

SPECIFICATION DIVISION	SECTION	PAGES
INDEX	00 00 10 Table of Contents	2
DIVISION 01	01 11 55 General Instructions	12
GENERAL	01 35 33 Health and Safety Requirements	8
REQUIREMENTS	01 35 43 Environmental Procedures	3
	01 51 00 Temporary Utilities	2
	01 74 19 Waste Management and Disposal	9
DIVISION 03	03 10 00 Concrete Forms and Accessories	3
CONCRETE	03 20 00 Concrete Reinforcing	3
	03 30 00 Cast-In-Place Concrete	6
DIVISION 05	05 12 00 Structural Steel Framing	5
METAL	05 14 00 Aluminum Structural Framing	6
	05 72 10 Steel Structural Cable and Wire Rope	5
DIVISION 06	06 90 00 Safety Nets	4
WOOD, PLASTIC AND COMPOSITES		
DIVISION 31	31 23 33.01 Excavating, Trenching and Backfilling	6
EARTHWORK	31 63 00 Rock Anchors	9
APPENDICES		
APPENDIX A	Environmental Management Plan	91
APPENDIX B	Archaeological Memo	137
APPENDIX C	Geotechnical Assessment Report	143
APPENDIX D	Survey Drawing - Topographic Plan of Part of Pacific Rim National Park West Coast Trail KM 56 Logan Creek	163

**DRAWING LIST (BOUND SEPARATELY)**

S300	COVER SHEET - LOCATION PLAN & SITE MAP
S301	GENERAL NOTES
S302	SITE PLAN

WEST COAST TRAIL  
LOGAN CREEK BRIDGE  
PACIFIC RIM NATIONAL PARK RESERVE  
VANCOUVER ISLAND, B.C.

**00 00 10**  
**TABLE OF CONTENTS**  
November 2017

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S303	NEW BRIDGE PLAN VIEW & ELEVATION VIEW
S304	ABUTMENT LOCATION PLANS & SITE PHOTOS
S305	SECTIONS & DETAILS SHEET – 1
S306	SECTIONS & DETAILS SHEET - 2
S307	SECTIONS & DETAILS SHEET - 3
S308	SECTIONS & DETAILS SHEET - 4

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1.0 GENERAL

1.1 CODES

- .1 Perform work in accordance with National Building Code Canada 2015, Canadian Highway & Bridge Design Code CSA S6-14, WORKSAFE BC, Construction Standards and Bylaws and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 Meet or exceed requirements of specified standards, codes and referenced documents.

1.2 DESCRIPTION OF WORK

- .1 Work under this Contract is to take place at West Coast Trail Logan Creek site at southwest of Port Renfrew and west of Owen Pt, B.C. The site is approximate 19km southwest from Gordon River Trailhead on West Coast Trail as shown on site map on S301. The nearby camp sites are the Cullite Cove Campsite, which is about 2km at its east, and the Walbran Creek Campsite, which is about 3km at its west.
- .2 Work to be performed includes, but is not limited to, the provision of all labour, materials, services and equipment necessary for the following items covered further in the Contract documents:
  - .1 Arrange the helicopter trip and assist the Departmental Representative for a site inspection of existing bridge in spring.
  - .2 Clear site as required for new bridge construction and remove danger trees that could possibly damage new bridge if falling as identified on the drawings and Appendix A – Environmental Management Plan. Follow the direction of the Departmental Representative for danger tree removal and disposal.
  - .3 Supply and construct suspension bridge including concrete footings, rock anchors, cables, aluminum beams/joists, aluminum plank, steel support piers and miscellaneous components
  - .4 Supply and construct boardwalk and/or ramp for access to the new bridge at both ends.
  - .5 Remove and dispose off site the existing cable suspension bridge including all cables, wood beams, decks, nets, etc and their connection components.
  - .6 Remove and dispose off site the existing wood ladders, wood platforms that provide access to the existing bridge at both ends.
- .3 “Green” requirements:
  - .1 Use materials/products containing highest percentage of recycled and recovered materials practicable – consistent with maintaining cost effective satisfactory levels of competition.
  - .2 Adhere to waste reduction requirement for reuse or recycling of waste materials, thus

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diverting material from landfill.

### 1.3 CONTRACT DOCUMENTS

- .1 The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

### 1.4 TIME OF COMPLETION

- .1 Commence work immediately upon official notification of acceptance of offer and complete the project by end of September 2018.

### 1.5 HOURS OF WORK

- .1 Hours of work:
  - .1 No restriction on hours of work by the Contractor but subject to provincial and/or municipal bylaw for noise control.

### 1.6 WORK SCHEDULE

- .1 Carry out work as follows:
  - .1 Within 10 working days after Contract award, provide a “phasing bar chart”, and a schedule showing anticipated progress stages and final completion of the work within the time period required by the Contract document. Indicating the following:
    - .1 Submission of shop drawings including construction methodology, environmental protection plan, and archaeology monitoring plan, product data, MSDS sheets and samples.
    - .2 Commencement and completion of work of each section of the specifications or trades for each phase as outlined.
    - .3 Final completion date within the time period required by the Contract documents.
  - .2 Do not change approved Schedule without notifying Departmental Representative.
  - .3 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.

### 1.7 DIVISION OF SPECIFICATIONS

- .1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.
- .2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the



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work rests solely with the Contractor.

- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

#### 1.8 COST BREAKDOWN

- .1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum prices in detail as directed by the Departmental Representative and aggregating Contract price. After approval by Departmental Representative, cost breakdown will be used as basis for progress payments.

#### 1.9 CODE, BYLAWS, STANDARDS

- .1 Perform work in accordance with the National Building Code of Canada (NBC) 2015, Canadian Highway & Bridge Design Code CSA S6-14, and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.
- .2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
- .3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
- .4 In any case of conflict or discrepancy, the most stringent requirements shall apply.

#### 1.10 DOCUMENTS REQUIRED

- .1 Maintain one copy each of the following at the job site:
- .1 Contract drawings.
  - .2 Contract specifications.
  - .3 Addenda to Contract documents.
  - .4 Copy of approved work schedule.
  - .5 Reviewed/approved shop drawings.
  - .6 Change orders.
  - .7 Other modifications to Contract.
  - .8 Field test reports.
  - .9 Reviewed/approved samples.
  - .10 Manufacturer's installation and application instructions.
  - .11 One set of record drawings and specifications for "as-built" purposes.
  - .12 National Building Code of Canada 2015.
  - .13 Current construction standards of workmanship listed in technical Sections.
  - .14 Project Safety Plan.
  - .15 Request for Information (RFI).
  - .16 Contemplated Change Notices.
  - .17 WHMIS Documents.
  - .18 Site Instructions.

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- .19 Contractor's Health and Safety Plan, including map to nearest hospital.

**1.11 REGULATORY REQUIREMENTS**

- .1 Permit
  - .1 Obtain and pay for Permit, Certificates, Licenses and other permits required by regulatory municipal and provincial authorities to complete the work.
- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.
- .4 Comply with conditions as stated in Standard Acquisition Clauses and Conditions (SACC) Manual.

**1.12 ENVIRONMENTAL REQUIREMENTS**

- .1 Hazardous Materials: product, substance, or organism that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .2 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Material Safety Data Sheets (MSDS).
- .3 Perform work with protective equipment and procedures applicable for the hazardous materials indicated and Comply with Canada Labour Code, Part II requirements and BC Occupational Health and Safety Regulation (OHSR) and Worksafe BC, whichever are more stringent.
- .4 All site clearing and danger tree removal will be monitored by Departmental Representative. Schedule of any site clearing and tree removal work must be provided to the Departmental Representative at least 72 hours in advance to allow them to be at site during the work. Contractor is to provide campsite at his own cost for the Department Representative to perform environmental monitoring work.
- .5 Contractor shall abide by the requirements specified in the Appendix A – Environmental Management Plan.

**1.13 CONTRACTOR'S USE OF SITE**

- .1 Use of site:
  - .1 Exclusive and complete for execution of work.
  - .2 Assume responsibility for assigned premises for performance of this work.
  - .3 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative such as concrete testing company

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- and rock anchor testing company.
  - .4 Provide security of Contractor's work site and all Contractors and Subcontractor's equipment and material.
  - .5 Perform work in accordance with the Contract documents. Ensure work is carried out in accordance with indicated phasing and approved schedules.
  - .6 Do not unreasonably encumber site with material or equipment.
  - .7 Do not obstruct access to the property outside of the Contractor's work site. Provide yellow safety taps around the boundary of the construction site and provide temporary detour routes for hiker's access to the existing bridge.
  - .8 Site clearing, and removal of danger trees must be completed by March 12<sup>th</sup> to reduce the risk of environmental impact. Also refer to Appendix A – Environmental Management Plan for precaution measures and recommendations to minimize the environmental impact.
  - .9 Provide his own water and sanitary services and his own electrical power and/or generators as required on site during the construction period.
  - .10 Strictly follow the Forest Fire Prevention and Suppression Regulation in B.C.
  - .11 There is no road to the Creek and there is a nearby logging road of West Coast Trail approximate 5km to 6km away and the access is subject to weather condition. Contract might need a helicopter to transport/deliver equipment, materials from the nearby logging road or from the beach at Logan Creek to the site. Access may be restricted by weather due to West Coast weather condition and access from the beach may be restricted due to water level.
  - .12 Contractor is to provide a safe access from the beach at Logan Creek to the new abutment at both sides of the bridge prior to construction on site.
  - .13 Contractor can use the areas adjacent to the proposed bridge abutment locations for the storage areas as shown in the drawing S302, but contractor is not allowed to camp at the construction site. Clearing outside the delineated boundaries is not allowed the permission from the Departmental Representative.

#### 1.14 EXAMINATION

- .1 Examine site and be familiar and conversant with existing conditions likely to affect work.
- .2 Provide photographs of surrounding properties, objects and structures liable to be damaged or be the subject of subsequent claims.

#### 1.15 EXISTING SERVICES

- .1 Where Work involves breaking into or connecting to existing services, carry out work as directed by the authority having jurisdiction.
- .2 Record locations of maintained, re-routed and abandoned service lines.

#### 1.16 SETTING OUT OF WORK

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

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- .2 Provide devices needed to lay out and construct work.
  - .3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.

#### 1.17 ACCEPTANCE OF SUBTRADES

- 1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to the General Contractor. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

#### 1.18 QUALITY OF WORK

- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.
- .2 The workmanship, erection methods and procedures to meet minimum standards set out in the City of National Building Code of Canada 2015, Canadian Highway & Bridge Design Code CSA S6-14 and Construction Standards as specified herein.
- .3 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

#### 1.19 WORKS COORDINATION

- .1 Coordinate work of sub-trades:
  - .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
  - .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
  - .2 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
    - .1 Pay particularly close attention to overhead work above existing bridge.
    - .2 Identify on coordination drawings, construction elements, services lines, rough-in points and indicate location services entrance to site.
  - .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
  - .4 Publish minutes of each meeting.
  - .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
  - .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
- .3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after

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coordination meeting for such items has taken place.

- .4 Work cooperation:
  - .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
  - .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.
  - .3 Ensure disputes between subcontractors are resolved.
  - .4 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.
  - .5 Maintain efficient and continuous supervision.

#### 1.20 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Shop drawings are to be prepared by Contractor, subcontractor, supplier or distributor. Drawings shall illustrate the appropriate portion of the work, showing fabrication, layout, setting or erection details as specified in appropriate sections.
- .2 Product data: certain specification sections specify that manufacturers' standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings, provided that the product concerned is clearly identified. Submit in sets, not as individual submissions.
- .3 Samples: Submit samples in sizes and quantities specified.
- .4 Submission requirements:
  - .1 Schedule submissions at least 10 days before the date the reviewed submissions will be needed.
  - .2 Submit the number of copiers of shop drawings and/or product data which Contractor requires for distribution plus copies which will be retained by the Departmental Representative.
  - .3 Accompany submissions with transmittal letter in duplicate.
  - .4 Submit either 4 diazo copies or 1 reproducible transparency as directed by the Departmental Representative.
- .5 Coordination of submissions:
  - .1 Review shop drawings, product data and samples prior to submission.
  - .2 Coordinate with field construction criteria.
  - .3 Verify catalogue numbers and similar data.
  - .4 Coordinate each submittal within the Contract documents and the requirements of the work of all trades.
  - .5 The Contractor's responsibility for errors and omissions in submittals is not relieved by the Departmental Representative's review of submittals.
  - .6 The Contractor's responsibility for deviations in submittals from the requirements of the

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Contract documents is not relieved by the Departmental Representative's review of submittals unless the Departmental Representative gives written acceptance of specified deviations.

- .6 Notify Departmental Representative in writing, at time of submission, of deviations in submittals from the requirements of the Contract documents.
- .7 Allow sufficient time (2 weeks) for each of the following:
  - .1 Review of product data.
  - .2 Approval of shop drawings.
  - .3 Review of re-submission.
- .8 The review of shop drawings by Departmental Representative is for the sole purpose of ascertaining conformance with the general concept. This review shall not mean that Departmental Representative approves the detailed design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of responsibility of errors or omissions in the shop drawings or of responsibility of meeting all the requirements of the construction and Contract document. Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

#### 1.21 PROJECT MEETINGS

- .1 Departmental Representative will arrange pre-construction meeting, project meetings and assume responsibility for setting times. Contractor is responsible to record and issue minutes within two (2) days after the meeting.

#### 1.22 TESTING AND INSPECTION

- .1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative are specified under various sections.
- .2 The Contractor will appoint and pay for the services of testing agency or testing laboratory, and where required for the following:
  - .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 mechanical and electrical equipment and systems.
    - .1 Mill tests and certificates of compliance.
    - .2 Tests specified in the contract documents to be carried out by Contractor which may be under the Departmental Representative's supervision.
- .3 Within 20 working days after Contract award provide a list of proposed testing services or testing laboratories for Departmental Representative's approval.

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- .4 The Departmental Representative may require, and pay for, additional inspection and testing services not included in paragraph 1.22.2.
  - .5 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.
  - .6 Contractor shall furnish labour and facilities to carry out specified testing and notify Departmental Representative in advance of planned testing.
  - .7 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
  - .8 Provide Departmental Representative with 2 copies of testing laboratory reports as soon as they are available.
  - .9 Ensure that work to be inspected is complete at the time of inspection and in accordance with the contract documents. Additional inspections required due to the incomplete work or poorly executed work, as judged by the Departmental Representative, as well as additional design or remedial work caused by deviations from these drawings, may be charged to the contractor.
  - .10 A minimum 72 hours notice shall be given to the Departmental Representative by the contractor for any inspection to be carried out.
  - .11 Arrange and pay for helicopter access for 18 site inspections to be carried out by the Departmental Representative. Arrange the helicopter to allow for 3 passengers full day per site inspection.
  - .12 Arrange and pay for campsite for the Department Representative to perform environmental and archeological monitoring work. Allow for 2 people for each of the monitoring work.

#### 1.23 RELICS AND ANTIQUITIES

- .1 Relics and antiquities and items of historical or scientific interest shall remain property of Departmental Representative. Protect such articles and request directives from Departmental Representative.
- .2 Give immediate notice to Departmental Representative if evidence of archeological finds are encountered during excavation, and await Departmental Representative's written instructions before proceeding with work in this area.
- .3 All sub-surface disturbances will be monitored by a departmentally designated Archaeologist during any excavation. Schedule of any excavation work must be provided to Archaeologist and the Departmental Representative at least 72 hours in advance to allow them to be at site during

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excavation. The encountered artifacts and/or features must be recovered and recorded and this may result in slower work. Contractor is to provide campsite at his own cost for the Department Representative and Archaeologist to perform archeological monitoring work.

- .4 If artifacts or archaeological features (including historic structures or objects) are encountered by a construction contractor, excavation is to be stopped, and the Parks Canada Representative on site, Departmental Representative and Archaeologist shall be notified. Documentation is to include photographs of what was seen, the location of where the material was encountered, what the surrounding soil looked like, how deep it was from the ground surface, or if it was at ground surface.
- .5 Refer to Appendix C on Archeological notes for requirements and measures to mitigate possible impacts to archaeological resources.

#### 1.24 AS-BUILT DOCUMENTS

- .1 The Departmental Representative will provide 2 sets of drawings and specifications and PDF files for “as-built” purposes.
- .2 Keep one set of current white prints of all contract drawings and all addenda, revisions, clarifications, change orders, and reviewed shop drawings in the site office; and have them available at all times for inspection by the Consultant.
- .3 As the work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.
- .4 Provide accurate as-built drawings by a qualified professional surveyor identifying the various elements shown on the drawings in the requested format.
- .5 At completion of the Work, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings and change order, to a set of Issued for Construction drawings. Submit the ‘red-marked’ as-built set to the Departmental Representative in hard copy with contractor’s review stamp and date confirming that the set submitted are a true record of “as-built” information.

#### 1.25 CLEANING

- .1 Daily conduct cleaning and disposal operations. Comply with local ordinances and anti\_pollution laws.
- .2 Ensure cleanup of the work areas and lock up the equipment each day after completion of work.
- .3 On completion of the work, remove all temporary buildings and offices, site sign, all debris, rubbish, etc., clean-up site and leave same neat and tidy to the satisfactory of the Departmental Representative.



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- .4 In preparation for interim and final inspections:
    - .1 Examine all sight\_exposed interior and exterior surfaced and concealed spaces.
    - .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight\_exposed interior and exterior finished surfaces, including glass and other polished surfaces
  - .5 Use cleaning materials and methods in accordance with instructions of the manufacturer of the surface to be cleaned.

#### 1.26 DUST CONTROL

- .1 Provide temporary dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work and public.
- .2 Maintain and relocate protection until such work is complete.

#### 1.27 ENVIRONMENTAL PROTECTION

- .1 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary enclosures during work.
- .2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.
- .3 Ensure proper disposal procedures in accordance with the Departmental Representative requirements and all applicable territorial regulations.
- .4 Refer to Appendix A – Environmental Management Plan for other requirements on environmental protection.

#### 1.28 ADDITIONAL DRAWINGS

- .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with drawings referred to in the Contract Documents.
- .2 Departmental Representative will furnish up to a maximum of four (4) sets of Contract drawings and four (4) sets of specification for use by the Contractor at no additional cost. PDF files of all documents will be provided. Should more documents be required, the Departmental Representative will provide them at additional cost.

#### 1.29 MATERIAL DISPOSAL

- .1 all material designated to be removed will become the property of the Contractor and will be disposed of in an environmentally acceptable manner so that they neither become a menace to marine navigation nor a nuisance to the public on adjacent or any other property.

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- .2 Unless otherwise specified, all existing material to be replaced or renewed will be disposed of in accordance with .1 above.

**1.30 SYSTEM OF MEASUREMENT**

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

**1.31 FAMILIARIZATION WITH SITE**

- .1 Before submitting tender, visiting site is recommended to become familiar with all conditions likely to affect the cost of the work but a site visit is not mandatory.

**1.32 SUBMISSION OF TENDER**

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

**END OF SECTION 01 11 55**

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**Part 1            General**

**1.1                REFERENCES**

- .1        Government of Canada
  - .1        Canada Labour Code, Part 2 Canada Occupational Safety and Health Regulations.
  - .2        Canada Occupational Health and safety Regulations.
- .2        National; Building Code of Canada (NBC) 2015
  - .1        Part 8 – Safety Measures at Construction and Demolition Sites
- .3        Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1        Material Safety Data Sheets (MSDS).
- .4        Province of British Columbia.
  - .1        Workers Compensation Act Part 3 - Occupational Health and Safety, RSBC 1996 – Current Edition.
- .5        Canadian Standards Association (CSA) as amended:
  - .1        CSA Z797-2009 Code of Practice for Access Scaffold.
  - .2        CSA S269.1-1975 (R2003) Falsework for Construction Purposes.
  - .3        CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures.
- .6        American National Standards Institute (ANSI):
  - .1        ANSI A10.3 Operations – Safety Requirements for Powder-Actuated Fastening Systems.

**1.2                RELATED SECTIONS**

- .1        All specification sections.

**1.3                WORKER'S COMPENSATION BOARD COVERAGE**

- .1        Comply fully with the Worker's Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of work.
- .2        Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

**1.4                COMPLIANCE WITH REGULATIONS**

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

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

## **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit to Departmental Representative, submittals in accordance with Section 01 11 55 - General Instructions.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Submit the following:
  - .1 Health and Safety Plan.
  - .2 Copies of Reports or Directions issued by Federal and Provincial health and safety inspectors.
  - .3 Copies of incident and accident reports.
  - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
  - .5 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's site-specific Health and Safety Plan and emergency procedures and provide comments to the Contractor within seven (7) business days after receipt of plan. Revise plan as appropriate and resubmit to Departmental Representative.
- .5 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .6 Submission and resubmission of the Health and Safety Plan to the Departmental Representative is for information and reference purposes only. It shall not:
  - .1 Be continued to imply approval by the Departmental Representative.
  - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
  - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

## **1.6 RESPONSIBILITY**

- .1 Assume responsibility as the Prime Contractor for work under this Contract.
- .2 Be Responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to the extent that they may be affected by conducted work.

- .3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local status, regulations, and ordinances, and with site-specific Health and Safety Plan.

## **1.7 HEALTH AND SAFETY CO-ORDINATOR**

- .1 The Health and safety Coordinator/Registered Occupational Hygienist/Certified Industrial Specified Hygienist must:
  - .1 Be responsible for completing all health and safety training sessions and ensuring that personnel not successfully completing training are not permitted to enter site to perform work.
  - .2 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
  - .3 Be on site during execution of work.

## **1.8 GENERAL CONDITIONS**

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
  - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
  - .2 Secure site at night time as deemed necessary by Departmental Representative to protect site against entry.

## **1.9 PROJECT/SITE CONDITIONS**

- .1 Work at site will involve:
  - .1 Environment and Climate Change Canada (ECCC) and site representatives.
  - .2 Departmental Representative – Parks Canada

## **1.10 REGULATORY REQUIREMENTS**

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental representative will advise on the course of action to be followed.

## **1.11 WORK PERMITS**

- .1 Obtain and pay for speciality permits related to a project before start of work.

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**1.12 FILING OF NOTICE**

- .1 The Contractor is to complete and submit a Notice of Project as required by provincial authorities.
- .2 Provide copies of all notices to the Departmental representative.

**1.13 HEALTH AND SAFETY PLAN**

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risk and safety hazards.
- .2 Prepare and comply with a site-specific project health and Safety Plan based on hazard assessment, including but not limited to, the following:
  - .1 Primary requirements:
    - 1. Contractor's safety policy.
    - 2. Identification of applicable compliance obligations.
    - 3. Definition of responsibilities for project safety/organization chart for project.
    - 4. General safety rules for projects.
    - 5. Job-specific safe work, procedures.
    - 6. Inspection policy and procedures.
    - 7. Incident reporting and investigation policy and procedures.
    - 8. Occupational Health and Safety Committee/Representative procedures.
    - 9. Occupational Health and Safety meetings.
    - 10. Occupational Health and Safety communications and record keeping procedures.
    - 11. Additional Requirements: Collaborate with Parks staff on site to be aware of Species at Risk that may be encountered on site during the work, for example nests. Co-operate with Parks staff on site in mitigation measures to protect Species at Risk.
  - .2 Include summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
  - .3 List hazardous materials to be brought on site as required by work.
  - .4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
  - .5 Identify personal protective equipment (PPE) to be used by workers.
  - .6 Identify personnel and alternates responsible for site safety and health.
  - .7 Identify personnel training requirements and training plan, including site orientation for new works.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

- .4 Revise and update Health and Safety Plan as required, and re-submit to Departmental Representative.
- .5 Departmental Representative's review: the review of the Health and Safety Plan by Parks Canada shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

#### **1.14 EMERGENCY PROCEDURES**

- .1 List standard operating procedures and measures to be taken in emergency situations, include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
  - .1 Designated personnel from own company.
  - .2 Regulatory agencies applicable to work and as per legislated regulations.
  - .3 Local emergency resources.
  - .4 Departmental representative site staff.
- .2 Include the following provisions in the emergency procedures:
  - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
  - .2 Evacuate all workers safely.
  - .3 Check and confirm the safe evacuation of all workers.
  - .4 Notify the fire department or other emergency responders.
  - .5 Notify adjacent workplaces which may be affected if the risk extends beyond the workplace.
  - .6 Notify Departmental representative site staff.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
  - .1 Work at high angles.
  - .2 Work with hazardous substances.
- .4 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

#### **1.15 HAZARDOUS PRODUCTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous regarding labelling and provision of Material Safety data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
  - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 11 55 – General Instructions.

- .2 In conjunction with Departmental Representative, schedule to carry out work during “off hours”.

#### **1.16 ELECTRICAL SAFETY REQUIREMENTS**

- .1 Comply with authorities.
  - .1 Maintain electrical safety procedures and take necessary precautions to ensure safety for all personnel working under this Contract, as well as safety of other personnel on site.

#### **1.17 OVERLOADING**

- .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation or damage to existing structure and finishes.

#### **1.18 FALSEWORK**

- .1 Design and construct falsework in accordance with CSA S269.1.

#### **1.19 SCAFFOLDING**

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797 and B.C. Occupation Health and Safety Regulations.

#### **1.20 FIRE SAFETY REQUIREMENTS**

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code.

#### **1.21 FIRE PROTECTION AND ALARM SYSTEM**

- .1 Fire protection and alarm system shall not be:
  - .1 Obstructed.
  - .2 Shut off.
  - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable from costs incurred from the fire department, Departmental Representative resulting from false alarms.



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**1.22 UNFORSEEN HAZARDS**

- .1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing. Refer to Specification Section 01 11 55 - General Instruction for information on existing hazardous materials.

