCES
- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
 - .2 Canadian Council of Ministers of the Environment
 - .1 PN1340-2005, Guidelines for Compost Quality.
 - .3 Canadian Nursery Landscape Association
 - .1 Canadian Standards for Nursery Stock (latest edition).
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Quality control submittals:
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- 1.4 QUALITY ASSURANCE
- .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
-

1.5 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 31 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 TOPSOIL

- .1 Stockpiled Topsoil from site: Employ use of stripped topsoil as approved by Departmental Representative. Supplement with imported topsoil as required.
- .2 Topsoil: for seeded and sodded areas. Mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7% clay, and contain 2 to 10% organic matter by weight.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .4 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

- .1 Fertilizer:
 - .1 Fertility: major soil nutrients present in following amounts:
 - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
 - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
 - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.

- 2.2 SOIL AMENDMENTS (Cont'd)
- .1 (Cont'd)
 - .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
 - .6 Ph value: 6.5 to 8.0.
 - .2 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
 - .3 Sand: washed coarse silica sand, medium to course textured.
 - .4 Organic matter: compost Category A, in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
 - .5 Limestone:
 - .1 Ground agricultural limestone.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
 - .6 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.
- 2.3 SOURCE QUALITY CONTROL
- .1 Contractor is responsible for amendments to supply topsoil as required.
 - .2 Soil testing by recognized testing facility for PH, P, N and K, and organic matter.
 - .3 Soil sampling, testing and analysis to be in accordance with Provincial standards.
-

PART 3 - EXECUTION

- 3.1 GENERAL .1 Construct rough grade in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling and Section 31 24 13 - Embankments.
- 3.2 PREPARATION OF EXISTING GRADE .1 Verify that grades are correct.
.1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
.2 Remove debris which protrudes more than 75 mm above surface.
.3 Dispose of removed material off site.
- 3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil as indicated to following minimum depths after settlement.
.1 150 mm for seeded areas.
.2 135 mm for sodded areas.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.
- 3.4 FINISH GRADING .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
.1 Prepare loose friable bed by means of cultivation and subsequent raking.

- 3.4 FINISH GRADING (Cont'd) .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
.1 Leave surfaces smooth, uniform and firm against deep footprinting.
- 3.5 ACCEPTANCE .1 Departmental Representative will inspect topsoil in place and determine acceptance of material, depth of topsoil and finish grading.
- 3.6 SURPLUS MATERIAL .1 Dispose of materials except topsoil not required where directed by Departmental Representative off site.
- 3.7 CLEANING .1 Proceed in accordance with Section 01 74 11 - Cleaning.
.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 32 91 19.13 - Topsoil Placement and Grading.
- 1.2 ADMINISTRATIVE REQUIREMENTS .1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.
- .2 Scheduling:
.1 Schedule hydraulic seeding to coincide with preparation of soil surface.
.2 Schedule hydraulic seeding using grass mixtures between dates recommended by Provincial Agricultural Department.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.
.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
- .3 Submit in writing 10 days prior to commencing work:
.1 Volume capacity of hydraulic seeder in litres.
.2 Amount of material to be used per tank based on volume.
.3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.
- .4 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
-

1.4 QUALITY
ASSURANCE

- .1 Qualifications:
 - .1 Landscape Contractor: to be a Member in Good Standing of Ontario Horticultural Trades Association.
- .2 Soils Testing:
 - .1 Contractor is responsible for soils testing to determine appropriate ratios and application rates for fertilizer, lime, and any soil amendments that may be required.
 - .2 Soil test report to prescribe ratios and rates for initial applications as well as subsequent applications during establishment and warranty period.
 - .3 Submit soil test report to Departmental Representative in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
 - .2 Inoculant containers to be tagged with expiry date.
- .3 Storage and Handling Requirements:
 - .1 Store fertilizer off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials.

1.6 WARRANTY

- .1 For seeding, 12 months warranty period is extended to 24 months.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.

PART 2 - PRODUCTS

- 2.1 HYDRAULIC SEED
- .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
 - .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
 - .1 Mixture composition:
 - .1 40% Kentucky Bluegrass.
 - .2 40% Creeping Red Fescue.
 - .3 20% Annual Ryegrass.
 - .2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
 - .1 Type I mulch:
 - .1 Made from wood cellulose fibre.
 - .2 Organic matter content: 95% plus or minus 0.5%.
 - .3 Value of pH: 6.0.
 - .4 Potential water absorption: 900%.
 - .3 Tackifier: water dilutable, liquid dispersion.
 - .4 Water: free of impurities that would inhibit germination and growth.
 - .5 Fertilizer:
 - .1 To Canada "Fertilizers Act" and Regulations.
 - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.
 - .6 Lime: of agriculture source, purity and fineness suitable for growth of turf grass.
 - .7 Inoculants: inoculant containers to be tagged with expiry date.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for hydraulic seeding in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 INSTALLERS .1 Use installers members in Good Standing of Ontario Horticultural Trades Association.
- 3.3 PROTECTION OF EXISTING CONDITIONS .1 Protect structures, signs, guide rails, fences, plant material, utilities and other surfaces not intended for spray.
- .2 Immediately remove any material sprayed where not intended as directed by Departmental Representative.
- 3.4 PREPARATION OF SURFACES .1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .2 Prepare surface in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.
 - .3 Fine grade areas to be seeded free of humps and hollows.
 - .1 Ensure areas are free of deleterious and refuse materials.
 - .4 Cultivated areas identified as requiring cultivation to depth of 25 mm.
 - .5 Ensure areas to be seeded are moist to depth of 150 mm before seeding.

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- 3.4 PREPARATION OF SURFACES
(Cont'd)
- .6 Obtain Departmental Representative's approval of grade and topsoil depth before starting to seed.
- 3.5 FERTILIZING PROGRAM
- .1 Fertilize prior to fine grading applying fertilizer equally distributed in accordance with the rate and ratio determined from soils tests.
- .2 Fertilize during establishment and warranty periods applying fertilizer equally distributed in accordance with the rate and ratio determined from soils tests.
- 3.6 PREPARATION OF SLURRY
- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
- .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
- .3 After materials are in seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.
- 3.7 SLURRY APPLICATION
- .1 Ensure seed is placed under supervision of certified Landscape Planting Supervisor.
- .2 Hydraulic seeding equipment:
- .1 Slurry tank.
 - .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.
 - .3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
- .3 Slurry mixture applied per 100m².
- .1 Seed: 2.0kg or as recommended by seed supplier.
 - .2 Mulch: 10kg.
 - .3 Tackifier: as recommended by manufacturer.
 - .4 Water: Minimum 100 L.
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- 3.7 SLURRY APPLICATION (Cont'd)
- .3 (Cont'd)
 - .5 Fertilizer: in accordance with rate and ratio determined from soils tests.
 - .4 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
 - .1 Using correct nozzle for application.
 - .2 Using hoses for surfaces difficult to reach and to control application.
 - .5 Blend application 300 mm into adjacent grass areas or sodded areas or previous applications to form uniform surfaces.
 - .6 Re-apply where application is not uniform.
 - .7 Remove slurry from items and areas not designated to be sprayed.
- 3.8 CLEANING
- .1 Progress Cleaning: leave Work area clean at end of each day.
 - .1 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .1 Clean and reinstate areas affected by Work.
 - .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
- 3.9 PROTECTION
- .1 Protect seeded areas from trespass until plants are established.
 - .2 Remove protection devices as directed by Departmental Representative.
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- 3.10 MAINTENANCE DURING ESTABLISHMENT PERIOD
- .1 Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.
 - .2 Perform following operations from time of seed application until acceptance by Departmental Representative.
 - .3 Grass Mixture:
 - .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
 - .2 Fertilize seeded areas after 10 weeks after germination provided plants have mature true leaves. Spread half of required amount of fertilizer in one direction and remainder at right angles; water in well.
 - .3 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
 - .4 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.
- 3.11 ACCEPTANCE
- .1 Seeded areas will be accepted by Departmental Representative provided that:
 - .1 Plants are uniformly established and seeded areas are free of rutted, eroded, bare or dead spots.
 - .2 Areas have been fertilized.
 - .2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.
- 3.12 MAINTENANCE DURING WARRANTY PERIOD
- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.
 - .2 Fertilize seeded areas as required. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 32 91 19.13 - Topsoil Placement and Grading.
- 1.2 ADMINISTRATIVE REQUIREMENTS .1 Scheduling:
.1 Schedule sod laying to coincide with preparation of soil surface.
.2 Schedule sod installation when frost is not present in ground.
.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for sod and fertilizer and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
.3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements of seed mix, seed purity, and sod quality.
.4 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties of seed mix, seed purity, and sod quality.
- 1.4 QUALITY ASSURANCE .1 Qualifications:
.1 Landscape Contractor: to be a Member in Good Standing of Ontario Horticultural Trades Association.
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1.4 QUALITY ASSURANCE
(Cont'd)

.1 (Cont'd)

.2 Landscape Planting Supervisor:
Landscape Industry Certified Technician with
Softscape Installation designation.

.3 Landscape Maintenance Supervisor:
Landscape Industry Certified Technician with
Turf Maintenance designation.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in
accordance with Section 01 61 00 - Common
Product Requirements and with manufacturer's
written instructions.

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

.3 Storage and Handling Requirements:
.1 Store materials in accordance with
supplier's recommendations.
.2 Replace defective or damaged materials
with new.

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 1 broadleaf weed and
up to 1% native grasses per 40 square
meters.

.2 Density of sod sufficient so that
no soil is visible from height of
1500mm when mown to height of 50mm.

.3 Mowing height limit: 35 to 65mm.

.4 Soil portion of sod: 6 to 15mm.

.5 Broken, dry, discoloured pieces of
sod will be rejected.

2.1 MATERIALS

(Cont'd)

- .1 (Cont'd)
- .2 (Cont'd)
- .2 Sod establishment support:
 - .1 Wooden pegs: 17 x 8 x 200 mm.
- .3 Water:
 - .1 Free of impurities that would inhibit plant growth.
- .4 Fertilizer:
 - .1 To Canada "Fertilizers Act" and Fertilizers Regulations.
 - .2 Complete, synthetic, slow release with 35% of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain written 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 INSTALLERS

- .1 Use installers who are Member in Good Standing of Ontario Horticultural Trades Association.

3.2 EXAMINATION

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

3.3 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative and commence work when 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 tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod, and to allow 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.

3.4 SOD PLACEMENT

- .1 Ensure sod placement is done under supervision of certified Landscape Planting Supervisor.
- .2 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .3 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.
- .4 Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.5 FERTILIZING PROGRAM

- .1 Fertilize during establishment and warranty periods to following program:
 - .1 Ratio for spring sodding: 1:2:2.
 - .2 Ratio for fall sodding: 1:4:4.
 - .3 Ratio for year one maintenance applications: May 3:0:0, July 3:1:3, September 1:2:3, or as recommended by an approved soils lab.

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- 3.6 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
 - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .1 Clean and reinstate areas affected by Work.
- 3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD .1 Perform following operations from time of installation until acceptance.
- .1 Water sodded areas in sufficient quantities immediately after laying and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
 - .2 Cut grass to 50 mm when or prior to it reaching height of 75 mm.
 - .3 Maintain sodded areas weed free 95%.
 - .4 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.
 - .5 Temporary barriers or signage to be maintained where required to protect newly established sod.
- 3.8 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.
-

- 3.8 ACCEPTANCE
(Cont'd)
- .3 When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.
- 3.9 MAINTENANCE
DURING WARRANTY
PERIOD
- .1 Perform following operations from time of acceptance until end of warranty period:
- .1 Water sodded Turf Grass Nursery Sod. 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 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. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
- .4 Eliminate weeds by mechanical means to extent acceptable to Departmental Representative.

PART 1 - GENERAL

1.1 SECTION
INCLUDES

- .1 Work includes but ins not limited to:
 - .1 Engaging a professional Engineer to design:
 - .1 Temporary cofferdam downstream of tailrace walls and upstream of waste weir and retaining walls for purpose of dewatering.
 - .2 Systems used to remove water from work spaces.
 - .3 Sediment control systems and devices such as sediment traps, silt control fences, filter bags, settling basins and other treatment facilities.
 - .2 Constructing and maintaining the temporary cofferdam 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 duration of the work.
 - .5 Providing and maintaining all dewatering equipment for duration of the work.
 - .6 Removing water from work spaces and maintaining these spaces in a dry state for 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 and Section 35 42 19 - Preservation of Watercourses.
 - .10 Complying with Regulatory Requirements.
 - .11 Complying with Environmental and Archaeological Requirements.
- .2 Except where noted, all work described in this specification to be done "in the dry".
- .3 Design and construction of temporary access/cofferdam to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 RELATED
REQUIREMENTS

- .1 Section 01 35 43 - Environmental Procedures.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Section 35 42 19 - Preservation of Watercourses.

1.3 REGULATORY
REQUIREMENTS

- .1 Adhere to local, provincial and federal requirements relating to:
 - .1 Protection of environment.
 - .2 Safety of construction.
 - .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. Contact Department of Fisheries and Oceans through Departmental Representative 10 days before starting cofferdam installation.
- .3 Pumping water out of cofferdam enclosure: to Section 01 35 43 - Environmental Procedures and Section 35 42 19 - Preservation of Watercourses.
 - .1 Obtain Departmental Representative approval to dewater enclosure by way of gravity flow through downstream lock gates and chamber.
- .4 Ensure that area to be dewatered behind cofferdam is clear of fish before being dewatered. Release alive immediately upstream of cofferdam into Sand Lake. Also clear area of other vertebrate animal in area to be dewatered. Catch and release fish that escape process noted above as dewatering commences.
- .5 Obtain all required work permits from governing Federal, Provincial, Municipal and/or Conservation authority.

1.4 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit shop drawings of cofferdams and other dewatering systems in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings must be complete with Professional Engineers seal and signature.

-
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)
- .1 (Cont'd)
 - .2 Submit design calculations and stability of cofferdams, and dewatering systems used for each stage of construction.
- 1.5 QUALIFICATIONS OF DESIGNERS
- .1 Designer of cofferdams and other related dewatering structures and systems must be a Professional Engineer 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.
- 1.6 DESIGN CRITERIA
- .1 Design cofferdams to ensure maintenance of work spaces in a dry state for duration of work.
 - .2 Flows in canal will be discharged through upstream waste weir. Cofferdam and any other temporary diversions shall not adversely impact the capacity of the waste weir.
 - .3 Plan and design dewatering systems 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.
 - .4 At all times, maintain environmental quality of water to Section 01 35 43 - Environmental Procedures.
 - .5 Ensure that no phase of work threatens safe performance of cofferdams.
- 1.7 WATER LEVELS
- .1 Estimated water levels during construction with temporary cofferdam in place are illustrated on drawings.
-

-
- 1.8 EXISTING SOILS .1 For subsurface information, refer to geotechnical report prepared by DBA Engineering (Ref. No. 15-2150-11) included in Appendix A.
.1 Although not included in report, the existing material found on the canal is expected to be a layer of sediment and miscellaneous debris underlain by bedrock.
- 1.9 ENVIRONMENTAL 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 any portion of work or cause erosion.
.1 Water quality downstream of construction site and/or released to watercourses not to exceed background turbidity readings of 8 nephelometric turbidity units (NTU) or change of 25 mg/l for suspended solids. Dispose of water so that it does not create a safety or health hazard, or cause damage to the environment, to adjacent property or cause erosion.
- .2 Do not release any silt or other materials into watercourse during construction or removal of cofferdams.
- .3 Refer to Section 01 35 43 - Environmental Procedures and Section 35 42 19 - Preservation of Watercourses.
- 1.10 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 conditions, approved by Departmental Representative and suitable for their use in the work.
- .2 Do not use materials which may cause environmental damage to waterway or to land at or near site.
-

2.1 MATERIALS

(Cont'd)

- .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. However, washed gravel or clean rock fill with 6mm minimum aggregate size can be used for the cofferdam.
 - .5 If using sandbags, sand must be washed of fines before placing in water.
 - .6 Use gravel/rock fill with rubber membrane, plastic sheeting, 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.
 - .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.
- .2 Address and seal any leaks discovered in cofferdam.

-
- 3.2 DEWATERING
- .1 Dewater work spaces and maintain them a fully dewatered state until work is finished.
 - .1 Continue dewatering operations, to enable work to proceed in the dry, for duration of work.
 - .2 Repeat entire dewatering procedure as often as may be necessary if flooding or other damage occurs before completion of work.
- 3.3 WATERKEEPER
- .1 Ensure continuity of dewatering by designating a watchkeeper to make periodic checks at times when work is not in progress. Waterkeeper's qualifications under this Section are to be sufficient to perform, on dewatering equipment, such duties as:
 - .1 Preventative maintenance and refuelling of generators normally performed during any shift.
 - .2 Emergency repairs of minor complexity.
 - .3 Placing standby items in service.
- 3.4 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.
- 3.5 COFFERDAM REMOVAL
- .1 At approved stages in work remove all cofferdams, temporary structures and dewatering systems to original channel bottom level.
-

- 3.5 COFFERDAM
REMOVAL
(Cont'd)
- .1 (Cont'd)
 - .1 Debris on canal bed shall be completely removed and area restored to its original condition.
 - .2 Dispose of all unwanted materials in approved manner off canal lands.
 - .3 Do not dispose of any materials in watercourses or canal.
 - .4 Maintain sediment controls in place during cofferdam removal.
- 3.6 CLEAN-UP AND
RECTIFICATION
- .1 To clean provisions of Section 01 74 11 - Cleaning.

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

.1 Section 31 11 00 - Clearing and Grubbing.

1.2 ENVIRONMENTAL
REQUIREMENTS

.1 Operation of construction equipment in water is prohibited.

.2 Do not use borrow material from watercourse beds.

.3 Design and construct temporary crossings to minimize environmental impact to watercourse and wetland.

.4 Ensure construction activities do not impact spawning beds. Constructing temporary crossings of watercourses where spawning beds are identified is prohibited.

.5 Dumping excavated fill, waste material, or debris in watercourse or wetland is prohibited.

.6 Underwater blasting is prohibited.

.7 Carry out work to requirements of any work permits.

.8 Install turbidity curtain and filter bag to prevent sediment from construction activities from entering the watercourse and being transported beyond the approved work area.

.9 Obtain work permits from governing Federal, Provincial, Municipal and/or Conservative Authority.

1.3 SITE CONDITIONS

.1 For site-specific ecologic/habitat information, potential impacts and mitigation measures, refer to the Basic Impact Analysis prepared by Parks Canada Agency (August 2016), included in Appendix B.

.1 In the case of disagreement between mitigation measures presented in the analysis and the provisions of this specification, the more stringent shall apply.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 EXISTING
CONDITIONS .1 Maintain existing flow pattern in natural
watercourse systems.
.2 In natural systems maintain existing riffle
pool and step pool patterns.
.3 In wetland systems, maintain existing
hydrological conditions.

3.2 SITE CLEARING
AND PLANT
PROTECTION .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
sediment and erosion control drawings,
sediment and erosion control plan, specific
to site, that complies with Section 01 35 43
- Environmental Procedures.
.2 Inspect, repair, and maintain erosion
sedimentation control measures during
construction until permanent vegetation has
been established.
.3 Remove erosion and sedimentation
controls and restore and stabilize areas
disturbed during removal.
.2 Minimize disturbance to vegetated buffer
zones and protect trees and plants on site
and adjacent properties where indicated.
.3 Wrap trees and shrubs adjacent to
construction work, storage areas and
trucking lanes in burlap.
.4 Conduct work to provide minimal disturbance
to vegetated buffer zones. Protect trees and
plants on site and adjacent properties where
indicated.

3.2 SITE CLEARING
AND PLANT
PROTECTION
(Cont'd)

- .5 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .6 Remove only trees that may offer future blockage problems as instructed by Departmental Representative.
- .7 Maintain temporary erosion and pollution control features installed under this contract.

3.3 DRAINAGE

- .1 Pumping water containing suspended materials into watercourse is prohibited.
- .2 Establish rock chute spillways to accommodate safe surface water entry to watercourse as directed by Departmental Representative.
- .3 Maintain existing drainage patterns on adjacent lands to the watercourse to the greatest extent possible.

3.4 SITE
RESTORATION

- .1 Establish vegetated buffer zones with suitable vegetation to minimum 3 m along edge of watercourse banks as determined by Departmental Representative.
- .2 Upon completion of work, install erosion protection on river and channel banks as indicated on the Contract drawings and re-establish vegetated buffer zones along edge of watercourse banks as approved by Departmental Representative.
- .3 Protect new planting material from disturbance by construction activities.
- .4 Remove sediment and erosion control measures with approval of Departmental Representative.

3.5 MITIGATION
MEASURES

- .1 Fish/Fish Habitat:
 - .1 Restrict in-water works to approved timing windows (no in-water works permitted between March 31 and July 01). Exception relates to removal of access road and access berms at end of designated construction periods to facilitate navigation.
 - .2 Should conditions at the work site indicate that there are unforeseen negative impacts to fish or their habitat, all work shall cease until the problem has been corrected and/or DFO are consulted.
 - .3 To prevent fish from being killed by the placement of rock in watercourses measures should be taken to move fish away from the immediate area before dumping the rock. Methods could include:
 - .1 The combination of noise and bubbles from an air compressor could be utilized for a sufficient amount of time to direct fish away from the area where rock will be dumped.
 - .2 Place both turbidity curtains side by side across the canal, then pull one away pushing fish away from corridor.
 - .3 Capture fish stranded behind turbidity curtains and release in safe area.
 - .4 Fish trapped in area to be dewatered must be captured alive and relocated outside areas to be dewatered before commencement of pumping.
 - .5 Implement mitigation measures in accordance with Fisheries and Oceans Canada recommendation, "Measures to avoid causing harm to fish and fish habitat".
- .2 Surface Water:
 - .1 Refuel equipment off slopes, and minimum of 30m away from waterbodies/aquatic habitats. Refuel heavy equipment in staging area designated for refueling with spill mitigation measures in place. Refuel machinery and follow spill avoidance procedures as specified above soil section.
 - .2 Store oils, lubricants, fuels and chemicals in secure areas on impermeable pads, 30m away from a waterbody, and provide containment berms as necessary.

3.5 MITIGATION
MEASURES
(Cont'd)

.2

(Cont'd)

.3 Materials and methods for use in cofferdams must comply with the regulations and guidelines of the Federal Department of Fisheries and Oceans. Earth or granular materials with sand and fines is not acceptable, however, washed gravel with 6 mm minimum aggregate size can be used for cofferdams construction. If using sand bags, sand must be washed of fines before placing in water. Use gravel/rock fill with rubber membranes, plastic sheeting, caissons, sheet piling, frame type structures or other cofferdams that do not generate turbidity.

.4 Turbidity curtains shall be installed before rock fill placement in the bed of the Canal and in any watercourse, and maintained in place until the end of construction and removal of the placed material. Locations include, but are not limited to, installation upstream of the temporary access road/cofferdam, immediately downstream of the waste weir, and downstream of the Upper Nicholsons lock station. The turbidity curtains to be marine grade, anchored and weighted along length to form a continuous barrier with adequate flotation at water surface. Inspect daily and maintain turbidity curtains until the end of construction.

.5 All materials placed in the water must meet applicable regulations governing placement of fill in water bodies.

.6 Do not operate heavy equipment in waterway except when operated from a barge. Any small tools and equipment operating in waterbodies must be cleaned prior to entering the water and inspected daily for leaks. Equipment should never be left in water overnight. Do not skid construction material across area and inspect daily for leaks.

3.5 MITIGATION

.2

(Cont'd)

MEASURES

(Cont'd)

- .7 Do not pump water that flows/seeps through cofferdam or seeps into construction excavation work area directly into waterways. Send all discharge to sediment traps in order to satisfy discharge requirements. Install sediment trap as required to treat surface water runoff in the construction area and prevent sediment from entering waterways. Water quality downstream of construction site and/or released to watercourses not to exceed background turbidity readings of 8 nephelometric turbidity units (NTU) or change of 25 mg/l for suspended solids. Dispose of water so that it does not create a safety or health hazard, or cause damage to the environment, to adjacent property or cause erosion.
- .8 Install sediment and erosion control structures in waterbodies (e.g. silt curtains, cofferdams) before construction and inspect defices daily.

