Part 1 General

1.1 Order of Precedence

.1 In the event of any discrepancy or conflict, order of precedence shall be as follows:

.1 The Division 1 Sections of these Specifications take precedence over the other sections of the Specifications.

.2 If conflict arises between an item in the main body of these Specifications (Division 1 – Division 33) and an item found in one of the Appendices (Reference Documents), the main body of the Specifications (Division 1 – Division 33) shall govern.

.3 Any technical and manufacturer's standard, Government Act, Regulation or Code of practice referred to in the Contract documents shall be the version currently (including applicable Amendments) available at the time of tender closing.

1.2 Work Covered by Contract Documents

.1 Work of this Contract includes construction of an Embankment Buttress using granular, geogrid reinforced fill against the existing northbound lane embankment to mitigate slope movements, improve drainage, and to flatten the overall embankment slope from the original 2H:1V to 3H:1V. The Embankment Buttress includes a shear key and subdrain. The work also includes construction of a rip-rap lined Ditch within the southbound lane Right-of-Way which drains towards the existing km 155.1 highway cross-culvert. A future trenchless installation of a highway cross-culvert near km 155.1 is not included as part of this Contract. The slope stabilization and drainage improvement is located between km 155 and 156 of the Alaska Highway, British Columbia; and further identified as the Site.

For reference, Dawson Creek is at approximately km 0, Fort St John is at approximately km 75 and Fort Nelson is at approximately km 455.

.2 The work under this contract generally comprises the following but is not limited to:

.1 Project Management including all requirements of Section 01 31 19 – Project Meetings, Management and Coordination.

.2 Contract submittals (using "CentralCollab") prior to and during the work (see 3.8 – Contract Submittals, Section 01 25 20 – Mobilization and Demobilization and Section 01 33 00 – Submittal Procedures).

.3 Supply and maintain all traffic management for the duration of the works.

.4 Quality Management.

.5 Development of construction access to facilitate construction in the dry. Restoration of the disturbed areas following construction.

.6 Supply of 25 mm IGB, 75 mm Pit Run, 25 mm drain rock, geogrid, non-woven geotextile, 200 mm diameter CSP subdrain, and 50 kg and 250 kg rip-rap.

.7 Re-grading, excavation and offsite disposal associated with embankment buttress and ditch construction.

.8 Construction of embankment buttress including backfilling and compaction of granular materials and installation of non-woven geotextile and geogrid.

.9 Construction of new ditch and installation of non-woven geotextile and rip-rap erosion protection.

.10 Supply of temporary pumps, construction of berms and implementation of other measures as necessary to ensure all work is completed in the dry, to environmental best practices and the accepted environmental protection plan.

.11 Restoration to pre-construction conditions and Hydraulic Seeding of all disturbed areas. Hydraulic Seeding not required for new ditch or embankment buttress.

.12 Re-instatement of asphalt shoulder and pavement affected by the work, as required.

.13 Surveys (construction layout, payment quantities, as-built survey, and others as required).

.14 Environmental protection and monitoring.

1.3 Codes

.1 Meet or exceed the requirements of:

.1 Contract documents.

.2 Specified standards, applicable legislation, codes, and referenced documents.

1.4 Contractor's Use of Site

.1 Restrict work to within the construction footprint shown on the Contract Drawings and as agreed to by the Departmental Representative.

.2 Contractor shall consult with the Departmental Representative should the Contractor require additional area outside the construction footprint shown on the Contract Drawings, the Alaska Highway Right-of-Way, or lands owned by PSPC. Any costs associated with the use, preparation and rehabilitation of additional lands, as approved by the Departmental Representative, shall be the Contractor's responsibility.

.3 Assume full responsibility for protection and safekeeping of products under this Contract.

1.5 Owner Supplied Materials

.1 Contractor shall supply all materials and products required to complete the project.

1.6 Submittals

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

.2 Submit Project construction progress schedule in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.

.3 Submit site-specific and Work Plan Health and Safety Plan in accordance with Section 01 35 33 - Health and Safety.

1.7 Future Work

.1 A trenchless culvert installation to twin the existing culvert at km 155.1 is proposed at a future date as part of a separate Tender.

.1 PSPC's maintenance crews will monitor water levels in the Ditch and the existing culvert inlet and outlet to manage risks associated with potential peak flows prior to installation of the future culvert.