**1.23 POSTED DOCUMENTS**

- .1 Post legible versions of the following documents on site:
  - .1 Health and Safety Plan.
  - .2 Sequence of Work.
  - .3 Emergency procedures.
  - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
  - .5 Notice of Project.
  - .6 Site plans.
  - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
  - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
  - .9 Material Safety Data Sheets (MSDS).
  - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all works and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

**1.24 MEETINGS**

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

**1.25 CORRECTION OF NON-COMPLIANCE**

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

- 
- .3 The Departmental Representative may issue a “stop work order” if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a “stop work order”.

**Part 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 EXECUTION**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

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1.0 GENERAL

The existing suspension bridge over Logan Creek was constructed in December 2006 after a windstorm destroyed the previous one. Due to the deterioration of the ladder system and ongoing maintenance within this section of the West Coast Trail (WCT), Parks Canada is seeking to replace the current suspension bridge with a full-span bridge that would connect the eastern and western banks. This new bridge will increase safety for hikers passing through this section of the WCT.

The existing suspension bridge over Logan Creek is approximately 62 m long and 0.5 m wide consisting of wooden planks suspended by two wire cables approximately 20 m above Logan Creek. The new bridge will be constructed in 2018 when the WCT is open to hikers to minimize delays associated with weather conditions. The new bridge will be wider than the existing bridge to allow hiker cross-traffic and will also be designed to support a much higher load. Additionally, the proposed bridge would be suspended much higher above the creek bed, eliminating the requirement for a ladder system.

It is important to follow and implement best management practices (BMPs) in Appendix A, which includes an Environmental Management Plan (EMP), and associated documentation developed for specific activities carried out during this Project. Adhering to this documentation will minimize the potential for negative impacts resulting from the work. All personnel involved in this Project have the responsibility to be familiar with the contents of the EMP and comply with the practices and procedures outlined within. Additionally, the EMP and associated documentation should be kept readily available throughout implementation of the Project.

2.0 DEFINITIONS

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

3.0 SUBMITTALS

- 3.1 Submittals: in accordance with Section 01 11 55 – General Instructions.

.2

4.0 FIRES

- 4.1 Fires and burning of rubbish on site is not permitted.
- 4.2 Clear minimum area necessary; trees should be removed only as necessary for wildfire risk reduction.

- 
- 4.3 Fuel and flammable material must be stored appropriately

1.4 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil, or paint thinner into waterways.
- .3 All construction materials must be removed from the site on project completion.
- .4 Contain waste and transport to an approved waste landfill.
- .5 Cover waste loads during transportation
- .6 Refer to BIA/EMP for specific mitigation measures

1.5 DRAINAGE

- .3 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .4 Do not pump water containing suspended materials into waterways, sewer, or drainage systems.
- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
- .6 Refer to BIA/EMP for specific mitigation measures

1.6 WORK ADJACENT TO WATERWAYS

- .1 Construction equipment to be operated on land only.
- .2 Waterways to be free of excavated fill, waste material and debris.
- .3 Do not skid logs or construction materials across waterways.
- .4 Refer to BIA/EMP for specific mitigation measures

1.7 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment.
- .3 Cover materials and rubbish to prevent blowing dust and debris.
- .4 Prevent extraneous materials from contaminating air and waterways beyond application area.

- .5 Provide temporary enclosures where directed by Departmental Representative.
- .6 Refer to BIA/EMP for specific mitigation measures

#### 1.8 SITE CLEARING AND PLANT PROTECTION

- .1 Take the necessary precautions when felling trees to minimise damage to surrounding vegetation
- .2 Protect trees and plants to be retained as indicated.
- .3 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Departmental Representative.
- .6 Flag all clearing activities.
- .7 Avoid wherever possible the removal of trees of wildlife value (e.g., snags with cavity nests, trees with stick nests).
- .8 When altering a tree on the bank of a waterbody, ensure the root structure and stability are maintained
- .9 Organic material and debris must not be allowed to enter waterbodies.
- .10 Refer to BIA/EMP for specific mitigation measures

#### 1.9 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed non-compliance with Federal, Provincial, or Municipal environmental laws or regulations, permits, and other elements of the BIA/EMP.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
- .3 The contractor will stop activities until 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.

**END OF SECTION 01 35 43**



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**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Temporary utilities.

**1.2                PRECEDENCE**

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

**1.3                RELATED SECTIONS**

- .1        Section 01 11 55 – General Instructions.

**1.4                INSTALLATION AND REMOVAL**

- .1        Provide temporary utilities controls in order to execute work expeditiously.
- .2        Remove from site all such work after use.

**1.5                DEWATERING**

- .1        Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

**1.6                WATER SUPPLY**

- .1        Provide continuous supply of potable water for construction use.
- .2        Arrange for connection with appropriate utility company and pay all costs for installation, maintenance and removal.
- .3        Pay for utility charges at prevailing rates.

**1.7                TEMPORARY HEATING**

- .1        Provide and pay for temporary heating required during construction period, including attendance, maintenance and fuel.
- .2        Construction heaters used must be non-flameless type. Solid fuel salamanders are not permitted.
- .3        Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

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**1.8 TEMPORARY POWER AND LIGHT**

- .1 Provide and 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 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.

**1.9 TEMPORARY COMMUNICATION FACILITIES**

- .1 Provide and pay for temporary telephone, data hook up, lines, equipment necessary for own use.

**1.10 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.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**



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## 1.0 GENERAL

### 1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Parks Canada's Waste Management Plan and Goals.
- .2 Accomplish maximum control of solid construction waste.
- .3 Preserve environment and prevent pollution and environment damage.

### 1.2 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
- .2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.
- .3 Demolition Waste Audit (DWA): relates to actual waste generated from project.
- .4 Inert Fill: inert waste - exclusively asphalt and concrete.
- .5 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.
- .6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .8 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.
- .9 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.
- .10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .11 Separate Condition: refers to waste sorted into individual types.
- .12 Source Separation: acts of keeping different types of waste materials separate beginning from first

time they became waste.

- .13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

### 1.3 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
  - .1 Waste Audit.
  - .2 Waste Reduction Workplan.
  - .3 Material Source Separation Plan.
  - .4 Schedules A, B, C, D, E completed for project.

### 1.4 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 completed Waste Reduction Workplan (WRW): Schedule B.
  - .2 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule C.
  - .3 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- .3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
  - .1 Failure to submit could result in hold back of final payment.
  - .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
  - .3 For each material reused, sold or recycled from project, include amount quantities by number, type and size of items and the destination.
  - .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

### 1.5 WASTE AUDIT (WA)

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA: Schedule A.

- .3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

#### 1.6 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
  - .1 Destination of materials listed.
  - .2 Deconstruction/disassembly techniques and sequencing.
  - .3 Schedule for deconstruction/disassembly.
  - .4 Location.
  - .5 Security.
  - .6 Protection.
  - .7 Clear labelling of storage areas.
  - .8 Details on materials handling and removal procedures.
  - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

#### 1.7 DEMOLITION WASTE AUDIT (DWA)

- .1 Prepare DWA prior to project start-up.
- .2 Complete DWA: Schedule C.
- .3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

#### 1.8 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .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.

#### 1.9 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect surface drainage, mechanical and electrical from damage and blockage.
- .4 Separate and store materials produced during dismantling of structures in designated areas.
- .5 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.

#### 1.10 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner, 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 tonnage generated.
  - .4 Tonnage 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.

1.11 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Provide temporary security measures approved by Departmental Representative.

1.12 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

2.0 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3.0 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.

3.3 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
  - .1 Mark containers or stockpile areas.
  - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged recovered reusable and/or recyclable materials is not permitted.
- .3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Acoustical Insulation	100	
Doors and Frames	100	
Electrical Equipment	80	
Mechanical Equipment	100	
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

.4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		

3.4 WASTE AUDIT (WA)

The following pertains to Schedule A - Waste Audit (WA). Column-1 refers to the category of waste, and a physical description of the material (e.g. off-cuts, clean drywall, etc.). Column-2 refers to the total quantity of materials received by the Contractor. Measurement units must be specified. Column-3 refers to the estimated percentage of material that is waste. Column-4 refers to the total quantity of waste (column-2 x column-3). Column-5 refers to the areas(s) in which the waste was generated. Column-6 refers to the total percentage of recycled material from the specified total quantity of waste (column-4). Column-7 refers to the total percentage of reused material from the specified total quantity of waste (column-4).

.1 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit %	(3) Estimated Waste	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood & Plastics						

Material Description						
Off-Cuts						
Warped						
Plastic						
Cardboard						
Other						
Doors & Windows						
Material Description						
Frames						
Glass						
Wood						
Metal						
Other						

### 3.6 WASTE REDUCTION WORKPLAN (WRW)

The following pertains to Schedule B - Waste Reduction Workplan (WRW). Column-1 refers to the category and type of waste materials. Column-2 refers to the persons responsible for completing the WRW. Column-3 refers to Column-4 of Schedule A. Column-4 refers to the amount of reused waste predicted and realized. Column-5 refers to the amount of recycled waste predicted and realized. Column-6 refers to the approved recycling facility.

.1 Schedule B:

(1) Material Quantity Category	(2) Person Amount Responsible Waste	(3) Total of Project (unit)	(4) Reused Actual (units)	(5) Recycle Actual (s) Amount	(6) Material Destination (s)
Wood & Plastics					
Material Description					
Chutes					
Warped					
Plastic					
Cardboard Packaging					
Other					
Doors & Windows					
Material					

Description					
Painted					
Frames					
Glass					
Wood					
Metal					
Other					

### 3.7 DEMOLITION WASTE AUDIT (DWA)

The following pertains to Schedule C - Demolition Waste Audit (DWA). Column-1 refers to the type of material salvaged. Column-2 refers to the material quantity shown in column-1. Several columns may be required to identify specific demolition areas. Column-3 refers to the unit of measurement used to describe Column-2. Column-4 refers to the total quantity of salvaged material. Column-5 refers to the cumulative volume of salvaged material. Column-6 refers to the total weight in kilograms. Column-7 refers to remarks and assumptions made about the specified material.

#### .1 Schedule C - Demolition Waste Audit (DWA):

(1) Material Description Assumptions	(2) Quantity	(3) Unity	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks & Assumptions
Wood						
Wood						
Stud						
Plywood						
Baseboard -wood						
Door						
Trim-Wood						
Cabinet						
Doors & Windows						
Panel						
Regular						
Slab Regular						
Wood						
Laminate						
Byfold-Closet						
Glazing						



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**3.8 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT**

.1 Schedule E - Government Chief Responsibility for the Environment:

- .1 Ministry of Environment Lands and Parks  
810 Blanshard Street, 4<sup>th</sup> Floor  
Victoria, BC V8V 1X4
- .2 Waste Reduction Commission Soils and Hazardous Waste  
770 South Pacific Blvd, Suite 303  
Vancouver BC, V6B 5E7

**END OF SECTION 01 74 19**



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**1.0     GENERAL**

**1.1     RELATED WORK**

- |    |                        |                  |
|----|------------------------|------------------|
| .1 | Concrete Reinforcing   | Section 03 20 00 |
| .2 | Cast-in-Place Concrete | Section 03 30 00 |

**1.2     REFERENCES**

- .1 CAN/CSA-A23.1-14/CAN/CSA-A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CAN/CSA-O86-14, Engineering Design in Wood (Limit States Design).
- .3 CSA O121-08, Douglas Fir Plywood.
- .4 CSA O151-04, Canadian Softwood Plywood.
- .5 CSA S269.1-1975, Falsework for Construction Purposes.
- .6 CAN/CSA-S269.3-M92, Concrete Formwork.

**1.3     SHOP DRAWINGS**

- .1 Prepare shop drawings for formwork and falsework in accordance with Section 01 11 55 – General Instructions.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings and comply with CAN/CSA-S269.3 for formwork drawings.
- .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.
- .5 The contractor is responsible for the design of all formwork and shoring and for complying with all Worksafe BC regulations pertaining to formwork construction, design and inspection.

**2.0     PRODUCTS**

**2.1     MATERIALS**

- 
- .1 Formwork materials:
    - .1 Use plywood and wood formwork materials to CSA-O121 and CAN/CSA-O86,
    - .2 For concrete with special architectural features, use formwork materials to CAN/CSA-A23.1.
  - .2 Pan forms: removable as indicated.
  - .3 Form ties:
    - .1 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
  - .4 Form liner:
    - .1 Plywood: Douglas Fir to CSA O121 or Canadian Softwood Plywood to CSA O151 square edge.
  - .5 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.
  - .6 Falsework materials: to CSA S269.1.

### **3.0 EXECUTION**

#### **3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork / falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .8 Align form joints and make watertight. Keep form joints to minimum.

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- .9 Use 20mm chamfer strips on external corners and/or 20mm fillets at interior corners of concrete members, joints, unless specified otherwise.
  - .10 Build in anchors, sleeves, and other inserts required to accommodate Work specific in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
  - .11 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

### **3.2 REMOVAL AND RESHORING**

- .1 Formwork removal and reshoring: Do not remove forms and shoring before the concrete has attained sufficient strength to ensure the safety of the structure and not before the following minimum and long term performance periods of time after placing concrete:
  - 24 hours                      footing sides
- .2 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .3 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

**END OF SECTION 03 10 00**



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**1.0     GENERAL**

**1.1     RELATED WORK**

- |    |                                  |                  |
|----|----------------------------------|------------------|
| 1. | Concrete Forming and Accessories | Section 03 10 00 |
| .2 | Cast-in-Place Concrete           | Section 03 30 00 |

**1.2     REFERENCES**

- .1     ANSI/ACI 315-99, Details and Detailing of Concrete Reinforcement.
- .2     ACI 315R-94, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .3     ASTM A775/A775M-04, Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4     CAN/CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction.
- .5     CAN3-A23.3-14, Design of Concrete Structures for Buildings.
- .6     CSA G30.3-M1983(R1991), Cold Drawn Steel wire for Concrete Reinforcement.
- .7     CSA G30.5-M1983(R1991), Welded Steel Wire Fabric for Concrete Reinforcement.
- .8     CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement.
- .9     CSA G30.14-M1983(R1991), Deformed Steel Wire for Concrete Reinforcement.
- .10    CSA G30.15-M1983(R1991), Welded Deformed Steel wire Fabric for Concrete Reinforcement.
- .11    CAN/CSA-G40.21-04, Structural Quality Steels.
- .12    CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .13    CSA W186-M1990, Welding of Reinforcing Bars in Reinforced Concrete Construction.

**1.3     SOURCE QUALITY CONTROL**

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

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## **1.4     SHOP DRAWINGS**

- .1     Produce shop drawings including placing of reinforcement.
- .2     Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacing, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacing and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with ANSI/ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .3     Detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated.

## **1.5     SUBSTITUTES**

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

## **2.0     PRODUCTS**

### **2.1     MATERIALS**

- .1     Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .2     Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA G30.18.
- .3     Cold-drawn annealed steel wire ties: to CSA G30.3.
- .4     Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.
- .5     Epoxy coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .6     Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .7     Mechanical splices: subject to approval of Departmental Representative.
- .8     Plain round bars: to CAN/CSA-G40.21.

### **2.2     FABRICATION**

- .1     Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise. For epoxy coated bars, fabricate in accordance with ASTM D3963.



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- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
  - .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
  - .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists. For epoxy coated bars, method of bundling and transportation should be in accordance with ASTM A775/A775M and ASTM D3963.

### **3.0 EXECUTION**

#### **3.1 FIELD BENDING**

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

#### **3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CAN/CSA-A23.1.
- .2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Prior to placing concrete obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

**END OF SECTION 03 20 00**



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**1.0     GENERAL**

**1.1     RELATED SECTIONS**

- |    |                                  |                  |
|----|----------------------------------|------------------|
| .1 | Concrete Forming and Accessories | Section 03 10 00 |
| .2 | Concrete Reinforcing             | Section 03 20 00 |

**1.2     REFERENCES**

- |     |   |
|-----|---|
| .1  | ASTM C109/C109M-08, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).   |
| .2  | ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.  |
| .3  | ASTM C332-09, Specification for Lightweight Aggregates for Insulating Concrete.   |
| .4  | ASTM C827-01a-(2005), Test Method for Early Volume Change of Cementitious Mixtures.   |
| .5  | ASTM C939-02, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.   |
| .6  | ASTM D412-06ae2, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.   |
| .7  | ASTM D624-00(2007), Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.  |
| .8  | ASTM D1751-04(2008) Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types). |
| .9  | ASTM D1752-04a(2008), Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.                       |
| .10 | CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.  |
| .11 | CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.  |
| .12 | CGSB 81-GP-1M-77, Flooring, Conductive and Spark Resistant.   |
| .13 | CAN/CSA- A3000-08, Cementitious Materials Compendium.   |
| .14 | CAN/CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction.  |
| .15 | CAN/CSA-A23.2-14, Methods of Test for Concrete.   |
| 16  | CSA A283-06 Qualification Code for Concrete Testing Laboratories.   |

- 17 CSA S269.1-1975 (R2003), Falsework for Construction Purposes
- .18 CAN/CSA-S269.3-M92 (R2008), Concrete Formwork
- .19 Canada Green Building Council (CaGBC)
  - .1 LEED® Canada-NC Version 1.0-[2009], LEED® (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations (including Addendum [2007]).
  - .2 LEED® Canada-CI Version 1.0-[2007], LEED® (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.

### **1.3 CERTIFICATES**

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

### **1.4 QUALITY ASSURANCE**

- .1 Minimum 2 weeks prior to starting concrete work, submit proposed quality control procedures for Departmental Representative's approval for following items:
  - .1 Falsework erection.
  - .2 Hot weather concrete.
  - .3 Cold weather concrete.
  - .4 Curing.
  - .5 Finishes.
  - .6 Formwork removal.
  - .7 Joints.

## **2.0 PRODUCTS**

### **2.1 MATERIALS**

- .1 Portland cement: to CAN/CSA-A3000 and CSA A23.1.
- .2 Supplementary cementing materials: to CAN/CSA-A3000.
- .3 Water: to CAN/CSA-A23.1.

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- .4 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.
  - .5 Low density aggregate for insulating concrete: to CAN/CSA-A23.1 and ASTM C332 group II.
  - .6 Air entraining admixture: to ASTM C260.
  - .7 Chemical admixtures: to ASTM C494M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
  - .8 Non-shrink grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
    - .1 Compressive strength: 50 MPa at 28 days.
    - .2 Consistency:
      - .1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 s.
      - .2 Flowable: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portion) 125 to 145%.
      - .3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125%.
      - .4 Dry pack to manufacturer's requirements.
  - .9 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
  - .10 Curing compound: to CAN/CSA-A23.1 and to ASTM C309, Type 1-chlorinated rubber.
  - .11 Ribbed waterstops: extruded PVC Arctic Grade of sizes indicated with welded corner and intersecting pieces:
    - .1 Tensile strength: to ASTM D412, method A, Die "C", minimum 11.4 MPa.
    - .2 Elongation: to ASTM D412, method A, Die "C", minimum 275%.
    - .3 Tear resistance: to ASTM D624, method A, Die "B", minimum 48 kN/m.
  - .12 Premoulded joint fillers:
    - .1 Bituminous impregnated fiber board: to ASTM D1751.
    - .2 Sponge rubber: to ASTM D1752, Type I, flexible grade.
  - .13 Weep hole tubes: plastic.
  - .14 Dampproofing: Emulsified asphalt, mineral colloid type, unfilled: to CAN/CGSB-37.2.
  - .15 Polyethylene film: 6 mil thickness to CAN/CGSB-51.34.
-

## 2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give the following properties:

- .1 Cement: Type GU Portland cement
- .2 Minimum compressive strength at 28 days, class of exposure and nominal size of coarse aggregate:

Member	minimum 28-days strength (Mpa)	maximum aggregate size (mm)	exposure class	air content Category
Concrete footings/piers	30	20	F-2	2

- .3 Slump at time and point of discharge: To CSA-A23.1 Clause 4.3.2.3. When superplasticizers are used, the slump may be increased by shall kept below the point where segregation will occur. The cost of superplasticizers shall be included in the cost of the concrete. Smaller aggregate size may be used where necessary to increase slump.
- .4 Air content: To CSA-A23.1 Table 2 & 4 to suit appropriate exposure class.
- .5 Chemical admixtures: following admixtures in accordance with to ASTM C494M. Admixtures shall contain no salts or acids.
- .6 Concrete mix designs shall be submitted to a material consultant for approval and to Departmental representative for review prior to any concrete work.

## 3.0 EXECUTION

### 3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete. Provide 48 h notice prior to placing of concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 Do not place load upon new concrete until authorized by Departmental Representative.

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### **3.2     CONSTRUCTION**

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1 and CAN/CSA-A23.2. Adhere strictly to CSA-A23.1 for proper preparation and protection for cold weather and hot weather concrete work.
- .2 Sleeves and inserts.
  - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
  - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Departmental Representative.
  - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.
  - .4 Check locations and sizes of sleeves and openings shown on drawings.
  - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts.
  - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
  - .2 With approval of Departmental Representative, grout anchor bolts in holes drilled after concrete has set. Drilled holes to be to manufacturer's recommendations.
  - .3 Protect anchor bolt holes from water accumulations, snow and ice build-up.
  - .4 Set bolts and fill holes with epoxy grout.
  - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .5 Finishing:
  - .1 Finish concrete in accordance with CAN/CSA-A23.1.
  - .2 Use procedures acceptable to Departmental Representative or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: Provide written declaration that compounds used are compatible.

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- .6 Supply and set anchor bolts, sleeves, pipe hangers, expansion joints and other inserts and openings as indicated in the structural drawings and specifications or in documents by other consultants.
  - .7 All dowels, anchor bolts, embedded plates and other inserts shall be placed before the concrete is poured.

### **3.3 SITE TOLERANCE**

- .1 All horizontal surfaces shall meet the Class A Slab and Floor Finish classification (+/- 8mm) in accordance with Table 21 of CAN/CSA-A23.1 straight edge method.
- .2 Tolerance closer than those specified in CSA-A23.1 may be required at certain locations for structural, architectural and construction requirements.

### **3.4 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by a CSA certified Testing Laboratory designated by Departmental Representative in accordance with CAN/CSA-A23.1. Submit all concrete testing results to the Departmental representative.
- .2 The costs of tests shall be borne by contractor as specified in Section 01 11 55 – General Instructions.
- .3 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .5 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

**END OF SECTION 03 30 00**





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#### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 11 55 – General Instructions. Shop drawings for anchor bolt layout and embedded plate layout shall also be submitted for review.
- .2 On erection drawings, indicate all details and information necessary for assembly and erection purposes such as, description of methods, sequence of erection, type of equipment used in erection and temporary bracings.
- .3 No fabrication or work shall be commenced until the review and approval of the shop drawings. The contractor shall assume full responsibility for any fabrication and work done prior to review and approval of the shop drawings.
- .4 Contractor shall co-ordinate and verify all dimension and locations prior to production of the drawing.

#### **1.5 QUALITY ASSURANCE**

- .1 Submit 2 copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work at least 2 weeks prior to fabrication of structural steel. Mill test reports shall be certified by metallurgists qualified to practice in British Columbia, Canada.
- .2 Fabricator of structural steel shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications.

#### **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 11 55 – General Instructions.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Structural steel: to CAN/CSA-G40.21 Grade as indicated on drawings.
- .2 Anchor bolts: ASTM A307 unless noted otherwise on drawings.
- .3 Bolts, nuts and washers: to ASTM F3125/F3125M Grade 325M or to ASTM 325
- .4 Pins: to ASTM A108 Grade 1117, with threads at ends for nuts
- .4 Welding materials: to CSA W48 Series and CSA W59 and certified by Canadian Welding Bureau.

- .5 Shop paint primer: to CISC/CPMA 1.
- .6 Hot dip galvanizing: galvanize all structural steel including connection components to CAN/CSA-G164, minimum zinc coating of 600 g/m2.

## **2.2 FABRICATION**

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.
- .2 Welding shall be performed by certified welders. Fabrication shops shall be approved by the Canadian welding bureau to CSA-W47.1 (Division 1 or 2). Certification shall be supplied to the Departmental Representative upon request.
- .3 Unless noted otherwise, install all rolled steel sections with mill camber upwards.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.
- .5 All areas of galvanized parts shall be grounded off prior to welding. Part 2 coats minimum of zinc rich primer read mix to CAN/CGSB-1.181 after welding.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

### **3.2 MARKING**

- .1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark for fit and match.

### **3.3 ERECTION**

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with

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- reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Departmental Representative.
  - .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
  - .4 Continuously seal members by continuous welds where indicated. Grind smooth.
  - .5 Install and torque all bolts and drilled anchors in accordance with manufacturer's specifications and procedures.
  - .6 Any misfit or misalignment must be reported to the Departmental Representative. The contractor shall provide proposed remedial measures to the Departmental Representative for review and approval. Any remedial work on connections must be reviewed and/or redesigned by the connection engineer. Costs of remedial work are at the expense of the contractor.
  - .7 Do not notch or cut openings in any of the framing members and connection without prior approval from the Departmental Representative.
  - .8 Provide temporary bracing to structure for stability and safety as required until the completion of the overall structure.
  - .9 Contractor shall do welding work in strict conformance with the requirements of CSA W59, in particular, preheating requirements and welding restriction in low temperature.
  - .10 No field weld should be provided without prior approval from the Departmental Representative.

### **3.4 FIELD QUALITY CONTROL**

- .1 The Departmental Representative will not be responsible for inspection of the Contractor's work as described in Clause 7.12 of the CISC Code of Standard Practice for Structural Steel. The Contractor is responsible for the accuracy and completeness of his own work and shall verify that the structural steel has been fabricated, erected and finished in accordance with the contract specifications.
- .2 Inspection and testing of materials and workmanship will be carried out by an independent testing laboratory approved by Departmental Representative.
- .3 Testing requirements are as follows:
  - .1 Visual Field Inspection and Bolt Torque Testing (Random 10% of Bolts) of all bolted connections.
  - .2 Non Destructive Testing of Welds: 100% of all welds to be visually inspected.