Appendix A

Geotechnical Report



Parks Canada Parcs Canada

Nicholson's Earth Dam and Clowes Upper West Embankment

Upper Nicholson's and Clowes Locks
Andrewsville, Ontario

Project No.: 15-2150-11

October 6, 2015

Distribution :
Mr. Jason Angel, M.Sc., P.Eng., LEED GA

1 copy PDF



Parks Canada Parcs Canada

Parks Canada, c/o
SNC-Lavalin Infrastructure and Construction
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Geotechnical Investigation Report

*Nicholson's Earth Dam and Clowes Upper West Embankment
Upper Nicholson's and Clowes Locks
Andrewsville, Ontario*

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Project No. : 15-2150-11
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TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1
2.0 PROJECT DESCRIPTION	3
3.0 METHOD OF INVESTIGATION	5
3.1 FIELDWORK.....	5
3.1.1 <i>General Remarks</i>	5
3.1.2 <i>Borehole Investigation – Nicholson's</i>	5
3.1.3 <i>Test Pit Investigation – Nicholson's</i>	6
3.1.4 <i>Borehole Investigation – Clowes</i>	7
3.1.5 <i>Borehole and Test Pit Elevations and Locations</i>	8
4.0 SUBSOIL CONDITIONS	10
4.1 GENERAL REMARKS	10
4.2 NICHOLSON'S EARTH DAM	10
4.2.1 <i>Surficial Coverings</i>	10
4.2.2 <i>Sand Fill</i>	11
4.2.3 <i>Cobble / Cobble and Boulder Fill</i>	12
4.2.4 <i>Silty Sand</i>	12
4.2.5 <i>Bedrock</i>	13
4.3 CLOWES UPPER WEST EMBANKMENT	14
4.3.1 <i>Surficial Coverings</i>	14
4.3.2 <i>Silty Sand Fill</i>	14
4.3.3 <i>Bedrock</i>	15
5.0 LABORATORY	17
5.1 GEOTECHNICAL LABORATORY TESTING	17
6.0 GROUNDWATER	18
7.0 DISCUSSION	20
7.1 GENERAL	20
7.2 EXCAVATION	20
7.2.1 <i>General</i>	20
7.2.2 <i>Temporary Shoring</i>	21
7.3 DEWATERING	22
7.4 RETAINING WALLS – NICHOLSON'S	23
7.4.1 <i>Wall Design</i>	23
7.4.2 <i>Foundation Considerations</i>	24
7.5 GRADE ALTERATIONS – CLOWES.....	25
7.5.1 <i>Site Preparation</i>	25
7.5.2 <i>Engineered Fill</i>	25
8.0 CLOSURE	27

TABLES

TABLE 1	Borehole and Test Pit Locations and Ground Surface Elevations	Page 8
TABLE 2	Bedrock Core Information – Nicholson's	Page 13
TABLE 3	Bedrock Core Information - Clowes	Page 15
TABLE 4	Grain Size Analysis Results	Page 17
TABLE 5	Water Levels – Nicholson's	Page 18
TABLE 6	Water Levels – Clowes	Page 19
TABLE 7	Soil Types	Page 21
TABLE 8	Earth Pressure Parameters – Excavations	Page 22
TABLE 9	Earth Pressure Parameters – Retaining Walls	Page 23

LIST OF APPENDICES

APPENDIX 1	Report Limitations	1 page
APPENDIX 2	Site Location Plan	1 page
APPENDIX 3	Borehole and Test Pit Location Plan – Nicholson's	1 page
APPENDIX 4	Borehole Location Plan – Clowes	1 page
APPENDIX 5	Record of Boreholes and Test Pits – Nicholson's	20 pages
APPENDIX 6	Record of Boreholes – Clowes	4 pages
APPENDIX 7	Test Pit Photo Log	8 pages
APPENDIX 8	Bedrock Core Photos	6 pages
APPENDIX 9	Geotechnical Laboratory Results	3 pages

Note 1: This report contains 27 pages and 9 appendices.

Note 2: The content of this report cannot be reproduced, in whole or in part, without written consent of **DBA Engineering Ltd.**

1.0 INTRODUCTION

DBA Engineering Ltd. (DBA) was retained by SNC-Lavalin Infrastructure and Construction on behalf of Parks Canada (the Client) to carry out a Geotechnical Investigation at the earth dam located at Upper Nicholson's Lock (Nicholson's) and at the upper west embankment adjacent to a hydraulic control structure at Clowes Lock (Clowes), on the Rideau Canal system, located near the village of Andrewsville, Ontario.

The objectives of this geotechnical assignment are:

- To secure soil and groundwater information/data (obtained from borehole and test pit locations) about the site that could affect the design of the rehabilitation efforts at each site, including the potential effects that the soil and groundwater may have on construction procedures; and
- To prepare a geotechnical report in order to provide factual geotechnical data in support of other disciplines, as well as discussion related to construction procedures (i.e. site preparation, excavation and earthworks, dewatering, backfilling) based on the information obtained during the geotechnical site investigation.

It must be noted that the scope of this mandate was solely limited to geotechnical investigation and did not include any environmental aspects pertaining to site soils or groundwater.

The report is prepared with the condition that all designs are in accordance with applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. Further, any recommendations and opinions expressed in this report are applicable only to the proposed project.

On-going liaison with DBA during the final design and construction phase of the project is recommended to ensure that the recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project should be directed to DBA for further elaboration and/or clarification.

This report has been prepared solely and exclusively for the Client for the purpose mentioned above and it is subject to the limitations stated in Appendix 1. All changes to the proposed project should be submitted to DBA to ensure the pertinence of the recommendations.

Contractors and others involved in the construction of this project are advised to make an independent assessment of the subsoil and groundwater conditions for the purpose of establishing quantities, schedules, and construction techniques. The contractor is responsible for the field operations including the work schedule and the equipment selection. DBA cannot be held responsible for faulty work and poor equipment selection and unexpected work resulting from poorly understood soil and groundwater conditions.

2.0 PROJECT DESCRIPTION

We understand that the project consists of two parts: rehabilitation of an existing earth dam at Upper Nicholson's lock station, and grade raising at the upper west embankment at Clowes lock station. The construction and repair approach at each location is to be finalized by the design team.

The rehabilitation effort at Nicholson's is due to observation of sink holes developing in the dam surface. Based on information provided by the Client, we understand the existing earth fill dam has been constructed behind a historic masonry wall (canal wall) with a reinforced concrete retaining wall constructed behind the masonry wall in approximately 1976. The goal of the rehabilitation will be to prevent any further ground loss by repairing the existing retaining wall and undertaking ground improvement on the existing dam adjacent to the wall area.



Figure 1 - Nicholson's Earth Dam - upstream side, looking west at canal wall (June 01-2015)

We understand that measures such as grade alterations at the Upper West Embankment at Clowes Lock station will be necessary in order to prevent the bypass of the hydraulic control structure (spillway) under high water conditions, and mitigate related erosion/ground loss

concerns. In addition to the geotechnical investigation, input from both civil engineering and hydraulic/hydrology specialists is expected to be required at this site, in order to determine upstream impacts of any grade raise on the river banks.

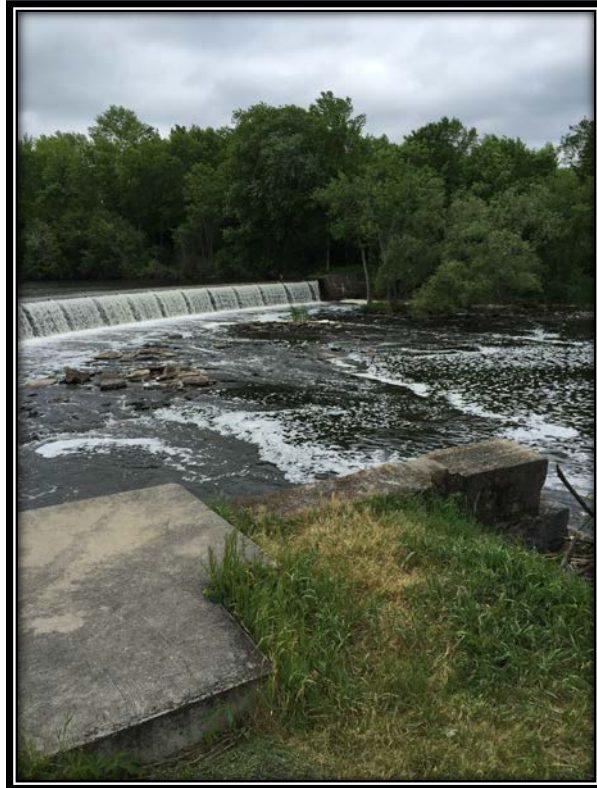


Figure 2 - Spillway structure and Clowes Upper West Embankment (June 01-2015)

It should be noted that DBA's scope of work does not include design work. Factual geotechnical data, as well as discussion pertaining to construction procedures will be provided for review by other disciplines, who will decide on corrective measures to be taken at each site.

A Site Location Plan is presented in Appendix 2 of this report.

3.0 METHOD OF INVESTIGATION

3.1 Fieldwork

3.1.1 General Remarks

An initial site visit was carried out on June 1, 2015 by DBA in order to review and evaluate existing site conditions, along with a Parks Canada representative.

Prior to field activities, public utility clearances were obtained in order to verify borehole and test pit locations were clear of buried utilities. Drilling and excavating activities were undertaken at Nicholson's between July 25th and August 5th, 2015, under the constant supervision of DBA technical staff. Drilling activities were undertaken at Clowes on August 7, 2015. Subsequent to the completion of drilling activities, all boreholes were backfilled, and installed piezometers protected with either flush mounted covers or above ground monument covers. Subsequent to completion of excavating activities, all test pits were backfilled.

3.1.2 Borehole Investigation – Nicholson's

3.1.2.1 Equipment

A total of eleven (11) boreholes, identified as BH1-N to BH11-N were advanced with a man-portable 'Beaver' drilling rig (pictured below) – this equipment was necessary due to a weight limitation of 5 tons on each of the bridges which allow access to this site.

Due to the presence of cobbles within the overburden and limited power of the small drill rig, boreholes were advanced by rotation of 'N' sized (89 mm diameter) drill casing. Samples were retrieved using a split-barrel sampler and 'N' sized double barrelled wireline coring equipment.

3.1.2.2 Sampling and Insitu Testing

Representative disturbed samples of the soil strata penetrated were obtained during drilling within the overburden, utilizing a 50 mm diameter split-barrel sampler. The sampler was advanced by dropping a 63.5 kg hammer from a free-fall height of 760 mm, in accordance with the standard penetration test method (ASTM D1586).

'N' size (47.6 mm core diameter) diamond wireline coring was utilized in all boreholes in order to clear the inside of the 'N' sized drill casing, and advance through cobble-laden overburden soils. Upon encountering suspected bedrock (based on visual observation of casing advance and return of spoils from casing), the core barrel was carried further into bedrock in retrieve a continuous bedrock sample and estimate bedrock depth below ground surface. The DBA field supervisor documented the percentage recovery of the bedrock, Rock Quality Designation (RQD), and presence of any apparent voids or cavities in the bedrock during this phase of coring. The spoils from advancing the core barrel through the cobble laden overburden as well as retrieved bedrock were placed in partitioned cardboard core boxes which were clearly marked.



Figure 3 – 'Beaver' man-portable rig during drilling operations (July 30-2015)

3.1.3 Test Pit Investigation – Nicholson's

Eight (8) test pits, identified as TP1-N through TP8-N were excavated at the Nicholson's site using a rubber tracked Case CX31 mini-excavator. Soil horizons and notable features within the test pits were measured and logged, and hand grab samples were collected where applicable. Six (6) of

the test pits were advanced adjacent to the canal wall in order to expose the reinforced concrete retaining wall and document existing wall conditions.

A photo log of the test pits can be found attached at the end of this report in Appendix 7.

3.1.4 Borehole Investigation – Clowes

A total of four (4) boreholes, identified as BH1-C to BH4-C were advanced with a track mounted CME-55 drilling rig (pictured below). Boreholes were advanced using 200 mm diameter continuous flight hollow stem augers. Samples were retrieved using a split-barrel sampler and 'N' sized double barrelled wireline coring equipment.

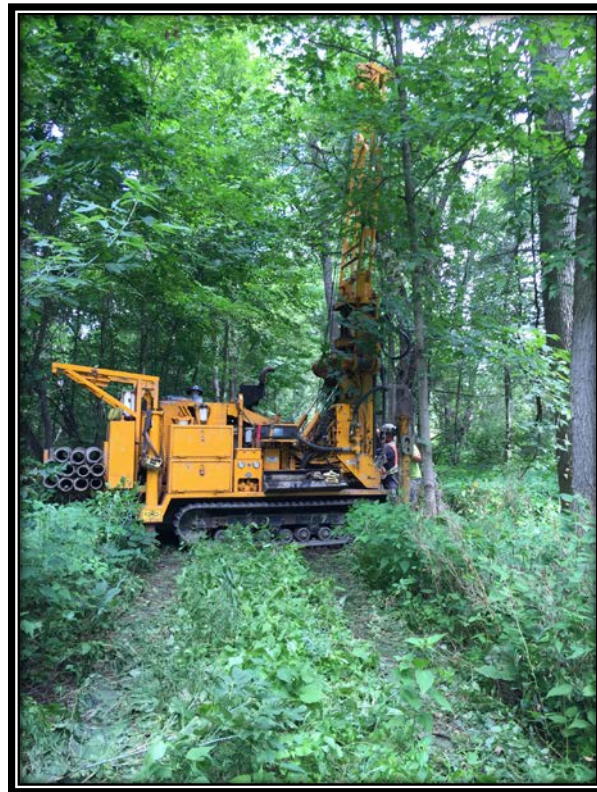


Figure 4 - CME-55 rig during drilling operations (August 07-2015)

3.1.4.1 Sampling and Insitu Testing

Representative disturbed samples of the soil strata penetrated were obtained during drilling within the overburden, utilizing a 50 mm diameter split-barrel sampler. The sampler was

advanced by dropping a 63.5 kg hammer from a free-fall height of 760 mm, in accordance with the standard penetration test method (ASTM D1586).

Diamond wireline coring was carried out upon encountering auger refusal, in order to confirm the bedrock elevation and to investigate the bedrock quality in borehole BH1. Rock coring was advanced to depth of 1.6 m below auger refusal. The DBA field supervisor documented the percentage recovery, Rock Quality Designation (RQD), and presence of any apparent voids or cavities in the bedrock. The rock cores were placed in partitioned core boxes and clearly marked.

3.1.5 Borehole and Test Pit Elevations and Locations

All boreholes and the test pit were laid out in the field by DBA, and final locations marked with wooden stakes. Borehole and test pit locations and ground surface were collected by a surveying sub-consultant, Annis O'Sullivan Vollebakk Ltd., and provided to DBA. The local benchmark utilized for surveying at both Nicholson's and Clowes was described as a tablet set into the top of the stone retaining wall adjacent to the swing bridge with an elevation of 93.905 m above mean sea level (AMSL). The following table summarizes the borehole and test pit locations and ground surface elevations at each test location, at both Nicholson's and Clowes sites. Reportedly, elevations are referred to the CGVD28 geodetic datum, and coordinates are referred to the Central Meridian of MTM Zone 9, NAD-83 (CSRS) (1997,0).

TABLE 1: Borehole and Test Pit Locations and Ground Surface Elevations

Nicholson's Earth Dam Site			
Borehole ID	Northing	Easting	Elevation (m AMSL)
BH1-N	4979216	358626	93.6
BH2-N	4979192	358615	93.5
BH3-N	4979143	358568	93.5
BH4-N	4979138	358578	94.4
BH5-N	4979136	358591	93.7
BH6-N	4979114	358540	93.1
BH7-N	4979096	358574	93.7
BH8-N	4979045	358551	93.5
BH9-N	4979015	358516	93.9
BH10-N	4979004	358531	93.6
BH11-N	4978960	358507	93.6
TP1-N	4979209	358623	93.6

Borehole ID	Northing	Easting	Elevation (m)
TP2-N	4979157	358601	93.7
TP3-N	4979141	358573	93.3
TP4-N	4979114	358582	93.7
TP5-N	4979105	358555	93.2
TP6-N	4979069	358563	93.5
TP7-N	4979019	358540	93.5
TP8-N	4978980	358522	93.6
Clowes Upper West Embankment Site			
Borehole ID	Northing	Easting	Elevation (m)
BH1-C	4978958	358412	93.4
BH2-C	4978942	358393	94.5
BH3-C	4978927	358382	93.6
BH4-C	4978906	358366	93.9

It should be noted that elevations and coordinates presented above are approximate, and should not be used for construction purposes.

Borehole and Test Pit Location Plans for Nicholson's and Clowes sites are presented in Appendices 3 and 4 of this report, respectively.

4.0 SUBSOIL CONDITIONS

4.1 General Remarks

The soil descriptions given in this report and the borehole logs are based on current geotechnical practice, as per the *Canadian Foundation Engineering Manual, 4th Edition*. The various terms describing the soils are given at the beginning of Appendix 5.

Details of the subsurface conditions encountered are presented on the individual borehole and test pit logs attached to this report for the Nicholson's and Clowes sites as Appendices 5 and 6, respectively. It is emphasized however, that the soil types, their sequence, thickness and physical properties may vary between test locations and samples both vertically and horizontally. The encountered subsoil conditions are summarized as follows:

4.2 Nicholson's Earth Dam

4.2.1 Surficial Coverings

A surficial covering of black sandy topsoil was encountered at all borehole and test pit locations except borehole BH9-N. A heavy root mat was also noted within the topsoil at test pits TP3-N and TP5-N locations. The approximate thickness of the topsoil observed at each borehole and test pit location was as follows:

- 75 mm at BH1-N;
- 100 mm at BH2-N;
- 75 mm at BH3-N;
- 50 mm at BH4-N;
- 100 mm at BH5-N;
- 50 mm at BH6-N;
- 50 mm at BH7-N;
- 50 mm at BH8-N;
- 50 mm at BH10-N;
- 50 mm at BH11-N;
- 50 mm at TP1-N;
- 50 mm at TP2-N;
- 150 mm at TP3-N;
- 100 mm at TP4-N;
- 300 mm at TP5-N;
- 100 mm at TP6-N;
- 75 mm at TP7-N; and
- 100 mm at TP8-N.

A black geosynthetic fabric (appeared to be non-woven) was noted in test pits TP7-N and TP8-N, directly underlying the topsoil layer.

4.2.2 Sand Fill

A brown sand fill with trace to some gravel, trace to some silt, and trace to some cobbles (depths are approximate - visually observed at test pit locations and inferred at borehole locations due to sampler refusals and recovered cobbles from casing), was encountered at all locations with the exception of borehole BH9-N, TP3-N and TP7-N, in the following intervals:

- BH1-N from 0.05 m below ground surface (mbgs) to 0.1 mbgs;
- BH2-N from 0.1 to 1.7 mbgs;
- BH3-N from 0.075 to 1.1 mbgs;
- BH4-N from 0.05 to 1.5 mbgs;
- BH5-N from 0.05 to 1.6 mbgs;
- BH6-N from 0.05 to 0.7 mbgs;
- BH7-N from 0.05 to 1.4 mbgs;
- BH8-N from 0.05 to 1.2 mbgs;
- BH10-N from 0.05 to 1.4 mbgs;
- BH11-N from 0.05 to 2.2 mbgs;
- TP1-N from 0.05 to 0.1 mbgs;
- TP2-N from 0.05 to 1.8 mbgs (end of test pit);
- TP4-N from 0.1 to 1.4 mbgs (end of test pit);
- TP5-N from 0.3 to 1.0 mbgs;
- TP6-N from 0.1 to 1.4 mbgs (end of test pit);
- TP8-N from 0.1 to 2.3 mbgs (end of test pit).

With the exception of samples identified as BH2-N-SS2, BH4-N-SS2, and BH7-N-SS1, with Standard Penetration Test (SPT) 'N' values of 43, 25 and 28, respectively, the SPT 'N' values within this material were found to range from 3 to 19 blows per 300 mm of penetration, indicating a very loose to compact state of compaction. Refusal to the sampler was encountered within this material at all borehole locations at depths varying from 0.2 to 1.5 mbgs, on assumed cobbles/possible boulders.

The recovered samples of the deposit were visually described to be in a moist to saturated condition. Moisture content measurements obtained on the extracted samples were found to be

between 6% and 29% by weight. It should be noted that moisture content observed and measured in borehole samples may not be indicative of in-situ conditions due to introduction of water during advancement of casing.

A white geosynthetic fabric (appeared to be non-woven) was noted in test pits TP1-N, directly underlying the sand fill layer.

4.2.3 Cobble / Cobble and Boulder Fill

A grey to light brown cobble and boulder fill was observed at borehole BH9-N and test pits TP1-N, TP3-N and TP7-N. A cobble fill was also observed at test pit TP1-N. Trace to some sand and gravel and trace silt and clay was noted within this material in the test pits. This material was observed in the following intervals:

- BH9-N from ground surface to 2.2 mbgs;
- TP1-N from 0.1 to 1.8 mbgs (end of test pit);
- TP3-N from 0.2 to 1.0 mbgs; and
- TP7-N from 0.075 to 1.4 mbgs.

The recovered samples of the deposit were visually described to be in a moist wet condition. Bulk samples of this material were not retrieved during this investigation.

4.2.4 Silty Sand

A light brown native silty sand with some gravel and trace cobbles, which had possibly been reworked, was observed in test pits TP3-N and TP5-N. This material was observed in the following intervals:

- TP3 from 1.0 to 1.5 mbgs (end of test pit); and
- TP5 from 1.0 to 1.3 mbgs (end of test pit).

The recovered samples were visually described to be in a moist condition. Moisture content measurements obtained on the extracted samples were found to be between 5% and 13% by weight.

4.2.5 Bedrock

A limited amount of bedrock coring was carried out upon suspected termination of cobble and boulder fill in all boreholes, based on visual observation of casing advancement, in order to estimate depth to bedrock surface – however, it should be noted that the presence of large boulders and/or weathered slabs may produce a false indication of bedrock surface.

Coring was carried out using 'N' sized double tube wireline equipment, allowing recovery of 47.6mm diameter cores. A summary of the obtained information is presented in the following table and the core drilling information and material description is reported on the respective borehole logs.

TABLE 2: Bedrock Core Information – Nicholson's

Borehole/Core Run ID	Depth of Borehole (m)	Depth to Bedrock Surface (m) / m AMSL	Total Core Recovery (%)	Solid Core Recovery (%)	RQD (%)
BH1-N-RC1	3.2	2.2 / 91.6	100	93	12
BH2-N -RC1	2.5	1.8 / 91.7	100	92	21
BH3-N -RC1	2.4	1.1 / 92.4	100	96	26
BH4-N -RC1	2.5	1.5 / 92.9	100	95	39
BH5-N -RC1	2.5	1.6 / 92.1	100	94	47
BH6-N -RC1	1.8	0.7 / 92.4	100	95	34
BH7-N -RC1	2.1	1.4 / 92.3	100	78	29
BH8-N -RC1	2.2	1.2 / 92.3	100	90	36
BH9-N -RC1	2.2	2.2 / 91.7	100	94	36
BH10-N -RC1	2.6	1.4 / 92.2	100	92	25
BH11-N -RC1	3.7	2.2 /	100	97	35

The samples were visually described by the field supervisor and subsequently re-examined in the laboratory. Photo logs of the obtained cores are presented in Appendix 8.

Detailed descriptions of the index properties at the location of this borehole are presented in the following paragraphs.

Total Core Recovery (TCR) of the obtained rock core was found to be 100%.

Solid Core Recovery (SCR) was found to be between 78% and 97%. The SCR index is generally influenced by the orientations of the joints and is low when joints oblique to the borehole axis are intercepted.

Rock Quality Designation (RQD) index is highly dependent on the frequency of joints and bedding plane partings in the rock cores. While the use of double tube core barrel provided reasonably good protection of the core during drilling and core retrieval, the nature of the encountered material greatly influences the RQD values. The recorded RQD values ranged between 12% and 47%, indicating rock quality ranging from very poor to poor. On the basis of the measured RQD values (a mean value of 31% within the depths cored), over all, the rock quality within the upper approximately 1.5 m is expected to be poor.

4.3 Clowes Upper West Embankment

4.3.1 Surficial Coverings

A surficial covering of black sandy topsoil was encountered at all borehole locations. The approximate thickness of the topsoil observed at each borehole location was as follows:

- 100 mm at BH1-C;
- 50 mm at BH2-C;
- 50 mm at BH3-C; and
- 50 mm at BH4-C.

4.3.2 Silty Sand Fill

A blackish brown silty sand fill with trace gravel, some organics and possible cobbles and boulders (inferred from auger grinding) was observed at all borehole locations. Possible peat material was noted within boreholes BH3 and BH4. This material was observed in the following intervals:

- BH1-C from 0.05 to 1.7 mbgs;
- BH2-C from 0.05 to 1.5 mbgs (end of borehole);

- BH3-C from 0.05 to 1.2 mbgs (end of borehole); and
- BH4-C from 0.05 to 1.5 mbgs (end of borehole).