Part 2 Products

2.1 Not Used

.1 Not used.

Part 3 Execution

3.1 Site Inspection

.1 Submission of tender is deemed to be confirmation that the Contractor has inspected the site and is conversant with all conditions affecting execution and completion of the work.

3.2 Work Completion

.1 Preparation of required submittals to commence immediately upon receipt of notice to proceed and to be completed prior to commencement of work (unless specified otherwise).

.2 Achieve Substantial Performance by 27 January 2021.

.3 Achieve Substantial Completion by 29 January 2021.

.4 Works may need to be temporally shut down during high flow, heavy rain events, or other adverse weather conditions. The works may be stopped by the following processes:

.1 The Contractor with approval from the Departmental Representative shall suspend works should the watercourse level or poor weather conditions adversely affect the Contractor's ability to achieve the Contract Specifications for quality of work.

.2 The Contractor's Environmental Monitor with approval from the Departmental Representative may suspend work should they feel it is not be possible to achieve the environmental requirements due to high water flows or adverse weather conditions.

.3 The Departmental Representative in conjunction with representatives from the British Columbia Ministry of Environment and Climate Change Strategy (MoE) may suspend instream works should they feel that it is not possible to achieve the environmental requirements or the Contract Specifications for quality of work due to high water flows or adverse weather conditions.

.5 Regardless of who suspends the work, the Contractor will be responsible for maintaining the site and protecting the works throughout the suspension period to ensure the site is in an acceptable condition safe to the public.

.6 The Contractor shall account for the possibility of not being able to complete work due to high water flows or adverse weather conditions in the construction schedule and in the unit prices. No payment for temporary work stoppages due to high water flows or adverse weather conditions will be made.

3.3 Special Precautions

.1 The Contractor's attention is drawn to the possibility of impacting utilities, etc., within the limits of work. The Contractor shall confirm the locations of all such utilities. All costs for utility locates shall be incidental to the work. The Contractor shall notify the Departmental Representative should utilities be located in areas other than those shown on the drawings or if they conflict with the construction, and await instructions from the Departmental Representative before proceeding with work in the vicinity of such encountered services and utilities.

.1 Overhead power lines and associated power poles are located along the southbound Right-of-Way (RoW) and are located adjacent to the new ditch.

.2 A buried Northwest Tel line is located within the embankment buttress footprint and will require attention. The line could not be detected within the active slide area during the spring 2020 investigation.

.3 Relocation of the existing fibre optic utility and/or power poles will be undertaken by others prior to or during the project work if it is determined that the fibre optic line or power poles interferes with the permanent work or if it may be damaged by the works. The Contractor shall allow the utility company the opportunity to locate and assess the potential proposed work / fibre optic line and power pole conflicts within the limits of the work. Where the fibre optic line interferes with the work the utility company may abandon the existing fibre optic line and install a new fibre optic line beyond the limits of work. Where the existing power poles interfere with the new ditch, relocation of the power poles may be undertaken by the utility company. See Contract Specifications Section 01 14 00 – Work Restrictions, Access Development, Construction Staging, and Restoration for further details.

.2 Existing structures, utilities, asphalt, culverts, cut / fill slopes, ditches and all other structures, services, piping or equipment within the limits of work shall be properly protected from any injury or damage, direct or indirect. Any damage that is caused as a result of the operations of the Contractor shall be repaired and made good at the Contractor's expense to the satisfaction of the Departmental Representative.

3.4 Sequence of Work

.1 Unless preapproved by the Departmental Representative, the sequencing of the work shall be in accordance with Item 1.9 Construction Staging in Section 01 14 00 - Work Restrictions, Access Development, Construction Staging, and Restoration.

3.5 Survey

.1 The Contractor shall be responsible for all layout surveys to complete the work per the design lines and grades, survey of construction for measurement for payment (see Section 01 29 00 – Payment Procedures), Survey Monitoring (see Section 01 14 00 – Work Restrictions, Access Development, Construction Staging, and Restoration), and as-built surveys (see Section 01 78 00 – Closeout Submittals). All surveys shall achieve the following:

.1 Be completed / collected to an accuracy of +/-0.02 m horizontal and +/-0.02 m vertical or better and shall be referenced / tie into the PSPC's monument / coordinate system or as otherwise directed by the Departmental Representative.