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- .4 Welding inspector shall be certified to CSA W178.2 Level 2 or Level 3.
  - .5 Provide safe access and working areas for testing on shop, as required by testing agency and as authorized by Departmental Representative.
  - .6 Submit test reports to Departmental Representative within 1 week of completion of inspection.
  - .7 Costs of tests shall be borne by the Contractor.

### **3.5 FIELD PAINTING**

- .1 Touch up damaged surfaces with 2 coating of galvacon.

**END OF SECTION 05 12 23**



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## **PART 1 - GENERAL**

### **1.1 SUMMARY**

- A. Related Documents:
  - 1. Drawings and the General Requirements of the Subcontract apply to this Section.
  - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Aluminum framing members, support members, bracing members and connections.
  - 2. Base plates, leveling plates, leveling nuts and bolts.
  - 3. Grouting under base plates.
- C. Related Sections:
  - 1. Section 01 11 55 – General Instructions

### **1.2 REFERENCES**

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
  - 3. Refer to Section 01 11 55 – General Instructions for the list of applicable regulatory requirements.
- B. Federal Specifications:
  - 1. TT-P-645 – Paint, Aluminum, Heat Resisting
- C. Aluminum Association:
  - 1. Aluminum Design Manual 2010
- D. ASTM International:
  - 1. ASTM B308 / B308M Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
  - 2. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - 3. ASTM B429 Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
- E. American Welding Society:
  - 1. AWS B2.1 – Specifications for Welding Procedure and Performance Qualification
  - 2. AWS D1.2 - Structural Welding Code, Aluminum.

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### **1.3 DESIGN REQUIREMENTS**

- A. Design connections not detailed on the Drawings under the direct supervision of a Structural Engineer experienced in design of aluminum and licensed in the province of British Columbia, Canada.
- B. Design details and connections in accordance with requirements of Aluminum Design Manual 2010 to resist forces, moments, shears and allow for movements indicated.
- C. If shears are not indicated, select or design connections to support reaction from 120% maximum uniformly distributed load that can be safely supported by beam in bending (60% each end), provided no point loads act on beam.

### **1.4 SUBMITTALS**

- A. Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 11 55 – General Instructions.
- B. Shop Drawings: For aluminum fabrications as follows:
  - 1. Complete fabrication and erection plans and procedures giving full information on all aspects of the erection that will affect alignment, plumb and dimensional accuracy of the structure.
  - 2. Connections, including size and spacing of bolts and welds.
  - 3. Indicate profiles, sizes, spacing, and locations of structural members, openings, camber and attachments.
  - 4. Indicate welded connections with AWS welding symbols. Indicate net weld lengths. Include details of welding materials, equipment, sequence and technique to be used.
- C. Manufacturer's Certificate: Submit certification that manufactured products (including bolts, nuts and washers) meet or exceed specified requirements.
  - 1. Deliver manufactured products to the site in unopened containers. Certification numbers must appear on product containers for bolts, nuts and washers and the numbers shall correspond to the identification numbers on the Manufacturer's Certificate. The Manufacturer's symbol and grade markings must appear on bolts, nuts and washers.
- D. Mill Test Reports: Submit mill test reports indicating structural strength, destructive and nondestructive test analysis and chemical analyses from the aluminum used in the Work.
- E. Welders' Certificates: Documentation certifying welders employed by the Subcontractor meet AWS qualifications.
- F. Submit the following as specified elsewhere in this Section:
  - 1. Written welding procedures in accordance with AWS D1.2 for each proposed joint.
  - 2. Procedure qualification records in accordance with AWS D.1.2 for procedures qualified by testing.
  - 3. Inspection reports of the Subcontractor's independent testing laboratory.



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- G. On erection drawings, indicate all details and information necessary for assembly and erection purposes such as, description of methods, sequence of erection, type of equipment used in erection and temporary bracings.
  - H. All fabricator designed assemblies, components and connections, and drawings to be stamped and signed by qualified professional engineer licensed in the province of British Columbia, Canada.
  - I. The Professional Engineer responsible for the shop drawings shall inspect the installation of the work for conformance with the design and the shop drawings, and shall upon completion of the work submit to the Consultant a completed Schedule S-B: Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional, and Schedule S-C: Assurance of Professional Field Review and Compliance by Supporting Registered Professional.

## **1.5 QUALITY ASSURANCE**

- A. Fabricate aluminum members in accordance with NBCC and Aluminum Design Manual 2010 “Specification for Aluminum Structures” by the Aluminum Association, Inc.
- B. Welders shall be qualified in accordance with AWS D1.2 for each process, position and joint configuration.
- C. Submit 2 copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work at least 2 weeks prior to fabrication of structural aluminum. Mill test reports shall be certified by metallurgists qualified to practice in British Columbia, Canada
- D. Fabricator of structural aluminum shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications

## **1.6 PROJECT CONDITIONS**

- A. Contractor shall verify dimensions on Shop Drawings in the field.

## **1.7 PROJECT CONDITIONS**

- A. Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Rolled and Extruded Members: Alloy and temper 6061-T6 unless otherwise indicated on the Drawings.

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- B. Aluminum Tubing: Alloy and temper 6061-T6.
  - C. Bolts, Nuts, and Washers:
    - 1. Bolts and Nuts in Structural Connections: Alloy 6061-T6 unless otherwise indicated on the Drawings.
    - 2. Flat Washers: Alclad 2024-T4.
    - 3. Spring Washers: Alloy 7075-T6 or AISI 316 stainless steel.
  - D. Rivets in Structural Connections: Alloy 6061-T6.
  - E. Welding Materials:
    - 1. Filler Metals: AWS D1.2.
    - 2. Electrodes and Equipment Settings: As recommended by the filler metal manufacturer for the position, thickness and conditions of use.
    - 3. Furnish written verification to the University that filler metal is appropriate to the materials and welding process
  - F. Sliding Bearing Plates: Teflon coated.

## **2.2 CONNECTIONS**

- A. Unless otherwise indicated on the Drawings, all field connections shall be bolted. For shop connections, weld or rivet or bolt. Weld in accordance with approved welding procedures.
- B. The Contractor is responsible for the design of the connections not detailed on the Drawings.
- C. Connections shall have a minimum of two bolts and the minimum thickness of connection plates shall be 10mm.

## **2.3 FABRICATION**

- A. Fabricate aluminum members in accordance with the approved Shop Drawings. Where practical, fabricate and assemble in the shop.
- B. Obtain field measurements necessary for fabrication.
- C. Dimensional Tolerances:
  - 1. Overall length of members with both ends milled shall vary by not more than 0.75 mm.
  - 2. Overall length of members without milled ends shall vary by not more than 1.6 mm for lengths less than 9m and not more than 3 mm for lengths 9m and over.
- D. Where structural joints are welded, the detail of the joints, welding technique, weld quality and appearance, and methods for correcting defective welds shall conform to the AWS D1.2.
  - 1. Welding Process: Inert shielded gas or resistance welding process.

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- E. Where milling is indicated on the Drawings, machine the contact surfaces true to obtain full and complete contact.
  - F. Structural members are selected from generally available rolled sections; however, if the specified sections are not available, provide sections with equivalent physical properties at no additional cost after approval by the Departmental Representative.

## **2.4 FINISHES**

- A. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces as follows:
  - 1. Where aluminum members are in contact with steel, prime both aluminum and steel members with one coat of paint meeting Federal Specification TT-P-645. Paint aluminum with an additional coat of varnish containing 1 kg of aluminum pigment per 3.8 liters.
  - 2. Where aluminum members are in contact with porous materials, masonry or concrete, apply to the contact surfaces of the aluminum members a heavy coat of alkali resistant bituminous paint.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Provide temporary supports and internal braces necessary to support structure during erection. Temporary supports and braces shall be adequate for anticipated equipment and erection loads. Remove temporary shoring after the erection is complete.
- B. Before erection, paint contact surfaces between dissimilar materials.

### **3.2 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready for erection.
- B. Beginning of installation means Contractor accepts that existing conditions meet the requirements for installation.

### **3.3 ERECTION**

- A. Where members can not be properly assembled due to misfabrication or deformation due to handling or transportation, report the condition to the Departmental Representative with a proposed method of correction for approval. Erect structure to the lines and grades indicated on the Drawings and in accordance with the Shop Drawings.
- B. Do not field cut or alter structural members without approval of the Departmental Representative.

- 
- C. Grout base plates with non-shrink grout. Clean concrete bearing surfaces from bond-reducing materials, and roughen if necessary to improve bond to surfaces. Paint the bottom surface of base plate. Set base plate on wedges or other adjustable devices. After the base plate has been positioned and plumbed, tighten the anchor bolts. Grout solidly between the bearing surfaces to ensure that no voids remain.

### **3.4 INSPECTION AND TESTING**

- A. Inspection and testing will be performed under provisions of Section 01 11 55 – General Instruction. The Contractor shall be responsible for in-house visual inspection and implementing a quality control program. The Contractor is responsible for the accuracy and completeness of his own work and shall verify that the structural aluminum has been fabricated, erected and finished in accordance with the contract specifications.
- B. Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.
- C. Testing requirements are as follows:
1. Perform visual testing of welds in the fabricator's shop.
  2. Visual Field Inspection and Bolt Torque Testing (Random 10% of Bolts) of all bolted connections
- D. Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.
- E. Submit test reports to Departmental Representative within 1 week of completion of inspection.
- F. Costs of tests shall be borne by the Contractor.

**END OF SECTION 05 14 00**



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performed of equal magnitude and scope within five (5) days after contract award.

#### **1.4 ASSEMBLY REQUIREMENTS**

- .1 Provide connection socket and pin with rating for minimum breaking strength of the cables/ropes at each connection.

#### **1.5 SHOP DRAWINGS**

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 11 55 – General Instructions.
- .2 Contractor shall co-ordinate and verify all dimension to suit the final selected abutment locations for bridge span confirmation prior to production of the shop drawings.
- .3 On erection drawings, indicate all details and information necessary for assembly and erection purposes such as, material properties of the cable/rope assembly, length of cable and wire rope, socket connection details with the confirmation on the connection capacity relative to the breaking force of the strand/rope, description of detailed methodology of erection and cable stressing, sequence of erection, type of equipment used in erection and stressing, temporary bracings and etc..
- .4 The temporary bracing shall be designed by a qualified professional engineer registered in the province of British Columbia, Canada.
- .5 All fabricator designed assemblies, components and connections, and drawings to be stamped and signed by qualified Professional Engineer licensed in the province of British Columbia, Canada.
- .6 The Professional Engineer responsible for the shop drawings shall inspect the installation of the work for conformance with the design and the shop drawings, and shall upon completion of the work submit to the Consultant a completed Schedule S-B: Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional, and Schedule S-C: Assurance of Professional Field Review and Compliance by Supporting Registered Professional.
- .7 No fabrication or work shall be commenced until the review and approval of the shop drawings. The contractor shall assume full responsibility for any fabrication and work done prior to review and approval of the shop drawings.

#### **1.6 QUALITY ASSURANCE**

- .1 Submit 2 copies of mill test reports showing mechanical and physical properties and other

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details of cables and ropes to be incorporated into work at least 2 weeks prior to fabrication of structural cables and ropes. Mill test reports shall be certified in accordance to ASTM A 586.

- .2 Manufacturer of structural cable and rope assembly shall have an industry accepted Quality Management System in place to ensure the Quality Control of the products is controlled and measured at each manufacturing step. The manufacturer shall provide a Certificate of Conformance for the final products listing the physical loads for pre-stretching, measuring, and proof-loading. Certificate of Conformance shall be signed by a member of the Quality Team of the manufacturer.
- .2 Manufacturer of structural cables and ropes shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Structural cable and ropes: to ASTM A 586, Grade 1 with Class C Zinc coating to ASTM A 153 / A153M with diameters indicated on drawings.
- .2 Socket body: structural steel to ASTM A148 with smooth hot dipped galvanized finish able to develop minimum breaking strength of the connecting cable and rope. 100% termination efficiency.
- .3 Socket pin: to ASTM A108 Grade 4140 minimum, size selected to develop minimum breaking strength of the connecting cable and rope. provide threads at ends for nuts
- .4 Bolts, nuts and washers: to ASTM A 325
- .5 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m2.

### **2.2 FABRICATION AND STORAGE**

- .1 Fabricate structural cables and ropes in accordance with ASTM A 586 and in accordance with reviewed shop drawings.
- .2 The prefabricated cable and wire rope shall be protected against physical damage, permanent damage and corrosion at all times prior to installation. Any strand component which is

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damaged during the work shall be replaced at the expense of the Contractor. Particular care will be required in this regard during transport to the remote project site.

### **Part 3       Execution**

#### **3.1       GENERAL**

- .1       Structural steel cable and wire rope work: in accordance with CAN/CSA-S6 and in accordance with reviewed shop drawings.

#### **3.2       MARKING**

- .1       Mark materials in accordance with ASTM A 586.

#### **3.3       ERECTION**

- .1       Erect structural steel, as indicated and in accordance with CAN/CSA-S6 and in accordance with reviewed erection drawings.
- .2       Field altering: to approval of Departmental Representative.
- .3       When tensioning/stretching cable, the suspension clamps shall be loose enough to allow free movement of the cable.
- .4       Suspension cable & ropes shall be placed and tensioned in accordance with the drawings.
- .5       Any misfit or misalignment must be reported to the Departmental Representative. The contractor shall provide signed and sealed remedial details/measures to the Departmental Representative for review and approval. Any remedial work on connections must be reviewed and/or redesigned by the contractor's engineer. Costs of remedial work are at the expense of the contractor.
- .6       Provide temporary bracing to structure for stability and safety as required and in accordance with reviewed shop drawings until the completion of the overall structure.

#### **3.4       FIELD QUALITY CONTROL**

- .1       The Contractor is responsible for the accuracy and completeness of his own work and shall verify that the structural cable and wire rope have been fabricated, erected and finished in accordance with the contract specifications and the reviewed shop drawings.
- .2       Inspection and testing of materials and workmanship will be carried out by an independent testing laboratory approved by Departmental Representative.
- .3       Testing requirements are as follows:



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- .1 Visual field inspection of cables and wire ropes and their associated connections for any damages.
  - .2 Confirmation of physical loads for prestressing, measuring, and proof-loading, bridge maximum sags under self weight.
  - .4 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.
  - .5 Submit test reports to Departmental Representative within 1 week of completion of inspection.
  - .6 Costs of tests shall be borne by the Contractor.

**END OF SECTION 05 72 10**





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## **1.5 DESIGN REQUIREMENTS**

- .1 Design the safety net system and its connections to the support members in accordance with the requirements of National Building Code (NBC) 2015 on guard rail/wall and Worksafe BC, whichever more stringent.
- .2 All new nets shall meet accepted performance standards of 17,500 foot pound minimum impact resistance as determined and certified by the manufacturers and shall bear a label of proof test.
- .3 Maximum size of mesh size of the nets shall be 4 inches x 4 inches (100mmx100mm).
- .4 The mesh rope or webbing should be anchored securely to the border at each crossing.
- .5 All mesh crossing should be anchored securely to eliminate friction war and prevent enlargement of the mesh openings.
- .6 Drop forged steel safety hooks or shackles, which support the design load, should be used to attach nets to supporting cables or plates projecting from structure. Such attachments should be spaced at intervals of not more than 4 feet (1.2m).
- .7 Connections between net panels shall develop the full strength of the net.

## **1.6 QUALITY ASSURANCE**

- .1 Submit 2 copies of mill test reports showing mechanical and physical properties and other details of safety net system to be incorporated into work at least 2 weeks prior to fabrication of safety nets.
- .2 Manufacturer of safety net system shall provide an affidavit stating that the safety net system provided had been tested for durability, weather resistance, breaking strength and impact resistance.
- .3 Manufacturer of safety net system shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.

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**Part 2            Products**

**2.1            MATERIALS**

- .1      Net material: to ANSI A10.11 and Worksafe BC.
- .2      Forged steel safety hooks or shackles: to ASTM A36.
- .3      Hot dip galvanizing: galvanize connection steel components to CAN/CSA-G164, minimum zinc coating of 600 g/m2.

**2.2            FABRICATION AND STORAGE**

- .1      Fabricate safety net system in accordance with ANSI A10.11 and in accordance with reviewed shop drawings.
- .2      The prefabricated safety net system shall be protected against physical damage, permanent damage and abrasions at all times prior to installation. Any net component which is damaged during the work shall be replaced at the expense of the Contractor.

**Part 3            Execution**

**3.1            GENERAL**

- .1      Safety net work: in accordance with Worksafe BC and in accordance with reviewed shop drawings.

**3.2            ERECTION**

- .1      Erect safety net in accordance with the net manufacturer's specifications and instructions as well as in accordance with reviewed erection drawings.
- .2      Field altering: to approval of Departmental Representative.
- .3      Nets shall be installed as close to its supporting members as possible with any gaps in between not greater than 4 inches (100mm).

**3.3            FIELD QUALITY CONTROL**

- .1      The Contractor is responsible for the accuracy and completeness of his own work and shall verify that the safety net system has been fabricated, erected and finished in accordance with the contract specifications and the reviewed shop drawings.
- .2      Provide safe access and working areas for testing on site, as required by testing agency and as

WEST COAST TRAIL  
LOGAN CREEK BRIDGE  
PACIFIC RIM NATIONAL PARK RESERVE  
VANCOUVER ISLAND, B.C.

**06 90 00**  
**SAFETY NETS**  
November 2017

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authorized by Departmental Representative.

**END OF SECTION 06 90 00**

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**Part 1            General**

**1.1        REFERENCES**

- 1        American Society for Testing and Materials International (ASTM)
  - .1        ASTM C117-13, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2        ASTM C136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3        ASTM D422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.
  - .4        ASTM D698-12ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ; ) (600 kN-m/m ; ).

**1.2        DEFINITIONS**

- .1        Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1        Rock : solid material which cannot be removed by means of a hand held gasoline Jack Hammer. Frozen material not classified as rock.
  - .2        Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2        Topsoil:
  - .1        Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .3        Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .4        Suitable material: material as per Section 2.1 of this specification.
- .5        Controlled Density Fill (CDF): Concrete with a minimum 7 day compressive strength of 10 MPa.

**1.3        EXISTING CONDITIONS**

- .1        Examine geotechnical report available from Departmental Representative that is provided for reference purposes only. The contractor shall use the geotechnical report based on their sole interpretation of the report.
- .2        Buried services:

- .1 Before commencing work verify 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 authorities having jurisdiction establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
- .6 Confirm locations of buried utilities by careful test excavations
- .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated on drawings.
- .8 Record location of maintained, re-routed and abandoned underground lines.
- .9 Confirm locations of recent excavations adjacent to area of excavation.

## **Part 2 Products**

### **2.1 SUITABLE MATERIALS**

- .1 Type 1 and Type 2 fill:
  - .1 Crushed, pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
  - .3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10
- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.



**Part 3            Execution**

**3.1                TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1      Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2      Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3      Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.2                SITE PREPARATION**

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

**3.3                PREPARATION/PROTECTION**

- .1      Protect existing features in accordance with applicable local regulations.
- .2      Keep excavations clean, free of standing water, and loose soil.
- .3      Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .4      Protect buried services that are required to remain undisturbed.
- .5      Contractor to implement all recommendations outlined in the Geotechnical Report in Appendix C in regards to subgrade protection and construction.
- .6      Abutment location/layout to be confirmed by the Departmental Representative after clearing and before excavation.
- .7      Obtain permit from authority having jurisdiction for temporary diversion of water course.

**3.4                STRIPPING OF TOPSOIL**

- .1      Begin topsoil stripping of areas as indicated as directed by Departmental Representative after area has been cleared of brush weeds and grasses and removed from site.
- .2      Strip topsoil to depths as indicated as directed by Departmental Representative.
  - .1      Do not mix topsoil with subsoil.
- .3      Stockpile top soil to be incorporated into the works in locations as directed by Departmental Representative.

- .1 Stockpile height not to exceed 0.6 m and should be protected from erosion and precipitation.
- .2 Dispose off site all excess topsoil material, as directed by Departmental Representative.

### **3.5 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 and moisture.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

### **3.6 SHORING, AND BRACING**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Work Safe British Columbia.
- .2 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 Remove excess materials from site and restore watercourses as indicated and as directed by Departmental Representative.

### **3.7 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for the Departmental Representative review details of proposed dewatering
- .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.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in manner not detrimental to public and private property, 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.

### **3.8 EXCAVATION**

- .1 Advise the Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.

- .2 Excavate to lines, grades, elevations and dimensions as directed by the Departmental Representative.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 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 and only with approval of the Departmental Representative.
- .5 All excavations are to adhere to WorkSafe BC requirements for excavations.
- .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material in approved location.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Remove unsuitable material from foundation support zone of the abutments including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .12 Correct unauthorized over-excavation within foundation support zone of the abutments and anchors with Controlled Density Fill (CDF). All other unauthorized excavation to be corrected as follows:
  - .1 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .13 Hand trim, make firm and remove loose or distributed material and debris from excavations as directed by the Departmental Representative.
- .14 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

### **3.9 ROCK REMOVAL**

- .1 Rock is to be removed by use of drilling and splitting only and only with approval of the Departmental Representative. Under no circumstances shall blasting be used. Shale, hardpan, frozen material, or soft or disintegrated rock material shall not be classified as “rock” that can be removed by a hand held gasoline Jack Hammer.

### **3.11 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 soil 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 not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

- 
- .5 Provide geotechnical testing for verification of compaction and backfill density in all trenches and submit test results to Departmental Representative.
  - .6 In place density testing to be completed by Independent Testing Agency approved by Departmental Representative for this project where backfill material supports structural elements.
  - .7 Costs of tests shall be borne by Contractor.
  - .8 Restore water courses as needed.

### **3.12 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as indicated as directed by Departmental Representative.
- .3 Reinstate adjacent ground to elevation which existed before excavation.
- .4 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .5 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

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1. WORK INCLUDED

.1 The unit prices submitted in the Form of Tender shall include the entire cost of supplying all labour, material, equipment and applicable taxes required to install rock anchors where called for on the drawings and outlined in this specification. The work to be performed under this section shall consist of drilling, furnishing, grouting, and testing of rock anchors at locations shown on the plans, or as directed by the Departmental Representative, and in conformity with this specification.

2. DEFINITIONS

- .1 Anchor Bond Length (fixed anchor length): Refers to the portion of the tendon that transmits the force to the surrounding rock.
- .2 Anchor Stressing Length (free length): Refers to the unbonded portion of the anchor tendon, which is free to elongate during stressing.
- .3 Anchor Tendon: Refers to the complete anchor assembly consisting of the anchorage and prestressing steel including corrosion protection as described in Section 4
- .4 Design Load (DL): Refers to the anticipated final maximum load in the anchor. It is also referred to as the factored load shown on the drawings.
- .5 Alignment Load (AL):  $AL = 10\%$  of design load (DL).
- .6 Maximum Test Load (TL):  $TL = 1.5 DL$ .
- .7 Transfer Load ( $P_e$ ): Refers to the pre-stressing force in the anchor following load testing immediately after the force has been transferred from the jack to the stressing anchorage.
- .8 Proof Test: Refers to the incremental loading of a prestressed anchor by recording the incremental movement of the anchor at each specified load stage and returning to the Alignment Load upon completion of the final load stage. A short duration creep test is conducted at the Test Load.
- .9 Performance Test: Refers to the incremental loading of a prestressed anchor by recording the incremental movement of the anchor at each specified load stage, holding for a minimum of 1 minute at each load stage and returning to the Alignment Load after each load stage. A short duration creep test is conducted at the Test Load.
- .9 Creep Test: Refers to a test used to determine the movement of the tendon at constant load over a specific period of time. A short duration (i.e. 10 min) creep test is completed as part of the proof and performance tests. An extended creep test (+/- 1 hour or more) is completed separate from the proof or performance tests.

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### 3. GENERAL

#### .1 Performance

Perform all work and supply materials as specified herein and in accordance with the Contract documents.

Rock anchor installation and testing is to be in accordance with Post Tensioning Institute  
“Recommendations for Prestressed Soil and Rock Anchors” 2004 Edition (PTI Recommendations)

#### .2 Geotechnical Report

A copy of WSP’s Geotechnical Report dated Oct 24, 2017 is attached for reference in Appendix C.

#### .3 Responsibility of the Contractor

Firms undertaking to bid this work shall have a minimum of five years experience in projects of this magnitude and shall have equipment and manpower suitable and available for the entire duration of the project. The Contractor shall submit with his proposal a reference list of work performed of equal magnitude and scope.

#### .4 Inspection and Testing

Contractor shall conduct quality control testing for grout, anchor installation and testing. The Departmental Representative will retain an independent testing agency for quality assurance testing of cement grout and the Departmental Representative will review the work independent of the Contractor’s QC program. The costs of testing will be borne by the Contractor. The contractor shall submit to the Departmental Representative the mill test certificate of the steel used to fabricate the anchors, couplers, plates, and nuts.

#### .5 Shop Drawings

Submit shop drawings of the rock anchor assembly for approval to the Departmental Representative a minimum of 4 weeks prior to commencement of work and delivery of materials to site.

Shop drawings shall include the following information:

- Anchor layout
- Anchor component details, including bonded and unbonded anchor length
- Anchor design capacity
- Grade and properties of the anchor material
- Steel producer mill test certificates of anchor, couplings, nut washers, wedges and plates
- Percent of anchor yield load at working load and test load
- Grout: cement type, strength, additive, mix design (pre-bagged product)
- Proposed drilling method and borehole diameter
- Sequence of drilling, installation and testing

- Method of proposed testing and stressing procedures clearly indicating independent reference point and method of measuring anchor tendon elongation

.6 Acceptability

Failure of any anchor to meet the anchor test criteria will result in rejection of the anchor in question. The criteria for anchor test acceptance are outlined in Subsection 9.