The SPT 'N' values within this material were observed to range from 2 to 7, indicating a very loose to loose consistency. Refusal to the sampler was observed in samples identified as BH1-C-SS2, BH1-C-SS3, BH2-C-SS2 and BH3-C-SS3.

The recovered samples were visually described as ranging from a moist to a saturated condition. Moisture content measurements obtained on the extracted samples were found to be between 7% and 41% by weight.

4.3.3 Bedrock

Bedrock coring was carried out in borehole BH1 upon encountering auger refusal, in order to confirm its presence, type and quality. The coring was carried out using 'N' sized double tube wireline equipment, allowing recovery of 47.6mm diameter cores. A summary of the obtained information is presented in the following table and the core drilling information and material description is reported on the respective borehole logs.

TABLE 3: Bedrock Core Information – Clowes

Borehole/Core Run ID	Depth of Borehole (m)	Depth to Bedrock Surface (m) / m AMSL	Total Core Recovery (%)	Solid Core Recovery (%)	RQD (%)
BH1-C-RC1	3.3	1.7 /	94	77	25

The samples were visually described by the field supervisor and subsequently re-examined in the laboratory. Photo logs of the obtained cores are presented in Appendix 8.

Detailed descriptions of the index properties at the location of this borehole are presented in the following paragraphs.

Total Core Recovery (TCR) of the obtained rock core was found to be 94%.

Solid Core Recovery (SCR) was found to be 77%. The SCR index is generally influenced by the orientations of the joints and is low when joints oblique to the borehole axis are intercepted.

Rock Quality Designation (RQD) index is highly dependent on the frequency of joints and bedding plane partings in the rock cores. While the use of double tube core barrel provided reasonably good protection of the core during drilling and core retrieval, the nature of the encountered material greatly influences the RQD values. The recorded RQD value was 25%, indicating poor rock quality.

5.0 LABORATORY

5.1 Geotechnical Laboratory Testing

All samples collected in the field were transported to DBA's Kingston, Ontario laboratory. Visual soil classifications made in the field were verified by peer review in the lab. Moisture contents were measured in all retrieved samples. Grain size testing was carried out on three (3) samples from Nicholson's identified as TP2-N-GS1, TP4-N-GS1 and TP8-N-GS1. Detailed results of geotechnical laboratory testing can be seen attached in Appendix 9 of this report. The following tables summarize the results of the grain size testing:

TABLE 4: Grain Size Analysis Results

Sample ID	Depth (mbgs)	Gravel (%)	Sand (%)	Silt and Clay (%)
TP2-N-GS1	0.1-0.6	1	92	7
TP4-N-GS1	0.1-1.4	3	91	6
TP8-N-GS1	0.3-1.4	4	90	6

6.0 GROUNDWATER

A hydrogeological study was not undertaken as a part of this scope of work. However, water levels were observed in open test pits prior to backfilling, and in boreholes and upon completion of drilling activities at Clowes, prior to coring activities or backfilling. Water observations in open boreholes at Nicholson's subsequent to drilling activities were not recorded due to introduction of water during the drilling process. In addition, a total of nine (9) 37.5 mm diameter PVC standpipe piezometers were installed in at Nicholson's, in boreholes BH1-N, BH3-N, BH5-N, BH6-N, BH7-N, BH9-N, BH10-N and BH11-N, in order to establish static water levels. Two (2) 50 mm diameter PVC monitoring wells were installed in boreholes BH2-C and BH4-C at Clowes. Water levels observed upon drilling and excavating completion and at subsequent measurements are summarized in the tables below:

TABLE 5: Water Levels – Nicholson's

Borehole ID	Water Level Observed Upon Drilling Completion (mbgs / m AMSL)	Water Level Observed Subsequent to Drilling in Installed Piezometers on August 12, 2015 (mbgs / m AMSL)
BH1-N	No level observed – water introduced during casing advancement. All piezometers developed prior to subsequent observations.	0.82 / 92.78
BH3-N		0.90 / 92.6
BH4-N		1.0 / 93.4
BH5-N		0.92 / 92.78
BH6-N		Dry
BH7-N		0.77 / 92.93
BH9-N		Dry
BH10-N		1.19 / 92.41
BH11-N		Dry
TP1-N		1.1 / 92.5
TP2-N	1.5 / 92.2	N/A
TP3-N	Dry	N/A
TP4-N	0.9 / 92.8	N/A
TP5-N	Dry	N/A
TP6-N	0.8 / 92.7	N/A

Borehole ID	Water Level Observed Upon Drilling Completion (mbgs / m AMSL)	Water Level Observed Subsequent to Drilling in Installed Piezometers on August 12, 2015 (mbgs / m AMSL)
TP7-N	0.8 / 92.7	N/A
TP8-N	Dry	N/A

*N/A – Not applicable, no piezometer installed

TABLE 6: Water Levels – Clowes

Borehole ID	Water Level Observed Upon Drilling Completion (mbgs / m AMSL)	Water Level Observed Subsequent to Drilling in Installed Piezometers on August 12, 2015 (mbgs / m AMSL)
BH1-C	1.5 / 91.9	N/A
BH2-C	0.7 / 93.8	0.8 / 93.7
BH3-C	0.9 / 92.7	N/A
BH4-C	0.7 / 93.2	0.5 / 93.4

*N/A – Not applicable, no piezometer installed

It should be noted that the groundwater levels can fluctuate greatly and be located at different elevations depending on the seasonal and the atmospheric conditions – i.e. heavy rains, spring thaw, dry spells, etc.

7.0 DISCUSSION

7.1 General

A small hole was observed at the base of the reinforced concrete retaining wall located behind the masonry block wall at test pit TP4-N, which allowed a heavy influx of canal water into the test pit. However, the exact source of groundwater throughout the Nicholson's site could not be positively identified – it should be considered that flow may be occurring both through the existing masonry and reinforced concrete walls, as well as through the canal bottom and weathered bedrock. Additional investigation of the canal bottom by both geotechnical and other disciplines should be considered.

Based on our understanding of the current issue of overflow of the existing embankment at Clowes, we understand that grade alterations may be undertaken. Fill soils encountered on site were noted to contain organics – such soils would not be considered suitable for reuse during an Engineered Fill operations, therefore imported backfill material may be required.

7.2 Excavation

7.2.1 General

It is expected that excavations of up to 2.3 m could take place at Nicholson's, depending on if/where the reinforced concrete retaining is exposed, and excavations up to 1.7 m may take place at Clowes, depending on grade alterations. It will be necessary to keep all excavations dry.

All excavations should be carried out in accordance with the latest edition of the Ontario Occupational Health & Safety Act and Regulations for Construction Projects.

The OHSA regulations require that if workmen must enter an excavation deeper than 1.2m, the excavation must be suitably sloped and/or braced in accordance with the OHSA requirements. OHSA specifies maximum slope of the excavations for four broad soil types as summarized in the following table:

TABLE 7: Soil Types

Soil Type	Base of Slope	Maximum Slope Inclination
1	Within 1.2 meters of bottom	1 horizontal to 1 vertical
2	Within 1.2 meters of bottom of trench	1 horizontal to 1 vertical
3	From bottom of excavation	1 horizontal to 1 vertical
4	From bottom of excavation	3 horizontal to 1 vertical

Loose to very loose fill soils at both Nicholsons and Clowes sites should be considered as Type 4 soils. If native soils are encountered at Nicholson's, they may be considered as Type 3, provided they are unaffected by seepage. Any soils affected by seepage must be considered as Type 4 soils.

Excavations into overburden should be relatively easy using conventional excavating equipment, however fill materials are expected to contain cobbles, as well as some boulder sized material.

Stockpiles of excavated materials must be kept from the edge of any excavation to avoid slope instability. It is therefore important to make sure to keep a distance from the edge at least equal to the depth of the excavation. This distance is also applicable for the passage of heavy machinery near excavations. This condition must be respected at all times unless specific studies are conducted for each case. Care must also be taken to avoid overloading of any underground services/structures by stockpile of materials.

7.2.2 Temporary Shoring

Temporary shoring may be required at this site towards the south end of the canal wall if insufficient working area should be available in order to properly backslope excavations. If shoring becomes necessary, systems such as braced trench boxes may be utilized. Based on the conditions encountered at the Site, the following design parameters can be used for the design of shoring systems:

TABLE 8: Earth Pressure Parameters - Excavations

Soil	Bulk Unit Weight	Angle of Internal Friction	At-rest Coefficient of Lateral Earth Pressure
	γ (kN/m ³)	ϕ	K_o
Earth Fill (clayey)	19	22	0.45
Earth Fill (gravelly)	20	25-29	0.57

Shoring of excavation systems should be designed in accordance with the most current edition of the Canadian Foundation Engineering Manual and the Occupational Health and Safety act and Regulations for Construction Projects.

Water level should be assumed to be at the ground surface in the design of all shoring systems.

7.3 Dewatering

A detailed groundwater study was not a part of this scope of work, however as mentioned above, standing water levels were observed between 0.77 and 1.5 mbgs at Nicholson's, and 0.7 and 0.9 mbgs at Clowes.

We understand that work at Nicholson's will take place during winter months when the canal is drained - it is expected that water levels behind the canal wall would correspondingly decrease as a result. However, a number of filtered sumps and pumps may be required in order to control localized perched water and/or surface water influx. It is recommended that several test pits be excavated by contractors so that they can properly evaluate groundwater conditions prior to the start of construction.

At the Clowes site, some overflow of the Rideau River onto the existing embankment adjacent to the control structure was observed at the time of the field investigation. Based on discussion with Parks Canada, we understand such overflow may increase significantly during wet seasonal periods. Diversion methods such as construction of cofferdams and pumping will likely be necessary at the Clowes site in order to perform the necessary grade alteration operations on/near the bank of the Rideau River. A Permit to Take Water (PTTW) under the Ontario Ministry of the Environment (MOE) may be required to facilitate diversionary pumping efforts,

which may require a further hydrogeological study and/or additional background engineering investigations.

7.4 Retaining Walls – Nicholson's

7.4.1 Wall Design

Based on the observations during the field investigation, and depending on the final remedial action determined by other disciplines, replacement of backfill material behind the existing reinforced concrete retaining wall may take place, in addition to possible reconstruction of some, or the entire wall itself. As such, the following comments and parameters are provided for use by designers: “

Backfill materials behind retaining structures should consist of non-frost susceptible, free draining granular materials, such as those described in Ontario Provincial Standard Specifications. For design purposes, the following parameters can be considered:

TABLE 9: Earth Pressure Parameters – Retaining Walls

Soil	Bulk Unit Weight	Angle of Internal Friction	Coefficient of Lateral Earth Pressure		
	γ (kN/m ³)	ϕ	K_a	K_o	K_p
Compacted Granular 'A'	22	35	0.27	0.43	3.70
Compacted Granular 'B' Type II	21	32	0.30	0.47	3.30
19mm Clean Crushed Stone	21	30	0.33	0.50	3.00

Structures subject to unbalanced earth pressures such as retaining walls must be designed to resist a pressure that can be calculated based on the following equation:

$$P = K[\gamma(h-h_w) + \gamma' h_w + q] + \gamma_w h_w$$

where: **P** = the horizontal pressure at depth, **h** (m)

K = the earth pressure coefficient,

γ = the bulk unit weight of soil, (kN/m³)

γ' = the submerged unit weight of soil, (kN/m³)

h_w = the depth below the groundwater level (m)

q = the complete surcharge loading (kPa)

The earth pressure coefficient to be used in design will depend on whether the retaining structure is restrained, or movements are allowed such that the active and passive states of earth pressure can develop. If retaining structures are restrained and do not allow lateral yielding, the at-rest pressures should be used for design.

The effects of compaction should be taken into account in the selection of the appropriate earth pressure coefficients.

7.4.2 Foundation Considerations

If portions of new retaining wall are constructed, it is expected that they would consist of shallow spread-type foundations bearing directly on weathered limestone bedrock.

In areas to be replaced, all existing foundations should be removed. Cobbles and loose slabs which are able to be manipulated with excavating equipment should be removed from foundation areas. The bedrock surface should be subsequently brushed or air-blown clean, and inspected by qualified geotechnical personnel. New foundations which are placed on weathered limestone which has been inspected as above may be designed with a bearing pressure of 250 kPa under Serviceability Limit States (SLS) conditions and 400 kPa under Ultimate Limit States (ULS) conditions. Higher bearing pressures may be available if excavations penetrate further through the weathered bedrock zone.

The upper fractured/weathered bedrock may also be considered as frost susceptible. Designers should consider a frost penetration depth of approximately 1.7 m in the Andrewsville, ON area. If rigid insulation is proposed, details on the most appropriate product type and its placement details are best obtained from individual product manufacturers.

7.5 Grade Alterations – Clowes

7.5.1 Site Preparation

Fill soils encountered at Clowes were all noted to contain organics at all borehole locations, including the possible presence of peat-type material in boreholes BH3 and BH4. In order to prevent possible settlements of new material placed during grade alteration operations due to time degradation of organic materials, excavation and removal of existing fills and the use of imported soils may be necessary.

If all fill soils are removed to expose a bedrock subgrade, it is recommended that they be examined by qualified geotechnical personnel prior to the placement of Engineered Fill (see section 7.5.2 below). If fill materials are left in place however, with the understanding that some settlements may occur over time, it is recommended that a thorough visual examination of the subgrade take place in order to identify and remove any pockets containing high concentrations of organic material. As well, a careful proof rolling of the subgrade should be carried out under the supervision of qualified geotechnical personnel. This would involve passing heavily loaded construction equipment (i.e. loaded tandem or tri-axel dump truck) over the subgrade surface in order to identify any localized weak areas. Identified areas should be sub-excavated and replaced with suitable fill soils as directed by geotechnical personnel.

7.5.2 Engineered Fill

The use of Engineered Fill for this project would be required for grade raising operations at Clowes, and also for possible material replacement at Nicholson's. For any fill operation to be considered Engineered Fill, the following criteria must be satisfied:

- Engineered Fill should consist of uniform, homogeneous material. The fill material should also be free of organics, deleterious materials (i.e. building debris such as bricks, metal etc.). Materials meeting Ontario Provincial Standard Specification, OPSS Granular B Type I or II specifications would be considered a suitable Engineered Fill material;
- Prior to the placement of Engineered Fill, it must be evaluated for suitability in the Geotechnical Laboratory. Samples should be provided to the Geotechnical Engineer and submitted for Standard Proctor and grain size analysis;
- Engineered fill must be compactable, and of a suitable moisture content such that it is within

- +/- 2.0% of its optimum moisture content, as determined through laboratory testing;
- Engineered Fill materials shall not be placed in a frozen state, nor on a frozen subgrade surface;
 - Engineered Fill must be placed under the continuous supervision of a Geotechnical Engineer or their designate;
 - Each layer of material should be placed in maximum 0.2m lifts, and uniformly compacted with heavy compaction equipment suitable for the type of fill used, to 100% of its SPMDD; and
 - Field density tests must be taken by the Geotechnical Engineer on each lift of Engineered Fill. Any Engineered Fill which is tested and found to be out of specification shall be either removed, reworked or retested.

8.0 CLOSURE

The information and discussion provided in this report is based on subsoil data obtained at the borehole locations. Experience indicates that the subsoil and groundwater conditions can vary significantly between and beyond the borehole and test pit locations. For this reason, the recommendations given in this report are subject to a field verification of the subsoil conditions at the time of construction.

Should any site condition encountered differ from those at the tested locations or any changes in the project, we request that we be notified immediately in order to permit reassessment of information provided in this report.

We trust that this report contains all of the information required at this time. If you have any questions regarding this report, or if we can be of further assistance on this project, please contact us.

APPENDIX 1
REPORT LIMITATIONS
(1 page)

REPORT LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the borehole and test pit locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the boreholes and test pits may differ from those encountered at the borehole and test pit locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the boreholes and test pits.

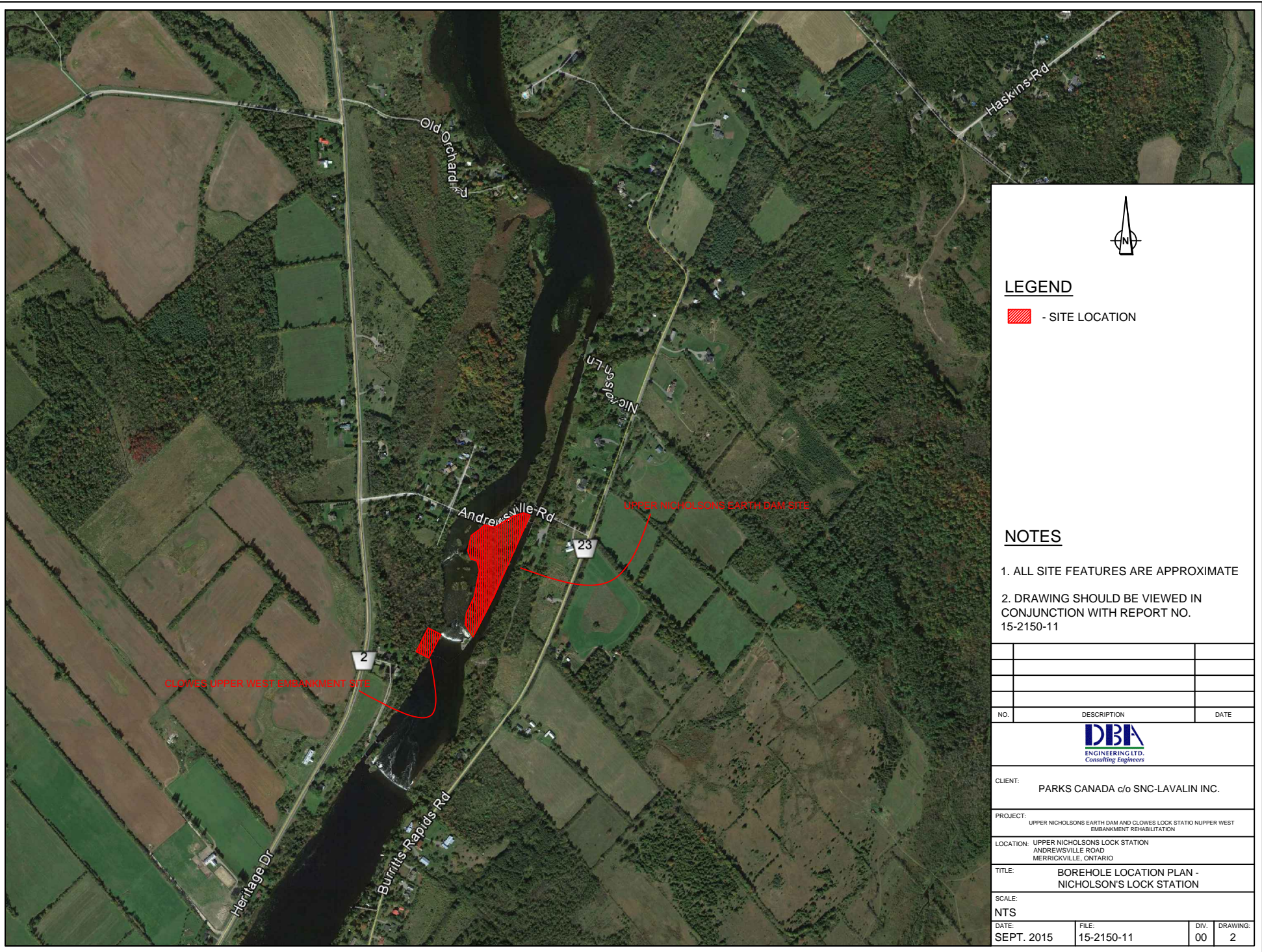
The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of the designer. The number of boreholes and test pits may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

The benchmark and elevations mentioned in this report were obtained strictly for use by this office in the geotechnical design of the project. They should not be used by any other party for any other purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. *DBA* accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

APPENDIX 2
SITE LOCATION PLAN
(1 page)



LEGEND

 - SITE LOCATION

NOTES

1. ALL SITE FEATURES ARE APPROXIMATE
2. DRAWING SHOULD BE VIEWED IN CONJUNCTION WITH REPORT NO. 15-2150-11

NO.	DESCRIPTION	DATE

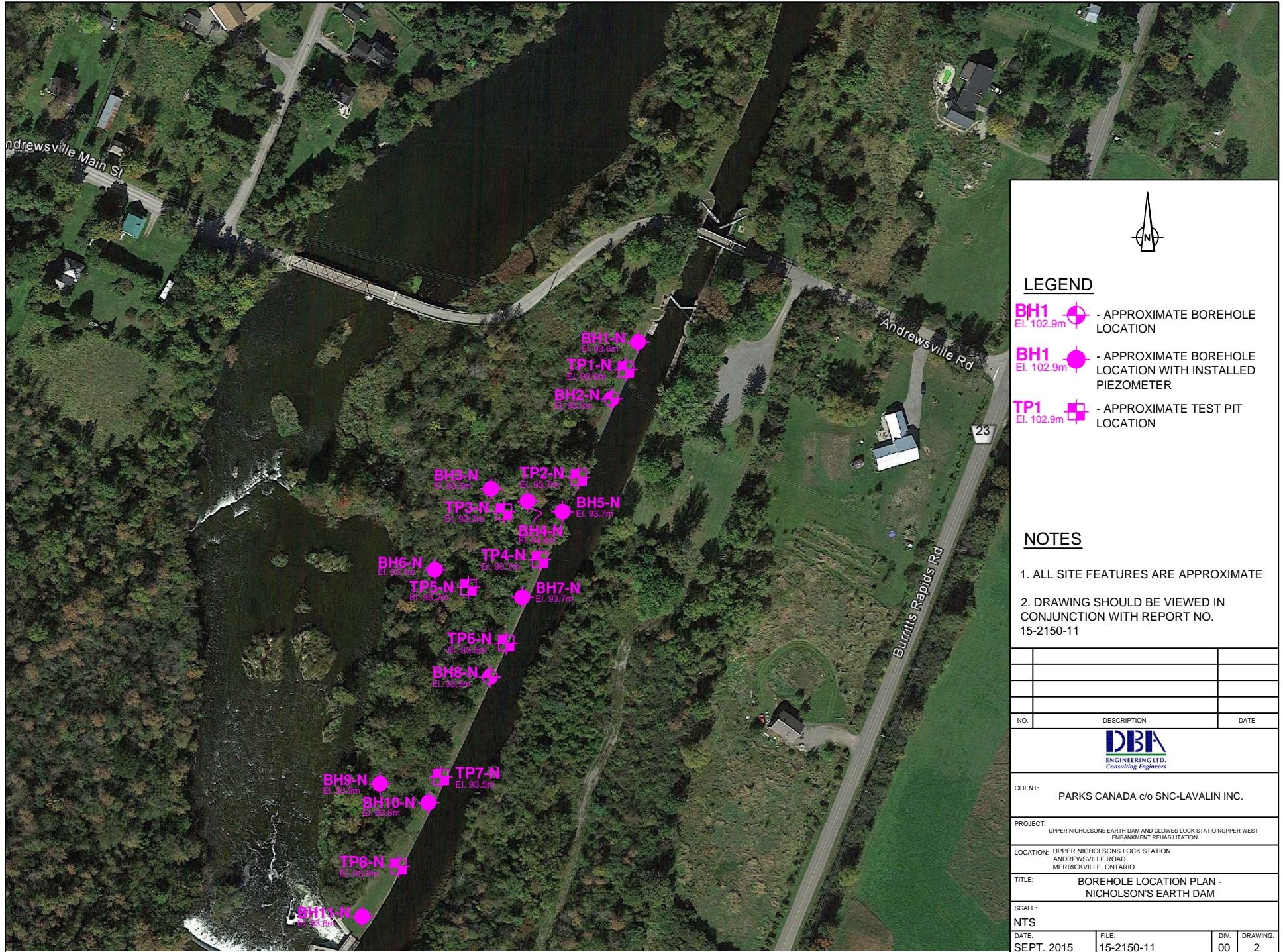


CLIENT: PARKS CANADA c/o SNC-LAVALIN INC.			
PROJECT: UPPER NICHOLSONS EARTH DAM AND CLOSES LOCK STATION NUPPER WEST EMBANKMENT REHABILITATION			
LOCATION: UPPER NICHOLSONS LOCK STATION ANDREWVILLE ROAD MERRICKVILLE, ONTARIO			
TITLE: BOREHOLE LOCATION PLAN - NICHOLSON'S LOCK STATION			
SCALE: NTS			
DATE: SEPT. 2015	FILE: 15-2150-11	DIV: 00	DRAWING: 2

APPENDIX 3

BOREHOLE AND TEST PIT LOCATION PLAN – NICHOLSON'S

(1 page)