.2 Use industry standards, methods, equipment, and the survey requirements of Section 01 29 00 – Payment Procedures, and other approaches (if necessary) as pre-approved by the Departmental Representative.

.3 All layout surveys, quantity surveys, and quantity calculations for the purposes of progress payments shall be completed by a Professional Engineer, an Applied Science Technologist or Certified Engineering Technician, or other qualified surveyor, with the knowledge, skills and abilities acceptable to the Departmental Representative. The surveyor or person(s) used for these tasks shall have a minimum of 5 years of experience working on projects of similar size, scope and cost. A resume detailing this experience shall be provided to the Departmental Representative for review and acceptance if requested.

.4 Prior to starting on-site construction work, complete a check of the survey control monument coordinates and elevations provided by the Departmental Representative via a static survey of each monument. Provide results to the Departmental Representative for review and acceptance. If deemed necessary by the Departmental Representative, design adjustments may be made by the Departmental Representative to suit the findings of the monument survey checks.

.5 Prior to starting affected work, complete a check of the survey control monument coordinates and elevations for any discrepancies relative to the design and existing conditions. Provide results to the Departmental Representative for review and acceptance as soon as they are discovered. Should a discrepancy be found, await written approval from the Departmental Representative prior to proceeding. If deemed necessary by the Departmental Representative, design adjustments may be made by the Departmental Representative to suit the findings of the survey checks undertaken.

.6 Establish working control points based on survey control monuments. Report to the Departmental Representative when a working control point is lost or destroyed because of necessary work. Replace working control points from the project survey control monuments.

.7 Establish / layout the proposed alignment(s) and grades using paint lines and survey stakes based on working control points and survey control monuments provided.

.8 The Departmental Representative may elect to verify surveys. Verification of the survey by the Departmental Representative does not abdicate the Contractor’s responsibility for the correctness and accuracy of the survey.

.9 Maintain a complete, accurate log of control and survey work as it progresses. On request of the Departmental Representative, submit documentation to verify the accuracy of the field engineering work.

.10 The Contractor shall regularly monitor the condition of the Work Site and of property on and adjoining the Work Site throughout the construction period and shall immediately notify the Owner if any deterioration in condition is detected. Such monitoring shall cover all pertinent features and property including, but not limited to, buildings, structures, roads, walls, fences, slopes, sewers, culverts and landscaped areas.

.11 The Departmental Representative may, but shall not be obligated to, survey and record the condition of the Work Site and of property on or adjoining the Work Site prior to the commencement of construction by the Contractor. If a survey is undertaken and if requested by the Contractor, the Departmental Representative will provide a copy of the survey records to the Contractor for reference.

.12 Whenever supplied with survey records, the Contractor shall satisfy itself as to the accuracy and completeness of the survey records provided by the Departmental Representative for any area before commencing construction in that area. Commencement of construction in any area shall be interpreted to signify that the Contractor has accepted such survey records as being a true record of the existing conditions prior to construction.

.13 The provision of the records of a survey of existing conditions by the Departmental Representative shall in no way limit or restrict the Contractor's responsibility to exercise proper care to prevent damage to all property within or adjacent to the Work Site, whether all such property is covered by the survey or not.

3.6 Contract Drawings

.1 Upon award of the project, PSPC will, at the request of the successful Contractor, provide the successful Contractor with up to 4 sets of 1000 mm x 707 mm and 6 sets of 279.4 mm x 431.8 mm (11" x 17") "Issued for Construction" or "Issued for Tender" hardcopy contract drawing sets. Preparation and plotting of the hardcopy drawing sets may take up to 14 days (excluding shipping).

.2 Upon award of the project, PSPC will provide the successful Contractor with a digital PDF version of the "Issued for Construction" or "Issued for Tender" Contract Drawings. Preparation of the PDF drawing file may take up to 14 days.

3.7 Electronic Contract Drawings

.1 If requested by the Contractor, the Departmental Representative will provide the Contractor with available Contract Drawings in electronic format for the Contractor to reference throughout the work.

.2 The format and software of the electronic Contract Drawings shall be at the Departmental Representative's discretion.