.7 Jobsite Conditions

Refer to geotechnical report in Appendix D for anchor length, bond length and free-stressing length. The anchor length and bond length of anchors have been determined based on available geological data.

If during construction, the site conditions are found to be significantly different from those anticipated, the length and/or the spacing of anchors may be changed as directed by the Departmental Representative.

.8 Basis of Payment

The price shall include all costs for mobilization and demobilization, supply, drilling, installation, grouting and testing of successfully completed anchors as measured by the Departmental Representative.

#### 4. PRODUCTS

.1 General Description

The anchor is a grouted tension Double Corrosion Protected (DCP) Threadbar. The grout cylinder encases the corrugated DCP Threadbar, protects the steel against corrosion, and transfers load to the ground by friction at the grout-rock interface. The Threadbar is kept in the center of the borehole by centralizers prior to grouting. A smooth, rigid plastic tubing (free stress sleeve) shall fit snugly over the corrosion protected bars in the unbonded length in the free-stressing zone to ensure unobstructed elongation during stressing and transfer of load to the underlying rock. The anchor load is transferred to the ground in the bond length by means of rock-grout bond.

.2 Threadbar

The anchor shall consist of DYWIDAG (or approved equivalent) hot rolled Threadbar manufactured in accordance with ASTM A615 or CSA G30.18M.

- 43mm diameter (#14)

Grade of Steel: 517/690 MPa  
Steel Area:  $A_s = 1,452 \text{ mm}^2$   
Yield capacity:  $P_y = 801 \text{ KN}$

- 28mm diameter (#9)

Grade of Steel: 517/690 MPa  
Steel Area:  $A_s = 645 \text{ mm}^2$

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Yield capacity:  $P_y = 334 \text{ KN}$

- 19mm diameter (#9)

Grade of Steel: 517/690 MPa

Steel Area:  $A_s = 284 \text{ mm}^2$

Yield capacity:  $P_y = 147 \text{ KN}$

The contractor shall provide manufacturer's test certificate for all batches of anchors supplied.

.3 Corrosion Protection

- .1 Provide Double Corrosion Protection (DCP) over the entire length of the anchor by means of a pre-grouted corrugated PVC sheathing. Anchorage and splicing shall be corrosion protected in accordance with the approved shop drawings.
- .2 The Threadbar shall be shop grouted inside a corrugated PVC sheathing for the entire length. Corrugated PVC sheathing for the outer corrosion protection of the anchor tendon shall have a minimum compressive strength of 103 MPa (14,500 psi) and a minimum tensile strength of 48 MPa (7,000 psi) at grout strength of 27MPa (4,000psi). PVC material shall be free of water-soluble chlorides and other ingredients that might enhance corrosion, hydrogen embrittlement or stress corrosion on the steel tendon.
- .3 Inside spacers, end caps, anchor head assembly, heat shrink sleeves and cement grout shall be in accordance with the manufacturer's standard specifications for "Double Corrosion Protected anchors".
- .4 The inner layer of corrosion protection shall consist of non-shrink Portland Cement grout with a minimum 7-day compressive strength of 25Mpa and a minimum 28 day compressive strength of 35 MPa when tested in accordance with CSA Test Method A23.2-1B.
- .5 Corrosion protection shall be provided for the assembly at the top of the anchor (i.e. plate, nut, exposed segment of bar, etc.) as directed on the drawings.

.4 Anchorage Nuts and Couplers

Anchor plates, nuts, couplers and other anchor components shall be compatible with the post-tensioning anchor system. Anchorage and splicing components shall develop at least 125% of the yield strength of the Threadbar. Minimum anchor plate size shall be 40x250x250mm.

5. ANCHOR FABRICATION AND STORAGE



- .1 Anchors shall be shop-fabricated in accordance with approved shop drawings, using personnel trained and qualified in this type of work.
- .2 The prefabricated anchor assemblies shall be protected against physical damage and corrosion at all times prior to installation. Any anchor or anchor component (including the protective sheathing) which is damaged during the work shall be replaced at the expense of the Contractor. Particular care will be required in this regard during transport to the remote project site.

#### 6. DRILLING

- .1 Anchor holes shall be drilled to a minimum borehole diameter of 100mm. Casing is to be provided as needed.
- .2 Anchor holes shall be drilled within plus or minus 1% of the theoretical centerline and shall be located within plus or minus 50mm from the location as shown on the contract drawings.
- .3 Anchor holes shall be thoroughly cleaned to the satisfaction of the Departmental Representative prior to the installation of anchors.
- .4 Anchor holes are to be over-drilled a minimum of 0.5 m.
- .5 The Contractor shall keep a record of all drilling procedures and drilling time, which shall be made available to the Departmental Representative.

#### 7. INSTALLATION

- .1 Anchors shall be installed in the presence of the Departmental Representative.
- .2 Plastic centralizers shall be provided to ensure that the micro-anchor assembly is centrally located in the hole, providing a minimum grout cover of 15 mm. Centralizer spacing is not to exceed 2 m.
- .3 The unbonded length of the anchor shall be protected with a design engineer approved free stressing sleeve. The free stressing sleeve may be attached to the anchor tendon using a heat shrink wrap.
- .3 The Contractor shall maintain a record showing the anchor number, cement grout quantity and installation date for each anchor.

- 
- .4 The contractor is to provide post-pressure grouting tubes for the back cable anchors to facilitate post grouting operations in the event that the anchor does not hold the test load (as an economical alternative to removal and reinstallation or modifications to the design).

## 8. GROUTING

- .1 The anchor grout shall be Basalite Concrete Products Microsil Grout (or approved equivalent) mixed in accordance with the manufacturer's instructions to achieve a pumpable mixture with a minimum design compressive strength of 40MPa at 7 days. The mixing water shall be free of any deleterious material.
- .2 Use equipment capable of continuous mechanical mixing and pumping to produce a grout free of lumps and undispersed cement.
- .3 The grout shall be pumped into the hole through a grout tube from the bottom (tremied) until grout reaches the bottom of the free stressing zone.
- .4 The grout shall always be injected at the lowest point of the anchor (i.e. tremied).
- .5 Post pressure grouting tubes are to be washed out.
- .6 If second stage pressure grouting is deemed necessary, the contractor is to submit their procedure to the Departmental Representative for review and approval prior to commencing.
- .7 After each grouting operation, the anchors shall remain in an undisturbed condition until adequate grout strength has been achieved.
- .8 After acceptance of the test results has been received from the Departmental Representative, grout the remaining annulus of the hole to the top with tremie grouting procedures. Preferably this will be conducted via a tremie tube installed through a pre-drilled hole in the anchor plate.

## 9. ANCHOR TESTING AND STRESSING

- .1 General:
- .1 Carry out testing and stressing only after the grout has attained its specified strength and in accordance with procedures described in the PTI Recommendations.

- 
- .2 Record all testing and stressing data on a form acceptable to the Departmental Representative. All testing shall be completed in the presence of the Departmental Representative. Testing and stressing data shall be recorded and made available to the Departmental Representative upon request.
  - .3 The Contractor shall provide all necessary devices and instruments for testing of the anchors in accordance with procedures described by the PTI. Reaction base shall be solid and stable for the duration of the test.
- .2 Equipment:
- .1 Testing set-up and procedures are to be submitted to the Departmental Representative for review and approval prior to mobilization of equipment to site. A sketch indicating the proposed procedure for providing an independent reference point shall be included in the submission.
  - .2 Testing and stressing of anchors shall be performed using a hollow core hydraulic jack and equipment specified by the anchor manufacturer.
  - .3 All performance testing equipment must be used in accordance with the specifications of the manufacturer and must at all times be maintained in good condition.
  - .4 Anchor stressing equipment (i.e. hydraulic jack and related set-up) shall
    - Be capable of applying at least 120% of the specified maximum tensile test load (TL) (i.e. minimum 120% of 1.5 DL).
    - Have a calibrated pressure gauge indicating the hydraulic jack pressure to an accuracy of  $\pm 3\%$ .
    - Have been calibrated by an acceptable authority within 6 months prior to use on this project. Submit calibration data to the Geotechnical Engineer and Departmental Representative.
- .3 Elongation measurements:
- .1 Anchor tendon elongations and displacements shall be measured and recorded to the nearest 0.0025mm (0.001 inches) with respect to an independent reference point.
- .4 Load versus displacement data for each test and stressing shall be plotted on a load extension graph.
- .5 Anchor displacements under constant creep test load shall be plotted as displacement in millimetres versus the log of time in minutes.

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- .6 Performance testing for the anchors shall be conducted as follows:
- .1 All anchors are to be proof tested. A minimum of one anchor from each abutment is to be performance tested and a minimum of one anchor from each abutment (different than for performance test) is to include an extended creep test for a minimum of 2 hours. Cost for testing shall be borne by the Contractor. The Departmental Representative may select that additional anchors be performance tested and extended creep tested.
  - .2 All anchors shall be proof tested to a test load (TL) of 150% of design load (DL).
  - .3 Proof testing shall proceed by incremental loading to the max. Test load in the following stages: AL, 0.25DL, 0.5DL, 0.75DL, 1.0DL, 1.25DL, 1.5DL and AL at intervals of 1 minute. Maximum test load is to be held for a minimum of 10 minutes and elongation readings taken at a minimum of 1, 2, 3, 4, 5, 6 and 10 minute intervals.
  - .4 Performance testing shall proceed by incremental loading to stages listed above for proof testing, returning to the alignment load after each stage. As the load is increased to the next stage, stop long enough at each of the previous load stages to measure elongation. Return to the alignment load at the end of the test.
  - .5 Perform extended creep testing on the back cable anchors by holding the maximum Test load constant for a minimum of 2 hours and record tendon elongation at 0, 1, 2, 3, 4, 5, 6, 10, 15, 20, 25, 30, 45, 60, 75, 90, 100, and 120 minutes.
- .7 Acceptance Criteria
- .1 Based on extension measurement of the anchor head taken during testing, an anchor will be rejected if any one of the following criteria is not met:
    - The total movement at the anchor head shall be more than 80% percent of the theoretical elastic elongation of the “Free-stressing length”, and less than 100% of the elastic elongation of the “Free-stressing length” plus 50% of the “Bond Length”.
    - The creep movement at the anchor head shall not exceed 1.5mm per log cycle, e.g., between the 1 and 10 minute time increment during the proof creep test.
  - .2 If any anchor fails to meet the acceptance criteria, the Contractor shall conduct an additional testing as requested by the Departmental Representative on all anchors that are in question at no extra cost to the Departmental Representative. The Contractor shall be

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responsible for costs of rock anchor remedial work. No payment shall be made by the Departmental Representative for any additional anchors or testing required as a result of failure of the acceptance criteria.

.8      Stressing of the Anchors

- .1      Following the acceptance of proof and creep testing, the anchors shall be locked off at the specified transfer load. Contractor is to conduct “lift-off” testing of each anchor after lock-off as required by the Departmental Representative. A minimum of one lift off test is to be conducted after 24 hours of lock-off.

**END OF SECTION 31 63 00**



## APPENDIX A

# ENVIRONMENTAL MANAGEMENT PLAN

## Logan Creek Bridge Replacement

**Prepared by:**  
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## TABLE OF CONTENTS

<b>GLOSSARY OF TERMS .....</b>	<b>III</b>
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
1.1 PURPOSE AND OBJECTIVES .....	1
<b>2.0 CONTACT INFORMATION .....</b>	<b>1</b>
<b>3.0 PROJECT OVERVIEW .....</b>	<b>2</b>
3.1 PROJECT LOCATION .....	2
3.2 PROJECT DESCRIPTION .....	2
<b>4.0 PROJECT TEAM / ROLES AND RESPONSIBILITIES .....</b>	<b>3</b>
4.1 CONTRACTOR .....	3
4.2 HEMMERA ENVIROCHEM INC. - ENVIRONMENTAL MONITOR.....	4
<b>5.0 ENVIRONMENTAL OVERVIEW .....</b>	<b>5</b>
5.1 POTENTIAL IMPACTS TO AQUATIC RESOURCES .....	5
5.2 POTENTIAL IMPACTS TO TERRESTRIAL RESOURCES .....	5
<b>6.0 REGULATORY OVERVIEW .....</b>	<b>6</b>
6.1 FISHERIES ACT.....	6
6.2 SPECIES AT RISK .....	6
6.2.1 Marbled Murrelet.....	11
6.2.2 Dromedary Jumping-Slug and Warty Jumping-Slug.....	11
6.3 MIGRATORY BIRDS CONVENTION ACT .....	11
6.4 CANADA NATIONAL PARKS ACT.....	11
<b>7.0 ENVIRONMENTAL MITIGATION MEASURES AND BEST PRACTICES .....</b>	<b>12</b>
7.1 GUIDING DOCUMENTS AND BEST MANAGEMENT PRACTICES.....	12
7.2 MITIGATION MEASURES .....	12
7.2.1 Working in or Around Natural Areas .....	12
7.2.2 Species at Risk .....	15
7.2.3 Cultural Resources .....	16
7.2.4 Erosion and Sediment Control .....	18
7.2.5 Equipment Operations .....	18
7.2.6 Staging/Laydown Areas.....	19
7.2.7 Noise, Dust, and Air Quality Control .....	20
7.2.8 Vegetation .....	20

7.2.9	Invasive Vegetation Management.....	20
7.3	WASTE MANAGEMENT .....	21
7.3.1	Hazardous Waste.....	21
7.3.2	Waste .....	21
7.3.3	Hazardous Material .....	21
7.4	ENVIRONMENTAL INCIDENTS AND SPILLS .....	22
7.4.1	Spill Prevention .....	22
7.4.2	Spill Kits .....	23
7.4.3	Spill Response and Reporting .....	23
8.0	<b>ENVIRONMENTAL MONITORING .....</b>	<b>24</b>
8.1	TAILGATE MEETINGS .....	24
8.2	ENVIRONMENTAL REPORTING REQUIREMENTS.....	24
9.0	<b>REFERENCES.....</b>	<b>26</b>

#### List of Tables

Table 1	Emergency Contact Numbers.....	1
Table 2	Species at Risk under Schedule 1 and Schedule 3 of the Species at Risk Act with the potential to occur within the Project site .....	7

#### List of Appendices

Appendix A	The “Bare” Campsite Program (Parks Canada)
Appendix B	Danger Tree Assessment Report and Recommendations (Strategic 2017)

## GLOSSARY OF TERMS

A list of terms and abbreviations used in this Environmental Management Plan, and their definitions, are provided below.

Term	Definition
BIA	Basic Impact Analysis
BMPs	Best Management Practices
cm	centimetre
EM	Environmental Monitor
EMP	Environmental Management Plan
ESC	Erosion and Sediment Control
m	metre
SARA	Species at Risk Act
Project	Logan Creek Bridge Replacement

## 1.0 INTRODUCTION

### 1.1 PURPOSE AND OBJECTIVES

The purpose of this Environmental Management Plan (EMP) is to provide Parks Canada and the Contractor, with environmental guidance, objectives, standard protocols, and mitigation measures in order to support compliance with applicable legislation during the Logan Creek Bridge Replacement Project (the “Project”).

This EMP has been produced as an attachment to the Basic Impact Analysis (BIA) produced for the Project. This EMP describes:

- Specific roles and responsibilities associated with the Project team members
- Existing environmental conditions
- Important legislative requirements
- Mitigation of environmental risks
- Emergency response procedures and reporting protocols in the event of an incident, and
- The environmental monitoring framework that will be implemented during the Project to inspect, evaluate, and report on work practices and the efficacy of the environmental remediation, effectiveness mitigation, and environmental protection efforts.

It is the responsibility of all members of the Project team to be familiar with the contents of this EMP and to comply with the practices and procedures described herein. The Contractor is also responsible for disseminating this EMP to their supervisors and crew members and must keep a hard copy of the EMP and associated appendices at the Project site where it is readily accessible.

The contents of this EMP are subject to change to reflect updated best management practices (BMPs) and mitigation measures developed in response to changes to the Project design or approach to construction.

## 2.0 CONTACT INFORMATION

A list of emergency contact numbers is provided below in **Table 1**. There is no cell reception within the Project area. Thus, a satellite phone must be kept on site and be accessible to all field personnel involved in the Project. The contractor is responsible for providing satellite phone contact information to Parks Canada and its representatives.

**Table 1 Emergency Contact Numbers**

Contact	Contact #
Fisheries and Oceans Canada - Spill Reporting Line	1-800-465-4336
Ministry of Environment - Conservation Officer	1-877-952-7277
Parks Canada - Emergency Dispatch	1-877-852-3100

## 3.0 PROJECT OVERVIEW

### 3.1 PROJECT LOCATION

The Project site is located immediately east of Kilometer 56 on the West Coast Trail near Port Renfrew, Vancouver Island, British Columbia (**Figure 1**). The approximate coordinates of the site are 48°34'13.15"N 124°36'59.35"W.



**Figure 1 Logan Creek Bridge Study area along the West Coast Trail**

### 3.2 PROJECT DESCRIPTION

The existing suspension bridge over Logan Creek was constructed in December 2006 after a windstorm destroyed the previous one. Due to the deterioration of the ladder system and ongoing maintenance within this section of the West Coast Trail, Parks Canada is seeking to replace the current suspension bridge with a full-span bridge that would connect the eastern and western banks. This new bridge will increase safety for hikers passing through this section of the trail.

## 4.0 PROJECT TEAM / ROLES AND RESPONSIBILITIES

This section provides an overview of the roles and responsibilities of each of the key on-site Project team members. The responsibilities identified for each role are presented within an environmental management context and are not exhaustive of the responsibilities of each member.

### 4.1 CONTRACTOR

The responsibilities of the Contractor will include, but are not limited to:

- Following construction safety standards (e.g. delineating construction zones, marking site-specific hazards and providing alternative routes to visitors) to minimize adverse impacts to field personnel and park visitors within the Project area and adjacent sites.
- Maintaining safety standards highlighted in **Section 7.2** of the EMP to minimize wildlife/human interactions by reducing waste and storing potential wildlife attractants such as food, waste materials, cleaning products, fuel etc.
- Ensuring all construction activities are completed according to Project designs approved by Parks Canada and that all construction work complies with the requirements of this EMP and the BIA.
- Completing all construction activities within the applicable timing windows. If construction is required beyond the duration of the timing windows, the Contractor must:
  - Take all necessary steps to obtain a permit/approval extension or renewal (for any Contractor-held permits/approvals), and
  - Notify and receive approval from Parks Canada and the Environmental Monitor (EM) well in advance of activities proposed outside the timing window.
- While Hemmera will provide an environmental orientation to the Contractor at the start of construction, the Contractor is responsible for ensuring all construction staff, including sub-contractors, have undergone an orientation and appropriate training on environmental mitigation measures as outlined in this EMP and the BIA.
- Keeping a current version of this EMP and the BIA, and any applicable permits/approvals on site during construction activities.
- Communicating regularly and effectively with all Project team members regarding the construction schedule and activities as it pertains to environmental and archaeological issues, and adjusting construction activities as needed to stay in compliance with the EMP and any relevant permits/approvals.
- Leaving all completed work areas in an environmentally stable (e.g. no eroding soils) condition.
- Notifying the EM in the event of:
  - Any incidents that have the potential to result in harm to the environment or wildlife (including impacts to habitat)
  - Any unforeseen changes in environmental conditions (e.g., slope instability, flooding etc.), and
  - Any other relevant activities that have potential to affect valued environmental components.

#### **4.2 HEMMERA ENVIROCHEM INC. - ENVIRONMENTAL MONITOR**

Specific responsibilities of the EM include, but are not limited to:

- Conducting necessary pre-construction environmental surveys
- Developing and overseeing environmental protection and monitoring programs
- Monitoring the removal of existing bridge features (i.e., ladders, platforms and boardwalks)
- Monitoring the construction of platforms for the new bridge
- Providing advice on key decisions such as stop work activities in any events of non-compliance with this EMP, and/or if Project activities result in harm to the environment
- Being available during normal working hours and (if not available) having a backup system in place to address any issues related to environmental performance that may arise
- Reporting to Parks Canada on the Contractor's compliance with this EMP through environmental monitoring reports, and
- Advising and reporting to Parks Canada in the event of any areas of non-compliance, ineffective mitigation measures, or environmental incidents.

## **5.0 ENVIRONMENTAL OVERVIEW**

This section provides a general overview of the environmental features present within the Project alignment and identifies the sensitivities associated with these habitats and features as well as the species which may be affected by the proposed construction activities.

### **5.1 POTENTIAL IMPACTS TO AQUATIC RESOURCES**

The Project site is located directly above/adjacent to Logan Creek which discharges to the Pacific Ocean approximately 150 metres (m) downstream of the Project site. An unnamed watercourse is also present approximately 6 m west of the proposed western bridge abutment.

Project activities have potential to cause erosion and sedimentation of surficial materials on the gully walls during construction and decommissioning activities. There is potential for accidental spills of small quantities of deleterious substances into the environment which could contaminate surface and groundwater resources. Also, due to the steep topography, construction supplies and equipment could potentially fall into the Logan Creek channel.

### **5.2 POTENTIAL IMPACTS TO TERRESTRIAL RESOURCES**

Construction activities associated with the Project consist of the installation of two terrestrial platforms that will connect the eastern and western bank of Logan Creek, construction of connecting trail infrastructure, and the removal of the existing bridge infrastructure (i.e., ladders, platforms and boardwalks). Note that removal of the cabled suspension bridge is not included under the scope of the current Project.

Removal of shrubs and trees located within the footprint of the bridge abutments, in addition to danger trees (see the Danger Tree Assessment Report in **Appendix A**), will be required to facilitate the Project. Additionally, installation of the bridge abutments, footings and anchor foundations, and clearing for laydown areas will disturb soil at the site due to movement of materials and equipment.



## 6.0 REGULATORY OVERVIEW

This section provides an overview of relevant federal environmental and archaeological legislation and regulations, that apply to construction of the new Logan Creek bridge and removal of existing bridge infrastructure (i.e., connecting ladders, platforms and boardwalks).

### 6.1 FISHERIES ACT

The *Fisheries Act* protects the quality and integrity of fish habitats for commercial recreational and Aboriginal (CRA) fisheries. Recent changes to Sections 32 and 35 of the *Fisheries Act* prohibit activity that may cause serious harm to fish, defined as the death of fish, or any permanent alteration to or destruction of fish habitat<sup>1</sup>, unless authorized by Fisheries and Oceans Canada. Other sections of the *Fisheries Act* that are applicable to the Project include Section 36(3) that prohibits the deposition of deleterious substances to waters frequented by fish, and Sections 38(4) and 38(5) that require a contravention of either Sections 35 or 36(3) be reported without delay.

### 6.2 SPECIES AT RISK

The goal of the *Species at Risk Act S.C. 2002, c. 29* (SARA) is to prevent Endangered or Threatened wildlife from becoming extinct or lost from the wild, and to help in the recovery of these species. SARA is also intended to manage species of Special Concern and to prevent them from becoming Endangered or Threatened. SARA protects at-risk fish and wildlife species covered under the federal *Fisheries Act R.S.C. 1985, c.F-14* and *Migratory Birds Convention Act S.C. 1994, C.22* and all species (including plants and mammals) on federal lands. Species listed as Extirpated, Endangered or Threatened under Schedule 1 of SARA cannot be killed or harmed and there are prohibitions against damaging or destroying their residences. Any negative Project impacts, including negative impacts to identified Critical Habitat for, Extirpated, Endangered or Threatened species listed under Schedule 1 of SARA, would require a permit under Section 73 of SARA.

**Table 2** summarizes species at risk listed under Schedule 1 and Schedule 3 of SARA, that have potentially suitable habitat within and around the Project area within Pacific Rim National Park Reserve of Canada (NPRC). Three species, from **Table 2** were carried forward for additional consideration; these include marbled murrelet, dromedary jumping-slug (*Hemphillia dromedarius*), and warty jumping-slug (*Hemphillia glandulosa*).

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<sup>1</sup> Fish habitat is defined as "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes." In the case of the Project, this includes all yellow, red, and red-dash coded watercourses within the Project area.