LEGEND

- BH1** El. 102.9m - APPROXIMATE BOREHOLE LOCATION
- BH1** El. 102.9m - APPROXIMATE BOREHOLE LOCATION WITH INSTALLED PIEZOMETER
- TP1** El. 102.9m - APPROXIMATE TEST PIT LOCATION

NOTES

1. ALL SITE FEATURES ARE APPROXIMATE
2. DRAWING SHOULD BE VIEWED IN CONJUNCTION WITH REPORT NO. 15-2150-11

NO.	DESCRIPTION	DATE

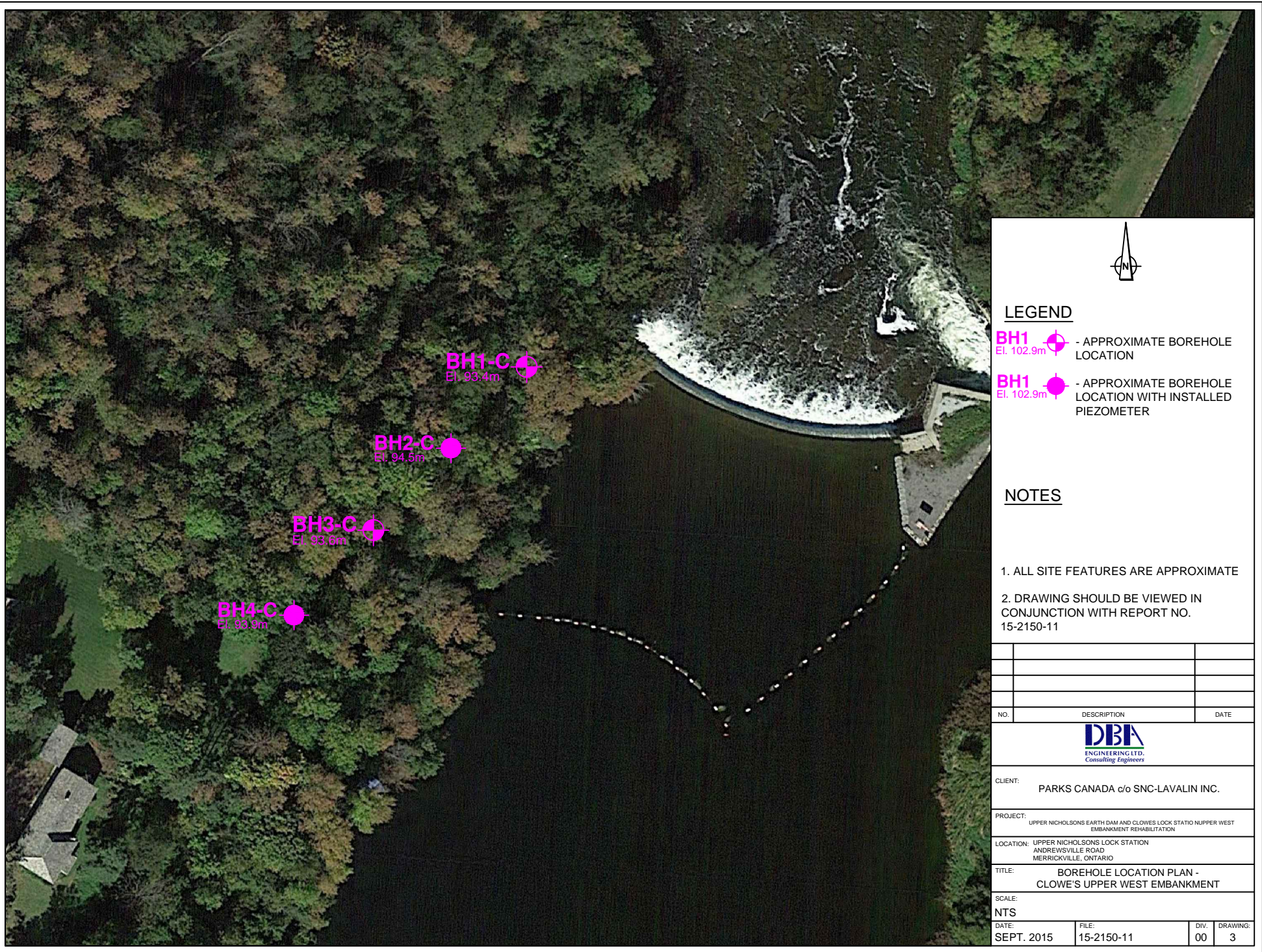


CLIENT: PARKS CANADA c/o SNC-LAVALIN INC.			
PROJECT: UPPER NICHOLSONS EARTH DAM AND CLOWES LOCK STATION NUPPER WEST EMBANKMENT REHABILITATION			
LOCATION: UPPER NICHOLSONS LOCK STATION ANDREWVILLE ROAD MERRICKVILLE, ONTARIO			
TITLE: BOREHOLE LOCATION PLAN - NICHOLSON'S EARTH DAM			
SCALE: NTS			
DATE: SEPT. 2015	FILE: 15-2150-11	DIV. 00	DRAWING: 2



APPENDIX 4

BOREHOLE LOCATION PLAN - CLOWES

(1 page)



LEGEND

- BH1**  - APPROXIMATE BOREHOLE LOCATION
- BH1**  - APPROXIMATE BOREHOLE LOCATION WITH INSTALLED PIEZOMETER

NOTES

1. ALL SITE FEATURES ARE APPROXIMATE
2. DRAWING SHOULD BE VIEWED IN CONJUNCTION WITH REPORT NO. 15-2150-11

NO.	DESCRIPTION	DATE



CLIENT: PARKS CANADA c/o SNC-LAVALIN INC.			
PROJECT: UPPER NICHOLSONS EARTH DAM AND CLOWES LOCK STATION NUPPER WEST EMBANKMENT REHABILITATION			
LOCATION: UPPER NICHOLSONS LOCK STATION ANDREWSVILLE ROAD MERRICKVILLE, ONTARIO			
TITLE: BOREHOLE LOCATION PLAN - CLOWE'S UPPER WEST EMBANKMENT			
SCALE: NTS			
DATE: SEPT. 2015	FILE: 15-2150-11	DIV: 00	DRAWING: 3

APPENDIX 5

RECORD OF BOREHOLES AND TEST PITS – NICHOLSON'S

(20 pages)

NOTES TO RECORD OF BOREHOLES

DRILLING DATA

Method:	
SolSt Auguring	- Solid Stem Auguring
HolSt Auguring	- Hollow Stem Auguring
WB	- Washed Boring

LABORATORY DATA

W _P	-	Plastic Limit
W	-	Water Content (%)
W _L	-	Liquid Limit
γ	-	Natural Unit Weight (kN/m ³)
UNDR STRNG or c _u	-	Undrained Shear Strength (kPa) Field Vane: St-sensitivity
pp	-	Pocket Penetrometer
UC	-	Unconfined Compression
UU	-	Unconsolidated Undrained at Overburden Pressure
CU	-	Consolidated Undrained
CD	-	Consolidated Drained
TOV	-	Total Organic Vapors

SAMPLES TYPE

SS	-	Split Spoon
AS	-	Auger Sample
TW	-	Thin wall Open
TP	-	Thin wall Piston
WS	-	Washed Sample
BS	-	Block Sample
RC	-	Rock Core
PH	-	Sample Advanced Hydraulically
PM	-	Sample Advanced Manually

Standard Penetration Test: The Standard Penetration Test (SPT) 'N'-values are the number of blows required to cause a standard 51 millimeters o.d. split barrel sampler to penetrate 0.3 meter into undisturbed ground in a borehole when driven by a hammer with a mass of 63.5 kilograms falling freely a distance of a 0.76 meter. For penetrations of less than 0.3 meter, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimeters penetration).

Dynamic Cone Penetration Test: Continuous penetration of a conical steel point (51 millimeters o.d. 60° cone angle) driven by 475 J impact energy on a size drill rods. The resistance to cone penetration is measured as the number of blows for each 0.3 meter advance of the conical point into the undisturbed ground.

Soils are described by their composition and consistency or relative density

CONSISTENCY: Cohesive soils are described on the basis of their undrained shear strength (c_u) or 'N'-values as follows:

c _u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	<i>VERY SOFT</i>	<i>SOFT</i>	<i>FIRM</i>	<i>STIFF</i>	<i>VERY STIFF</i>	<i>HARD</i>
N (blows/0.3 meter)	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	>30

COMPACTNESS CONDITION: Cohesionless soils are described on the basis of compactness condition as indicated by 'N'-values as follows:

N (blows/0.3 meters)	0 - 4	4 - 10	10 - 30	30 - 50	>50
	<i>VERY LOOSE</i>	<i>LOOSE</i>	<i>COMPACT</i>	<i>DENSE</i>	<i>VERY DENSE</i>

Rocks are described by their composition and structural features and/or strength

RECOVERY: Sum of all recovered rock core pieces from a coring run expressed as a percent of the total length of the coring run.

ROCK QUALITY DESIGNATION (RQD): Sum of those intact core pieces, 100 millimeters in length expressed as a percent of the length of the coring run. Classification of a rock based on the RQD value as follows:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	<i>VERY POOR</i>	<i>POOR</i>	<i>FAIR</i>	<i>GOOD</i>	<i>EXCELLENT</i>

JOINTING AND BEDDING:

SPACING	50 mm	50 - 300 mm	0.3 - 1.0 m	1.0 - 3.0 m	>3.0 m
JOINTING	<i>VERY CLOSE</i>	<i>CLOSE</i>	<i>MOD. CLOSE</i>	<i>WIDE</i>	<i>VERY WIDE</i>
BEDDING	<i>VERY THIN</i>	<i>THIN</i>	<i>MEDIUM</i>	<i>THICK</i>	<i>VERY THICK</i>

RECORD OF BOREHOLE No. BH1-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 89 mm 'N' Casing and Rods Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Man-portable 'Beaver' Drill Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 5, 15 Date Completed: Aug 5, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing	Soil Vapour Reading	Lower Explosive Limit (LEL)	Undrained Shear Strength (kPa)		
	Local Ground Surface Elevation: 93.6 m													
	black topsoil - sandy (approx. 75 mm) moist	93.525 0.075	SS	1	67	6								
	fill - sand, trace silt, trace gravel, trace organics possible cobbles loose moist		SS	2	25	7								
	refusal to sampler - advancing casing through 1.2 cobbles (fill, recovered from casing)	92.4												
	grey Limestone - very poor quality, moderately weathered, occasional calcite inclusion	91.6 2.0	RC	1	100									
	end of borehole in limestone	90.8 2.8												
	Note: 1. Coordinates: N 4979216 E 358626 2. Water level upon completion not applicable due to introduction of water during drilling process.													

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∇ Groundwater depth on completion of drilling: (N/A) m.
 ▽ Groundwater depth observed on August 12, 2015 at a depth of: 0.82 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH2-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 89 mm 'N' Casing and Rods Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankmen Drilling Machine: Man-portable 'Beaver' Drill Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Jul 31, 15 Date Completed: Jul 31, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING			INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 Lower Explosive Limit (LEL) W _p W _L Plastic Liquid 20 40 60 80			
	Local Ground Surface Elevation: 93.5 m												
	black topsoil - sandy (approx. 100 mm) moist brown fill - sand, trace silt, some gravel possible cobbles loose moist	93.4 0.7	SS	1	51	7		○	○ ₉				
			SS	2	13	43	1	○	○ ₆				
			SS	3	17	9		○	○ ₁₅				
	refusal to sampler - advancing casing through cobbles (fill, recovered from casing)	91.8 91.7											
	grey LIMESTONE - very poor quality, moderately weathered, occasional calcite inclusion	1.8	RC	1	100		2						SCR: 92% RQD: 21%
	end of borehole in limestone	91.0 2.5											
	Note: 1. Coordinates: N 4979192 E 358615												

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∇ Groundwater depth on completion of drilling: (N/A) m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

Scale: 1 : 26

Page: 1 of 1

RECORD OF BOREHOLE No. BH3-N



Project Number: 15-2150-11 Drilling Location: Cleared area within trees/brush Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 89 mm 'N' Casing and Rods Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Man-portable 'Beaver' Drill Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 4, 15 Date Completed: Aug 4, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing	Rinse pH Values	Soil Vapour Reading	Lower Explosive Limit (LEL)		
	Local Ground Surface Elevation: 93.5 m													
	black topsoil - sandy (approx. 75 mm) moist	93.425 0.075	SS	1	35	R				29				
	brown fill - sand, trace silt, some gravel possible cobbles moist	93.3 0.2												
	refusal to sampler - advancing casing through cobbles (fill, recovered from casing)						93							- bentonite seal, 37.5 mm PVC riser
	grey LIMESTONE- poor quality, moderately weathered, occasional calcite inclusion	92.4 1.1	RC	1	100									SCR: 96% RQD: 26%
	end of borehole in limestone	91.1 2.4												- filter sand, 37.5 mm PVC well screen
	Note: 1. Coordinates: N 4979143 E 358568 2. R denotes refusal to sampler													

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Groundwater depth on completion of drilling: (N/A) m.
 Groundwater depth observed on August 12, 2015 at a depth of: 0.9 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. **BH4-N**



Project Number: **15-2150-11** Drilling Location: **Cleared area within trees/brush** Logged by: **DH**
 Project Client: **Parks Canada, c/o SNC-Lavalin** Drilling Method: **89 mm 'N' Casing and Rods** Compiled by: **DH**
 Project Name: **Nicholsons Earth Dam and Clowes Upper West Embankment** Drilling Machine: **Man-portable 'Beaver' Drill** Reviewed by: **FB**
 Project Location: **Upper Nicholsons Locks, Andrews ville, ON** Date Started: **Aug 4, 15** Date Completed: **Aug 4, 15** Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing	Rinse pH Values	Soil Vapour Reading	Lower Explosive Limit (LEL)		
	Local Ground Surface Elevation: 94.4 m													
	black topsoil - sandy (approx. 50 mm) moist	93.05												
	fill - sand, some silt, some gravel possible cobbles loose to compact moist	94	SS	1	13	7								- bentonite seal, 37.5 mm PVC riser
			SS	2	41	25								- filter sand, 37.5 mm PVC well screen
	refusal to sampler - advancing casing through cobbles (fill, recovered from casing)	93.2												
	grey LIMESTONE - poor quality, moderately weathered, occasional calcite inclusion	92.9												SCR: 95% RQD: 39%
			RC	1	100									- bentonite seal
	end of borehole in limestone	91.9												
	Note: Coordinates: N 4979138 E 358578	2.5												

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Groundwater depth on completion of drilling: (N/A) m.
 Groundwater depth observed on August 12, 2015 at a depth of: 1 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH6-N



Project Number: 15-2150-11 Drilling Location: Previously cleared area Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 89 mm 'N' Casing and Rods Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Man-portable 'Beaver' Drill Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Jul 29, 15 Date Completed: Jul 29, 15 Revision No.: _____

Lithology Profile	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)						
Local Ground Surface Elevation: <u>93.1 m</u> black topsoil - sandy (approx. 50 mm) moist brown fill - sand, some silt, some gravel possible cobbles moist refusal to sampler - advancing casing through cobbles (fill, recovered from casing)	SS	1	76	R	93		Rinse pH Values: 2, 4, 6, 8, 10, 12 Soil Vapour Reading parts per million (ppm): 100, 200, 300, 400 Lower Explosive Limit (LEL): W _p , W, W _L Undrained Shear Strength (kPa): 20, 40, 60, 80			
grey Limestone - poor quality, moderately weathered, occasional calcite inclusion	RC	1	100		92					- bentonite seal, 37.5 mm PVC riser SCR: 95% RQD: 34% - filter sand, 37.5 mm PVC well screen
end of borehole in limestone					91.3					
Note: 1. Coordinates: N 4979114 E 358540 2. R denotes refusal to sampler										

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Groundwater depth on completion of drilling: (N/A) m.
 Groundwater depth observed on August 12, 2015 at a depth of: -m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH7-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 89 mm 'N' Casing and Rods Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Man-portable 'Beaver' Drill Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Jul 28, 15 Date Completed: Jul 28, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80				
	Local Ground Surface Elevation: 93.7 m													
	black topsoil - sandy (approx. 50 mm) moist 93.65 0.05													
	brown fill - sand, some silt, some gravel possible cobbles compact moist		SS	1	51	28			○		○19			- bentonite seal, 37.5 mm PVC riser
			SS	2	51	11		93	○		○23			- filter sand, 37.5 mm PVC well screen
	refusal to sampler - advancing casing through cobbles (fill, recovered from casing) 92.5													
	grey Limestone - poor quality, moderately weathered, occasional calcite inclusion 92.3 1.4		RC	1	100			92						SCR: 78% RQD: 29%
	end of borehole in limestone 91.6 2.1													- bentonite seal
	Note: 1. Coordinates: N 4979096 E 358574													

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▽ Groundwater depth on completion of drilling: (N/A) m.
 ▼ Groundwater depth observed on August 12, 2015 at a depth of: 0.77 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

Scale: 1 : 26

Page: 1 of 1

RECORD OF BOREHOLE No. **BH8-N**



Project Number: **15-2150-11** Drilling Location: **Landscaped area, adjacent to canal** Logged by: **DH**
 Project Client: **Parks Canada, c/o SNC-Lavalin** Drilling Method: **89 mm 'N' Casing and Rods** Compiled by: **DH**
 Project Name: **Nicholsons Earth Dam and Clowes Upper West Embankment** Drilling Machine: **Man-portable 'Beaver' Drill** Reviewed by: **FB**
 Project Location: **Upper Nicholsons Locks, Andrews ville, ON** Date Started: **Jul 28, 15** Date Completed: **Jul 28, 15** Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 △ Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80				
	Local Ground Surface Elevation: 93.5 m													
	black topsoil - sandy (approx. 50 mm) moist	93.45 0.05												
	brown fill - sand, some silt, some gravel possible cobbles very loose moist		SS	1	30	3								
			SS	2	21	4								
	refusal to sampler - advancing casing through possible cobbles	92.4 92.3												
	grey LIMESTONE - poor quality, moderately weathered, occasional calcite inclusion	1.2	RC	1	100	R								
	end of borehole in limestone	91.3 2.2												
	Note: 1. Coordinates: N 4979045 E 358551 2. R denotes refusal to sampler													

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∇ Groundwater depth on completion of drilling: (N/A) m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. **BH9-N**



Project Number: **15-2150-11** Drilling Location: **Cleared area within trees/brush** Logged by: **DH**
 Project Client: **Parks Canada, c/o SNC-Lavalin** Drilling Method: **89 mm 'N' Casing and Rods** Compiled by: **DH**
 Project Name: **Nicholsons Earth Dam and Clowes Upper West Embankment** Drilling Machine: **Man-portable 'Beaver' Drill** Reviewed by: **FB**
 Project Location: **Upper Nicholsons Locks, Andrews ville, ON** Date Started: **Jul 30, 15** Date Completed: **Jul 30, 15** Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS	
	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 △ Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80					
	Local Ground Surface Elevation: 93.9 m														
	grey fill - cobbles and boulders, visually identified at ground surface at borehole location material recovered from casing						93	1							- bentonite seal, 37.5 mm PVC riser
							92	2							- filter sand, 37.5 mm PVC well screen
	grey LIMESTONE - poor quality, moderately weathered, occasional calcite inclusion	91.7 2.2	RC	1	100		91	3						SCR: 94% RQD: 36%	- bentonite seal
	end of borehole in limestone	90.7 3.2													
	Note: 1. Coordinates: N 4979015 E 358516														

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Groundwater depth on completion of drilling: (N/A) m.

Groundwater depth observed on August 12, 2015 at a depth of: -m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

Scale: 1 : 26

Page: 1 of 1

RECORD OF BOREHOLE No. BH10-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 89 mm 'N' Casing and Rods Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Man-portable 'Beaver' Drill Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Jul 29, 15 Date Completed: Jul 29, 15 Revision No.: _____

Lithology Profile	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)						
Local Ground Surface Elevation: <u>93.6 m</u> black topsoil - sandy (approx. 50 mm) moist brown fill - sand, some silt, some gravel possible cobbles very loose moist	SS	1	16	6		93	○	○19		
	SS	2	49	R				○20		- bentonite seal, 37.5 mm PVC riser
refusal to sampler - advancing casing through possible cobbles (fill, recovered from casing)						1				
grey LIMESTONE - poor quality, moderately weathered, occasional calcite inclusion	RC	1	100			2				SCR: 92% RQD: 25%
end of borehole in limestone										- filter sand, 37.5 mm PVC well screen

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▽ Groundwater depth on completion of drilling: (N/A) m.
 ▼ Groundwater depth observed on August 12, 2015 at a depth of: 1.19 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH11-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 89 mm 'N' Casing and Rods Compiled by: DH
 Project Name: Nicholson's Earth Dam and Clowes Upper West Embankment Drilling Machine: Man-portable 'Beaver' Drill Reviewed by: FB
 Project Location: Upper Nicholson's Locks, Andrewsville, ON Date Started: Jul 27, 15 Date Completed: Jul 27, 15 Revision No.: _____

Lithology Profile	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)						
Local Ground Surface Elevation: 93.6 m										
black topsoil - sandy (approx. 50 mm) moist brown fill - sand, some silt, some gravel possible cobbles loose to compact moist	SS	1	30	8		93.55		8		- bentonite seal, 37.5 mm PVC riser
	SS	2	33	12	1	93.00		11		
	SS	3	89	R			92.10		11	
refusal to sampler - advancing casing through 1.5 possible cobbles (fill, recovered from casing)										
grey Limestone - poor quality, moderately weathered, occasional calcite inclusion	RC	1	100		3	91.40				SCR: 97% RQD: 35%
						89.90				- bentonite seal
end of borehole in limestone										
Note: 1. Coordinates: N 4978960 E 358507 2. R denotes refusal to sampler 3. Water level upon completion not applicable due to introduction of water during drilling process.										

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Groundwater depth on completion of drilling: (N/A) m.
 Groundwater depth observed on August 12, 2015 at a depth of: - m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF TEST PIT No. TP1-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: _____ Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankmen Drilling Machine: Case CX31 Mini-excavator Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 6, 15 Date Completed: Aug 6, 15 Revision No.: _____

Lithology Profile	SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80			
Local Ground Surface Elevation: <u>93.6 m</u> black topsoil - sandy (approx. 50 mm) moist light brown fill - sand, trace gravel, trace silt and clay moist - geotextile fabric located between sand fill layer and underlying clear stone brownish grey fill - cobbles, some gravel, some sand (possible cave-in) moist 93.55 0.05 93.5 0.1 93 92												
end of test pit by practical refusal to excavation 1.8 m on assumed bedrock (view obscured by water) Note: 1. Coordinates: N 4979209 E 358623 2. Concrete retaining wall behind canal wall measured to be 0.3 m wide, 0.2 m below existing site grades. View of footing base obscured by water. 3. Heavy seepage near assumed bedrock interface.												

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∇ Groundwater depth on completion of excavation: 1.1 m

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF TEST PIT No. TP2-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: _____ Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankmen Drilling Machine: Case CX31 Mini-excavator Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 6, 15 Date Completed: Aug 6, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 △ Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80				
	Local Ground Surface Elevation: 93.7 m													
	black topsoil - sandy (approx. 50 mm) moist light brown fill - sand, trace gravel, trace silt and clay moist G: 1% SA: 92% SI/CL: 7%	93.65 0.05	GS	1										
	becoming dark brown, some cobbles	93.1 0.7					93							
							1							
								92						
	end of test pit by practical refusal to excavation 1.8 m on assumed bedrock (view obscured by water)	91.9												
	Note: 1. Coordinates: N 4979157 E 358601 2. G, SA, SI and CL denotes gravel, sand, silt and clay, respectively. 3. Concrete retaining wall behind canal wall measured to be 0.3 m wide, 0.2 m below existing site grades. View of footing base obscured by water. 4. Slow to moderate seepage near assumed bedrock interface.													