.3 The Departmental Representative accepts no responsibility for the accuracy or completeness of the electronic Contract Drawings. Should the Contractor choose to reference the electronic Contract Drawings, the Contractor shall satisfy itself as to the accuracy and completeness of the electronic contract drawings before commencing construction. Should a discrepancy between the electronic Contract Drawings and the hardcopy Contract Drawings be discovered at any time during the work, the hardcopy Contract Drawings shall govern. The Contractor will be responsible for all costs associated with any corrections to ensure the work is in conformance with the hardcopy Contract Drawings. The Departmental Representative shall not be responsible for updating or correcting any discrepancies between the electronic Contract Drawings and the hardcopy Contract Drawings identified by the Contractor.

3.8 Contract Submittals

.1 Complete and submit for Departmental Representative review, all required contract submittals as detailed in the relevant sections of the contract specifications. Work affected by the submittals shall not proceed until the submittal is accepted by the Departmental Representative. Allow for submittal review periods as required for each submittal and as detailed in Section 01 33 00 – Submittal Procedures. Required submittals include but are not limited to the following:

.1 Project Schedule (see Section 01 32 16.19).

.2 Traffic Management Plan (see Section 01 55 26).

.3 Project Specific Health and Safety Plan (see Section 01 35 33) including:

.1 Appendix 1 – Preliminary Hazard Assessment Form located in Appendix B – Project Specific Health and Safety Template.

.2 Appendix 2 – Confirmation of Prime Contractor's Main Responsibilities Under the WorkSafeBC Occupational Health and Safety Regulations and Worker's Compensation Act form located in Appendix B – Project Specific Health and Safety Template.

.3 Environmental Protection Plan (see Section 01 35 43).

.4 Quality Management Plan and related Quality Management documentation (see Section 01 45 00).

.5 As-built Survey, As-built Drawing mark-ups, and Shop Drawing mark-ups (see Section 01 78 00).

.6 Shop Drawings (if applicable, including professional seal for design work required).

.7 Progress Payment Request Form (see Appendix E).

3.9 Supervisory Personnel

.1 Within five days of contract award notification, the Contractor shall submit to the Departmental Representative confirmation of the names of the supervisory personnel and other key staff designated for assignment on the Contract. At a minimum the following personnel shall be included on the list:

.1 Project Superintendent.

.2 Deputy Project Superintendent.

.3 Health and Safety Coordinator.

.4 Quality Control Manager.

.5 Environmental Monitor(s).

.2 The above personnel shall perform the following duties:

.1 Project Superintendent: shall be employed full time and shall be present on the Work Site each and every work day that Work is being performed, from the commencement of Work to Substantial Performance and Completion of the Work.

.2 Deputy Project Superintendent: shall have the authority of the Project Superintendent during the latter's absence for short periods of time.

.3 Health and Safety Coordinator: shall possess safety experience in general construction. Duties shall encompass all matters of safety activities from commencement of work until Substantial Performance and Completion of the Work (see Section 01 35 33 – Health and Safety for further requirements).

.4 Quality Control Manager: shall be experienced in Quality Management, available to address quality matters from commencement of work until Substantial Performance and Completion of the Work, and remain onsite at all times the Contractor is performing work which must be tested or inspected in-process (see Section 01 45 00 – Quality Control for further requirements).

.5 Environmental Monitors: shall be a P.Biol, RPBio or Qualified Environmental Professional (QEP) (see Section 01 35 43 – Environmental Procedures for further requirements).

3.10 Work by Others

.1 The Contractor is advised that concurrent with this project there may be other Contractors working in nearby adjacent projects. Should other Contractors be working in nearby adjacent projects, the Contractors shall coordinate his operations with the other Contractors, including traffic management.

.2 The Contractor is advised that utility relocations within the limits of the work will be undertaken by others before work on this project commences. See Section 01 14 00 – Work Restrictions, Access Development, Construction Staging, and Restoration for further details.

3.11 Contractor's Personnel

.1 Upon request by the Departmental Representative, the Contractor shall remove any personnel from the project work site who, in the opinion of the Departmental Representative, is incompetent or has been guilty of improper conduct.

END OF SECTION

Part 1 General

1.1 Use of Work Site

.1 The Work Site will be specified by the Departmental Representative and shall only be used for the purposes of the Work. The Work Site will be made available to the Contractor for its exclusive use for the duration of the Work, unless otherwise provided in the Contract Documents.