**Table 2 Species at Risk under Schedule 1 and Schedule 3 of the Species at Risk Act with the potential to occur within the Project site**

Common Name	Scientific Name	SARA Schedule	SARA Legal Status	COSEWIC Status	Habitat Suitability at the Site / Potential Effect
<b>Mammals</b>					
Little Brown Myotis	<i>Myotis lucifugus</i>	Schedule 1	Endangered	Endangered	Feeds along riparian zones, uses open features to navigate. Roosts in bark crevices or natural cavities within mature or dead decaying trees.  <b>Potential for foraging habitat along Logan Creek. No mapped Critical Habitat within Project footprint.</b>
Keen's Myotis	<i>Myotis keenii</i>	Schedule 3	-	-	Taxonomic validity is not supported but currently maintained; as such, the species is considered here. Generalist. Ubiquitous in forested habitats along west coast BC. Overwintering habitat generally associated with rock and / or mature wildlife trees. No mapped Critical Habitat (Schedule 3).  <b>Potential for foraging habitat along Logan Creek. No mapped Critical Habitat for SARA Schedule 3 Species.</b>
<b>Birds</b>					
Ancient Murrelet	<i>Synthliboramphus antiquus</i>	Schedule 1	Special Concern	Special Concern	Nest colonially in burrow on rock crevices. Nests along rocky seacoasts.  <b>Nesting colony not identified during site visit; nesting use within Project area is considered highly unlikely. No anticipated direct effect based on temporal mitigation for proposed Project works. Critical Habitat not mapped for species of Special Concern.</b>
Band tailed Pigeon	<i>Patagioenas fasciata</i>	Schedule 1	Special Concern	Special Concern	Nests on sturdy tree limbs within mid to upper canopy of mature coniferous trees within mature temperate forests.  <b>Potential for nesting habitat in area around the site. No anticipated direct effect based on temporal mitigation for proposed Project works. Critical Habitat not mapped for species of Special Concern.</b>

Common Name	Scientific Name	SARA Schedule	SARA Legal Status	COSEWIC Status	Habitat Suitability at the Site / Potential Effect
Great Blue Heron <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>	Schedule 1	Special Concern	Special Concern	Builds large conspicuous platform nests constructed within the upper canopy of deciduous and mature coniferous trees. Great blue heron typically nests colonially.  <b>No nest structures identified during the site visit. Critical Habitat not mapped for species of Special Concern.</b>
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	Schedule 1	Threatened	Threatened	Nests in branches on old growth trees and mature conifers.  <b>Site falls within federally identified Critical Habitat for this species; refer to the detailed habitat assessment (below). Based on the detailed habitat assessment, no potential nesting habitat was identified within the Project area.</b>
Peregrine Falcon <i>pealei</i> subspecies	<i>Falco peregrinus pealei</i>	Schedule 1	Special Concern	Special Concern	Typically nests on cliff ledges along large vertical cliff faces.  <b>No identified potential nesting habitat noted within, or surrounding, the Project area. No nests observed during the site visit. Critical Habitat not mapped for species of Special Concern.</b>
Western Screech-Owl <i>kennicottii</i> subspecies	<i>Megascops kennicottii kennicottii</i>	Schedule 1	Threatened	Threatened	Generalist in coastal forested habitats below 1,200 m (above sea level), however general preference for riparian mixed-wood and coniferous forested habitat with natural openings in mature forested ecosystems.  <b>Potential for nesting and foraging habitat in area around the site. No mapped western screech-owl Critical Habitat within the Project area. No anticipated direct effect based on temporal mitigation for proposed Project works.</b>
Northern Goshawk <i>laingi</i> subspecies	<i>Accipiter gentilis laingi</i>	Schedule 1	Threatened	Threatened	Occupies large home-range areas in coastal forested ecosystems, generally below 1,200 m (above sea level). May nest in treated forests but generally nests in forests >80 years old.  <b>Potential nesting and foraging habitat in Project area. No mapped northern goshawk Critical Habitat within the Project area. No anticipated direct effect based on temporal mitigation for proposed Project works.</b>

Common Name	Scientific Name	SARA Schedule	SARA Legal Status	COSEWIC Status	Habitat Suitability at the Site / Potential Effect
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Schedule 1	Threatened	Threatened	Ubiquitous occupant of many forested habitat types., often associated with edges (natural or cleared). Nests in dead standing trees.  <b>Potential for nesting and foraging habitat in area around the site. No mapped Critical Habitat within the Project area. No anticipated direct effect based on temporal mitigation for proposed Project works.</b>
<b>Amphibians</b>					
Northern Red-legged Frog	<i>Rana aurora</i>	Schedule 1	Special Concern	Special Concern	Requires aquatic breeding and terrestrial foraging habitats usually at low elevations (~500 m).  <b>Potential habitat within Logan Creek adjacent to the site. Critical Habitat not mapped for species of Special Concern. Lentic features will be checked for egg masses if effect is anticipated.</b>
Western Toad	<i>Anaxyrus boreas</i>	Schedule 1	Special Concern	Special Concern	Uses a wide variety of aquatic and upland habitats, they breed in a variety of wetlands including shallow, sandy margins of lakes, ponds, streams, river deltas, river backwaters, river and estuaries  <b>Potential habitat within Logan Creek adjacent to the site. Critical Habitat not mapped for species of Special Concern. No anticipated direct effect based on temporal mitigation for proposed Project works.</b>

Common Name	Scientific Name	SARA Schedule	SARA Legal Status	COSEWIC Status	Habitat Suitability at the Site / Potential Effect
<b>Invertebrates</b>					
Dromedary Jumping-slug	<i>Hemphillia dromedarius</i>	Schedule 1	Threatened	Threatened	Associated with rich mesic mature / old-growth coniferous temperate forests in the Coastal Western Hemlock biogeoclimatic zone from sea level to 1,200 m above sea level.  <b>Potential habitat located within areas anticipated for development adjacent to Logan Creek. No mapped Critical Habitat within the Project area however habitat assessment presented to describe potential for direct effects during construction.</b>
Warty Jumping-slug	<i>Hemphillia glandulosa</i>	Schedule 1	Special Concern	Special Concern	Inhabits moist coniferous and mixed wood mature forests (>60 years old), from sea level to 1,060 m above sea level. Associated with riparian and moist areas dominated by western red-cedar and western hemlock.  <b>Potential habitat located within areas anticipated for development adjacent to Logan Creek. Critical Habitat not mapped for species of Special Concern.</b>
<b>Plants</b>					
Seaside centipede	<i>Heterodermia sitchensis</i>	Schedule 1	Endangered	Endangered	Small arboreal lichen persisting on small twigs of Sitka Spruce ( <i>Picea sitchensis</i> ) (obligate species) within metres of the high tide zone in nutrient enriched sites.  <b>Unlikely to occur; Sitka spruce limited and site is more than a few metres above the high-tide zone. No mapped Critical Habitat within the Project area.</b>

**Note:** <sup>1</sup> SARA listing: 1 = schedule 1, E = Endangered, T = Threatened, SC = Special Concern, - = no listing  
<sup>2</sup> Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listing: E = Endangered, T = Threatened, SC = Special Concern, - = no listing.

### **6.2.1 Marbled Murrelet**

The Project site falls within a 43,188 ha polygon of federally identified mapped Critical Habitat for marbled murrelet. The marbled murrelet is legally protected in BC and federally listed as Threatened under Schedule 1 of SARA. It is a small seabird that forages in nearshore waters throughout coastal British Columbia (typically less than 1 km from land), and nests on large mossy limbs or platforms of coniferous trees in mature (140 to 200 year old) and old growth (>200 year old) forests. An on-site habitat assessment was undertaken by a Qualified Environmental Professional from Hemmera on October 10, 2017. Based on the assessment, it was determined that the Project footprint does not currently support suitable breeding habitat for marbled murrelet. As such, the Project is unlikely to harm marbled murrelet habitat. More details regarding the marbled murrelet habitat assessment is available in the main body of the BIA. Mitigation measures specific to marbled murrelet are available in **Section 7.2.2.1**.

### **6.2.2 Dromedary Jumping-Slug and Warty Jumping-Slug**

Dromedary jumping-slug is legally protected in BC and federally listed as Threatened on Schedule 1 of SARA. Warty jumping-slug is federally listed as a species of Special Concern, and designated on Schedule 1 of SARA. Both species are known to occupy most forested habitats and riparian sites from low to mid elevations within Pacific Rim National Park. The area anticipated for clearing is recognized as suitable habitat for both species. Mitigation measures specific to dromedary and warty jumping-slugs are available in **Section 7.2.2.2**.

### **6.3 MIGRATORY BIRDS CONVENTION ACT**

The *Migratory Birds Convention Act* protects various species of migratory birds including gamebirds, insectivorous birds, and non-gamebirds. This Act restricts the possession of live and dead migratory birds and bird parts, and prohibits the taking of migratory bird nests and the deposit of harmful substances in waters or areas frequented by migratory birds.

### **6.4 CANADA NATIONAL PARKS ACT**

The *Canada National Parks Act* protects national parks from environmental damage from pollution, and provides regulations and rules for protections of native flora, fauna, and watercourses. The *Act* restricts use of natural objects within a park to permits holders only. Under the *Act*, the *National Parks Wildlife Regulations* also prevents disturbance to wildlife and wildlife habitat within a national park.

## **7.0 ENVIRONMENTAL MITIGATION MEASURES AND BEST PRACTICES**

Project activities have the potential to negatively impact environmental values associated with Pacific Rim National Park. Many of these impacts can be avoided or minimized through implementation of site-specific mitigation measures. **Sections 7.2.4 to 7.4** outline mitigation measures and standard best practices that may be implemented to keep the Project in compliance with applicable legislation, regulations, and policies.

### **7.1 GUIDING DOCUMENTS AND BEST MANAGEMENT PRACTICES**

Guiding documents and BMPs ensure that a project is planned and carried out in compliance with applicable legislation, regulations, and policies. Guiding documents and BMPs that should be followed during Project activities and where practical, include, but are not limited to the following:

- A Field Guide to Fuel Handling, Transportation, and Storage (MWLAP and MOF 2002)
- Environmental Guidelines for Urban and Rural Land Development in British Columbia (MOE 2014)
- (Draft) Oregon Forestsnail and Other Land Snails at Risk in the Coastal Lowlands (MOE and MFLNRO 2012)
- Guidelines for Amphibian and Reptile Conservation during Urban and Rural Development in British Columbia (MFLNRO 2014)
- Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (MOE 2013)
- Land Development Guidelines for the Protection of Aquatic Habitat (DFO and MELP 1992)
- (Draft) Parks Canada National Best Management Practices for Migratory Birds (Parks Canada 2017*b*)
- Parks Canada National Best Management Practices for Trail Maintenance and Modification (Parks Canada 2016).

Other planning documents and BMPs may be provided to the Contractor depending on the task and potential for environmental impacts.

### **7.2 MITIGATION MEASURES**

#### **7.2.1 Working in or Around Natural Areas**

It is expected that all field personnel will receive the appropriate training regarding sensitive ecological features and their locations prior to working on the Project. The following sections outline mitigation measures for working in and around parks, greenspaces and wildlife habitat. Additionally, it outlines mitigation measures for managing invasive vegetation.

#### **7.2.1.1 Wildlife Habitat**

The following mitigation measures will be implemented when working in and around these wildlife habitat areas:

- The *Canada National Parks Act* and related Regulations will apply to all areas within the park, including the camp and work areas.
- All staff will be required to attend on site human/wildlife conflict prevention training provided by Parks Canada staff.
- Any camps established will adhere to the “BARE Campsite Program” recommendations (**Appendix A**).
- The camp and work areas must be kept completely free of uncontained wildlife attractants such as food, waste materials, cleaning products, fuel etc. Failure to comply with these requirements will result in a stop work order until deficiencies have been addressed.
- All food and wildlife attractants should be secure when not in use: items can be hung between two trees at least 4 m above the ground when a bear proof food cache is not accessible.
- When camping, the cooking, eating and supply areas shall be at least 100 m from tenting areas.
- The Contractor is responsible to ensure any material that may be blown or washed away is retrieved.
- Garbage shall not be burned, buried, or disposed of in the Park Reserve.
- All garbage generated during the Project will be contained and removed regularly for appropriate off-site disposal, including recycling where applicable.
- Feeding, enticing, hunting, or destroying wildlife is prohibited under park regulations.
- The work sites must be kept free of items that could attract or harm wildlife.
- Liquid waste (grey water) will be disposed of in a way that minimizes environmental pollution and risks to wildlife (disposal methods require pre-approval from Parks Canada).
- Fuels, lubricants etc. are known bear attractants and care will be taken fueling generators, chain saws etc. to prevent drips or spills.
- Designated Parks Canada staff must be alerted immediately to any potential wildlife conflict (e.g., aggressive behaviour, persistent intrusion etc.), distress or mortality. In the case of aggressive behaviour or persistent intrusion, stop work and evacuate the area.

#### **7.2.1.2 Bird Nest Surveys and Timing Windows**

The *Migratory Birds Convention Act* protects various species of migratory birds including gamebirds, insectivorous birds, and non-gamebirds. This Act restricts the possession of live and dead migratory birds and bird parts, and prohibits the taking of migratory bird nests and the deposit of harmful substances in waters or areas frequented by migratory birds. BMPs outlined for migratory birds (Parks Canada 2017) and in ‘Develop with Care’ (MOE 2014) recommend tree and vegetation clearing outside the bird breeding



period. While the breeding season for bird species varies by species, the nesting period is considered to be from mid March to late August (Bird Studies Canada 2016). Vegetation clearing is to be completed prior to the onset of the general federal bird breeding period (mid-March), and prior to the commencement of the marbled murrelet nesting period (i.e., between March 12 and August 17). The following are mitigation measures to be implemented for the protection of nesting birds.

**Pre-construction phase:**

- Surveys must be completed by a Qualified Environmental Professional.
- During the “caution” nesting period (August 1 to 11, and between March 12 to April 13), conduct 2 surveys within a 5 day period prior to construction. Given no breeding activity is detected, the “free-to-work” period is 3 days. On the 4th day after the start of the “free-to-work” period, conduct an additional survey to extend the “free-to-work” period as needed.
- Results must be documented and provided to the designated Parks Canada contact prior to work commencing.
- If breeding activity or nests are identified during the survey, the area will be left undisturbed with a suitable buffer zone established and maintained until the young have permanently left the vicinity of the nest.
- Limits of the buffer zone must be flagged to clearly identify the area especially in the direction of approaching construction activities. BMPs for migratory birds contain detailed information on buffer areas.
- Never mark individual nests using flagging tape or other similar material as this increases the risk of nest predation.

**During-construction phase:**

- If bird breeding activity is identified during the construction phase, work must stop immediately, the designated Parks Canada contact must be notified, and an appropriate buffer zone must be established.
- The Prime Contractor or person with primary responsibility for the site, is responsible to ensure all personnel, including any sub-contractors are aware of the buffer zone, and conduct activities as directed to minimize disturbance, and remain outside of its boundaries.
- The EM will monitor the area during construction to ensure the established buffer zone is effective.
- If there is evidence that a buffer zone is ineffective (e.g., continued agitation/guarding behavior, frequently leaving the nest) work must stop immediately and the buffer zone must be adjusted by the EM.
- Incidents must be reported immediately to Parks Canada staff and the EM.
- The buffer zone can only be removed upon confirmation from the EM that young have left the nest.
- Minimize construction noise above ambient levels by installing temporary structural noise barriers such as sand bags, baffle boxes, or sound walls.

- Limit construction activities to the time between dawn and dusk to avoid the illumination of adjacent habitat.
- Avoid chemical contamination of nesting habitat (e.g., manage hazardous waste appropriately, refuel over tarps, maintain spill kits on site).

### 7.2.2 Species at Risk

- If any previously unidentified species at risk or their potential habitat is encountered within the work area, immediately notify the EM. All work in the immediate area will be suspended until an appropriate course of action has been determined.
- The EM will record the location of any species at risk encountered during construction activities in the daily monitoring report.
- Removal of vegetation outside the potential marbled murrelet nesting period (March 12 – August 17), is anticipated to mitigate direct impacts on the nesting birds listed in **Table 2**.
- Where practicable, retain adjacent wildlife trees with particular conservation emphasis, such as those containing cavities greater than three (3) inches in diameter.

#### 7.2.2.1 Marbled Murrelet

The Project area falls within designated Critical Habitat for marbled murrelet. Although the habitat assessment (included in the BIA) determined that the Project site is unsuitable as nesting habitat for marbled murrelet, precautionary mitigation measures are required. The footprint of the Project must avoid suitable nest trees and associated canopy cover. Otherwise further assessment, review, and authorization under SARA may be required. To minimize and avoid negative impacts to marbled murrelet habitat or individuals, all personnel involved in the Project must follow BMPs for migratory birds (Parks Canada 2017) which include the following mitigation measures:

- All tree clearing/removal must be scheduled to avoid the entire potential marbled murrelet nesting period (March 12 - August 17).
- A pre-clearing habitat survey within a minimum 60-m buffer (approximately one and a half tree lengths) from the clearing area is to be conducted before felling trees.
- Limit clearing to only those trees necessary for removal per the design drawings, including those that are classified as danger trees (**Appendix B**).
- No large-diameter, veteran trees (e.g., >100 cm diameter at breast height, >35 m height) are to be felled except for those identified in the danger tree assessment. If additional veteran trees are targeted for removal, this activity is to be formally authorized by Parks Canada.
- The Project will avoid clearing potentially suitable nest trees (e.g., with limb diameters >15 centimetres (cm) in the upper third of the canopy) as well as causing damage to their roots.
- For work around large trees, avoid impacting structural/tap roots (>5 cm) diameter that provide stability for the tree) and dig by hand around them, if possible. Limit soil compaction around and over tree roots.

- Where practicable, do not impact canopy cover over any adjacent potential marbled murrelet nesting platforms. Removal of canopy cover over potential nesting platforms will require formal authorization from Parks Canada staff.
- To minimize impacts to any suitable nesting habitat for marbled murrelet, a buffer of at least 60-m should be maintained around potential nesting trees.
- Minimize disturbance to vegetation and avoid siting access routes within these areas, as much as practicable.

#### **7.2.2.2 Dromedary Jumping-Slug and Warty Jumping-Slug**

Due to the inconspicuous nature of both dromedary and warty jumping-slugs, and in recognition of timing for proposed works (including vegetation clearing and bridge construction), effective salvage and removal of these species is likely not feasible. Both species are subject to direct mortality as a result of soil compaction and/or physical disturbance to microhabitats on the forest floor (as anticipated during proposed Project works). However, the following mitigation measures can be implemented to help reduce potential impacts to both of these species:

- Leave coarse woody debris (including large decaying logs) on site to retain microhabitat moisture/humidity conditions.
- Reduce disturbance of moss and hummock layers.
- Reduce removal of both overstory and understory vegetation (e.g., salal (*Gaultheria shallon*), elderberry (*Sambucus racemosa*), blueberry (*Vaccinium spp.*), deer fern (*Blechnum spicant*) etc.).
- Avoid soil compaction, where possible, by using designated trails and/or work access routes.

#### **7.2.3 Cultural Resources**

- All mitigation measures outlined by Millennia Research, as reviewed by Parks Canada's Terrestrial Archaeology section, will be implemented (see the Archaeological Impact Assessment).
- Millennia Research will oversee the Project to ensure compliance with mitigation measures.
- Mitigation measures may include requirements for archaeological monitoring by a qualified archaeologist (a "Monitoring Archaeologist") and for a First Nations Observer(s) that may be required during ground disturbing activities that could impact surface and buried soils and sediments, removal of trees, and/or as identified in the cultural resource mitigations.
- Site visits may be requested by the Parks Canada Cultural Resource Management Advisor to view the on-going work, and will be scheduled with the Parks Canada Project Manager
- All Project personnel must receive 'Cultural Resource Awareness' training prior to Project start-up. Any new staff that join the Project must also go through this training. The Contractor will inform the Parks Canada Project Manager of new staff joining so training can be arranged in a timely manner. The training program includes a review of the Chance Find Procedure (see **Section 7.2.3.1**).
- If cultural resources are encountered, implement the Chance Find Procedure (see **Section 7.2.3.1**)

### **7.2.3.1 Chance Find Procedure**

As archaeological testing is by nature sampling and does not cover 100% of a project area, there could be a chance, however low, that cultural features, deposits or artifacts are encountered. The Chance Finds Procedure will be implemented to minimize the risk of inadvertent impacts to cultural resources, and will be followed throughout the duration of the entire Project. It is imperative in implementing this Procedure that Project personnel understand that they are not expected to interpret the origin, integrity or significance of potential cultural deposits or artifacts.

- The most common Chance Finds cultural site types which may be encountered are:
  - Pre-Contact Archeological Sites – These sites can include artifact scatters, shell middens, shell-less middens, culturally modified trees (CMTs), rock art, waterlogged organic materials, and trails;
  - Found or suspected Human Remains;
  - Historical Sites – These sites can include historical artifacts and structures, and historical refuse such as crockery, metal and glass-ware indicating presence of historical camp sites, shipwrecks, WWII features, cabins, temporary shelters, or sites associated with early logging and mining. Historical sites and objects are evaluated based on heritage value and significance, and can be 40 years or older.
- If potential cultural features, artifacts, human remains or suspected human remains are identified, the following procedures must be immediately implemented:
  - STOP WORK IMMEDIATELY in the area.
  - If available on site, immediately contact the Millennia Research archaeologist (the “Monitoring Archaeologist”). Otherwise, immediately contact the Parks Canada Project Manager, who will then immediately contact the Parks Canada Reserve Cultural Resource Management Advisor and/or Parks Canada Reserve Resource Conservation Manager.
  - Record location of the find:
    - Date (when the find was encountered);
    - Observer (name of the person recording information about the find);
    - Location of Find (Labelled flagging so that it may be relocated, GPS coordinates if possible);
    - Type of find (e.g., archaeological, historical, suspected human remains);
    - Description of the obvious disturbance to the find (by equipment, work, erosion etc.); and;
    - Photograph of find, with scale in photograph if possible. In the case of suspected human remains photographs are only be permitted to be taken by Parks Canada staff or a PCA delegate for the purpose of confirming if the remains are human, and document and maintain chain of custody;

- Under direction of the Monitoring Archaeologist or Parks Canada Project Manager, be prepared to initiate work at another location while archaeological testing and/or mitigation is conducted. Work may only continue in the location of the Chance Find under the direction of the Monitoring Archaeologist or Parks Canada Project Manager.
- In the event that a Chance Find is confirmed to be of found human remains, local law enforcement police will be informed by Parks Canada. The human remains must be accorded full dignity and respect by prohibiting public access and photographs by Project workers and the public. A cover will be placed over any exposed bones with plastic sheeting or blanket. If the affected location is busy or has high public visibility, a delegate of the Contractor will be assigned to stand watch and secure the location until a Parks Canada staff person can relieve the Contractor employee.

#### **7.2.4 Erosion and Sediment Control**

Project activities, including drilling, and vehicle and equipment movement, have the potential to cause the erosion of soil and transport of sediment by water. It is expected that the Contractor identify and implement erosion and sediment control (ESC) measures prior to any work starting on the site.

- Schedule operations to avoid wet, windy, and rainy periods or very dry periods that may increase erosion and sedimentation.
- Halt construction during periods of heavy precipitation and runoff to minimize soil disturbance.
- Install ESC measures prior to onset of work, especially within 30 m of a watercourse.
- Inspect and maintain ESC structures during all phases of the Project and modify as necessary.
- Utilize ESC products that correspond with the nature and duration of the Project.
- Select ESC products that are 100% biodegradable when possible. Select products that are not potential wildlife attractants and do not contain invasive species.
- Plan for as little soil disturbance as possible and limit the duration of soil exposure.
- Divert surface runoff away from exposed areas and manage water flowing onto the site as appropriate.
- Retain natural drainage patterns wherever possible.
- Minimize vegetation clearing and avoid clearing and grubbing areas around sensitive soils when possible.
- Remove temporary ESC products when they are no longer required.

#### **7.2.5 Equipment Operations**

- Hand tools must be in good working order, tuned and be free of leaks and contaminants (e.g., fuel, oil, or grease) prior to arrival on site.
- Consider using bio-degradable chain oil/vegetable oils in chain saws, especially when working within 30 meters of waterbodies.
- Equipment operators must be fully trained and experienced.

- Equipment must be secured when working on/around steep topography.
- Equipment must be inspected daily to ensure tools are fully functioning with no leaks of any fluids.
- Equipment (e.g., chainsaws and generators) must be stored, maintained and refuelled on a flat surface, a minimum of 30 meters from waterbodies, as measured from the High-Water Mark to prevent the release of wash water that may contain deleterious substances.
- An impervious tarp or drip tray must be placed underneath equipment when servicing.
- Do not overfill any equipment fuel tanks.
- Refuelling of equipment must be supervised always.
- Sealable hazardous waste containers will be used for disposal of items such as oil containers, grease tubes, and used absorbent pads. The Contractor will dispose of these items at a facility that processes hazardous materials.
- If operating chain saws directly over or adjacent to waterbodies is unavoidable, use measures such as tarps to trap and prevent debris from entering the waterbody as much as possible.
- Gas generators must be secured to prevent movement during operation and set up on an impermeable fuel mat with a berm or within a container that can contain 110% containment of the volume of fuel in the generator.

#### **7.2.6 Staging/Laydown Areas**

- Staging areas for material and equipment must be carefully identified with preference for existing disturbed areas (e.g., roadway, gravel surface, previously disturbed area with high resiliency).
- When transporting material via helicopter:
  - Material drop, staging areas and drop-off sites must be approved by Parks Canada staff.
  - Choose a drop point that is open and easily accessible from the construction site and that will minimize travel to and from the construction site.
  - Plan multiple drop sites at strategic locations to avoid doubling back on the trail to distribute materials.
- Cover construction material with weighted tarps when appropriate. Minimise damage to adjacent plant material and rehabilitate if necessary.
- Use existing roadways, trails, disturbed areas, or other areas as approved by designated Parks Canada staff for site access, travel within the site and construction activities.
- Clearly mark the work site and restricted areas with stakes, flagging tape or other means and remove them when the Project is completed.
- Keep the disturbance footprint as small as possible.

The Contractor will work with the EM to ensure that the requirements listed above are undertaken prior to and during construction.

### **7.2.7 Noise, Dust, and Air Quality Control**

As work will be taking place in a remote setting using hand tools, noise, dust, and exhaust generated during construction activities are not considered to be a significant consideration. However, it may have indirect effects on sensitive wildlife and vegetation in the immediate area. To prevent excessive noise during construction, the Contractor shall implement the following noise control measures:

- Ensure that all equipment is well-maintained during construction to minimize unnecessary noise.
- Ensure the size and power of tools used is appropriate to the job in order to limit noise from power tool operations.

### **7.2.8 Vegetation**

- Carry cut branches and slash away from trail infrastructure and out of trail user view. Spread branches out with cut ends facing away from trail.
- Protect trees and plant species of high ecological, heritage or cultural value. All clearing activities must be flagged and pre-approved by designated Parks Canada staff.
- Conduct minimal selective clearing by hand to ensure soil stability and prevent run off.
- Limit soil compaction over tree roots.
- Clear the minimum area necessary and trim back vegetation instead of full removal when feasible.
- Only trees outlined in the design drawings are permitted for removal. Any additional trees identified by the Contractor that may require removal for visitor/trail crew safety or wildfire risk reduction is to be discussed with Parks Canada and the EM.
- For danger trees (see **Appendix B**), removal of full tree trunks is recommended only when required for safety purposes. Where felling is avoidable, mitigation techniques including topping the trunk at the defect and removal of large and dead branches over the trail, should be implemented instead.
- Schedule vegetation clearing outside of the bird breeding window.