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∇ Groundwater depth on completion of excavation: 1.5 m

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF TEST PIT No. TP3-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: _____ Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankmen Drilling Machine: Case CX31 Mini-excavator Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 6, 15 Date Completed: Aug 6, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80				
	Local Ground Surface Elevation: 93.3 m black topsoil - sandy, heavy root mat (approx. 150mm) moist 93.15 grey fill - cobbles and boulders, trace sand, trace silt and clay 0.15 92.3 light brown 1.0 SILTY SAND - some gravel, trace cobbles possibly reworked moist 91.8 end of test pit by practical refusal to excavation 1.5 m on limestone bedrock Note: 1. Coordinates: N 4979141 E 358573 2. No seepage.	93					93							
		92	GS	1			92							

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∇ No freestanding groundwater measured in open test pit on completion of excavation.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

Scale: 1 : 26
 Page: 1 of 1

RECORD OF TEST PIT No. TP4-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: _____ Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankmen Drilling Machine: Case CX31 Mini-excavator Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 6, 15 Date Completed: Aug 6, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Local Ground Surface Elevation: 93.7 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80				
	black topsoil - sandy (approx. 100 mm) moist light brown fill - sand, trace gravel, trace silt and clay moist to wet G: 3% SA: 91% SI/CL: 6%	93.6 0.1	GS	1			93							
	end of borehole by practical refusal to excavation on limestone bedrock Note: 1. Coordinates: N 4979114 E 358582 2. Concrete retaining wall behind canal wall measured to be 0.3 m wide, 0.2 m below existing site grades. Small hole observed at base of wall - heavy influx of canal water from hole.	92.3 1.4												

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∇ Groundwater depth on completion of excavation: 0.9 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF TEST PIT No. TP5-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: _____ Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankmen Drilling Machine: Case CX31 Mini-excavator Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 6, 15 Date Completed: Aug 6, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS	
	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80					
	Local Ground Surface Elevation: 93.2 m														
	black topsoil - sandy, heavy root mat (approx. 300mm) moist 92.9						93								
	light brown fill - sand, some gravel, some cobbles, trace silt and clay moist 92.2														
	light brown SILTY SAND- some gravel, trace cobbles possibly reworked moist 91.9	GS	1				92				o ⁵				
	end of test by practical refusal to excavation on 1.3 limestone bedrock														
	Note: 1. Coordinates: N 4979105 E 358555 2. No seepage.														

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∇ No freestanding groundwater measured in open borehole on completion of excavation.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF TEST PIT No. TP6-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: _____ Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Case CX31 Mini-excavator Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 6, 15 Date Completed: Aug 6, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING			INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Local Ground Surface Elevation: 93.5 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 △ Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80			
	black topsoil - sandy (approx. 100 mm) moist light brown fill - sand, trace gravel, trace cobbles, trace silt and clay moist becoming dark brown, some cobbles	93.4 0.7 93.2 0.3 92.2	GS	1			93						
	end of test pit by practical refusal to excavation 1.4 m on assumed bedrock (view obscured by water) Note: 1. Coordinates: N 4979069 E 358563 2. Concrete retaining wall behind canal wall measured to be 0.3 m wide, 0.2 m below existing site grades. View of footing base obscured by water. 3. Moderate seepage near assumed bedrock interface.												

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∇ Groundwater depth on completion of drilling: 0.8 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF TEST PIT No. TP7-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: _____ Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankmen Drilling Machine: Case CX31 Mini-excavator Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 6, 15 Date Completed: Aug 6, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS	
	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80					
	<p>Local Ground Surface Elevation: 93.5 m</p> <p>black 93.25 topsoil - sandy (approx. 75 mm) 0.075 moist</p> <p>- geotextile fabric located between topsoil and underlying fill material</p> <p>light brown fill - cobbles and boulders, trace to some sand, trace to some gravel moist to wet</p>						93								
	<p>92.1</p> <p>end of test pit by practical refusal to excavation 1.4 m on assumed bedrock (view obscured by water)</p> <p>Note:</p> <ol style="list-style-type: none"> Coordinates: N 4979019 E 358540 Concrete retaining wall behind canal wall measured to be 0.3 m wide, 0.4 m below existing site grades. View of footing base obscured by water. Heavy seepage near assumed bedrock interface. 														

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∇ Groundwater depth on completion of excavation: 0.8 m

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF TEST PIT No. TP8-N



Project Number: 15-2150-11 Drilling Location: Landscaped area, adjacent to canal Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: _____ Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankmen Drilling Machine: Case CX31 Mini-excavator Reviewed by: FB
 Project Location: Upper Nicholsons Locks, Andrews ville, ON Date Started: Aug 6, 15 Date Completed: Aug 6, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Local Ground Surface Elevation: 93.6 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80				
	black topsoil - sandy (approx. 100 mm) moist - geotextile fabric located between topsoil and underlying fill material light brown fill - sand, trace gravel, trace silt and clay, trace cobbles moist G: 4% SA: 90% SI/CL: 6%	93.5 0.1	GS	1			93 1 92 2							
	end of test pit by practical refusal to excavation 2.3 m on limestone bedrock Note: 1. Coordinates: N 4978980 E 358522 2. G, SA, SI and CL denotes gravel, sand, silt and clay, respectively. 3. Concrete retaining wall behind canal wall measured to be 0.3 m wide, 0.4 m below existing site grades. Footing projection approximately 0.2 m wide at 1.2 m below top of wall, bearing on limestone bedrock. 4. No seepage.	91.3												

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∇ No freestanding groundwater measured in open test pit on completion of excavation.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

Scale: 1 : 26
 Page: 1 of 1

APPENDIX 6
RECORD OF BOREHOLES - CLOWES
(4 pages)

RECORD OF BOREHOLE No. BH1-C



Project Number: 15-2150-11 Drilling Location: Adjacent to concrete control structure Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 200 mm Hollow Stem Augering Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Track Mounted CME-55 Reviewed by: FB
 Project Location: Clowes Locks, Andrewsville, ON Date Started: Aug 7, 15 Date Completed: Aug 7, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS	
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing	Rinse pH Values	Soil Vapour Reading	Lower Explosive Limit (LEL)			Undrained Shear Strength (kPa)
	Local Ground Surface Elevation: 93.4 m														
	black topsoil - sandy (approx. 100mm) moist	93.3													
	blackish grey fill - silty sand, trace gravel, some organics possible cobbles and boulders inferred from auger grinding very loose moist to very moist	0.7	SS	1	67	4		93							
			SS	2	75	R									
	becoming wet	91.7	SS	3	100	R									
	grey Limestone - poor quality, moderately weathered	1.7													
			RC	1	94			91							
	end of borehole in limestone bedrock	90.1													
		3.3													
	Note: 1. Coordinates: N 4978958 E 358412 2. R denotes refusal to sampler														

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∇ Groundwater depth on completion of drilling: 1.5 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

Scale: 1 : 26
 Page: 1 of 1

RECORD OF BOREHOLE No. BH2-C



Project Number: 15-2150-11 Drilling Location: Cleared pathway in treed area Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 200 mm Hollow Stem Augering Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Track Mounted CME-55 Reviewed by: FB
 Project Location: Clowes Locks, Andrewsville, ON Date Started: Aug 7, 15 Date Completed: Aug 7, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Local Ground Surface Elevation: 94.5 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 △ Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80				
	black topsoil - sandy (approx. 50 mm) moist	94.45 0.05												
	blackish grey fill - silty sand, trace gravel, some organics possible cobbles and boulders inferred from auger grinding loose moist		SS	1	67	5		○			○ ¹⁶			- filter sand, 50 mm PVC riser
			SS	2	42	R	1	▽			○ ⁷			- filter sand, 50 mm PVC slotted well screen
	end of borehole by practical auger refusal	93.0 1.5												

Note:
 1. Coordinates: N 4978942 E 358393
 2. R denotes refusal to sampler

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▽ Groundwater depth on completion of drilling: 0.7 m.
 ▼ Groundwater depth observed on August 12, 2015 at a depth of: 0.8 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH3-C



Project Number: 15-2150-11 Drilling Location: Cleared pathway in treed area Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 200 mm Hollow Stem Augering Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Track Mounted CME-55 Reviewed by: FB
 Project Location: Clowes Locks, Andrewsville, ON Date Started: Aug 7, 15 Date Completed: Aug 7, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS	
	DESCRIPTION	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing	Soil Vapour Reading	Lower Explosive Limit (LEL)	W _p			W _L
	Local Ground Surface Elevation: 93.6 m														
	black topsoil - sandy (approx. 50 mm) moist	93.55													
	blackish grey fill - silty sand, trace gravel, some organics (possible peat) possible cobbles and boulders inferred from auger grinding very loose very moist	0.05	SS	1	67	3									
			SS	2	20	R									
	end of borehole by practical auger refusal	92.4													
	Note: 1. Coordinates: N 4978927 E 358382 2. R denotes refusal to sampler	1.2													

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∇ Groundwater depth on completion of drilling: 0.9 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH4-C



Project Number: 15-2150-11 Drilling Location: Cleared pathway in treed area Logged by: DH
 Project Client: Parks Canada, c/o SNC-Lavalin Drilling Method: 200 mm Hollow Stem Augering Compiled by: DH
 Project Name: Nicholsons Earth Dam and Clowes Upper West Embankment Drilling Machine: Track Mounted CME-55 Reviewed by: FB
 Project Location: Clowes Locks, Andrewsville, ON Date Started: Aug 7, 15 Date Completed: Aug 7, 15 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Local Ground Surface Elevation: 93.9 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 △ Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W W _L Plastic Liquid 20 40 60 80				
	black topsoil - sandy (approx. 50 mm) moist	93.85 0.05												
	blackish grey fill - silty sandy gravel, some organics (possible peat) possible cobbles and boulders inferred from auger grinding very loose wet to saturated		SS	1	25	7								- bentonite seal, 50 mm PVC riser
							93							
			SS	2	54	2	1							- filter sand, 50 mm PVC slotted well screen
	end of borehole by practical auger refusal	92.4 1.5												

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▽ Groundwater depth on completion of drilling: 0.7 m.
 ▼ Groundwater depth observed on August 12, 2015 at a depth of: 0.5 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

APPENDIX 7
TEST PIT PHOTO LOG
(8 pages)



Figure 1 –TP1-N, concrete retaining wall



Figure 2 –TP1-N, overburden material – *note geotextile fabric on edges of test pit*



Figure 3 –TP2-N, concrete retaining wall



Figure 4 –TP2-N, overburden material



Figure 5 –TP3-N, overburden material



Figure 6 –TP3-N, spoils from excavation (fill materials)

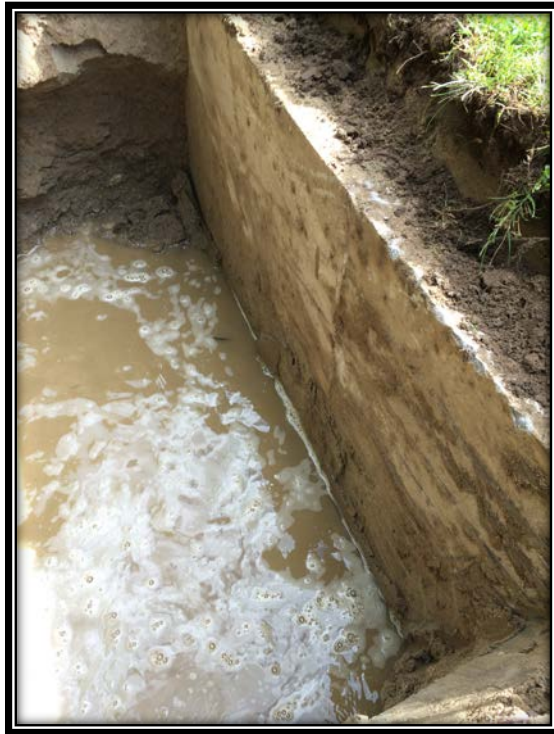


Figure 7 – TP4-N, concrete retaining wall

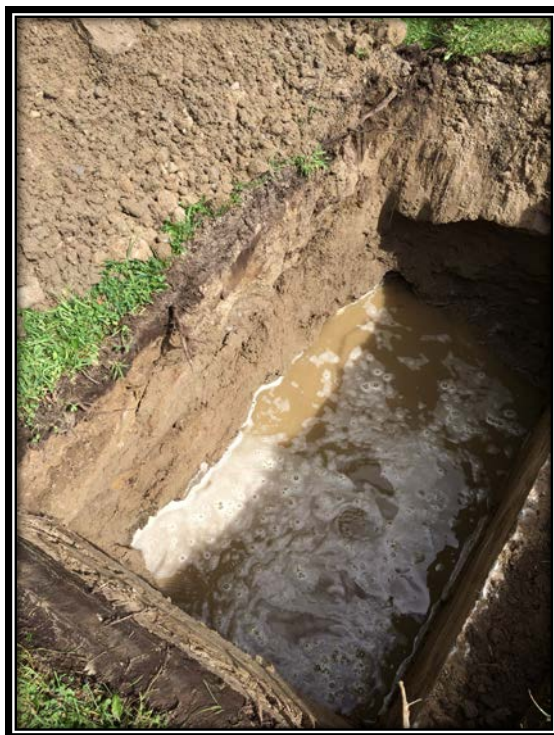


Figure 8 –TP4-N, overburden material



Figure 9 –TP5-N, overburden material



Figure 10 –TP5-N, spoils from excavation (fill and native material)



Figure 11 –TP6-N, concrete retaining wall



Figure 12 – TP6-N, overburden material



Figure 13 –TP7-N, concrete retaining wall



Figure 14 –TP7-N, overburden material, geotextile fabric – note geotextile fabric on edges of test pit



Figure 15 – TP8-N, concrete retaining wall



Figure 16 – TP8-N, concrete retaining wall and overburden, termination on bedrock – *note geotextile fabric on edges of test pit*

APPENDIX 8
BEDROCK PHOTO LOG
(6 pages)



Figure 1 – Nicholson's - BH1-N



Figure 2 – Nicholson's – BH2-N



Figure 3 – Nicholson's – BH3-N



Figure 4 – Nicholson's – BH4-N



Figure 5 – Nicholson's – BH5-N



Figure 6 – Nicholson's – BH6-N



Figure 7 – Nicholson's – BH7-N



Figure 8 – Nicholson's – BH8-N



Figure 9 – Nicholson's – BH9-N



Figure 10 – Nicholson's – BH10-N



Figure 11 – Nicholson's – BH11-N



Figure 12 – Clowes – BH1-C

APPENDIX 9
GEOTECHNICAL LABORATORY RESULTS
(3 pages)

Grain Size Analysis Test Report

Project No.: 15-2150-11 **Project Description:** Parks Canada- Geotechnical Investigation- **Date:** Aug 27, 2015
Project Location: _____ **Contract No.:** _____

SAMPLE DATA

Material: _____
Date Sampled: Aug 12, 2015
Time Sampled: _____
Sample Type: Other
Sample Location: Nicholsons, Test Pit #4
Lot: _____ **Sublot:** _____
Source: _____
Sampled By: Dylan Hill P.Eng.

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	100	100 - 100
106.0		-
75.0		-
53.0		-
37.5		-
26.5	100	50 - 100
22.4		-
19.0		-
16.0		-
13.2		-
9.5		-
6.7		-
4.75	96.6	20 - 100
2.36		-
1.18	86.9	10 - 100
0.600		-
0.300	50.6	2 - 65
0.150		-
0.075	6.3	0 - 8

LAB DATA

Lab No.: 14520 X **Date Tested:** Aug 25, 2015
Specification: OPSS1010, Granular B Type I

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		30
% Flat and Elongated		

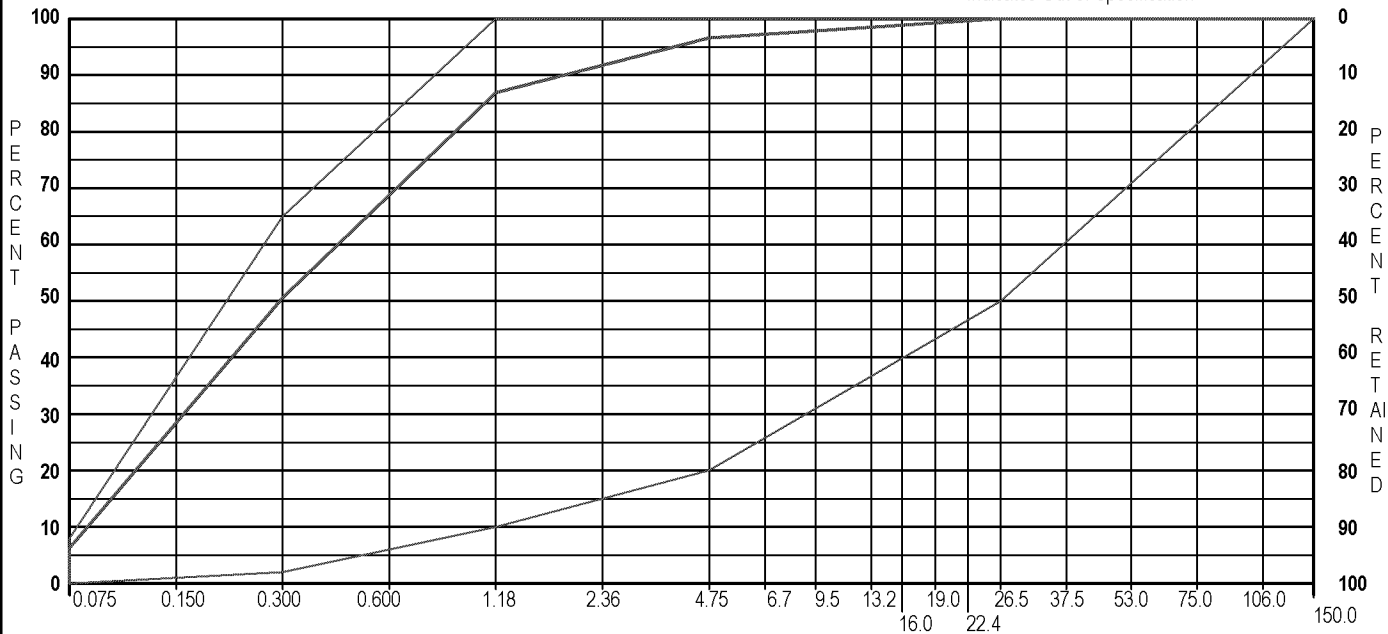
WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		
FINENESS MODULUS	0.66	

Comments: Moisture Content is 13.0%

Sample: _____ **Specs:** _____

* Indicates Out of Specification



Data presented hereon is for the sole use of the stipulated client. DBA is not responsible, nor can be held liable, for use made of this report by any other party, with or without the knowledge of DBA. The testing services reported herein have been performed by a DBA technician to recognized industry standards, unless otherwise noted. No other warranty is made. This data does not include or represent any interpretation or opinion of specification compliance or material suitability. Should engineering interpretation be required, DBA will provide it upon written request.

Project Manager: Farsheed Bagheri, P. Eng.

Grain Size Analysis Test Report

Project No.: 15-2150-11 Project Description: Parks Canada- Geotechnical Investigation- Date: Aug 27, 2015
Project Location: _____ Contract No.: _____

SAMPLE DATA

Material: _____
Date Sampled: Aug 12, 2015
Time Sampled: _____
Sample Type: Other
Sample Location: Nicholsons, Test Pit #8
Lot: _____ Sublot: _____
Source: _____
Sampled By: Dylan Hill P.Eng.

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	100	100 - 100
106.0		-
75.0		-
53.0		-
37.5		-
26.5	100	50 - 100
22.4		-
19.0		-
16.0		-
13.2		-
9.5		-
6.7		-
4.75	98.9	20 - 100
2.36		-
1.18	96.2	10 - 100
0.600		-
0.300	73.5*	2 - 65
0.150		-
0.075	6.2	0 - 8

LAB DATA

Lab No.: 14520 AA Date Tested: Aug 25, 2015
Specification: OPSS1010, Granular B Type I

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		30
% Flat and Elongated		

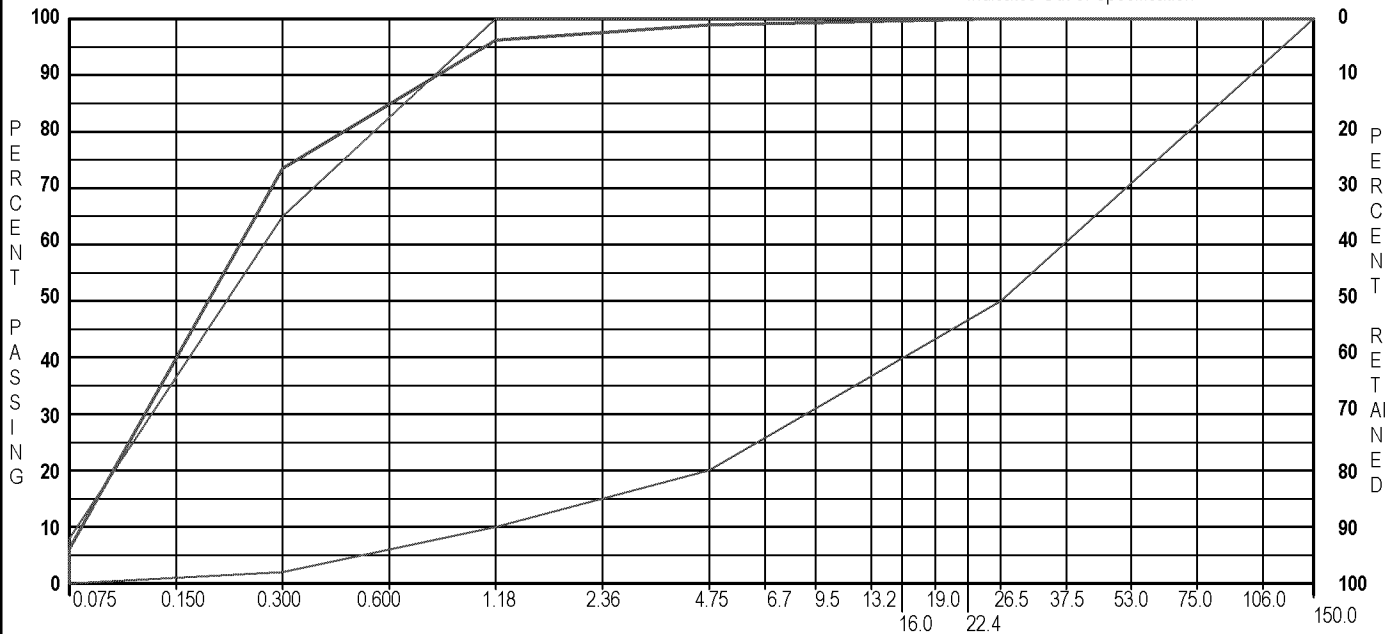
WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		
FINENESS MODULUS	0.31	

Comments: Moisture Content is 3.7%

Sample: _____ Specs: _____

* Indicates Out of Specification



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Canada K7P 2E4

Appendix B

Basic Impact Analysis



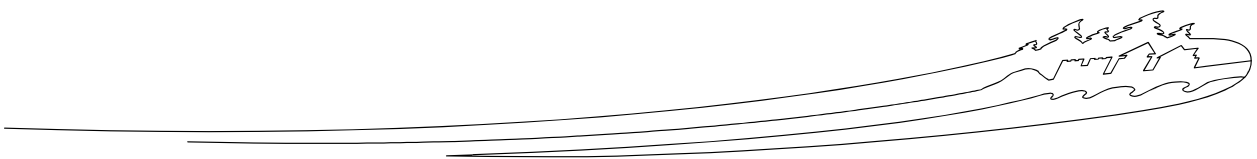
Basic Impact Analysis

Upper Nicholson's Earth Dam Rehabilitation

Rideau Canal, Merrickville-Wolford, ON



August 2016



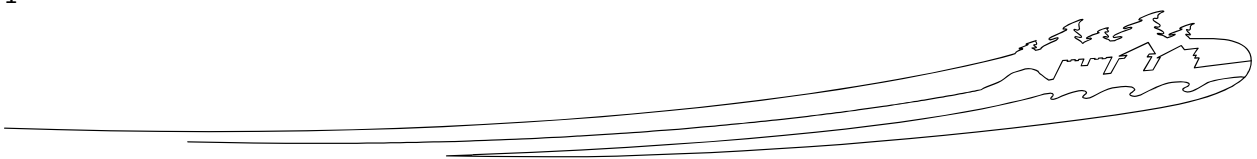


1. PROJECT TITLE & LOCATION

Upper Nicholson Earth Dam Rehabilitation. Upper Nicholson Lockstation is located between Merrickville and Burritts Rapids, with access just off of Andrewsville Road. Lat/Long coordinates are N 44° 57.070' W 75° 49.050'



Figure 1. Overview of Upper Nicholson Lockstation (ESRI, 2016).