.2 While the Work Site is under the Contractor's control, the Contractor shall be entirely responsible for the security of the Work Site and of the Work.

.3 The Contractor shall keep the Work Site clean and free from accumulation of waste materials and rubbish regardless of the source. Snow / ice shall be removed by the Contractor as necessary for the performance and inspection of the Work.

.4 The Contractor shall provide sanitary facilities for the workforce in accordance with governing regulations and the Environmental Procedures for this project. The Contractor shall post notices and take such precautions as required by local health authorities and keep area and premises in sanitary condition.

.5 Any damage to the Work Site caused by the Contractor shall be repaired by the Contractor at the Contractor's expense.

.6 The Contractor may complete onsite highway work during daylight hours only, seven days per week with the following restrictions.

.1 Work in excess of 12 hrs per day shall require pre-approval from the Departmental Representative. At a minimum, pre-approval shall require a plan from the Contractor to ensure all necessary QC work per the Contract requirements is completed during all times of work. The Departmental Representative may withdraw approval for the extended work hours at any time should the Contractor fail to achieve all necessary QC requirements or any other contractual requirement as a result of the extended work hours.

.2 Request for approval to work in excess of 12 hrs per day must be submitted in writing to the Departmental Representative a minimum of five (5) days in advance of the planned change in working hours.

.3 Work during non-daylight hours shall be lit with Contractor-supplied lighting such that none of the work is being completed in darkness.

.4 No hauling of material during inclement weather.

1.2 Work Conducted In and Adjacent to Waterways

.1 All components of the work shall be conducted in accordance with Section 01 35 43 – Environmental Procedures.

1.3 Existing Services

.1 There are active utilities within the Highway Right of Way. The Contractor shall be responsible to have utility locates completed in advance of the work. Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 The locations of Utilities shown are not necessarily exact nor is there any guarantee that all Utilities in existence within the limits of the Work Site have been shown on the Contract Drawings.

.3 The Contractor shall allow the utility company the opportunity to locate and assess the potential proposed work / utilities conflicts within the limits of the work. If it is determined by the Departmental Representative and utility owner that the utilities are affected by the permanent Work, the utilities will be abandoned in place rerouted temporarily on the native ground surface outside the limits of the work or the utility will be raised/relocated at the time of construction by Other Contractors. The Contractor shall cooperate and coordinate as required with Other Contractors engaged in Utility relocation operations on the Work Site.

.4 The Contractor shall notify the Departmental Representative and the Utility companies at least seven (7) Days in advance of any activities which may interfere with the operation of such Utilities.

.5 Whenever working in the vicinity of Utilities, the Contractor shall locate such Utilities and expose those that may be affected by the Work, using hand labour as required.

.6 The Contractor shall assess the possible impact of its operation on all utilities and shall protect, divert, temporarily support or relocate, or otherwise appropriately treat such Utilities to ensure that they are preserved.

.7 The Contractor shall immediately report any damage to Utilities to the Departmental Representative and to the Utility company or authority affected and shall promptly undertake such remedial measures as are necessary at no additional cost to PSPC.

1.4 Protection of Persons and Property

.1 The Contractor shall comply with all applicable safety regulations of WorkSafeBC including, but not limited to the, Workers Compensation Act, Occupational Health and Safety Regulations, Industrial First Aid Regulations, and Workplace Hazardous Materials Information System Regulations (see Section 01 35 33 – Health and Safety for additional requirements).

.2 The Contractor shall take all necessary precautions and measures to prevent injury or damage to persons and property on or near the Work Site.

.3 The Contractor shall promptly take such measures as are required to repair, replace or compensate for any loss or damage caused by the Contractor to any property.

1.5 Use of Public Areas

.1 Off-road construction equipment (including equipment which exceeds legal highway load limits or dimensions) will not be allowed on the Alaska Highway. Steel tracked equipment with cleats will not be allowed on asphalt unless measures are taken to protect the existing asphalt road surface against any damage.