### **7.2.9 Invasive Vegetation Management**

- Footwear, clothing, and equipment coming into contact with the terrestrial or aquatic environment must be free of invasive alien species individuals, seeds, propagules (i.e., any other material that may cause the spread of the species) and pathogens.
- Equipment must be clean prior to arrival.
- All untreated construction lumber, ESC products (e.g., straw, mulch), or other applicable materials from outside the Project site must be from a certified weed-free source.
- Minimize ground disturbance and vegetation removal, as practical.
- Minimize bare soil exposure (e.g., cover stockpiled material with tarps, plant native species, cover with natural mulch/ground coverings etc.).
- Monitor disturbed and re-vegetated areas for several growing seasons to ensure that native vegetation is growing successfully and invasive species spread is prevented.

## **7.3 WASTE MANAGEMENT**

### **7.3.1 Hazardous Waste**

For the purpose of this EMP, hazardous materials include dangerous goods, any controlled or restricted products, and any substance that has the potential to negatively affect the environment if discharged into water or land. The following mitigation measures are specific to hazardous materials management, and will be followed during all Project activities that have the potential to generate hazardous waste.

### **7.3.2 Waste**

- All wildlife attractants must be secured (e.g., petroleum products, human food, recyclable drink containers and garbage) within wildlife-proof containers. Keep food waste separate from construction waste and secure garbage until it can be removed.
- Notify Parks Canada staff immediately should wildlife gain access to the above-mentioned attractants.
- Contain and stabilize waste material (e.g., construction waste and materials) above the high water mark to prevent them from entering any waterbody.
- All construction materials (e.g., refuse material, waste petroleum, construction material) must be removed from the site upon completion of the Project.

### **7.3.3 Hazardous Material**

- Prevent the release of hazardous substances into the environment, including but not limited to, concrete leachate, petroleum products and their derivatives.
- All on-site personnel must be briefed on reporting requirements for hazardous materials spills. All spills must be reported immediately to Parks Canada staff.
- All construction sites must be equipped with containers suitable for the secure, temporary storage of hazardous wastes, separated by type.
- A spill contingency response kit including sorbent material and berms to contain 110% of the largest possible spill (i.e., fuel or other toxic liquids) related to the work must be available on site at all times. On-site personnel must be aware of its location and trained in its use. Any contaminants must be recovered at source and disposed according to applicable laws, policies, and regulations.
- Identify and handle all toxic/hazardous materials as required under the *Canadian Environmental Protection Act*, *Transportation of Dangerous Goods Act*, and Workplace Hazardous Materials Information Service.
- Petrochemical products, paints and chemicals must be stored a minimum of 30 m away from waterbodies and secured overnight in a Parks Canada approved enclosed area under lock and key. The 30 m buffer may be increased depending on level of risk and site-specific conditions.
- Any hazardous waste or contaminated material uncovered during excavation/construction, must be investigated, removed, and disposed of at an approved location outside the Project site. Disposal documentation must be provided to Parks Canada staff.



- Conduct any work to be done with concrete or cement in dry weather such that no sediments, debris, or wash water are deposited into any watercourse.
- Contain all materials associated with concrete pours within secondary containment to prevent accidental releases.
- Cover curing concrete with poly or other materials to prevent accidental migration of material.
- Handle all concrete and washout water with care to prevent these substances from indirectly or directly entering a watercourse.
- Ensure all crew members who will be handling hazardous materials and wastes have valid Workplace Hazardous Materials Information System training.
- Material Safety Data Sheets are to be onsite in a readily-available location for all potential encounters of hazardous materials.

#### **7.4 ENVIRONMENTAL INCIDENTS AND SPILLS**

It is expected that all reasonable preventative measures will be taken to avoid the release of waste or hazardous materials into the environment. The Contractor is responsible for implementing the following measures in order to avoid and/or mitigate the potential effects of environmental incidents and spills.

##### **7.4.1 Spill Prevention**

The Contractor will identify potential spill hazards (e.g., refuelling equipment on a slope), determine the level of risk for activities that could result in a spill, and take measures to reduce the potential of a spill. All efforts will be taken to minimize the risk of spills, including:

- Maintaining equipment in the work site in a manner that prevents spills to the environment.
- Appropriately training equipment operators and crews on how to contain spills or leakage from equipment.
- Placing absorbent pads underneath areas of the equipment or vehicles that require maintenance.
- Transferring liquid waste into containers using funnels, pumps, or other flow control devices to minimize the potential for spills.
- Ensuring that any equipment left at the work site overnight is secure.
- Conducting a daily pre-construction inspection of equipment, focusing on any potential leaks.
- Storing all fuels and lubricants brought onto the work site in properly labelled containers.
- Ensuring all products and equipment are used in a manner that avoids potential spills.

#### **7.4.2 Spill Kits**

Spill kits must be available in every vehicle and piece of equipment operating at the Project site. All spill kits must be fully stocked and restocked as soon as possible if used. All spill kits will include the following, at a minimum:

- 2 each - 10' oil only socks
- 15 each - polypropylene sorbent pads (oil only) 18" x 18" x 3/8"
- 2 each - 10-quart cellulose sorbent material, oil only
- 1 each - barrier ribbon, yellow "Caution Do Not Enter"
- 1 each - poly disposal bags (45-gallon drum size, minimum 6 millimetres)
- 1 each - blank labels for plastic bags
- 1 each - plastic bag tie
- 1 each - epoxy plug compound (hydrocarbon compatible)
- 1 each - spill kit container marked "Spill Response Kit"

#### **7.4.3 Spill Response and Reporting**

The Contractor must ensure that crew members are trained in spill recognition, response, reporting and cleanup procedures. All spills, regardless of size must be properly cleaned. Any ground spills greater than 1 L, or any spills entering any watercourses (regardless of size) must be reported to the EM. The EM will be responsible for contacting Parks Canada and the appropriate regulatory agencies as needed.

## **8.0 ENVIRONMENTAL MONITORING**

Environmental monitoring will be undertaken during the removal of the Project to provide advice and guidance to the Contractor related to protection of the environment. The EM will assess the efficacy of mitigation measures and will report on the Contractor's compliance with all relevant environmental obligations, including conditions as listed under this EMP. The EM will coordinate and conduct environmental monitoring activities and will be present during sensitive Project activities, including but not limited to the following:

- Vegetation clearing activities
- Construction commencement
- Concrete pouring for the bridge abutments, and
- Construction conclusion.

Environmental surveillance by Parks Canada staff will also occur during Project activities. In the event of any non-compliance with this EMP, the EM will determine if the work needs to be stopped. The Contractor must implement all appropriate mitigation measures to address the non-compliance or will wait until conditions change such that construction activities can once again be initiated in compliance with all environmental obligations. Parks Canada would be consulted by the EM following a site shut down.

### **8.1 TAILGATE MEETINGS**

Field crew tailgate meetings will be convened by the Contractor, and will be attended by the EM prior to the commencement of daily works. Tailgate meetings, including content pertaining to environmental management and protection, will be documented and kept on file for inspection/auditing by the applicable regulatory agencies.

Pacific Rim National Park will also provide pre-trip and onsite arrival information for all onsite personnel. Parks Canada will also provide a cultural resource orientation to all crew staff as part of the tailgate meeting.

### **8.2 ENVIRONMENTAL REPORTING REQUIREMENTS**

The EM will complete an environmental monitoring update report. Once approved by Parks Canada, the reports will be sent to the Contractor.

The content of the report will include the following, at a minimum:

- Monitoring dates and times
- Weather over the reporting period
- Construction activities undertaken

- Any issues identified
- Environmental protection and mitigation measures recommended and implemented and an update regarding maintenance of these items
- Representative photographs, and
- Outstanding items, including non-compliances with this EMP and BIA, recommendations from the EM, regulatory agencies, or regulatory documents.

## 9.0 REFERENCES

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## **APPENDIX A**

### **The “Bare” Campsite Program (Parks Canada)**



parkscanada.gc.ca

# The “Bare” Campsite Program



wolf photo: Jordy Shepherd; background: Bob Hansen

## Welcome!

You are camping in a very special place, a national park. We share this landscape with wild animals that depend on it for their survival. These can include black bears, cougars, wolves and others.



Pacific Rim National Park of Canada has a “Bare” Campsite program in place. A special effort is being made here by both park staff and campers to ensure that wildlife attractants are never left unattended at any campsite. The “Bare” Campsite program is in place for your safety, and to help keep the wildlife in our national parks alive and wild.



Parks  
Canada

Parcs  
Canada

Canada



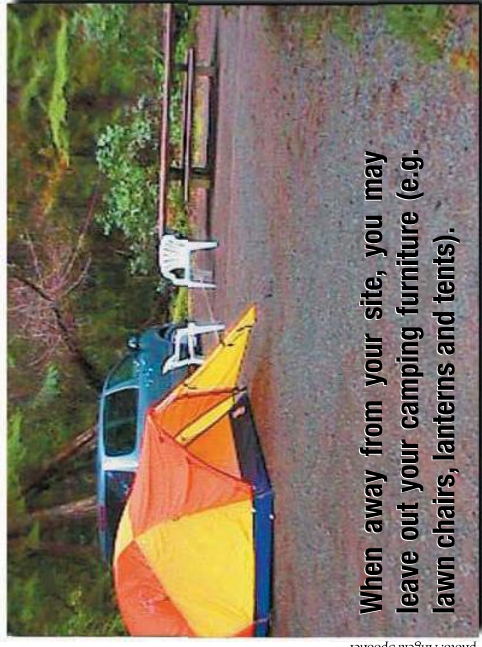
## How to keep a "bare" campsite

If you are camping here, you are agreeing to:

Store ALL FOOD and WILDLIFE ATTRACTANTS in a hard-sided vehicle/trailer/motor home or in the campground food storage lockers (not in a tent or tent-trailer) when not in use.

This policy applies whenever these items are not in use such as while you are sleeping at night, or when your site is unattended for any length of time (e.g. to go to the washroom).

### A "bare" campsite



When away from your site, you may leave out your camping furniture (e.g. lawn chairs, lanterns and tents).

**Attention Pet Owners!** Please keep pets on a leash at all times. Don't leave pets unattended outside – especially at night. They can attract carnivores such as bears, cougars and wolves, and may be attacked.

*We are the key to the long term survival of wildlife in our parks.*



Attractants are things that have an odour or could appear to be food to wildlife. Your campsite should look like the picture of the "bare" campsite.

#### Wildlife attractants

- Coolers – full/empty
- Food and Condiments
- Garbage/Wrappings/Plastic Bags
  - Dishes/Pots
  - Pet Food/Bowls
- Bottles/Cans - full/empty
  - Tablecloths
- Toiletries/Suntan Lotion/Insect Spray
- Campstoves/Barbeques
- Containers of Gasoline/Oil
- ANY item associated with food preparation or clean up (soap, dish clothes and towels)
- Grey Water Pails

When people leave their food out, bears and other wildlife can lose their fear of humans. Once an animal gets used to human food, it becomes a risk to public safety, and may be destroyed. By keeping a "bare" campsite, you are playing an important part in preventing the creation of "problem" animals.

## If your campsite is not "bare" ...

Park staff will be patrolling the campground regularly to ensure that campers have not left anything out at their site that could attract wildlife.

If you return to your site and discover that items are missing, they may have been moved to wildlife-proof storage. Look for a notice left by park staff. It contains further instructions.

### A "Wildlife at risk" (and cancelled permit) site



Photo: Angela Spooner

Campers who fail to comply with the requirements of the "Bare Campsite" program may have their camping permit cancelled, with no refund, and may be charged under the *Canada National Parks Act and Regulations*.

## Sharing an Ecosystem – *You are camping within wildlife habitat*

Animals rely on every part of this landscape for their survival. Their travel routes, natural food sources, mating grounds, and resting sites don't necessarily stop at the campground boundary! You may encounter wildlife at any time. Be aware of your surroundings, especially at dusk and dawn, or in densely vegetated areas. Surprising a bear feeding on natural food such as berries can be dangerous.



## Wildlife viewing – a word about Safety!



photo: Steve Diggon

Seeing wild animals in the park can be a thrilling and rewarding experience, but remember:

- All wild animals are potentially dangerous.
- Never approach, feed, or entice wildlife of any kind, regardless of size.
- Keep a safe viewing distance at all times (30 to 100 metres).

***Please report all bear, cougar and wolf sightings to park staff immediately.***

*Thank you! Your efforts in keeping a "BARE" campsite are appreciated by Parks Canada and your fellow campers. Please take what you have learned here to other campgrounds in the future – we can all help to keep each other safe and wildlife wild.*

**APPENDIX B**  
**West Coast Trail Danger Tree Assessment and**  
**Recommendations (Strategic 2017)**



October 13, 2017

# **West Coast Trail Danger Tree Assessments and Recommendations**

Jordan Yano, FIT  
Parks DTA #P1362

PROFESSIONALLY RESOURCEFUL

## Disclaimer

All of the assessments found within this document have been conducted on October 10<sup>th</sup> 2017, and are only valid up until the next major weather event, or three seasons, whichever comes first. In the event of a major storm, each site will need to be assessed again in order to maintain each sites safety. All of the information found within this document has been prepared for the Pacific Rim National Park and Public Works staff in order to implement and maintain a safe working site for the construction of the Pacific Rim Traverse trail. The selected crossing site has been assessed as seen in the field. Any lateral movement of the site itself will require new assessments to be conducted. If the trail moves or is re-routed from it's current location, this will also trigger another re-assessment.





Table of Contents

Disclaimer ..... 2

Site Overview ..... 4

Methodology ..... 4

Assessment Results ..... 5

    West Bank Construction Site ..... 5

    East Bank Construction Site ..... 5

Conclusions ..... 6

Appendix – DTA FIELD CARDS ..... 7



## Site Overview

The West Coast Trail is located between Bamfield and Port Renfrew on the west coast of Vancouver Island. It is an Old Growth forest type with a heavy mix of Western red cedar (*Thuja plicata*) Western hemlock (*Tsuga heterophylla*). The danger tree assessments occurred at the Logan creek where there is currently a foot bridge crossing the stream which is slated for replacement just upstream of the current crossing site. This phase of the project is aimed at keeping the construction crews for this project safe from a forestry perspective, and not the continual safety of parks guests. The safety of guests using the trail should be maintained by utilizing a Parks certified danger tree assessor annually.

## Methodology

The danger tree assessment for the West Coast trail was conducted by Strategic Natural Resources Consultants (SNRC) staff trained in the Parks methodology of danger tree assessment. Due to the nature of this construction project, management styles had to be amended slightly in order to ensure worker safety. When thinking about management of a dangerous stem, it was first determined whether or not this specific hazard would impact any person working on the construction site. If the hazard was within a tree length and a half of the work site, and not leaning away from it, the stem was recommended for removal.

Assessments were conducted one and a half tree lengths away from the construction site, which averaged out to be 60m from the footings. The field portion was conducted utilizing one field assessor. Once a tree has been identified as dangerous by the assessor, it had a single white ribbon attached in order to be visible for faller identification, with tree number and species written on it. Trees found not to be dangerous were left with no markings in order to not disturb the visual quality of the newly constructed trail.

During the assessment, assessors were encouraged to think of ways to mitigate the danger, while saving the stem for wildlife or recreational reasons. Removal of the stem was recommended only when safety over ruled these other resources. Some mitigation techniques include topping the stem at the defect, removal of large and dead branches over the trail site etc. These special management strategies have been described in the attached danger tree field cards.

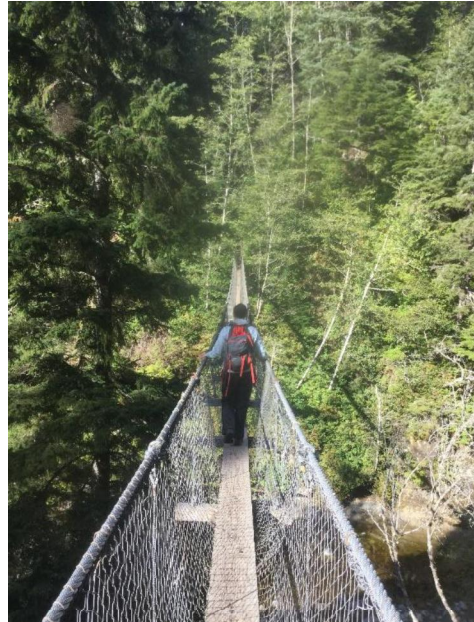


Figure 1: Bridge to be replaced by new structure



## Assessment Results

### *West Bank Construction Site*

The west side of Logan creek had a highly variable stand, ranging from short advanced regenerating to old growth Western hemlock and Western red cedar. The site is fairly wet with deep soils. The Western hemlock on this site showed signs of advanced witches broom and mistletoe affecting the stems. This is something to monitor but is widely spread and past the point of containment.

All assessments were conducted to a level of disturbance 3 for this site. The work conducted falls under the “maintenance or construction activities with heavy equipment” from the Parks module of the danger tree assessor’s handbook.

The danger tree assessment on this side was mostly composed of highly decadent snags and recently induced lean. Both of these conditions are very hazardous and therefore all have been recommended for removal. The assessment produced 7 trees that rated out as dangerous and one to be considered during the felling stage. This is tree 3, a Western red cedar leaning over where the proposed trail site is located. If feasible, this stem could be left as it is well rooted and self-correcting during growth. This stem should be left if possible in order to improve the aesthetics of the trail site, but worker safety should be of the utmost concern.



Figure 2: East bank patch of dead trees. Patch is located roughly 75m East of crossing site

stems as they can crumble at any time.

### *East Bank Construction Site*

The east side of Logan creek was sparser than the west side. This is due to the impact wind has had on this stand over the long history of the trail. This site is also wet with deep soils producing lots of rot and decadence in the standing stems. Roughly 75m East of the proposed bridge site there is between 7 and 10 dead standing stems that were left to increase wildlife value. If the trail is re-routed past this stand, they should be reassessed as they will rate out as dangerous if a trail is in the vicinity.

All assessments were conducted to a level of disturbance 3 for this site. The work conducted falls under the “maintenance or construction activities with heavy equipment” from the Parks module of the danger tree assessor’s handbook.

The assessment produced 9 dangerous trees, all of which require felling. Most of the dangerous stems were riddled with heart rot conks and close to failure. Fallers should exercise extreme caution when felling highly decadent





Directly south of the crossing site there is approximately 10 culturally modified stems. These are not dangerous stems and must be kept for cultural reasons, but should also be monitored for the yearly advancement of decay. The bark strips provide access for pathogens to enter the stem and infect the host. Black rot radiating from the bark strip or resinosis surrounding the wound are good indicators of the beginnings of the rot process.

## Conclusions

The west and east banks are stable stands going through the normal processes that climax forests go through. Stems will grow to maturity and then die back to give way for the new growth in the understory, creating complexity in the overall stand structure. In order to maintain the complexity of these stands and try to preserve this natural stand cycle, the felling and construction phases should be made aware of their potential impact to the stands. Flora and fauna both benefit from a complex stand structure and in order to keep the Pacific Rim National park a naturally managed stand, the anthropogenic impacts must be minimized.

Following construction of the crossing, wind firming should be conducted on the surrounding stand. Spiral pruning 1/3 of the crown will help reduce the potential impact wind can pose to the new structure. This process can be conducted by helicopter, by hanging an attachment from its body, or with climbers which is preferred and has less of an impact to the site itself.



Figure 3: Vertical stand complexity can be seen here. Different vegetation layers are clearly delineated within the stand itself.





## Appendix – DTA FIELD CARDS



District: South Island			Location: Pacific Rim National Park			Name: J. Yano		Date: October 2017																	
License: Parks Canada/Public Works			Block: West Coast Trail			Other Reference: Assessing stems for the felling and construction phase of a newly constructed crossing		Cert #: 1362 Map Attached: No																	
LOD	Tree#	Species	Tree Class	Wildlife Value	Tree Height	LOD=1		LOD = 2 or 3										Management Act			Comment				
						Insecurely lodged or hanging limbs/tops = D	Highly Unstable Tree = D	Recent lean with unstable roots = D	Tree Defects (S= defects rated Safe; D = Defects rated dangerous; / = absent)										Overall Rating (S or D)	Safe-no Action Required		Dangerous - Fall Tree	Install NWZ	Other	
									Roots ( S or D )	Stem (S or D)	RST (radius x 0.3)	AST (cm)	DSH (cm)												
														HT	DL	WB	ST	SD							SB
3	1	Hw	7M		10				/	/	/	D	/	/	D	D	D								
3	2	Cw	7L		10				/	/	S	D	/	/	/	D	S								
3	3	Cw	4L		15				/	/	/	/	/	/	/	S	S								
3	4	Cw	4L		12				D	/	D	/	/	/	/	S	S								
3	5	Cw	3L		30				/	/	/	D	/	/	/	D	D								
3	6	Hw	7L		10				/	/	/	D	D	/	D	/	D								
3	7	Cw	6L		12				S	/	/	D	/	/	/	D	D								
3	8	Hw	3M		30				/	/	/	D	/	/	D	S	S								
3	9	Cw	4L		20				/	/	/	D	/	/	/	D	D								
3	10	Hw	7L		7				/	/	/	D	/	/	D	/	D								
3	11	Ss	3M		30				D	/	/	D	/	/	D	/	D								
3	12	Cw	5L		20				/	/	/	D	/	/	/	/	D								
3	13	Cw	7L		15				D	/	/	/	/	/	/	/	D	D							
3	14	Cw	6L		13				D	/	/	D	/	/	/	/	/	D							
3	15	Hw	7L		10				D	/	/	D	/	/	/	/	D	D							
3	16	Hw	6L		17				D	/	/	/	D	/	/	/	D	D							
3	17	Cw	2L		10				/	/	/	/	D	/	/	/	D	D							



## APPENDIX B

Archaeological reconnaissance date: May 25, 2017

Field personnel: Stan Jones (Pacheedaht First Nation), Paul Ewonus (Millennia Research; Field Director)

AIA recommended: No

Archaeological Monitoring recommended: Yes

Dear Katrina,

Background research suggested moderate to high archaeological potential for the Logan Creek locality. It is the location of a named place, Wi'ê', translated as "Negative Beach" (Arima et al. 1991: 259-260). According to Stan Jones, traditional knowledge indicates that a village site was situated at the mouth of the creek. The area is also identified as a kelp, shellfish (e.g. mussels, barnacles) and fish (e.g. rockfish, lingcod) harvesting area.

Our field assessment of archaeological potential was not as high. We assessed the general area of the mouth of Logan Creek as having moderate potential for archaeological resources. No surficial evidence of precolonial human use of the intertidal zone, beach or creek mouth area was observed. A small coastal terrace was noted on the west side of the mouth of the creek. The terrain is slightly sloping, with a south aspect, and the ground surface moderately uneven in places. Storm wash has covered this small terrace with logs originating primarily in booms off/near shore or in nearby ports. Many of these have been cut with industrial saws, and one example is a part of a floating structure such as a camp (heavy rebar was used to hold the log in place). Since it is not anticipated that existing bridge and ladder deconstruction or replacement bridge construction will directly impact this backshore zone, no further archaeological work in this area is presently recommended.

The antiquity of subareal exposure of the backshore terrace is also poorly known. It is possible that tectonic uplift resulted in exposure of this coastal zone as recently as during the last 100 years.

In the area of the existing bridge and ladder footings/locations, as well as the proposed location of the new bridge as communicated to us in the field, the following observations may be offered. On both sides of the creek old growth forest cover is extensive. The canopy is predominantly veteran western redcedar and the understory is dominated by salal in the areas of old growth. No evidence of historic European-style logging activity was noted during our reconnaissance, however historic and recent trail construction activity could be observed. As it approaches the Pacific Ocean, Logan Creek runs through a large ravine cut into bedrock and glacially deposited sediment. Initial ravine/stream downcutting and the formation of the elevated creek terraces would have occurred during the late/terminal Pleistocene, as glaciers receded and periglacial stream flow was high.

We surveyed at least 50 m on the WCT from the upper edge of the creek ravine on both sides of Logan Creek. Survey coverage north of the current WCT extended at least 80 m on both sides of the ravine terrace, in a 30 m wide transect. On the west side of the creek ravine, coverage extended south of the WCT in a 25 m wide transect for a distance of only 20-25 m, as development is not planned in this area. No above-ground archaeological or traditional use features were identified.

On the east side of the creek ravine, we observed a number of natural scars on western redcedar (trees between ~60-150 years old). These are hypothesized to have been the direct result of heavy blowdown in this immediate area. These scars lack important features of cultural

bark strip scars, such as even, uninterrupted sides, bark-free scar faces, scar crust, and any consistency in scar orientation, size and height-above-ground. It was agreed by Stan Jones and myself that they should be categorized as natural features. Stan did request that we ask Parks Canada whether they would be willing to arrange for trees that are felled in preparation for bridge construction to be sent to Pacheedaht First Nation in Port Renfrew. I suggested that the cost of removing these trees from the park may be prohibitive and that they may be required for other purposes. Stan quickly acknowledged this issue, but I nonetheless offered to pass along the request.

Our revised assessment of archaeological potential in the area of bridge demolition and construction is moderate to low. The ground surface adjacent to the ravine is moderately to slightly hummocky on both east and west sides. It is also approximately 50 m asl by an almost-vertical drop to the creek bed below. Therefore, subsurface evaluation of sediments via systematic testing is not recommended. In light of the close proximity of the bridge to the mouth of Logan Creek and its association with multiple place names, including a possible habitation site, archaeological monitoring however of the bridge replacement is recommended. If construction of work camp facilities includes subsurface ground disturbance or is located along the WCT more than 50 m from the creek ravine edge, these activities should also be monitored.