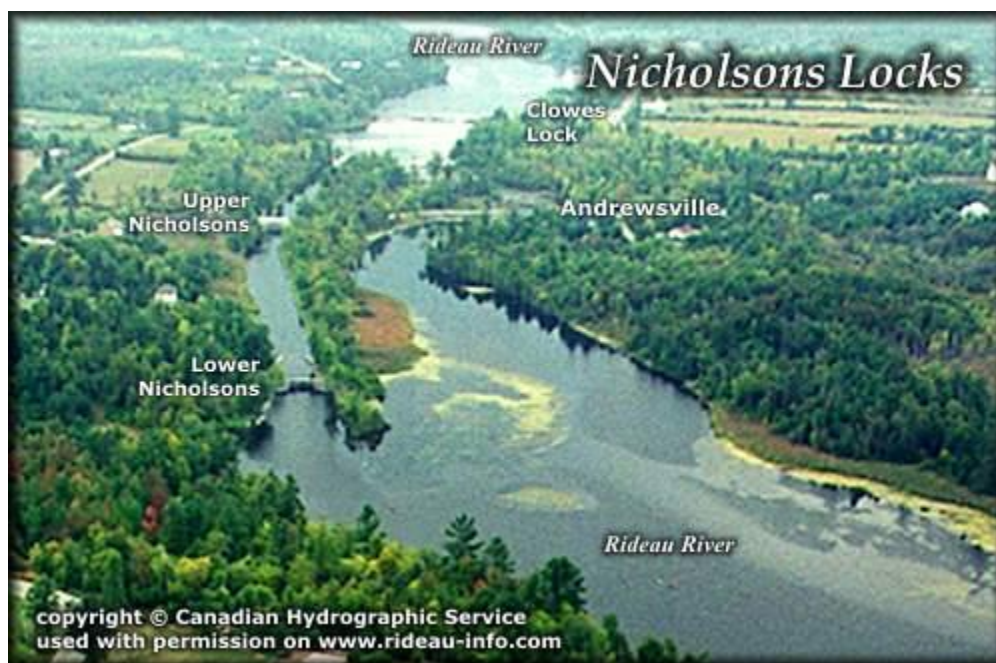


Figure 2. Aerial overview of Upper and Lower Nicholsons Lockstation.

2. PROPONENT INFORMATION

Jean-Francois Charron
Project Engineer
Parks Canada Agency, Ontario Waterways
Email: jean-francois.charron@pc.gc.ca
Tel: 613-713-2199 ext. 248
Cell: 613-284-7832

3. PROPOSED PROJECT DATES

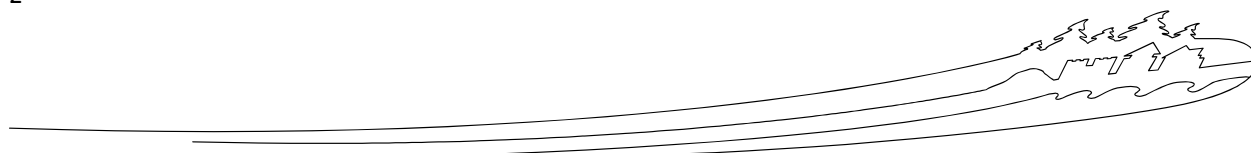
Planned commencement: 2016-10-12
Planned completion: 2017-05-01

4. INTERNAL PROJECT FILE # 20034960

5. PROJECT DESCRIPTION

The lock system embankment has been subject to development of sinkholes likely caused by water leaking through the canal wall as described in the project Terms of Reference. Water movement flushes fines from behind the wall leaving a void, leading to formation of sinkholes. It is understood that sediment deposits are evident in the adjacent Rideau River as well as that water can be heard running behind the wall in the vegetated areas. It is expected that the lock wall which consists of a stone wall in front of a concrete retaining wall is leaking and allowing water from the canal system to migrate through the adjacent embankment.

This project entails the reconstruction of an existing earth embankment, the comprehensive reconstruction of an existing masonry faced concrete retaining wall and the excavation and replacement of the existing retaining wall backfill. The work will occur at two locations in the vicinity of the Upper





Nicholsons Lock Station: the earth dam/masonry wall on the west side of the canal cut, and on the western embankment located on the western shoreline of the Rideau River between Clowes Lockstation and the Upper Nicholsons spillway dam (Figure 3). Work is scheduled to begin in October 2016 and be completed in May 2017. The installation of a cofferdam and dewatering of the canal cut will be required to complete the work – the cofferdam will be in place from October 2017 (after navigation season) until March 14th 2017.

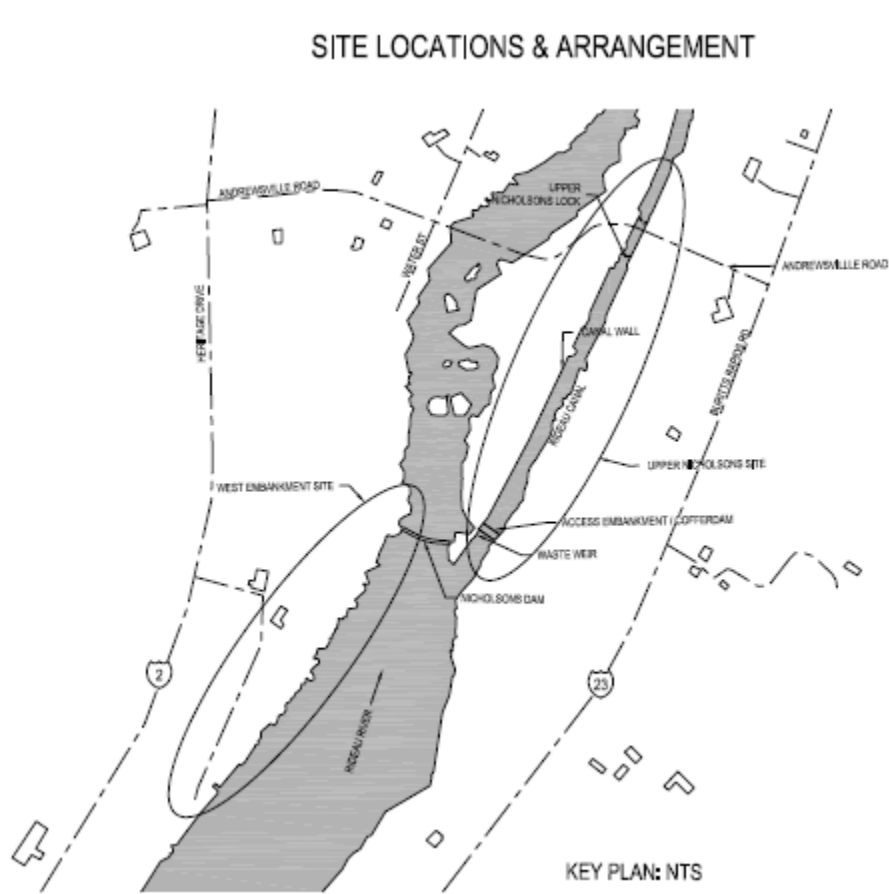
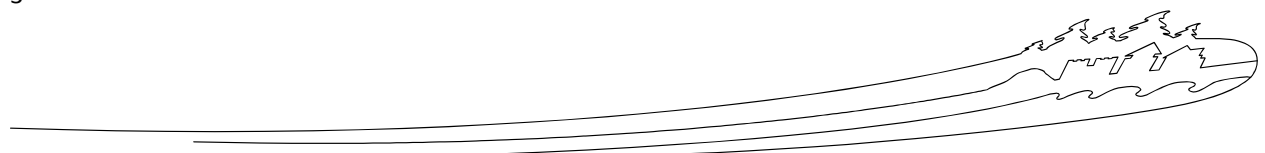


Figure 3. Key Plan drawing, SNC Lavalin, 2016 (for information purposes only)

The work under this project includes the elevation of the existing earth embankment on the west side of the Rideau River between Clowes Lockstation and the Upper Nicholsons spillway dam, the dismantling, cleaning and reconstruction of the existing masonry wall facing of the concrete retaining wall on the Upper Nicholsons canal cut, and the removal and replacement of the existing retaining wall backfill to allow for better drainage. The project includes but is not limited to the following:

- Site erosion and sedimentation measures including silt fencing, fibre filtration tubes, filter bags, turbidity curtains, hay/straw bales, vegetative stabilization and other measures as required, maintained for the duration of the project.
- Temporary site access and facilities including staging area, access roads and cofferdam/access embankment. The access road will follow the path of an access road that was cleared for a project in 2008. Some minor tree and shrub removal may be required. The staging area will be located in





a cleared area adjacent to the access road. The cofferdam will act as an access road to the western side of the masonry/concrete wall.

- Dewatering procedures to allow for all work "in the dry", and preservation of existing watercourses.
- Tree clearing, grubbing and soil stripping, including stockpiling of re-usable topsoil. Tree clearing will be required along the crest of the western embankment, along the access road and possibly behind the masonry/concrete wall. It is not known the exact number of trees that will be removed because the contractor will only remove trees that are absolutely necessary to remove for the work to proceed.
- Supply and compaction of clean Engineered Fill as backfill and embankment, including geosynthetic reinforcement and separation.
- Supply and compaction of granular base.
- Surface treatment and protection, including clean topsoil free of invasive species seeds (stockpiled and imported), hydraulic seeding, sodding and rip rap.
- Existing masonry wall dismantling.
- Masonry stone, grout and mortar reconstruction, complete with installation of new anchored timber "rub-rail"

The locks 18 & 19, channel, spillway dam and landscape are cultural resources of "National Significance" (NS, formerly known as Level I cultural resources, Cultural Resource Inventory, 1994-95, rev. Nov. 2015) and are part of the UNESCO Rideau Canal World Heritage Site and National Historic Site.

6. VALUED COMPONENTS LIKELY TO BE AFFECTED

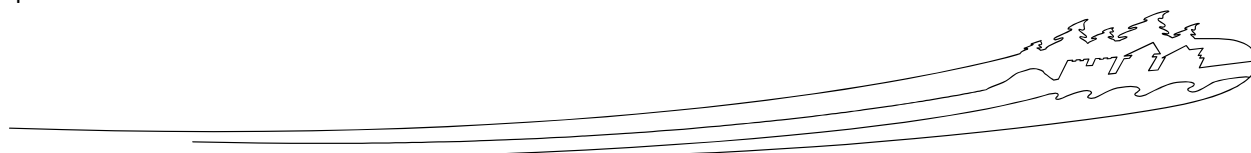
The following section identifies valued components in the study area that will potentially be impacted by the proposed works.

Soil and Landforms

This section of the Rideau Canal passes through the Smiths Falls Limestone Plain, characterized by shallow soil and exposed limestone. Soils and landforms surrounding the lockstation have been historically disturbed by development including the building of canal infrastructure, residential development, transportation infrastructure, agriculture and manicured parkland (Photo 1).

Terrestrial Vegetation

Upper Nicholson's Lockstation is located in the St. Lawrence Lowlands Ecoregion and has a vegetation community that is representative of disturbed sites in this region. Vegetation observed along the earth dam includes: Basswood (*Tilia americana*), American Elm (*Ulmus americana*), White Ash (*Fraxinus americana*), Manitoba Maple (*Acer negundo*), riverbank grape (*Vitis riparia*), Virginia creeper (*Parthenocissus quinquefolia*), tartarian honeysuckle (*Lonicera tatarica*)*, and European Buckthorn (*Rhamnus cathartica*)*. Species with an asterisk (*) beside them are non-native species. Purple Loosestrife, a non-native invasive wetland plant, and Wild Parsnip, an invasive species commonly found in ditchlines throughout Eastern Ontario, have been identified as present in the Village of Merrickville-Wolford and may be found on site (EDDMapS, 2016). During construction, non-native species will be





excavated completely to try to ensure that they do not return post-construction, improving the overall ecological condition of the site.

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 the non-native invasive Eurasian Water Milfoil (*Myriophyllum spicatum*) (Canadian Museum of Nature, 2001).

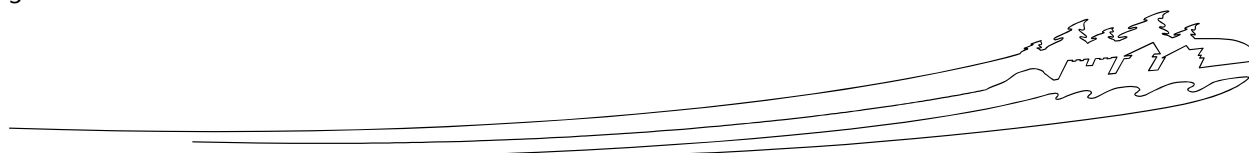
The Rideau River has a diverse warm and coolwater fish community. During fish community sampling as part of the Rideau River biodiversity project conducted in 1999-2000, thirty-five fish species were identified within the river (Canadian Museum of Nature, 2001), twenty-two species in the section from Smiths Falls to Burritts Rapids, which includes the Upper Nicholson's 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 olmstedii*)
- Logperch (*Percina caprodes*)

Habitat adjacent to the earth dam and western embankment 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 adjacent to the earth dam is canal cut and characterized by being uniform with very little in-stream structure. Fish habitat adjacent to the western embankment is slow moving and includes quite a bit of in-stream large wood debris because of failing banks. No critical habitat for at risk fish has been identified adjacent to the Upper Nicholson's Lockstation or dam.

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*)





A fish habitat assessment will be completed during September 2016 to help further define the habitat conditions. Results from the assessment will then refine restoration efforts or mitigations measures for this project specific to the site conditions.

Wildlife

The area surrounding the Upper Nicholson's Lockstation is likely used by a variety of terrestrial and aquatic wildlife including frogs, beaver, muskrat, mink and turtles (Ontario Nature Reptile and Amphibian Atlas, 2015). Migratory birds also utilize the vegetation adjacent to the lockstation and waterfowl can be found on the water as well and on the lockstation grounds. An active Osprey nest can be found on an artificial nesting platform installed between the Upper Nicholson's lockstation and the Andrewsville Bridge over the Rideau River.

Species at Risk

The study area for this project lies within zones of identified Critical Habitat for three species classified as Threatened under the Species at Risk Act (SARA), the Eastern Musk Turtle (*Sternotherus odoratus*), Blanding's Turtle (*Emydoidea blandingii*) and the Eastern Whip-poor-will (*Caprimulgus vociferus*).

Additional species at risk that may be found in the study area, both federally listed species and species listed under the Ontario Endangered Species Act (ESA), have been identified using the Natural Heritage Information Centre (NHIC) database, the Atlas of Breeding Birds of Ontario and the Ontario Reptile and Amphibian Atlas. These species can be found in Table 1.

Basic habitat characteristics for each species have been included in Table 1 and an assessment given as to the likelihood of that species using habitat within the study area. For species at risk that do not have critical habitat described in a recovery strategy, mitigation measures will be employed to ensure that individuals and their habitat are protected.

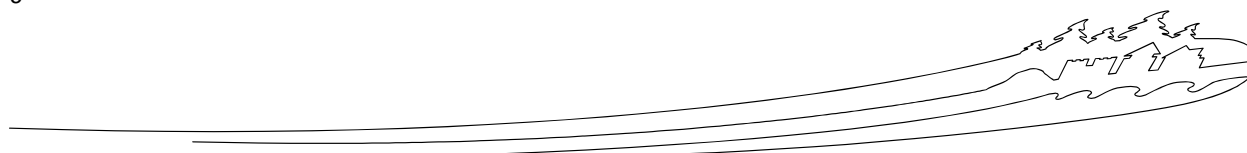


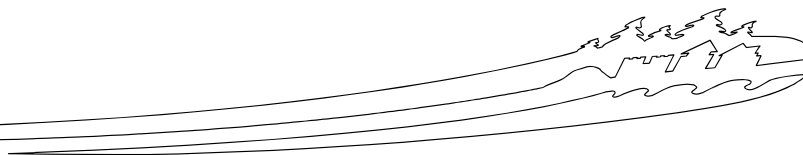


Table 1. Species at Risk with potential to be found within the study area.

Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Habitat Potential on Project Site	Preferred Habitat
BIRDS						
Eastern Whip-poor-will ^{1, 3}	<i>Caprimulgus vociferus</i>	Threatened	Threatened	Threatened	No	Semi-open forests or patchy forests with clearings, such as barrens or forests that are regenerating following major disturbances
Red-shouldered Hawk ³	<i>Buteo lineatus</i>	Not at Risk	Special Concern	Not at Risk	No	Deciduous or mixed-wood forests containing shade-tolerant hardwood trees close to wetland areas. Large woodlots (10 to 100 hectares) can sustain viable Red-shouldered Hawk populations.
Least Bittern ³	<i>Ixobrychus exilis</i>	Threatened	Threatened	Threatened	Not likely	Can be found in a variety of wetland habitats, but most commonly found in cattail marshes with a mix of open pools and channels.
Common Nighthawk ³	<i>Chordeiles minor</i>	Threatened	Threatened	Special Concern	Not likely	Open, vegetation-free habitats (dunes, beaches, recently harvested forests, burnt-over areas, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores, and river banks)
Barn Swallow ³	<i>Hirundo rustica</i>	Threatened	No Status	Threatened	No historical nests observed.	Nest almost exclusively on man-made structures (bridges, culverts, barns)
Eastern Wood-pewee ³	<i>Contopus virens</i>	Special Concern	No Status	Special Concern	No	Edges of mixed or deciduous forests, intermediate-aged mature forests

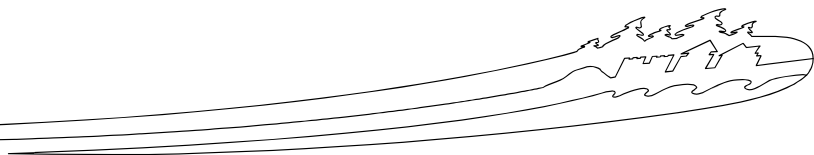


Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Habitat Potential on Project Site	Preferred Habitat
Wood Thrush ³	<i>Hylocichla mustelina</i>	Threatened	No Status	Special Concern	No	Mature mixed or deciduous forests, often moist, well-developed undergrowth, large forest stands.
Bobolink ³	<i>Dolichonyx oryzivorus</i>	Threatened	No Status	Threatened	No	Bobolink nest in tallgrass prairie and other open meadows, including hayfields.
Eastern Meadowlark ³	<i>Sturnella magna</i>	Threatened	No Status	Threatened	No	Nest in moderately tall grasslands, such as pastures and hayfields, but also nest in alfalfa fields, weedy borders of croplands, roadsides, orchards, shrubby overgrown fields, or other open areas.
Reptiles and Amphibians						
Eastern Musk Turtle ^{1, 2, 4}	<i>Sternotherus odoratus</i>	Special Concern	Threatened	Special Concern	Yes	Eastern Musk Turtle require shallow water with little or no current, and soft earth to bury into when they hibernate. Nesting habitat is variable, but it must be close to the water and exposed to direct sunlight.
Blanding's Turtle ^{1, 4}	<i>Emydoidea blandingii</i>	Threatened	Threatened	Threatened	Possible	Blanding's Turtles can be found in several types of freshwater environments, including lakes, permanent or temporary pools, slow-flowing streams, marshes and swamps. They will travel long distances overland (>410m) for basking and nesting sites.
Snapping Turtle ^{2, 4}	<i>Chelydra serpentina</i>	Special Concern	Special Concern	Special Concern	Yes	Usually found in large bodies of water, but will sometimes inhabit small ponds. Rarely leave water





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Habitat Potential on Project Site	Preferred Habitat
						except to nest and migrate to overwintering habitat.
Western Chorus Frog	<i>Pseudacris triseriata</i>	Threatened	Threatened	Not at Risk	Not likely	Forest openings around woodland ponds, damp meadows, marshes, bottomland swamps and temporary ponds in open country. Western Chorus Frog breeds in almost any fishless pond with at least 10 centimetres of water, including quiet, shallow, usually temporary waterbodies with vegetation that is submerged or protrudes from the water, and especially in rain-flooded meadows and ditches. The Western Chorus Frog overwinters underground or under surface cover, such as fallen logs.
Insects						
Monarch ⁵	<i>Danaus plexippus</i>	Special Concern	Special Concern	Special Concern	Likely	Monarchs can be found wherever milkweed and wildflowers grow. This includes abandoned farmland, along roadsides, and other open spaces.
Mammals						
Little Brown Myotis ⁵	<i>Myotis lucifugus</i>	Endangered	Endangered	Endangered	Not likely	Little Brown Myotis hibernate from October or November to March or April, most often in caves or abandoned mines that are humid and remain above freezing. In summer they forage at night and roost in trees and buildings during the day.





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Habitat Potential on Project Site	Preferred Habitat
Northern Myotis ⁵	<i>Myotis septentrionalis</i>	Endangered	Endangered	Endangered	Not likely	Similar habitat preferences to Little Brown Myotis - they bats hibernate from October or November to March or April, most often in caves or abandoned mines. Northern Myotis often roost under loose bark or in tree cavities.
Tri-coloured Bat ⁵	<i>Perimyotis subflavus</i>	Endangered	Endangered	Endangered	Not likely	Often found hibernating in same locations as Little Brown Myotis and Northern Myotis – abandoned mines and caves. Relatively rare species in Canada.
Eastern Small-footed Bat ⁵	<i>Myotis leibii</i>	Not Assessed	Not Assessed	Endangered	Not likely	Often found hibernating in same locations as Little Brown Myotis and Northern Myotis, but they tend to occupy cooler, drier areas of the cave. In summer they forage at night and roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees.

¹COSEWIC Draft Critical Habitat Mapping

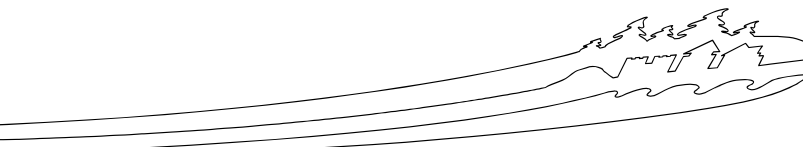
²NHIC

³Atlas of Breeding Birds of Ontario

⁴Ontario Reptile and Amphibian Atlas

⁵Field Observation

Critical Habitat identified in 10km x 10km square surrounding site





Cultural Resources

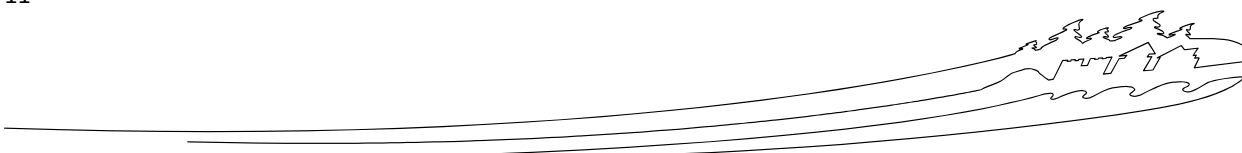
Nicholsons Lockstation includes two locks, lock 18 (Lower Nicholsons) and lock 19 (Upper Nicholsons), situated 385 m apart along an excavated channel, a unique configuration on the canal designed to bypass the Rideau River's rapids and shallows. The proposed project involves locks, dam, channel and a landscape that are cultural resources of "National Significance" (NS, formerly known as Level I cultural resources, Cultural Resource Inventory, 1994-95, rev. Nov. 2015) and are part of the Rideau Canal UNESCO World Heritage Site and National Historic Site. The lower lock is at the eastern entrance of the channel, and the upper lock is located near its middle. The Nicholsons Lockstation Landscape also includes a masonry spillway dam that extends 76m across the river at the western tip of the narrow island created between the excavated channel and the river; it creates a slackwater section to Clowes Lockstation to the west. The existing spillway dam was built in 1830 and represents one the best three surviving spillway dams on the Rideau Canal. The locks, dam, channel and landscape are fundamental cultural resources of the Canal system and integral to the Rideau's unique historical environment. The Parks Canada Cultural Resource Management Policy identifies cultural landscapes as "any geographical area that has been modified, influenced, or given special cultural meaning by people".

The heritage value of the Nicholsons Lockstation landscape and associated cultural resources (dam, locks and channel) 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.

The character-defining elements contributing to the heritage value of the Nicholsons Lockstation landscape include:

- Locks 18-19, which contribute to maintaining the original appearance and function of the canal;
- The 800m long excavated channel;
- The 76m long masonry spillway dam, important in the continuing operation of the canal;
- The 1920 one-bay stoplog weir, important in the continuing operation of the canal;
- The location, form and scale of the 1838 lockmaster's house overlooking lock 18, with its truncated hipped roof, thick limestone first floor walls, wood-framed second story addition and one story summer kitchen;
- The 1838 chicken coop adjacent to the lockmaster's house (subsequently removed due to damage from a falling tree);
- The manually-operated replica timber swing bridge over lock 19;





- The local road crossing north-south over lock 19;
- The surviving spatial organization of the landscape, including its open spaces and circulation patterns;
- The unobstructed lines of sight between locks 18 and 19;
- The unobstructed line of sight from lock 19 westward to the stone arch spillway dam at Clowes Lockstation;
- The known and potential underwater and terrestrial archaeological resources.