.2 The Contractor shall ensure that its vehicles and equipment do not cause nuisance in public areas. All vehicles and equipment leaving the Work Site and entering public roadways shall be cleaned of mud, dirt, snow, and ice clinging to the body and wheels of the vehicle. All vehicles arriving at or leaving the Work Site and transporting materials shall be loaded in a manner which will prevent dropping of materials or debris on the roadways, and, where contents may otherwise be blown off during transit, such loads shall be covered by tarpaulins or other suitable covers. Spills of material, including rocks and debris from loaded trucks, shall be removed or cleaned immediately by the Contractor at no cost to PSPC. All activities shall be in accordance with Section 01 35 43 – Environmental Protection and the Environmental Protection Plan prepared by the Contractor for the project. The traveled lanes of the Alaska Highway shall remain a Public Highway subject to the rules and laws of Public Highways in the Province of British Columbia. The Contractor is responsible for ensuring all equipment accessing the Alaska Highway meets all requirements for vehicles traveling on Public Highways in the Province.

1.6 Construction Signage

.1 No Signs or advertisements, other than regulatory or warning signs, PSPC supplied signage, and portable electrically illuminated message signs are permitted on site.

.2 Signs and notices for Safety and instruction shall be provided by the Contractor (see Section 01 55 26 – Traffic Control for additional details.

.3 Maintain approved signs and notices in good condition for duration of Project and dispose of off-site on completion of Project or earlier as directed by the Departmental Representative.

.4 Signage shall be coordinated with other Contractors working in the area as needed.

1.7 Access Development

1.8 The Contractor is required to develop access to the required work areas. The Contractor is fully responsible for the selection and implementation of all methods to accomplish this requirement. Any access roads or trails extending outside the limits of the work shown on the Contract Drawings shall be submitted to the Departmental Representative for approval. All construction access shall be completed in conformance with the requirements of Section 01 35 43 – Environmental Procedures and the Contractor's Environmental Protection Plan.

1.9 Construction Start-Up

.1 The Contractor or their Sub-Contractors shall not perform any onsite work until all necessary submittals have been provided, reviewed, and accepted by the Departmental Representative and the Contractor has received from the Departmental Representative a completed version of the "On-site Construction Start-up Form" (see Appendix D) which has been completed and signed by the Departmental Representative. PSPC reserves the right to refuse payment for any on-site work performed prior to issuing the completed and signed "On-site Construction Start-up Form".

1.10 Construction Staging

.1 The project shall be completed per the dates provided in Item 3.2 – Work Completion of Section 01 11 00 – Summary of Work and the following construction sequence:

.1 The Contractor's accepted Environmental Protection Plan (EPP) shall be provided to the Departmental Representative a minimum of 15 days prior to the start of Construction. The Contractor shall allow time in their schedule for the review of the EPP by the Departmental Representative and revisions to the EPP following receipt of any comments.

.2 The Contractor shall stage the work ensuring that:

.1 All design requirements as specified in the Contract Drawings, contractor prepared Shop Drawings, and contract specifications are achieved.

.2 All requirements of Section 01 55 26 – Traffic Control are achieved.

.3 All requirements of the Section 01 35 43 – Environmental Procedures and the Contractor's Environmental Protection Plan are achieved.

.4 The work is completed in accordance with the date for Substantial Performance and Completion provided in Section 01 11 10 – Summary of Work.

The Contractor is fully responsible for the selection and implementation of all methods to accomplish these requirements.

1.11 Restoration

.1 Remove access points, roads, detours, laydown areas, pads, and all other works installed during access development and construction staging. Re-instate the worksite to a condition equal to or better than the site condition prior to construction, and acceptable to the Departmental Representative, by:

.1 Restoring organic soils (if removed or damaged during access development or other works).

.2 Eliminating uneven areas and low spots.

.3 Removal of all gravels, other materials, and structures placed to create access points, temporary detour roads, or pads. Dispose of gravels, other materials, or structures at an off-site disposal facility acceptable to the Departmental Representative.

.4 Restoring asphalt shoulder and pavement.

.5 Hydraulically Seed all disturbed areas and areas designated for Hydraulic Seeding (see Section 32 92 19.16 – Hydraulic Seeding).

.1 Hydraulic seeding not required for Embankment Buttress and rip-rap segment of Ditch. Hydraulic Seeding will be required where soils are exposed above rip-rap within Ditch.