Please do not hesitate to contact us by phone or email if we can answer any questions you might have.

Reference:

Arima, Eugene, Denis St. Claire, Louis Clamhouse, Joshua Edgar, Charles Jones, and John Thomas

1991 Between Ports Alberni and Renfrew: Notes on West Coast Peoples. Canadian Ethnology Service, Mercury Series, Paper No.121. Canadian Museum of Civilization, Ottawa.

Yours sincerely,

Paul Ewonus, Ph.D.  
Senior Archaeologist  
Millennia Research Limited  
510 Alpha Street  
Victoria, BC V8Z 1B2





East side of Logan Creek ravine, facing west; Stan Jones standing on WCT.





Stan Jones climbing WCT ladders on the east side of Logan Creek ravine, with the creek mouth and coastal terrace in the background.



## APPENDIX C



PUBLIC WORKS & GOVERNMENT SERVICES CANADA

# **WEST COAST TRAIL - LOGAN CREEK BRIDGE REPLACEMENT PHASE 2 - GEOTECHNICAL ASSESSMENT REPORT**

OCTOBER 24, 2017



# **WEST COAST TRAIL - LOGAN CREEK BRIDGE REPLACEMENT PHASE 2 – GEOTECHNICAL ASSESSMENT REPORT**

**PUBLIC WORKS & GOVERNMENT SERVICES  
CANADA**

**12TH FLOOR – 800 BURNARD STREET  
VANCOUVER, BC V6Z 0B9**

**ATTENTION: MR. GEORGE STRAZICICH, P.ENG., STRUCT. ENG.**

**PROJECT NO.: 161-17340-01  
DATE: OCTOBER 24, 2017**

**WSP  
150-12791 CLARKE PLACE  
RICHMOND, BC, CANADA V6V 2H9**

**WSP.COM**



# TABLE OF CONTENTS

1	INTRODUCTION .....	1
2	PROJECT DESCRIPTION & BACKGROUND.....	1
3	GROUND CONDITIONS .....	2
4	DISCUSSION & RECOMMENDATIONS.....	3
4.1	Discussion .....	3
4.2	Abutment Location.....	3
4.3	Abutment Design .....	4
4.4	Rock Anchors.....	5
4.5	Site Preparation .....	6
5	FUTURE GEOTECHNICAL.....	6
6	CLOSURE.....	7

Figures 1, 2 and 3

Terms of Reference for Geotechnical Reports



# 1 INTRODUCTION

As requested, WSP Canada Inc. (WSP) has completed a detailed site investigation for the Logan Creek Bridge Replacement project on the West Coast Trail in the Pacific Rim National Park on Vancouver Island, BC. The assessment was conducted in general accordance with our proposal dated May 23, 2017 for which authorization from Public Works & Government Services Canada (PWGSC) was received on May 30, 2017. The Logan Creek crossing upgrade is a component of a larger project of on-going maintenance and upgrades for the West Coast Trail, a popular backcountry hiking trail that was originally used as a life-saving trail for survivors of shipwrecks. Geotechnical review in support of select sections of boardwalk described in the referenced proposal is on-going and summary reporting for that work will be provided under separate cover.

A site location plan and abutment set-back plans are attached to this report.

A previous version of this report was submitted in July 2017. Subsequently, additional field work was conducted and the design has been refined. This report supercedes the July report and incorporates geotechnical recommendations specific to the current design.

## 2 PROJECT DESCRIPTION & BACKGROUND

As part of on-going maintenance and upgrades for the West Coast Trail, PWGSC is proposing to replace the existing Logan Creek Suspension Bridge, which is within the trail at approximately km 56, as shown on the attached Drawing 1. The Existing Logan Creek Suspension bridge has a span of approximately 60 m and the ends of the bridge are located approximately 25 m down from the crest of the 45 m high Logan Creek embankments. The bridge is accessed by ladder approaches that allow hikers to descend to platforms at each end of the bridge. In the past, the bridge has been washed out by powerful water surges in Logan Creek as a result of storm waves, tides and extreme rainfall events. In order to avoid future damage (or replacement) and to eliminate the current ladders and platforms, the bridge is to be replaced with a longer cable stayed suspension bridge that spans from crest to crest. The replacement bridge will be located further inland from the current location to allow the existing bridge to be in operation until the replacement bridge is completed.

Based on information provided by PWGSC and CWMM Consulting Engineers Ltd. (CWMM), we understand that abutments are to be reinforced concrete bases with vertical towers to redirect the anchor cables. Two cables are proposed at an approximate 1.1 m horizontal spacing. Each cable is to be supported with two anchors at 0.55 m center to center spacing at each end of the cable. Backstay cable angles ranging from 30 to 45 degrees relative to horizontal were considered. Design ULS tension forces in each cable for a 45 degree orientation is approximately 800 kN (Per CWMM email dated 17 July 2017), which means that anchors are to be designed for a ULS tension force of 400kN per anchor.

Two vertical anchors with an approximate 3.2 m horizontal spacing are proposed within each foundation to increase base friction to resist lateral loads. Per CWMM, vertical anchors are to be designed for structural ULS tension force of 170 kN per anchor.



WSP completed a geotechnical desktop review of conditions at the Logan Creek Bridge crossing along with a site reconnaissance on December 6, 2016. The results of that review along with observations made during our site reconnaissance, are summarized in our report dated January 16, 2017. The initial review indicated that a cable suspension bridge is geotechnically feasible and further assessment and survey was recommended in support of detailed design.

Field review was undertaken over the course of several site visits in May and June, 2017 and included site reconnaissance with PWGSC, CWMM, Hemmera, and Parks Canada to identify suitable abutment locations, hand excavated test pits in the area of the proposed abutments, survey by PWGSC and tape and clinometer measurements of the west abutment slope by WSP to in-fill survey data that could not be obtained due to access and visibility restrictions. Detailed survey of the proposed abutment areas was completed by PWGSC on 24 May 2017. Survey information was provided to WSP on June 9, 2017 and updated to include ground surface profiles on June 19, 2017.

On October 10, 2017, WSP conducted supplementary assessment in the area of the west abutment to refine structure layout in relation to an environmentally sensitive drainage feature and locally thicker soft soils identified in June. Hand augering and/or probing with a 10 mm diameter steel rod was conducted at accessible locations. A description of soil conditions observed and/or inferred is presented in Section 3 below.

### 3 GROUND CONDITIONS

Published surficial geology mapping indicates that this section of the West Coast Trail is underlain by colluvium or till veneer, with locally thicker areas over bedrock with a hummocky surface expression (i.e. non-linear rises and hollows with many slopes steeper than 15 degrees). The Logan Creek valley is incised approximately 45 m below the adjacent relatively flat topography. Exposed in the side walls of the valley were deposits of sedimentary bedrock that were dominated by strong, fine to medium grained sandstone. In general, the bedrock was described as massive with some stress relief jointing running parallel to the slope face. Surficial soils exposed in the upper 1 to 2 m at the crest consisted of a very dense till-like silt and sand deposit with a veneer of organic soils approximately 0.3 m thick.

The sedimentary bedrock is shown on the BC Ministry of Environment Geofile 2003-4 to belong to the Carmanah Group of Cenozoic age. This deposit includes siltstone, shale, conglomerate and, as exposed in the valley sides, sandstone. Survey work completed by PWGSC indicates that the upper 5 to 10 m of the valley sides were very steep and locally near vertical. Below the steepened upper sections, the valley sides were generally inclined at 45 to 60 degrees below the horizontal. Exposures of bedrock were observed in the bed of the creek at the toe of the slope. On the west side of the valley, a “nose” type feature with a pronounced and well vegetated 3 m wide bench was observed at a height approximately 15 m below the crest of the slope. It was not possible through observation to verify if this feature was the result of preferential erosion or possibly ancient slumping.

A number of shallow translational slides were observed on both valley side slopes but with more significant and recent activity being noted on the east side of the creek. The slides on the east side appeared to be limited to weathered bedrock and colluvial materials on the slope face and were less than about 1 m in thickness. Some deciduous trees that had been caught in recent sliding were heaped at the toe of the valley slope. No significant erosion of the toe of the bedrock at the toe of the slope was observed.

Hand excavated test pits were advanced in the vicinity of both abutment locations. Hand auger and probe holes were advanced in the vicinity of the proposed west abutment footing. Near surface conditions were variable and included numerous roots and rootlets. In summary, the following conditions were encountered at each abutment area:

## WEST ABUTMENT

- Effective refusal was encountered at depths below ground surface ranging from 0.6 to 1.2 m with a 10 mm diameter steel hand probe at various locations in the general vicinity of the west abutment. Refusal conditions ranged from stiff soil-like to gravelly to rock-like (“hard, ringing”);
- In the area of the proposed west abutment footing, nine hand auger and probe holes were advanced to effective refusal at the approximate locations shown on Figure 2 (HA17-1 to 9). The depth and nature of refusal ranged from hard (till/bedrock like) at approximately 0.6 m below ground surface to the east (HA17-3, 4, 6, and 7) to stiff (clay-like) at approximately 1 to 1.2 m below ground surface to the west (HA17-5, 8, and 9). Effective refusal on inferred cobbles was encountered at 0.7 m depth at HA17-1 and 2 to the west;
- HTP17-1 (2 m south of the proposed abutment) Stiff, laminated silt and sand was encountered at 0.4 m depth in a hand excavated test pit near to the watercourse shown on Figure 2. The deposit became hard at 1 m depth. Advancement was terminated within the soil deposit at 1.2 m depth due to slow progress and obscured view due to light seepage accumulating in the base of the test pit; and,
- HTP17-2 (7.5 m southwest of the proposed abutment): Firm silt/clay was encountered at 0.3 m depth in a hand excavation approximately 6 m northeast of the HTP17-1 as shown on Figure 2. Weathered sandstone bedrock was encountered at 0.5 m depth and the test pit was terminated at 0.8 m depth due to slow advancement. Seepage was not observed at this location.

## EAST ABUTMENT

- At 10 m away from the slope crest, probing with a 10 mm diameter steel hand probe encountered low penetration resistance over effective refusal at 1 m depth on an inferred dense soil deposit;
- At 12 m behind the crest, cobbles and coarse gravel were encountered below 0.3 m depth in a hand excavation (terminated at 0.6 m depth due to effective refusal on cobbles); and,
- At 17 m behind the crest, weathered sandstone was encountered in a hand excavated test pit at 0.3 m depth.

# 4 DISCUSSION & RECOMMENDATIONS

## 4.1 DISCUSSION

Constructing a cable stayed suspension bridge at the top of the banks of Logan Creek is considered to be geotechnically feasible. In general, abutments can be founded on the overlying till-like deposits (if present) or bedrock. The bridge cables may be supported with rock anchors embedded into the sandstone that is visible in both abutments.

Geotechnical recommendations for abutment set-back, rock anchor design, and site preparation are presented in the following sections.

## 4.2 ABUTMENT LOCATION

Geotechnical comments and recommendations are focussed towards abutment areas that have been discussed with the design team previously. In general, a new bridge location approximately 10 to 20 m upstream of the existing bridge is being proposed by the design team based on input from PWGSC and Parks Canada.

Recommendations provided herein are intended to facilitate bridge design. The locations of the abutments are governed by the long term stability of the bedrock controlled slopes, in particular the oversteepened crest sections. In general, erosion at the toe does not appear to be aggressive and has a low potential to influence the final bridge abutment locations.

## **WEST ABUTMENT**

We recommend that the west abutment be located in the vicinity of Cedar 1028 as shown on the attached marked up Drawing No. 2. We recommend a minimum set-back from the crest of the slope of 10 m based on the slope configuration determined from PWGSC survey supplemented by tape and clinometer measurements at accessible parts of the upper and lower parts of the slope by WSP. Locally, this may be reduced to 8 m near Cedar 1028 due to the peninsula of land that extends eastward.

A zone outlining a geotechnically acceptable abutment location was identified in the July 2017 report and that area is shown on the attached Figure 2. Based on information available at that time, an abutment located to the north or southeast part of the area identified on the sketch was geotechnically preferred due to increased separation from the water feature to the west (i.e. deeper bedrock, wet soil conditions, and environmental sensitivity) or confirmed shallow bedrock near the southeast. Recent probing and hand auger work has confirmed this interpretation and it is recommended that the abutment proposed by CWMM be moved approximately 1.2 to 1.5 m towards the crest of the slope (i.e. to the approximate footprint shown in red on Figure 1).

Steep slopes to the northeast and southwest make locations in those areas less geotechnically preferred. We note that there is a significant cedar tree at the proposed abutment location and some further discussion regarding the future of this tree (and potentially others near the crest of the slope) will be required during detailed design. For example excavation within the drip line of the tree could damage it or anchors that pass below the tree or through the root zone could be compromised if the tree were to topple in the future.

If further consideration is to be given to a bridge alignment closer to the existing bridge (i.e. Alignment D proposed by CWMM (14 June 2017), an abutment located west of the water feature is recommended (i.e. between trees 1051 and 1059).

The final west abutment layout should be confirmed by WSP at the time of construction once the area is cleared and more accessible for testing. Subject to the actual location of the transition to thicker soils (i.e. deeper bedrock) on the west side of the abutment, a modest (i.e. in the order of 2 m or less) shift to the north, south and/or east may need to be considered.

## **EAST ABUTMENT**

In general, the abutment location shown by CWMM is consistent with discussions in the field. The area of the proposed abutment that was discussed and is considered geotechnically acceptable is shown on the attached marked up Dwg No. 3. As previously discussed, a minimum 8 m set-back from the crest is recommended for the east abutment.

## **4.3 ABUTMENT DESIGN**

The geotechnical preference is that abutments would be founded on competent, intact bedrock thoroughly cleaned of soil and weathered or broken rock. However, given the remote site location and potential difficulties in hand excavating hard till, consideration could be given to supporting the abutments on hard, till-like, natural silt and sand deposits or a combination of till and bedrock. The depth to bedrock is variable and based on hand test pits, probing and soil exposures in the slope is anticipated to be in the order of 1 to 2 m depth in the vicinity of the proposed abutments. Locally shallower bedrock is also present (i.e. 0.3 to 0.6 m depth).

Abutment footings bearing on geotechnically approved, prepared, competent bedrock and/or hard, till-like silt and sand may be designed based on a serviceability limit states bearing capacity of 150 kPa and factored ultimate limit states bearing capacity of 300 kPa. Bedrock or hard till subgrades steeper than 6:1 (horizontal to vertical) should be leveled by chipping. Sliding resistance may be based on a coefficient of friction between cast-in-place concrete and undisturbed, hard till or clean sandstone bedrock of 0.4. Higher design capacities could be considered but would require additional site preparation and further geotechnical review.

Geotechnically approved subgrade shall be protected from degradation prior to placement of concrete.

## 4.4 ROCK ANCHORS

Uplift and lateral resistance at the abutments may be provided by rock anchors drilled into the underlying sandstone bedrock. The anchors should be double corrosion protected and designed based on an allowable grout to rock bond stress of 300kPa and grout to weathered bedrock bond stress of 150kPa. These values may be refined following review of the actual rock/soil conditions encountered during drilling. For design purposes, the upper 1.5 m thickness of bedrock is assumed to be weathered. The grout should be a commercially available, non-shrink, bagged product to be reviewed and approved by WSP (i.e. Microsil, or approved equivalent).

Based on the ULS loads provided by CWMM for the back cables of 800 kN (i.e. 400 kN per anchor), we recommend DYWIDAG #14 double corrosion protected, high tensile steel anchor bars installed in a minimum 0.1 m diameter drill hole. To accommodate both individual and group effects, rock anchors should have a minimum bond length of 7.5 m, with the length within overburden and footing disregarded. We recommend that a free-stress length of 1 m be provided for each anchor. Centralizers should be installed at minimum 2 m spacing or closer. We recommend a minimum 0.3 m overdrill to accommodate drill cuttings that stick to the side of the hole during washout. Higher loads may require a larger bar and/or drill hole.

Due to the remote location of the site and potential challenges related to a reinstall for a failed anchor, we recommend that post pressure grouting tubes be included in the initial installation.

We understand that CWMM proposes to improve the lateral friction and uplift resistance with two vertical rock anchors within the new footing at an approximate spacing of 3.2 m. Based on a ULS design load of 170 kN per anchor provided by CWMM, we recommend DYWIDAG #9 double corrosion protected, high tensile steel anchor bars. For installation within a 0.1 m diameter hole, we recommend a minimum 4 m bond length with a minimum 0.5 m overdrill. Centralizers shall be provided as for the back cable anchors.

All rock anchors should be performance tested following installation in general accordance with recommendations provided by the Post Tensioning Institute. In summary, performance testing consists of loading and unloading the anchor in increments up to 1.5 times the design tension load with the load sustained at each increment to determine creep characteristics. Since the back cable anchors are to be loaded permanently, pull testing should include an extended creep load test.

To reduce permanent elastic strain on the anchors, consideration could be given to locking-off anchors at a load that represents typical load conditions. WSP should review the proposed lock-off load prior to tender.

## 4.5 SITE PREPARATION

Site preparation is anticipated to include removal of vegetation at the abutment footing locations and adjacent hazard trees (identified by others). Near surface organic soil, silt/clay, and/or loose sand should be removed to expose the underlying hard, till-like silt and sand and/or Sandstone bedrock. A range of conditions should be expected including numerous roots and rootlets in the upper 0.5 m, cobbles and coarse gravel and/or firm to stiff clay. Excavation is anticipated to be difficult at some locations. As noted in Section 4.3 above, the depth to soils suitable for abutment foundation support will be variable and could range from 0.5 to more than 1.2 m but is not likely more than 2 m. Structural design should be based on the most onerous of these conditions.

Underside of footing elevation may be re-established with mass concrete.

Seepage conditions are anticipated to be variable and in general, manageable with conventional sump and pump / ditching techniques. Adverse groundwater seepage conditions could be encountered in an excavation in the vicinity of the existing watercourse shown on Figure 2.

The near surface soils are not expected to be stable in a temporary cut condition and Worksafe BC regulations for excavations is to be followed. For preliminary planning purposes a net temporary slope angle of 1H:1V may be used and is subject to review at the time of construction.

Soils contain fine grained materials (i.e. silt/clay) and a siltation management plan should be in place prior to breaking ground to prevent silt laden water from entering the adjacent environment. This is particularly important given the proximity of Logan Creek and the watercourse near the west abutment.

For the permanent condition, disturbance of vegetation between the abutments and the crest of the slopes must be minimized to avoid exposing soils that could be subject to erosion. These areas will need to be reviewed by WSP at the time of construction to determine whether any erosion protection measures are required.

## 5 FUTURE GEOTECHNICAL

WSP should be retained to complete geotechnical services during the tendering and construction stages in order to verify that the intent of our recommendations is met and the ground conditions encountered are consistent with our design assumptions. Based on our understanding of the project, we anticipate that geotechnical services could include the following:

- Final geotechnical review of the tender drawings in the context of recommendations presented herein;
- Geotechnical support during the tendering stage (as needed);
- Field review of prepared bearing surfaces at each abutment location;
- Observation of drilling and installation and pull testing of each rock anchor.

# CLOSURE

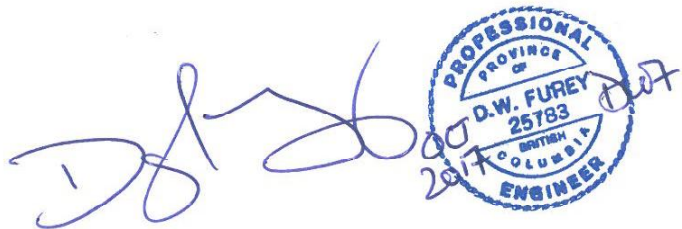
This geotechnical report has been prepared by WSP Canada Inc. exclusively for Public Works & Government Services Canada and their appointed agents. The report reflects our judgement in light of the information provided to us at the time that it was prepared. Any use of the report by third parties, or any reliance on or decisions made based on it, are the responsibility of such third parties. WSP Canada Inc. does not accept responsibility for damages suffered, if any, by a third party as a result of their use of this report. The attached Terms of Reference are an integral part of this geotechnical report.

Contractors should make their own interpretation of the soil logs and the site conditions for the purposes of bidding and performing work on the site.

We trust this meets your current need.

Yours truly,

Randy R. Hillaby, M.Eng., P.Eng.  
Senior Engineer, Geotechnical



Darryl Furey, M.Eng., P.Eng.  
Senior Engineer, Geotechnical


Encl.    Figure 1 Site Location Plan  
          Figure 2 Abutment Set-Back Plan – West  
          Figure 3 Abutment Set-Back Plan – East  
          Terms of Reference for Geotechnical Reports

# FIGURES 1-3

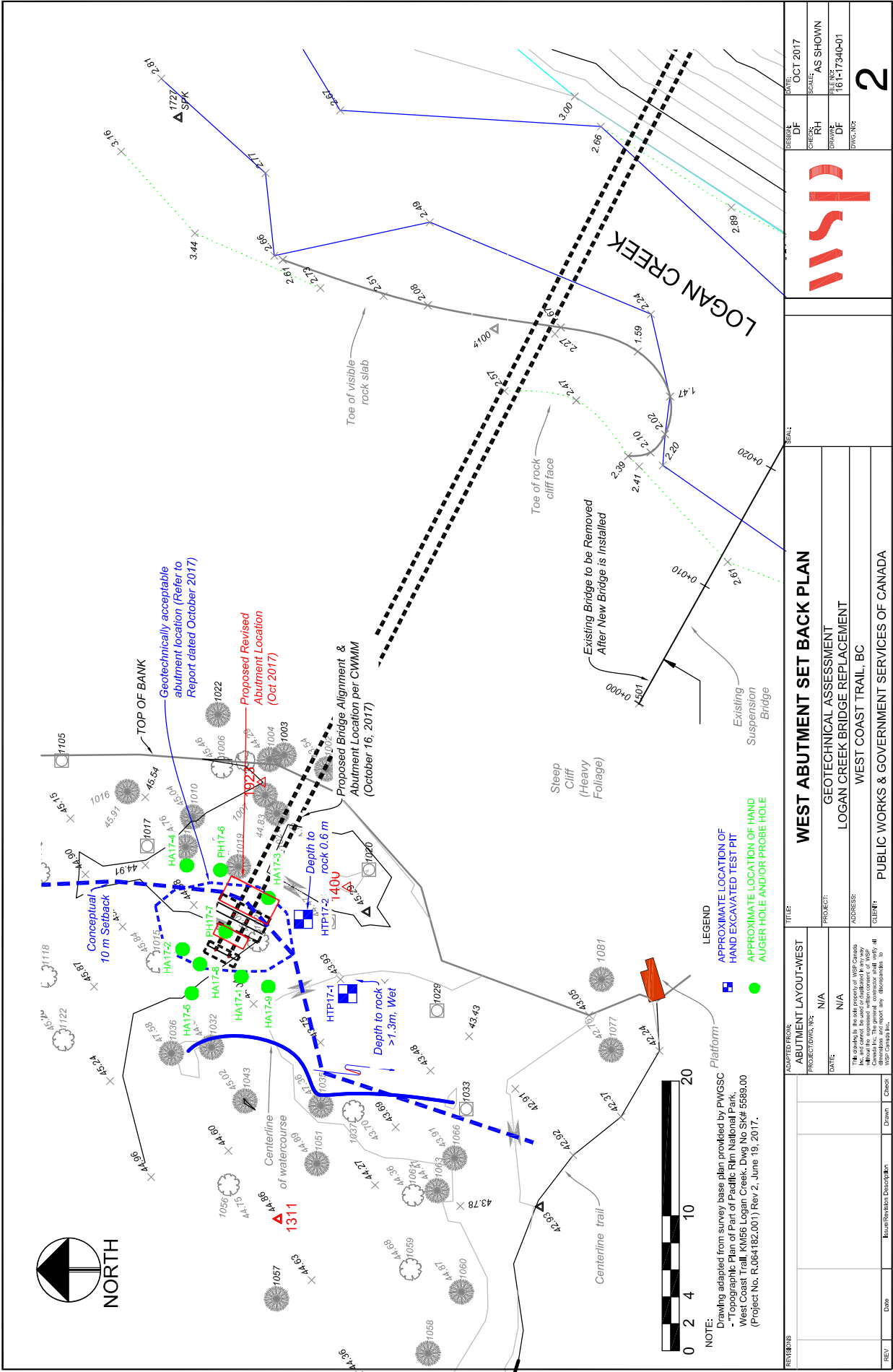




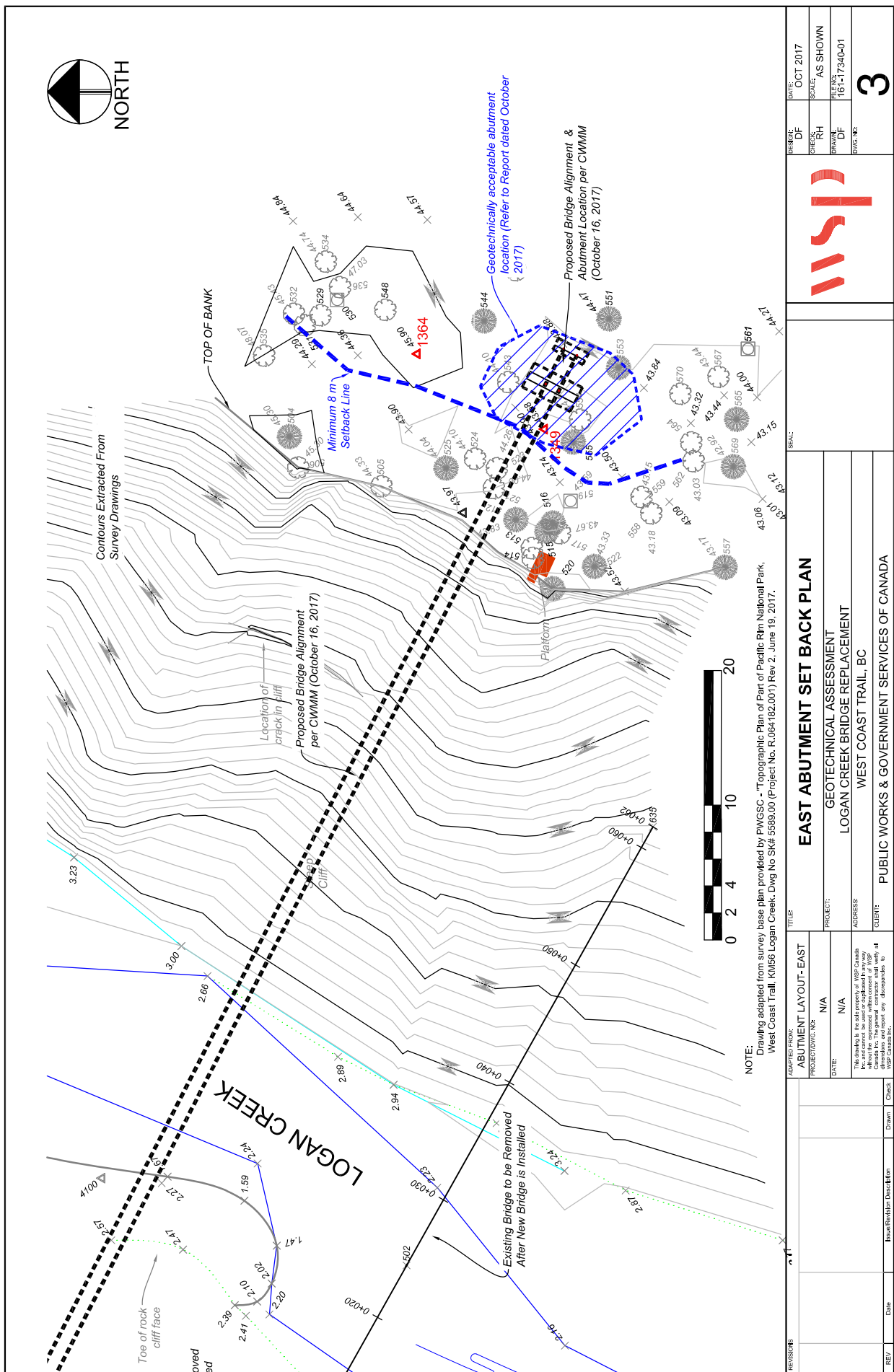


	PROJECT:	GEOTECHNICAL ASSESSMENT WEST COAST TRAIL - LOGAN CREEK BRIDGE REPLACEMENT	
	TITLE:	SITE LOCATION – APPROXIMATELY KM 56	
	CLIENT:	PUBLIC WORKS & GOVERNMENT SERVICES OF CANADA	
	DATE:	OCTOBER 2017	FILE NO.: 161-17340-01
FIGURE NO.: 1			