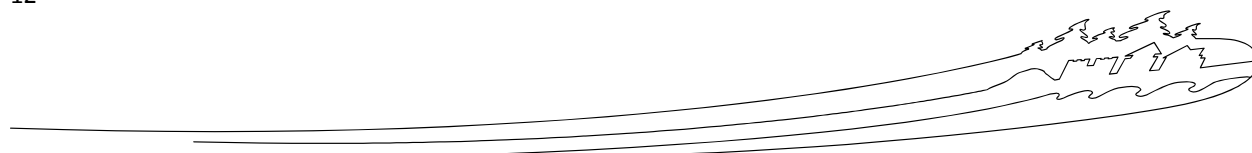
The heritage value ascribed to cultural resources guides conservation efforts and investments. Under the CRM Policy, conservation of heritage value must be a primary consideration in any intervention directed at a cultural resource. Therefore, the primary recommended conservation approach based on the Standards and Guidelines for the Conservation of Historic Places in Canada is Rehabilitation with an emphasis on minimal intervention. Minimal intervention in the context of heritage conservation means doing what is required to arrest and correct deterioration or meet necessary codes while protecting heritage value as much as possible.

Archaeology

Both an archaeological overview assessment and archaeological impact assessment were completed by Parks Canada archaeologists to determine the existing conditions in the proposed work areas. Testing revealed the remains of a gravel roadway by the west embankment. The recommendations from the AIA are as follows: in support of the Upper Nicholson's Dam Rehabilitation Project, an archaeological assessment was undertaken by Parks Canada in August 2016. Archaeological test pits, approximately 40 cm² in size, were excavated across the west embankment to assess the archaeological potential of the area. No known archaeological resources are situated at proximity to be impacted by the concrete retaining wall with masonry facing that extends from the lock to the waste weir. There is no potential that excavation activities may yield Aboriginal and/or historical artefacts. But the West Side Embankment upstream of the spillway (towards Clowes) rehabilitation project and related works will require an AIA. There is a potential in that case, that excavation activities may yield Aboriginal and/or historical artifacts. This archaeological potential is based on Geotechnical boreholes soil analysis and probable location of a "pre-contact" portage site to avoid the rapids in the Rideau River.

The AOA was based on a review of the 66% construction design drawings. There is potential for significant impact to archaeological resources based on the scope of work found within the 66% design concept rehabilitation for the West side Embankment upstream of the spillway area (AOA, Figure 4, Appendix 5). Given the archaeological potential, an Archaeological Impact Assessment (AIA) was completed for the West Side Embankment upstream of the spillway area (AOA, Figure 5, Appendix 5). Findings from this assessment informed mitigation measures.

Should any archaeological resources be uncovered during construction, work should cease in the immediate area, the findings photographed, and Parks Canada's Terrestrial Archaeology section contacted for advice and assessment of significance, which will in turn determine what will be required to mitigate the find.





7. EFFECTS ANALYSIS

The following section outlines the potential impact of the proposed works on valued components in the study area.

Soil, Landforms and Air

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.

The short-term use of machinery/equipment will generate exhaust and smoke emissions that could affect air quality. However, these types of disturbances are temporary and not foreseen to be a threat to local flora, fauna, and people with appropriate mitigation measures in place.

Terrestrial Vegetation

Project activities, especially rehabilitation work on the earth dam and western embankment, will require the removal of terrestrial vegetation. The vegetation removed includes a variety of trees, shrubs and forbs common to the area, both native and exotic invasive species. No species at risk vegetation is located in the study area. Additional vegetation at this location may be removed for the creation of a staging area and access road; however, the staging area and access road have been cleared for previous projects so the vegetation that will be removed is not mature forest. Vegetation loss will be short-term in nature, since the area will be re-colonized by vegetation after construction and a tree planting program, to be carried out by Parks Canada, will be developed to replace trees removed for the project. Also, much of the vegetation that will be removed is invasive species. Exotic invasive species will be completely excavated to reduce the risk of them re-growing.

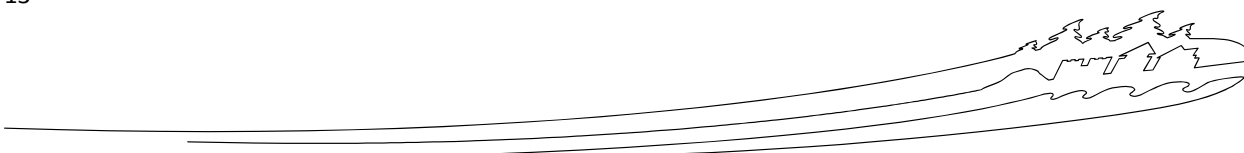
Aquatic Resources and Fish and Fish Habitat

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 may be altered during construction but it will be restored to pre-construction conditions before being re-watered. All dewatering will take place outside of the sensitive fish spawning window of March 15th to July 15th.

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 coarse 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 Upper Nicholson's 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 during late-summer (August or September) 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 along the earth dam and western embankment will result in habitat loss for migratory birds; however, the habitat loss will be 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. Finally, vegetation removal is planned to take place throughout the late fall and winter, outside of the critical nesting season for birds and outside of the active season for most migratory birds.

Other Wildlife

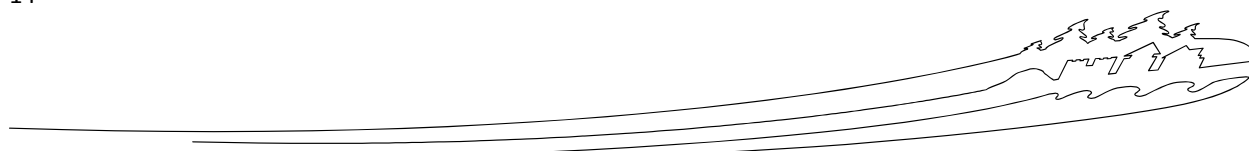
Project activities will take place outside of reptile and amphibian nesting season. However, reptiles and amphibians may still be found on site in the early stages of the project in the fall as they migrate to overwintering habitat in the case of turtles, or in the later stages of the project in the spring as they emerge from hibernation. Mitigation measures that will be employed to reduce the risk to 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 work area.

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 three threatened species – the Eastern Whip-poor-will, Eastern Musk Turtle and Blanding's Turtle.

Eastern Whip-poor-will

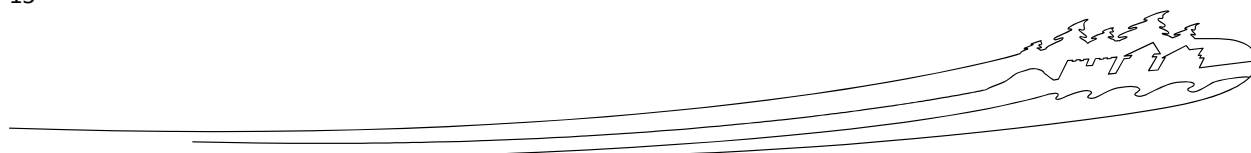
The recovery strategy for Eastern Whip-poor-will (Environment Canada, 2015) identifies both nesting and foraging critical habitat. Nesting habitat includes most types of forest at early stages of succession (or edges of forests with a dense tree cover but showing a similar structure at the ground level), rock or sand barrens with scattered trees, savannahs, old burns, as well as sparse conifer plantations. Foraging habitat include prairies, wetlands with shrubs, regenerating clear-cuts as well as agricultural fields and other habitats with low tree cover and availability of foraging perches as these conditions favor the localization of prey by lunar light as well as foraging efficiency.

Since the 10 km x 10 km grid square that contains Upper Nicholson's Lockstation was identified as potential Eastern Whip-poor-will habitat in the recovery strategy, it is understood that the habitat occupancy requirement for the identification of critical habitat is satisfied. There is forest and wetland habitat located approximately 750 m east and 1200 m west of the lockstation that meets the physical attributes for nesting and foraging habitat, foraging-only habitat and nesting-only habitat. However, the project site (including the western embankment) does not provide habitat that meets the biophysical attributes for nesting or foraging habitat. It does not have well-drained soils (most tree and shrub cover is in the riparian zone), and where soil drainage is deficient, the tree cover is moderate to full. A complete assessment can be found in Appendix 2.

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 bounding polygon of critical habitat stretches along the Rideau River from Merrickville to just north of Burritt's Rapids. Aquatic habitat in the vicinity of Upper Nicholson's 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 impact to Eastern Musk Turtle will be caused by the placement of a cofferdam between the overflow weir and the lock at Upper Nicholson's to facilitate the work on the earth dam. The dewatering of the work area of the overflow dam will remove approximately 5400 m² of overwintering habitat within the canal cut for one winter. Habitat will not be destroyed, it will only be unavailable during construction due to the installation of the cofferdam. Compared to the 516 ha of similar riverine habitat in the bounding critical





habitat polygon (1 ha = 10 000 m²), the amount of habitat that will be temporarily unavailable due to dewatering is negligible.

There is potential for impacts to individual Eastern Musk Turtles as well due to construction activities taking place in Eastern Musk Turtle habitat. If any species at risk, including Eastern Musk Turtles, are found within the construction area, work will cease and Parks Canada will be contacted for guidance on how to proceed.

A full assessment can be found in Appendix 2.

Blanding's Turtle

The proposed recovery strategy for the Blanding's Turtle (Environment Canada, 2016) has two criteria for identifying critical habitat: habitat occupancy and habitat suitability. Since the 10 km x 10 km grid square that includes Upper Nicholson's was identified as potentially having critical habitat in the proposed recovery strategy, the assessment will move forward assuming Blanding's Turtles are in the general area of the project. In terms of habitat suitability, no known nesting location is found within 150 m of the Upper Nicholson's lockstation. However, habitat at the Upper Nicholson's lockstation and western embankment provides habitat that exhibits the physical attributes of critical habitat required for mating, thermoregulation, foraging, summer inactivity and movement. Although the site does contain critical habitat, there will be no permanent loss of critical habitat due to the proposed project. Movement may be temporarily impacted due to active construction, but it will not be completely impeded. Foraging may be altered due to the presence of active construction, but this will be a short-term disruption (October 2016 to May 2017)

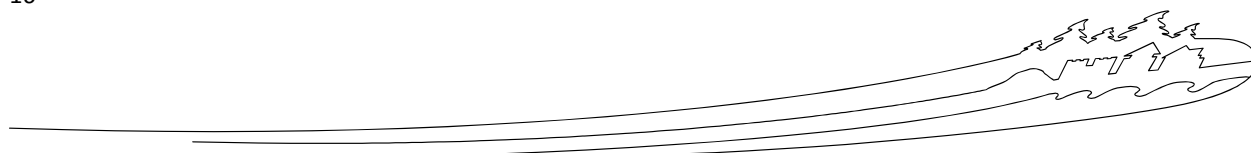
Cultural Resources

Although the Upper Nicholson's Locks, Dam, Channel and Landscape are considered to be cultural resources of National Significance, it is not anticipated that the project of rehabilitating the earth dam will negatively impact the site if appropriate mitigation measures are employed. In principle, the proposed interventions for the rehabilitation of the cultural resources located at Upper Nicholson's are recommended as they conform to the "minimal intervention" approach of the Standards and Guidelines.

As such, the primary treatment is that of "Rehabilitation" and Standards 1-12 are applicable along with the relevant Guidelines on Cultural Landscapes (Section 4.1), Engineering Structures (Section 4.4) and Materials (Section 4.5). Further, the proposed interventions are based on surveys and investigations of the existing condition and heritage recording, an approach promoted by the Standards and Guidelines (Standard 7). In addition, all replacement materials, such as concrete, mortar, stone and wood, etc. should match (physically and visually) the existing as closely as possible. A close, compatible match can be achieved through testing and examination of materials in order to determine their properties, composition and quality of workmanship. The proposed early procurement and testing of the replacement stone to ensure its compatibility is recommended.

Also, the Standards and Guidelines require that all new work should be "aesthetically and physically compatible with, subordinate to and compatible with the heritage character of the historic place".

CRM will provide clarification of the heritage value and character-defining elements for each intervention on the site in order to properly assess impacts and propose mitigation measures. Specific recommendations and required mitigations – based on heritage value and character-defining elements -





should be incorporated throughout the phases of the projects. If an opportunity arises to address or correct past repairs that are no longer considered best conservation practices or that seriously impacted heritage value, CRM advice should be sought to determine whether it makes sense to address this as a part of this project. Therefore, a Statement of Cultural Impact Assessment (SCRIA) will be required in order to properly assess impacts of this project on cultural resources.

Throughout the course of construction, continued involvement and surveillance by CRM, Built Heritage and archaeology advisors is recommended. This approach will ensure the use of recognized conservation methods, appropriate level of intervention and quality control for the repair works on the engineering structures.

Archaeology

In support of the Upper Nicholson's Dam Rehabilitation project (the Project), an archaeological assessment was undertaken by Parks Canada in August 2016. Archaeological test pits, approximately 40 cm² in size, were excavated across the west embankment to assess the archaeological potential of the area. The remains of a former gravel roadway were uncovered along the west embankment. No artifacts or evidence of *in-situ* occupation were uncovered during the assessment. No further archaeological assessment is required, however, the following mitigation measures are required to minimize Project impacts:

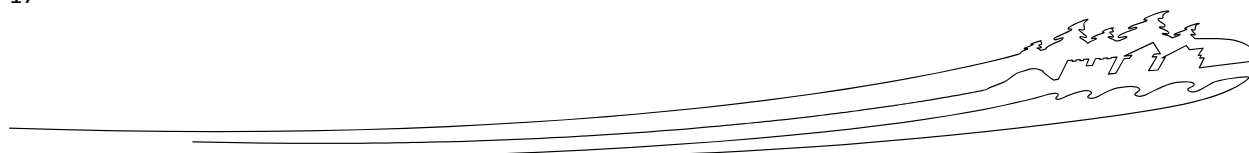
1. Vehicular access routes and staging areas will be restricted to present-day roadways, parking lots and significantly disturbed areas. If this is not possible, the use of protective covering such as geotextile protective mats with granular "A" gravel is required. All protective measures employed must be removed following construction and the area restored to a pre-construction state. Excavation is not permitted during installation or removal of protective covering.
2. Should vegetation clearing be required, excavation or grubbing of the ground surface is not permitted.
3. As archaeological testing is by nature sampling (not 100 percent coverage) there could be a chance, however low, that features or artifact concentrations are encountered. If significant features (i.e., structural remains and/or high artifact concentrations) are encountered, development work should stop in the immediate area, photographs taken 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 that will in turn determine what will be required to mitigate the chance find.

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*

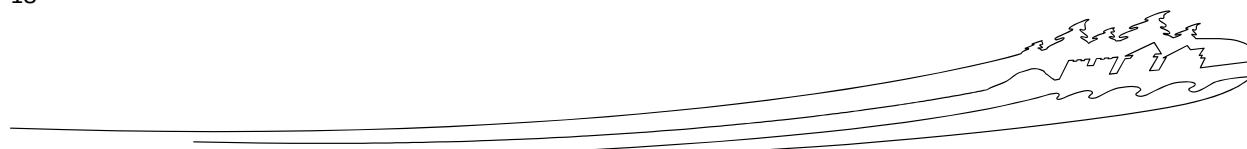
13. SARA NOTIFICATION

Notification is:

- not required
- required under the *Species at Risk Act* (outline the nature of and response to any notification).

14. EXPERTS CONSULTED

Department/Agency/Institution: Parks Canada Agency	Date of Request: July 8, 2016
Expert's Name & Contact Information: Barbara Leskovec	Title: Federal Infrastructure Investments Archaeologist
Expertise Requested: Archaeological assessment of the work area at Upper Nicholsons	





Response: AOA/AIA provided.

Department/Agency/Institution: Parks Canada Agency	Date of Request: August 23, 2016
Expert's Name & Contact Information: Joanne Tuckwell	Title: Species Conservation Specialist
Expertise Requested: Review of Critical Habitat impact analysis and permitting discussion	
Response: Project does not require a permit for harm to individuals.	

Department/Agency/Institution: Parks Canada Agency	Date of Request: July 8, 2016
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. SCRIA to be completed prior to tender.	




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: 2016-08-31
Signature: 	
Recommended by: Valerie Minelga, Environmental Assessment Scientist	Date: 2016-09-01
Signature: 	
Recommended by (Functional Manager of Project): Jean-Francois Charron, Project Engineer	Date: 2016-09-02
Signature: 	
Approved by (Director of Ontario Waterways): Jewel Cunningham, Director, Ontario Waterways	Date: YYYY-MM-DD 2016-09-02





Signature:

 FOR J. CUNNINGHAM

17. ATTACHMENTS

Appendix 1 - Environmental Impact Analysis Tool: Effects Identification Matrix

Appendix 2 - Critical Habitat Destruction Analysis for Upper Nicholson's Earth Dam Rehabilitation

Appendix 3 – Mitigation Measures

Appendix 4 – Site Photos

18. NATIONAL IMPACT ASSESSMENT TRACKING SYSTEM

Project registered in [tracking system](#)

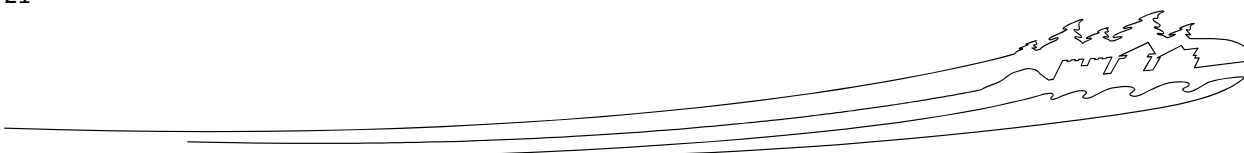
Not yet registered (CEAA 2012 requires PCA submit a report to Parliament annually. EIAs must be entered in the tracking system by the end of April to enable reporting.





References

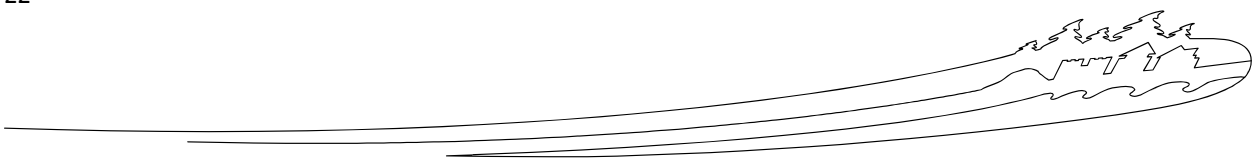
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- COSEWIC. 2010. COSEWIC assessment and status report on the Bobolink (*Dolichonyx oryzivorus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 43 pp.
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- COSEWIC. 2011. COSEWIC assessment and status report on the Barn Swallow (*Hirundo rustica*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 37 pp.
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- Environment Canada. 2015. Recovery Strategy for the Eastern Whip-poor-will (*Antrastomus vociferus*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa, v + 59pp.
- Environment Canada. 2016. Recovery Strategy for the Blanding's Turtle (*Emydoidea blandingii*), Great Lakes / St. Lawrence population, in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa, vii + 49pp.
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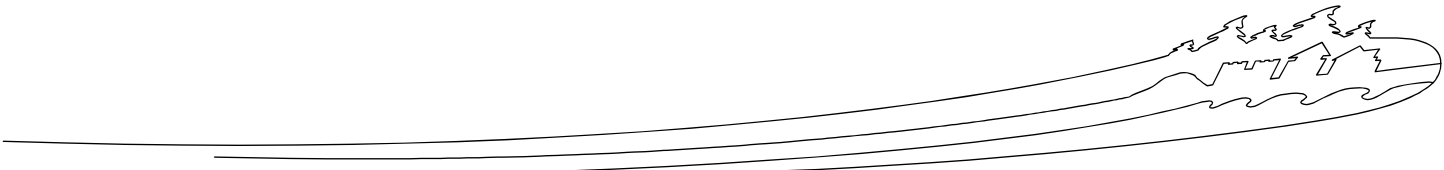




Appendix 1 - Environmental Impact Analysis Tools: Effects Identification Matrix

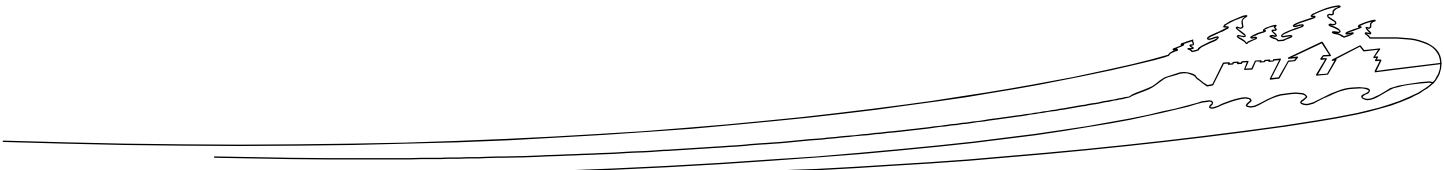
Section A focuses on direct effects of the project and **Section B** on indirect effects that are caused by changes to the environment.

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)	Upper Nicholson's Lockstation Landscape	Upper Nicholson's Cultural Resources of National Significance	
Phase	Examples of Associated Activities								
Project Components	Preparation / Construction / Operation / Decommissioning	Supply and storage of materials	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Burning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Clearing	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Demolition	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		Disposal of waste	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Blasting/ Drilling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Dredging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Drainage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Excavation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Grading	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Backfilling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Use of machinery	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Transport of materials/ equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Building of fire breaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Use of Chemicals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Set up of temporary facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Other...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		





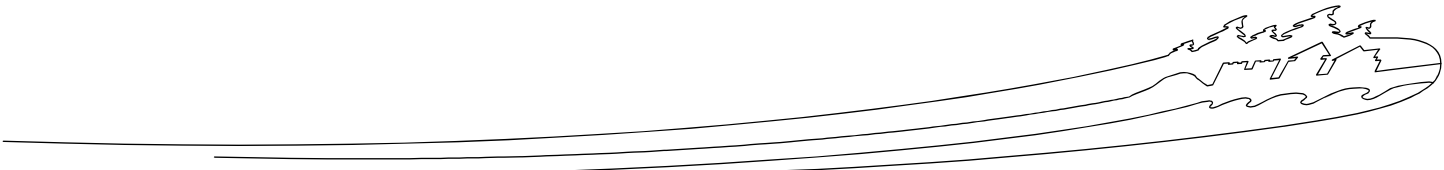
A. Direct effects continued									
		Valued components potentially affected by the proposed project							
		Natural Resources					Cultural Resources		
		Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora (specify, including SAR)	Fauna (specify, including SAR)	Upper Nicholson's Lockstation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





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...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>soils and landforms</u> lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>water</u> (e.g. surface, ground water and water crossings) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>flora</u> (including SAR) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>fauna</u> (including SAR) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

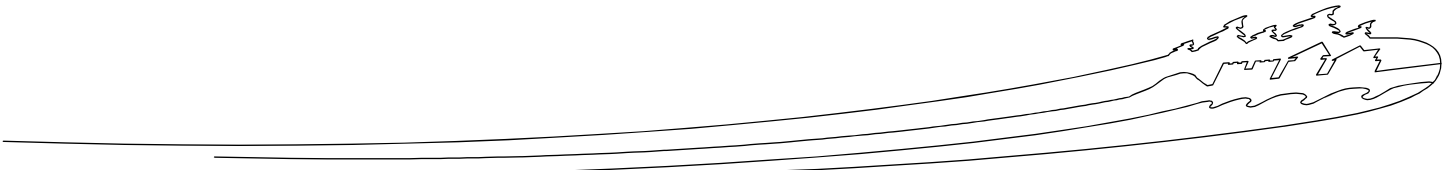




Appendix 2 Critical Habitat Destruction Analysis for Upper Nicholsons Earth Dam Rehabilitation

Part A - General Information					
Date	Where this activity will occur:	SAR implicated by this activity:	Project	Author	Collaborators
August 2016	Rideau Canal NHS – Upper Nicholsons Lockstation	Eastern Whip-poor-will (<i>Antrastomus vociferous</i>) Threatened Schedule 1	Upper Nicholsons Earth Dam Rehabilitation	S.McIntosh	V. Minelga
		Eastern Musk Turtle (<i>Sternotherus odoratus</i>) Threatened Schedule 1			
		Blanding's Turtle (<i>Emydoidea blandingii</i>) Threatened Schedule 1			

Part B – Determining whether the proposed activity(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?
<input type="checkbox"/> 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.
<input checked="" type="checkbox"/> 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?
<ul style="list-style-type: none"> • A site survey may be required to determine the biophysical attributes of the affected habitat.
<input checked="" type="checkbox"/> 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.
<p><i>Eastern Whip-poor-will</i></p> <p>The recovery strategy for Eastern Whip-poor-will (Environment Canada, 2015) identifies both nesting and foraging critical habitat. Nesting habitat includes most types of forest at early stages of succession (or edges of forests with a dense tree cover but showing a similar structure at the ground level), rock or sand barrens with scattered trees, savannahs, old burns, as well as sparse conifer plantations. Foraging habitat include prairies, wetlands with shrubs, regenerating clear-cuts as well as agricultural fields and other</p>





habitats with low tree cover and availability of foraging perches as these conditions favor the localization of prey by lunar light as well as foraging efficiency.

Since the 10 km x 10 km grid square that contains Upper Nicholson's Lockstation was identified as potential Eastern Whip-poor-will habitat in the recovery strategy, it is understood that the habitat occupancy requirement for the identification of critical habitat is satisfied. There is forest and wetland habitat located approximately 750 m east and 1200 m west of the lockstation that meets the physical attributes for nesting and foraging habitat, foraging-only habitat and nesting-only habitat. However, the project site (including the western embankment) does not provide habitat that meets the biophysical attributes for nesting or foraging habitat. It does not have well-drained soils (most tree and shrub cover is in the riparian zone), and where soil drainage is deficient, the tree cover is moderate to full.

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 bounding polygon of critical habitat stretches along the Rideau River from Merrickville to just north of Burritt's Rapids. Aquatic habitat in the vicinity of Upper Nicholson's 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).

Blandings Turtle

The proposed recovery strategy for the Blanding's Turtle (Environment Canada, 2016) has two criteria for identifying critical habitat: habitat occupancy and habitat suitability. Since the 10 km x 10 km grid square that includes Upper Nicholson's was identified as potentially having critical habitat in the proposed recovery strategy, the assessment will move forward assuming Blanding's Turtles are in the general area of the project. In terms of habitat suitability, no known nesting location is found within 150 m of the Upper Nicholson's lockstation. However, habitat at the Upper Nicholson's lockstation and western embankment provides habitat that exhibits the physical attributes of critical habitat required for mating, thermoregulation, foraging, summer inactivity and movement.

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 destroy critical habitat

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

Eastern Musk Turtle

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 Upper Nicholson's Lockstation. Critical habitat mapping identified in the recovery strategy identifies a bounding polygon of critical habitat stretches along the Rideau River from Merrickville to just north of Burritt's Rapids, an area of 516 ha.

Blanding's Turtle

The scale for assessing destruction for Blanding Turtle habitat is the bounding polygon identified in the recovery plan and project area proportional to available habitat. The Recovery Strategy indicates that a 2 km radial distance around occurrence records is appropriate based on the intermediate values of average home range length observed in Ontario and Quebec. The critical habitat polygon that covers Upper Nicholson's is directly connected to many other polygons that create an area of 36,739 ha. Not all habitat within that area exhibits the biophysical attributes of critical habitat, but the size of the area indicates that there is a substantial amount of Blanding's Turtle habitat near Upper Nicholson's.

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 critical habitat will be caused by the dewatering of the canal cut between the overflow weir and the lock at Upper Nicholson's to facilitate the work on the earth dam. The dewatering of the work area of the overflow dam will remove approximately 5400 m² (0.54 ha) of overwintering habitat within the canal cut for one winter. Habitat will not be destroyed, it will only be unavailable during construction due to the installation of the cofferdam. Compared to the 516 ha of similar riverine habitat in the bounding critical habitat polygon (1 ha = 10 000 m²), the amount of habitat that will be temporarily unavailable due to dewatering is negligible (0.1%).

Blanding's Turtle

The impact to Blanding's Turtle critical habitat will be caused by the dewatering of the canal cut between the overflow weir and the lock at Upper Nicholson's to facilitate the work on the earth dam. The dewatering of the work area of the overflow dam will remove approximately 5400 m² (0.54 ha) of overwintering habitat within the canal cut for one winter. Habitat will not be destroyed, it will only be unavailable during construction due to the installation of the cofferdam. Compared to the 36,739 ha of habitat in the bounding critical habitat polygon (1 ha = 10 000 m²), the amount of habitat that will be temporarily unavailable due to dewatering is negligible (0.001%).

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

Blanding's Turtle

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

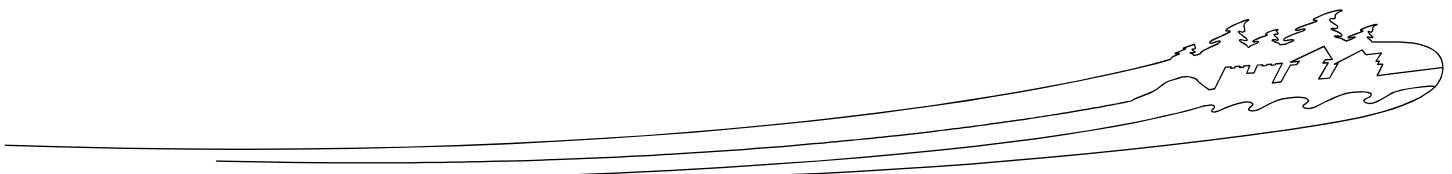
6. Does the project impact the ability of critical habitat in the ERA to support those life processes listed in Question 5?

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. The impact is not permanent and the size of the impact is negligible when compared to the amount of habitat available.

Blanding's Turtle

The project does not impact the ability of critical habitat in the ERA to support the life processes listed in Question 5. The impact is not permanent and the size of the impact is negligible when compared to the amount of habitat available.





Appendix 3: Mitigation Measures

General

1. The Contractor is required to prepare and submit an Environmental Protection Plan and an Erosion & Sediment Control Plan detailing all proposed protection/mitigation strategies (locations of silt fence, spills prevention / cleanup, etc.). The Contractor's plan will be required to be submitted to the Departmental Representative and reviewed and approved by Parks Canada prior to the commencement of work.
2. Inform the Departmental Representative regarding 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.
3. The project manager/contractor shall convene a pre-construction meeting to identify all concerns/mitigation measures to all staff working on the project.
4. Ensure that all on-site personnel are aware of, and comply with, mitigation measures.
5. Should conditions at the work site indicate that there are unforeseen negative impacts to fish, wildlife or cultural resources at any time, all works shall cease and the Departmental Representative shall be contacted immediately. Parks Canada has the right to require that work be altered or ceased immediately.
6. 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. The permit process will be facilitated by Parks Canada.

Species at Risk

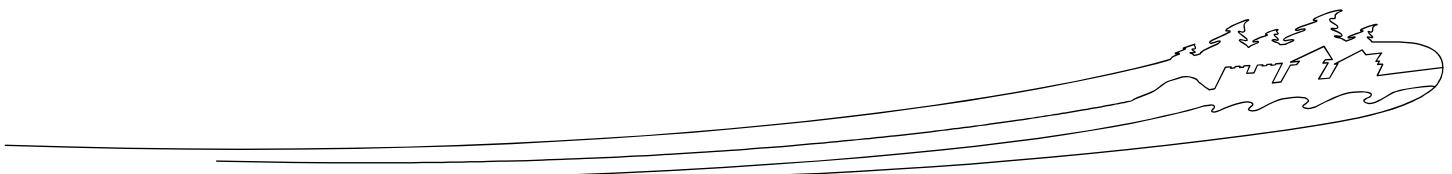
7. Should any suspected species at risk be encountered during project staging, construction or demobilization, contact the Departmental Representative immediately and cease work in the area until guidance on how to proceed is provided.
8. Species at Risk training shall be provided to all employees before they begin work on site (materials to be included in 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.

Eastern Musk Turtle & Blanding's Turtle

9. A sweep of the work area should be completed at the start of every work day to ensure that there are no turtles or snakes within the work area. Sweeps won't be required from approximately mid-November until late March while turtles are over-wintering.

All Species

10. Minimize the disturbed area; clearly mark the work space.
11. Park only on roads or disturbed areas.



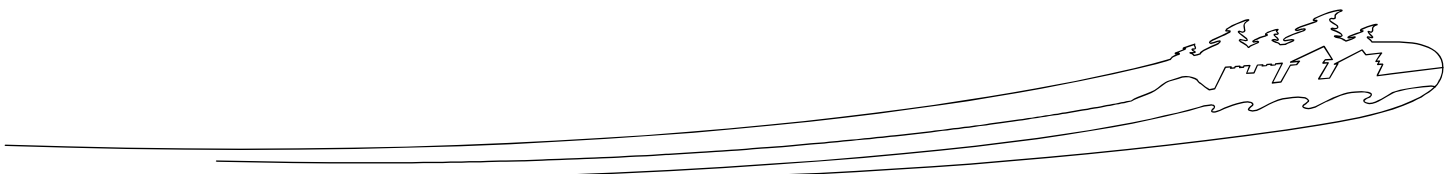


Vegetation removal

- 12.** Migratory birds, their nests and eggs are protected under the Migratory Birds Convention Act (1994). Project works or activities are potentially disruptive activities to birds and should be avoided during breeding times. No vegetation shall be removed from April 1st to August 28th to protect nesting birds. If vegetation must be removed during this period, an avian biologist must screen the area to be cleared for nests no more than two days prior to clearing. If active nests are found, a buffer shall be implemented and the vegetation cannot be removed until the nest is no longer active.

In-water Work

- 13.** No in-water work is permitted between March 15th and June 30th to protect spawning fish.
- 14.** All work is to be completed in the dry. A Dewatering Plan shall be submitted to the Departmental Representative for review and approval by Parks Canada prior to any dewatering.
- 15.** Fish (and reptiles/amphibians if encountered) shall be rescued from areas that are going to be dewatered. Rescued fish shall be released into the Rideau River. Advise the Departmental Representative at minimum 24 hours prior to fish rescue and the commencement of dewatering.
- 16.** All debris on the channel bed (including unused aggregate/concrete rubble) shall be completely removed and area restored to original state upon completion of work.
- 17.** All concrete, sealants, or other compounds used for this project shall be utilized according to the appropriate Product Technical Data Sheet, stating guidelines and methods for proper use, and provided by the manufacturer of the product.
- 18.** Ensure that all works involving the use of concrete, cement, mortars, and other Portland cement or lime-containing construction materials are not deposited, directly or indirectly into any watercourse. Concrete materials cast-in-place must remain inside the formed structure. Containment facilities shall be provided for the wash-down of concrete equipment including concrete delivery trucks, concrete pumping equipment and hand tools. All concrete wash water will be captured and disposed of off-site in a location where it will not enter subsurface drains, waterbodies or storm drains. Water that contacts uncured or partly cured concrete shall be prevented from entering any watercourse or stormwater system. 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. Use only non-toxic biodegradable form stripping agents. Ensure that pH shall not exceed 9 in the water column.
- 19.** Any water containing a high level of silt or sediment will be treated by discharging to settling basins, vegetated areas or sediment traps prior to release to streams (to be identified in a Dewatering Plan). Water quality downstream of construction activities and turbidity curtain should not exceed recommended DFO and 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://cegrcqe.ccme.ca/download/en/217/>. If such a change is observed, work may be stopped until the problem is addressed.





Erosion and Sediment Control

20. Sediment and erosion control measures shall be implemented prior to work and maintained throughout the work phase, to prevent entry of sediment into the water where site access or other activities cause exposed soil.
21. All sediment and erosion control measures shall be inspected daily to ensure they are functioning properly and must be maintained and/or upgraded as required to prevent entry of sediment into the water.
22. 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.
23. If sediment and erosion control measures are not functioning properly, no further work shall occur until the sediment and/or erosion problem is addressed.
24. 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.
25. Avoid activity during excessively wet weather conditions; monitor forecasts for heavy rainfall watches & warnings.
26. The contractor will provide a marine grade turbidity curtain across all areas where sediments can enter the watercourse. Turbidity curtain 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.
27. 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.
28. The contractor will maintain a standby supply of pre-fabricated silt fence barrier, or an equivalent ready-to install sediment control device.
29. Mandatory submission - and approval by Parks Canada - of an Erosion and Sediment Control Plan, as stand alone or part of the EMP, demonstrating:
 - a) 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;
 - b) Drainage areas and patterns based on pre-construction topography and construction design;
 - c) 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;
 - d) How clean storm run-on will be diverted around the site and away from exposed areas;
 - e) Channels that are designed and constructed to the necessary design discharge;
 - f) Temporary and permanent erosion control needs for all drainage channels;
 - g) Consideration of project schedule in selecting, designing and laying out environmental controls;
 - h) Consideration of seasonal requirements (for longer-term projects); select and design controls and practices for controlling erosion and sedimentation including shutdown periods.

Staging/Work Area

30. Keep worksite clean; daily garbage (incl. cigarette butts) removal.





- 31.** Maintain equipment to avoid leakage of fuels and liquids. Ensure measures are in place to minimize impacts of accidental spills; an emergency spill kit shall be kept on-site and employed immediately should a spill occur. In case of a spill, the Ontario Spill Action Centre shall be notified immediately at 1-800-268-6060 and the Departmental Representative shall also be notified. Should a spill occur, further mitigation and/or remediation measures may be required.
- 32.** Store all oils, lubricants, fuels and chemicals in a secure designated area on impermeable pads.
- 33.** Refuelling of equipment and maintenance shall be conducted off slopes and away from water bodies on impermeable pads at a recommended distance of 30 meters from any watercourse to allow full containment of spills. In the event that the recommended distance is not feasible or practical, proper storage/re-fuelling mats will be employed at the project site.
- 34.** 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.
- 35.** All materials and equipment used for the purpose of site preparation and project completion shall be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum products, debris etc.) from entering the water.
- 36.** 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.

Cultural Resources /Archaeology

- 37.** Repair deteriorated parts of constructed elements in a manner that is physically and visually compatible with the engineering work as per contract drawings and specifications.
- 38.** Repair constructed elements or their components using recognized conservation methods as per contract drawings and specifications.
- 39.** Repair masonry by repointing the mortar joints where there is evidence of deterioration, such as disintegrating or cracked mortar, loose stone, or damp walls.
- 40.** Fully repoint the walls as deep as required, grouting the remaining voids, and undertake stone repairs as outlined in contract drawings and specifications.
- 41.** Use mortars that ensure the long-term preservation of the masonry assembly, and are compatible in strength, porosity, absorption and vapour permeability with the existing masonry units, as outlined in contract drawings and specifications. Based on documentary and physical evidence, duplicate original mortar joints in colour, texture, width and joint profile.
- 42.** Remove all incompatible cement repairs to prevent eventual deterioration of surrounding stone.
- 43.** If the stones are unstable before or during work, the stonework should be carefully taken down and rebuilt. Such rebuilding should be preceded by numbering and recording so that the stonework can be restored exactly as it was. Temporary numbering in chalk should be placed on the face of the stone units for photographic recording. Parks Canada requires, when temporary structures are installed on a site, that the contractor safeguards the character-defining elements of the sites on Rideau Canal National Historic Site WHS. The contractor should bear in mind that at national historic sites, the recommended practice is





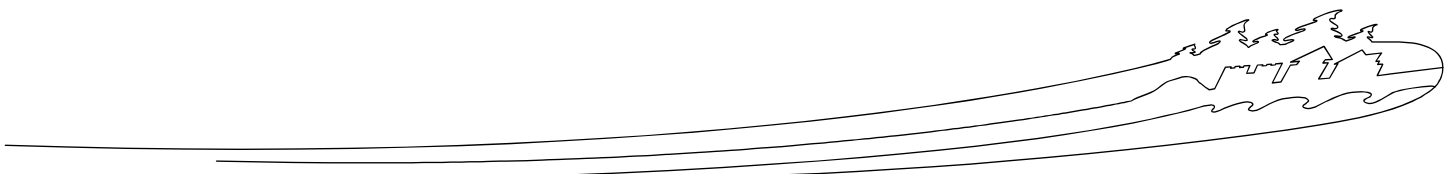
- what is called a minimal intervention approach, as defined in the Standards and Guidelines for the Conservation of Historic Places in Canada.
- 44.** Vehicular access routes and staging areas will be restricted to present-day roadways, parking lots and significantly disturbed areas. If this is not possible, the use of protective covering such as geotextile protective mats with granular “A” gravel is required. All protective measures employed must be removed following construction and the area restored to a pre-construction state. Excavation is not permitted during installation or removal of protective covering.
 - 45.** Should vegetation clearing be required, excavation or grubbing of the ground surface is not permitted.
 - 46.** Cleared vegetation will be piled and extracted from a designated area, to be identified by PCA staff. Burning of cleared vegetation is not permitted on site.
 - 47.** If significant features (i.e., structural remains and/or high artifact concentrations) are encountered during construction activities, excavation should cease in the immediate area, and the Parks Canada Project Manager be informed. The Project Manager should then contact Parks Canada's Terrestrial Archaeology section for advice and assessment of significance, which will in turn determine the requirements to mitigate the find.

Air/Noise

- 48.** 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. Environmental Assessment 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.
- 49.** Monitor and mitigate public complaints by keeping a record of complaints and addressing any issues raised by the public.
- 50.** 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.

Waste Disposal

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





Appendix 4 – Site Photos



Photo 1. Earth dam and masonry/concrete wall at Upper Nicholsons – looking towards the weir from the lock (July 2016).

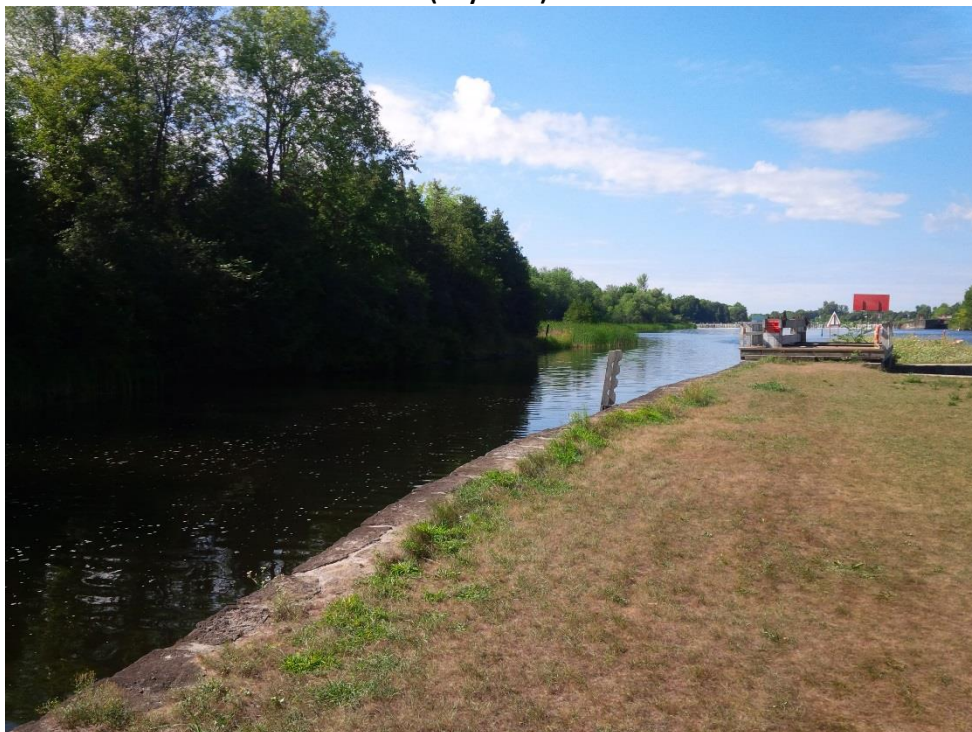


Photo 2. View of earth dam, masonry/concrete wall and waste weir at Upper Nicholsons (July 2016).

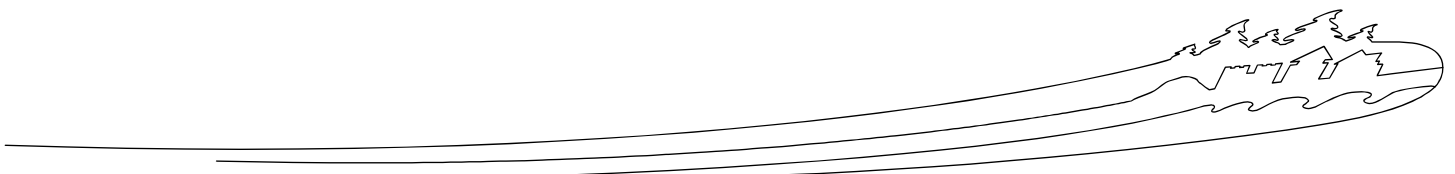
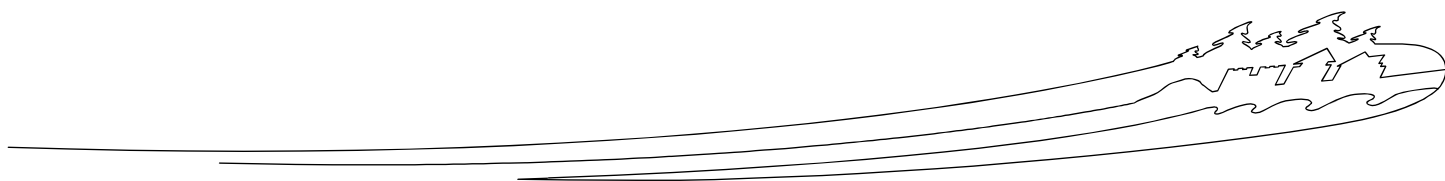




Photo 3. View of spillway dam and western embankment (July 2016).



Photo 4. View of the crest of the western embankment (July 2016).



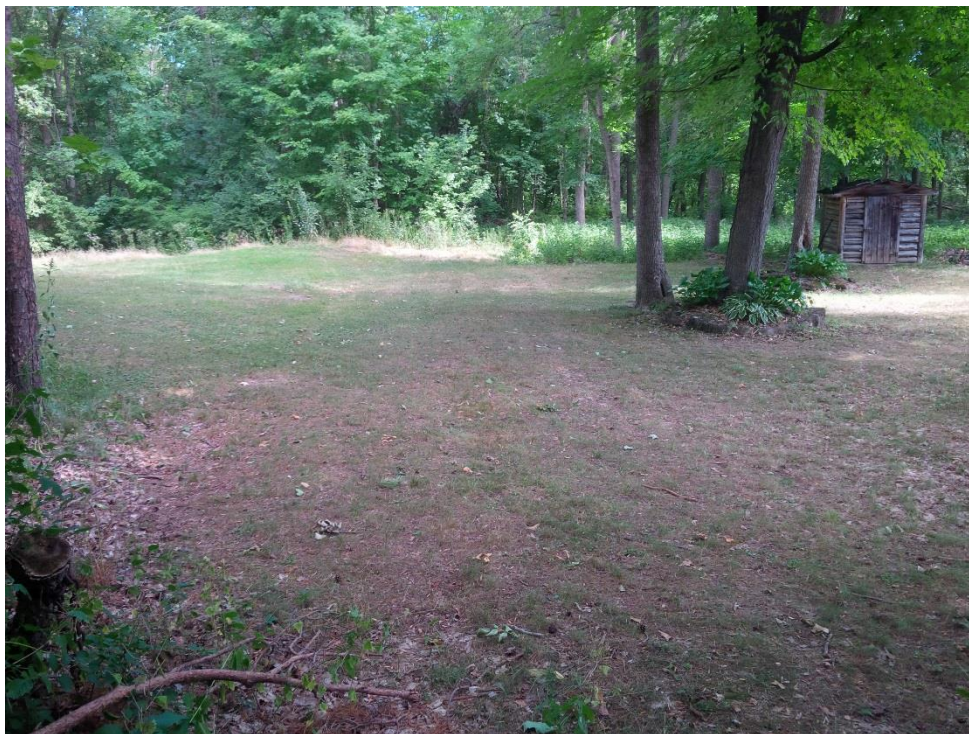


Photo 5. Easement through a private property where work will begin to raise the crest of the western embankment (July 2016).



Photo 6. View of the Rideau River downstream of the Upper Nicholson's spillway dam (July 2016).

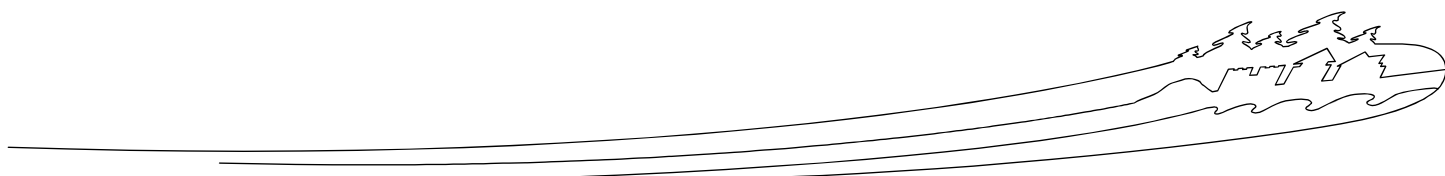




Photo 7. Active Osprey nest located between the Upper Nicholsons lockstation and the Rideau River (July 2016).