REVISIONS					ADAPTED FROM: ABUTMENT LAYOUT-WEST		TITLE: WEST ABUTMENT SET BACK PLAN		DESIGN: DF		DATE: OCT 2017	
REV	Date	Revision Description	Drawn	Checked	PROJECT/NOV, YES	N/A	PROJECT: GEOTECHNICAL ASSESSMENT LOGAN CREEK BRIDGE REPLACEMENT WEST COAST TRAIL, BC	CHECKED: RH	SCALE: AS SHOWN			
					DATE:	N/A	ADDRESS: WEST COAST TRAIL, BC	DRAWN: DF	FILE NO: 101-17340-01			
					NOTE: This drawing is the sole property of WSI Engineering Inc. and is not to be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written permission of WSI Engineering Inc. The general contractor shall verify all dimensions and locations of existing structures and utilities prior to construction. All dimensions are in meters unless otherwise noted. All dimensions are to the centerline of the road unless otherwise noted. All dimensions are to the centerline of the road unless otherwise noted. All dimensions are to the centerline of the road unless otherwise noted. All dimensions are to the centerline of the road unless otherwise noted. All dimensions are to the centerline of the road unless otherwise noted. All dimensions are to the centerline of the road unless otherwise noted. 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# TERMS

## TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS



## **TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY WSP CANADA INC.**

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may fail to locate some conditions. All investigations or assessments utilizing the standards of Paragraph 1 involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to changes over time and the parties making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or when the Client has special considerations or requirements, the Client must disclose them to WSP so that additional or special investigations may be undertaken, which would not otherwise be within the scope of investigations made by WSP or the purposes of the Report.

- b. **Reliance on information:** The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site investigation and field review and on the basis of information provided to WSP. WSP has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, WSP cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.
- c. **Additional Involvement by WSP:** To avoid misunderstandings, WSP should be retained to assist other professionals to explain relevant engineering findings and to review the geotechnical aspects of the plans, drawings and specifications of other professionals relative to the engineering issues pertaining to the geotechnical consulting services provided by WSP. To ensure compliance and consistency with the applicable building codes, legislation, regulations, guidelines and generally-accepted practices, WSP should also be retained to provide field review services during the performance of any related work. Where applicable, it is understood that such field review services must meet or exceed the minimum necessary requirements to ascertain that the work being carried out is in general conformity with the recommendations made by WSP. Any reduction from the level of services recommended by WSP will result in WSP providing qualified opinions regarding adequacy of the work.

## **6 ALTERNATE REPORT FORMAT**

When WSP submits both electronic and hard copy versions of the Instruments of Professional Services, the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding upon WSP. The hard copy versions submitted by WSP shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions; furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed and sealed versions of the Instruments of Professional Services maintained or retained, or both, by WSP shall be deemed to be the overall originals for the Project.

The Client agrees that the electronic file and hard copy versions of Instruments of Professional Services shall not, under any circumstances, no matter who owns or uses them, be altered by any party except WSP. The Client warrants that the Instruments of Professional Services will be used only and exactly as submitted by WSP.

The Client recognizes and agrees that WSP prepared and submitted electronic files using specific software or hardware systems, or both. WSP makes no representation about the compatibility of these files with the current or future software and hardware systems of the Client, the Approved Users or any other party. The Client further agrees that WSP is under no obligation, unless otherwise expressly specified, to provide the Client, the Approved Users and any other party, or any or all of them, with specific software and hardware systems that are compatible with any electronic submitted by WSP. The Client further agrees that should the Client, an Approved User or a third party require WSP to provide specific software or hardware systems, or both, compatible with the electronic files prepared and submitted by WSP, for any reason whatsoever included but not restricted to an order from a court, then the Client will pay WSP for all reasonable costs related to the provision of the specific software or hardware systems, or both. The Client further agrees to indemnify and hold harmless WSP, its officers, directors, employees, agents, representative or sub-consultant, or any or all of them, against any claim or any nature whatsoever brought against WSP, whether in contract or in tort, arising or related to the provision or use of any specific software or hardware provided by WSP.

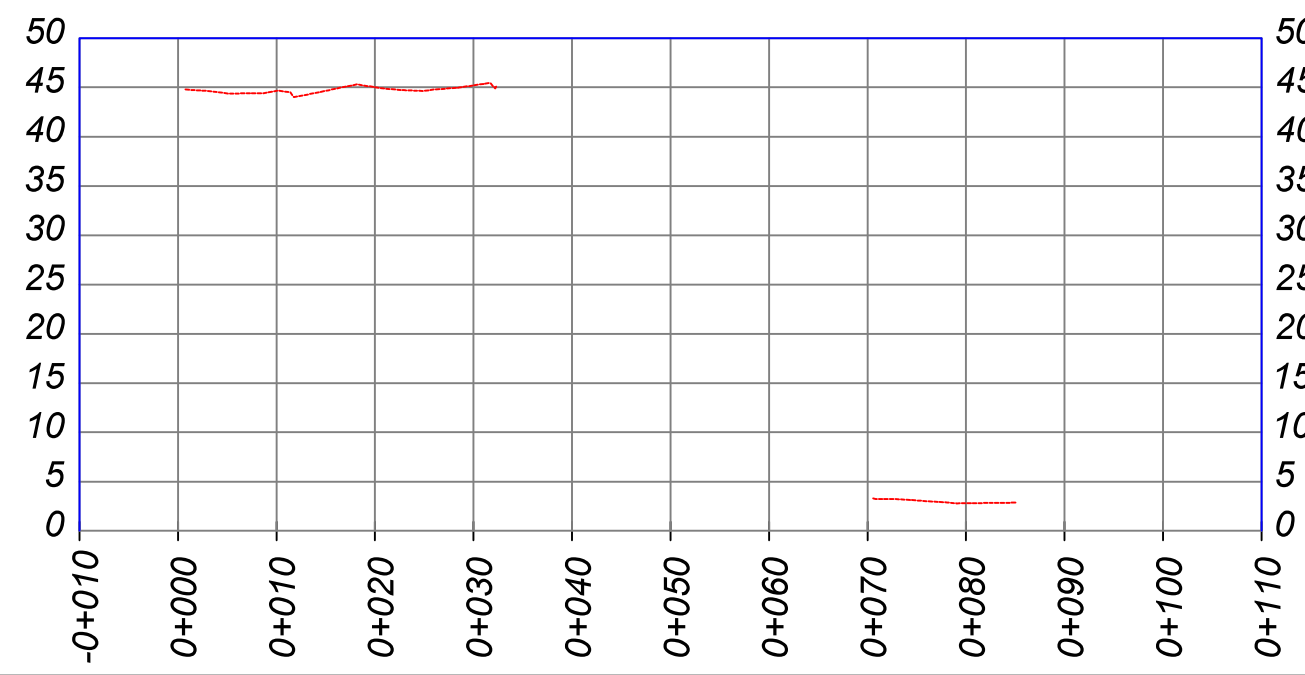


## APPENDIX D



Scale 1:750 Hz. Vert Exag: 1x  
10 0 10 20 30

Profile "B"

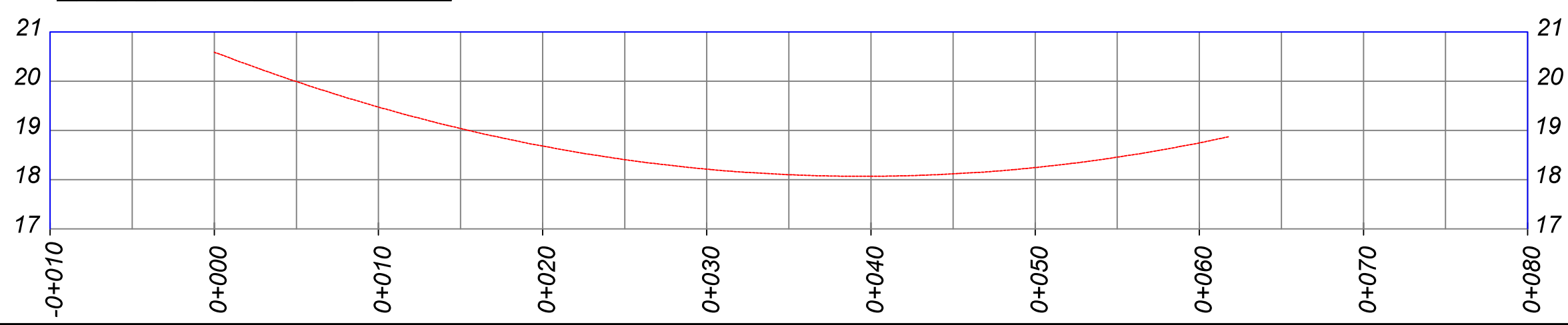


West Side Trees

Tree #	Dis. (m)	Tree Type	Tree #	Dis. (m)	Tree Type	Tree #	Dis. (m)	Tree Type
1002	0.34	HEMLOCK	1029	0.45	SNAG	1067	3.00	CEDAR
1003	0.20	HEMLOCK	1032	0.60	HEMLOCK	1077	0.70	HEMLOCK
1004	0.25	HEMLOCK	1033	0.58	SNAG	1081	0.70	HEMLOCK
1005	0.29	FIR	1035	0.60	HEMLOCK	1101	1.00	SNAG + HEM
1006	2.00	CEDAR	1036	0.80	HEMLOCK	1104	0.40	HEMLOCK
1007	0.23	HEMLOCK	1037	0.50	CEDAR	1105	0.45	SNAG
1010	0.35	HEMLOCK	1043	0.50	HEMLOCK	1106	1.15	CEDAR
1012	0.56	HEMLOCK	1051	0.60	HEMLOCK	1107	0.60	HEMLOCK
1015	1.20	SNAG	1056	3.00	CEDAR CLUSTER	1109	0.60	HEMLOCK
AND	0.50	CEDAR	1057	0.80	HEMLOCK	1111	0.42	HEMLOCK
1016	0.36	HEMLOCK	1058	0.60	HEMLOCK	1112	0.25	HEMLOCK
1017	0.60	SNAG	1059	1.40	CEDAR	1113	2.50	CEDAR
1019	0.30	HEMLOCK	1060	0.80	HEMLOCK	1117	1.50	CEDAR/HEM
1020	1.50	SNAG	1061	0.80	CEDAR	1118	0.30	CEDAR
1021	0.20	HEMLOCK	1063	0.40	HEMLOCK	1122	1.00	CEDAR
1022	0.60	HEMLOCK	1064	0.20	HEMLOCK			
1024	0.76	SNAG	1065	0.45	CEDAR			
1028	1.20	CEDAR	1066	0.30	HEMLOCK			

Scale 1:250 Horizontal. Vertical Exaggeration: 3x  
5 0 5 10 15

Existing Bridge Profile  
(Elevation on top cable)



Public Works and Government Services Canada  
Travaux Publics et Services gouvernementaux Canada  
219-800 Burrard St  
Vancouver, B.C. V6Z 0B9  
604-775-7079



Location Map BCGS 92C.057

Topographic Plan of  
Part of Pacific Rim National Park  
West Coast Trail KM 56  
Logan Creek

Elevations are derived from NRCan Point number (240)  
Elevation = 43.97m  
All Distances Shown are Ground

Note: Contours are at 1.0m and 5.0m intervals  
Date of Survey: May 24-26, 2017.  
FB #052 Pg 40-63

drawn date C. M. BRYNTON 2017-06-07  
approved date I. R. ROBERTSON 2017-06-07  
project no. R.064182.001  
project no. SF #3488.01  
drawing no. SK #5589.00  
EDRM no. 611757

Revisions:  
Rev1.: Add proposed profile: June 13/17  
Rev2.: Add additional profiles: June 19/17  
Rev3.: Show control points: August 28/17

Legend:

- DENOTES TOP OF BANK
- DENOTES MAJOR CONTOUR
- DENOTES MINOR CONTOUR
- DENOTES TREELINE
- DENOTES TREE HEMLOCK
- DENOTES TREE CEDAR
- DENOTES TREE SNAG

Scale 1:250  
5 0 5 10 15  
The intended plot size of this plan is 864mm in width and 560mm in height (D size) when plotted at a scale of 1:250.

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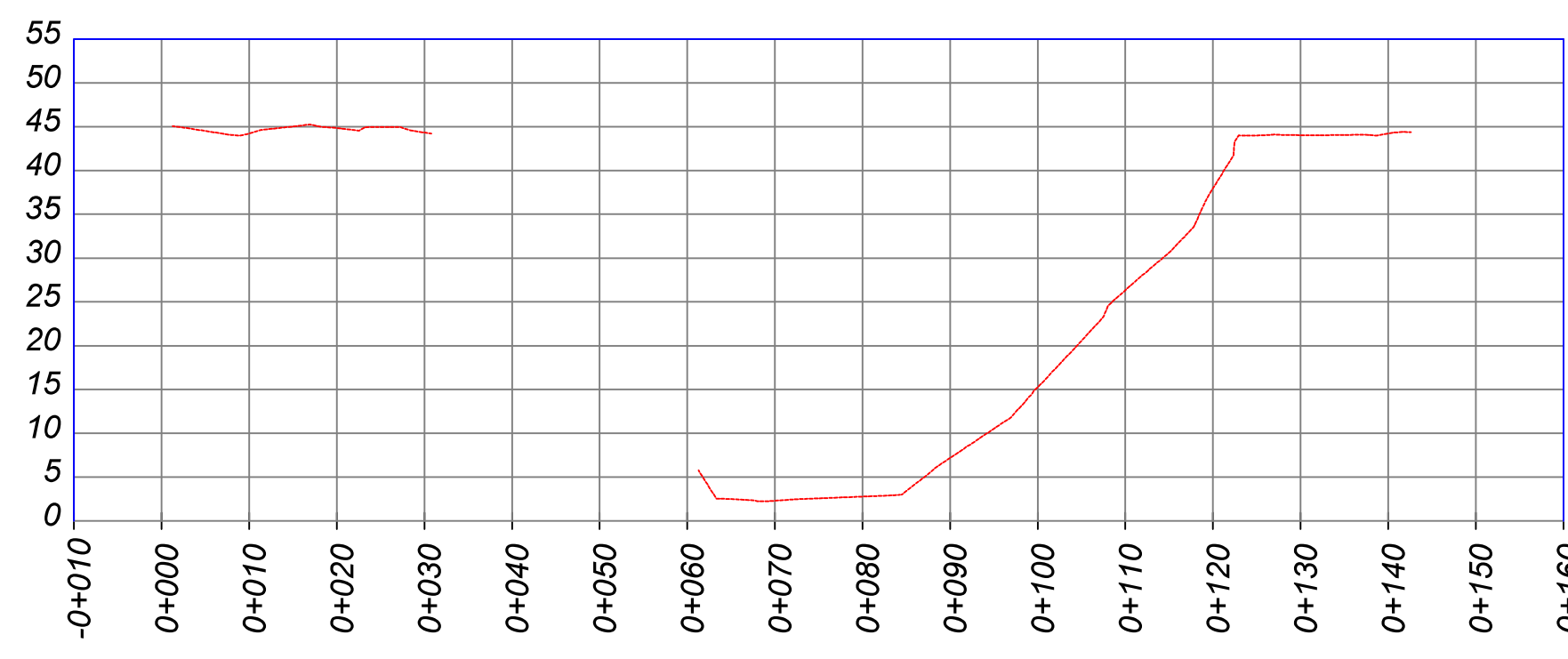
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Certified Correct this 7th day of June, 2017

Ian R Robertson, BCLS

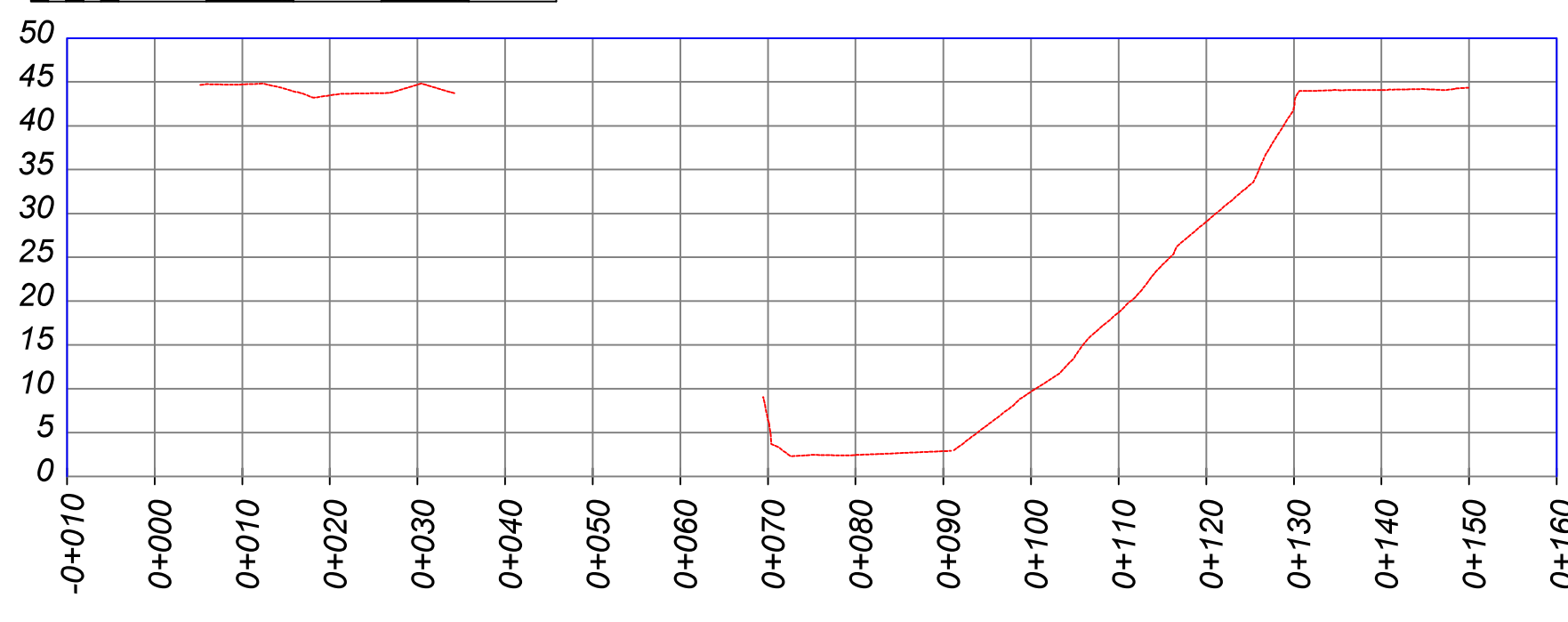
Scale 1:750 Horizontal. Vertical Exaggeration: 1x  
10 0 10 20 30 40 50

Profile "A"



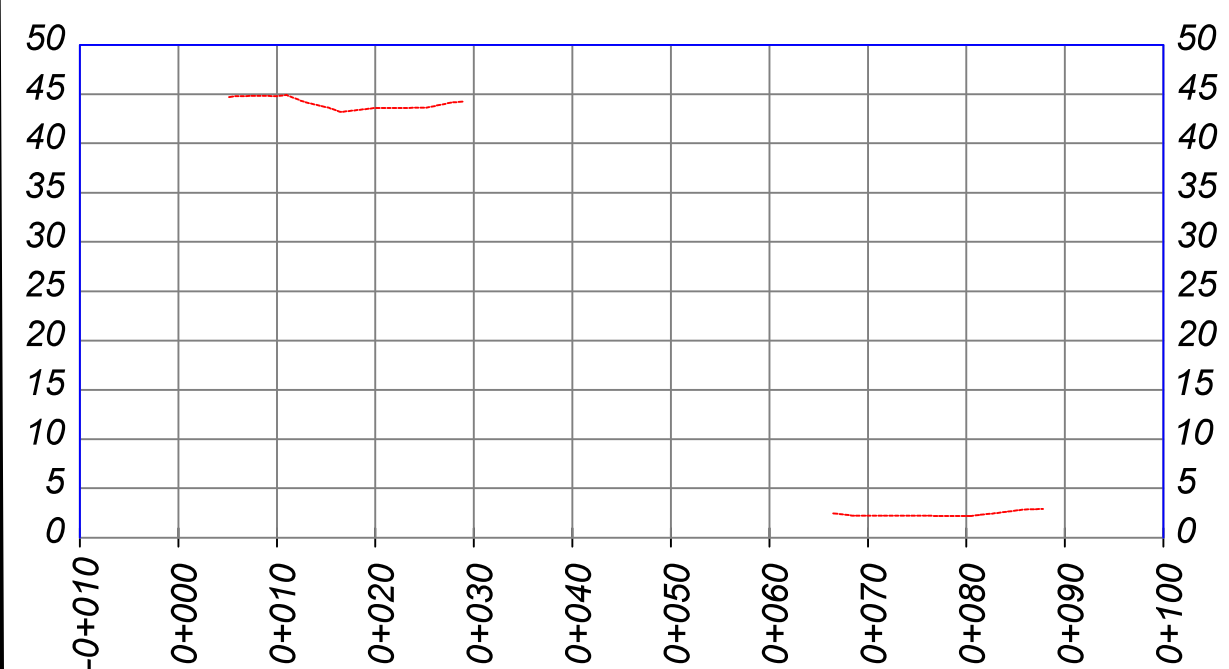
Scale 1:750 Horizontal. Vertical Exaggeration: 1x  
10 0 10 20 30 40 50

Profile "D"



Scale 1:750 Hz. Vert Exag: 1x  
10 0 10 20 30

Profile "C"



East Side Trees

Tree #	Dis. (m)	Tree Type	Tree #	Dis. (m)	Tree Type	Tree #	Dis. (m)	Tree Type
504	0.35	HEMLOCK	531	0.70	CEDAR	564	0.7	CEDAR
505	0.60	CEDAR	532	0.80	CEDAR	565	0.6	HEMLOCK
506	0.75	CEDAR	534	0.50	CEDAR	567	0.7	CEDAR
512	0.46	HEMLOCK	535	CLUSTER	CEDAR	569	0.4	HEMLOCK
513	0.19	CEDAR	536	0.20	SNAG	570	0.2	CEDAR
514	0.14	CEDAR	543	0.70	CEDAR			
515	0.35	HEMLOCK	544	0.27	HEMLOCK			
516	0.30	HEMLOCK	546	0.50	CEDAR			
517	0.20	CEDAR	548	0.70	CEDAR			
519	0.26	SNAG	551	0.30	HEMLOCK			
520	0.26	HEMLOCK	553	0.50	HEMLOCK			
521	0.45	CEDAR	554	0.50	HEMLOCK			
522	0.40	HEMLOCK	555	0.80	CEDAR			
523	0.50	CEDAR	557	0.55	HEMLOCK			
524	0.80	CEDAR	558	0.56	CEDAR			
525	0.45	HEMLOCK	559	0.68	CEDAR			
529	1.10	CEDAR	561	0.40	SNAG			
530	1.00	SNAG	562	0.26	CEDAR			