END OF SECTION

Part 1 General

1.1 Definitions

.1 Mobilization and Demobilization: Consists of preparatory work and operations, including but not limited to:

- .1 Preparation and acceptance of submittals (Construction Schedule, Traffic Management Plan, Quality Management Plan, Environmental Protection Plan, Project Specific Safety Plan, and any other submittals required prior to starting work).
- .2 Work and costs incurred necessary for the movement of personnel, equipment, supplies and incidentals to/from the work site.
- .3 Work and costs incurred in the establishment and operations of offices and other facilities necessary to undertake the work.
- .4 Work and costs incurred in the completion of clean-up and project completion.
- .5 All other work and costs incurred in the successful completion of Mobilization and Demobilization.

1.2 Measurement and Payment Procedures

.1 Payment for Mobilization and Demobilization will be made on the basis of Price per Unit Bid for Mobilization and Demobilization. The Price per Unit Bid shall include all costs associated with the items of work listed in 1.1 Definitions above.

.2 Measurement and Payment for completion of Mobilization and Demobilization will be made at the Lump Sum price and sill be scheduled as follows:

- .1 50% of the Lump Sum bid price to a maximum of 5% of the Total Tender price at the beginning of construction after the Contractor's required submittals (including Construction Schedule, Traffic Management Plan, Quality Management Plan, Environmental Protection Plan, Project Specific Health and Safety Plan, and any other submittals noted in the specifications as being required prior to starting work) have been submitted for review, accepted for the work in its entirety, and work onsite has commenced to the satisfaction of the Departmental Representative. Should the Departmental Representative allow work to start prior to the submission or acceptance by the Departmental Representative of any of the submittals listed above, the Departmental Representative may choose to holdback a minimum of 5% of the 50% Mobilization and Demobilization payment for each outstanding submittal until an acceptable submission is provided.
- .2 50% once the project has achieved "Completion" and all equipment has been demobilized from the site, the site has been cleaned to the satisfaction of the Departmental Representative, remaining deficiencies identified during final inspection (Section 01 77 00 – Closeout Procedures) are corrected, and all the closeout submittals are provided and accepted by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 Terms of Payment

.1 The Project's terms of payment shall be per General Conditions (GC) 5 – Terms of Payment. Progress Payments shall be submitted by the Contractor on a monthly basis unless accepted otherwise by the Departmental Representative. The Progress Payment shall use PSPC's Request for Progress Payment – Construction Contracts form: PWGSC-TPSGC 1792, found online (see link to Public Services and Procurement Canada – Acquisition Forms within the Reference Documentation section of the Table of Contents).

With each progress payment, provide to the Departmental Representative the required documentation as listed below. Upon receipt of this required documentation, PSPC will commence a review of the progress payment request in accordance with General Conditions (GC) 5 – Terms of Payment.

.1 Documentation required by General Conditions (GC) 5 – Terms of Payment, including signed statutory declaration.

.2 Progress Payment Request Form (see Appendix E) completed and signed by the Contractor's representative. Upon receipt of this form and all other required documentation, PSPC will commence review of the progress payment request in accordance with General Conditions (GC) 5 – Terms of Payment.

.3 WorkSafeBC Clearance Letter, indicating the Contractor is in active and good standing per the end date of the progress payment in accordance with Section 51 of the Workers Compensation Act (Departmental Representative may waive this requirement).

.4 Updated construction progress schedule (accepted project schedule shown as the baseline and actual start dates / completion dates / percent complete shown for each task, see Section 01 32 16.19 – Construction Progress Schedule – Bar (Gantt) Chart).

.5 All survey information (digital .csv file with .xyz data and breaklines in DXF file format) for each payment item claimed on the progress payment and measured by survey as defined in the Contract Specifications.

1.2 Basis of Payment

.1 Basis of payment shall be per the Measurement and Payment Procedures in the applicable Contract Specification section. Where not specified, basis of payment for all work included in these Specifications or Contract Drawings not specifically mentioned is considered incidental to other work and is part of the Total Contract Amount.
No additional payment will be made for incidental work.

.2 Payment for work shall be made per the Price per Unit as shown in the Unit Price Table.

.3 For unit price items in the Bid and Acceptance Form, progress payments shall be made based on the quantities of work in place (prior to excavation or following placement and compaction), compacted (if required), surveyed, and accepted by the Departmental Representative in the field.

.4 For lump sum items in the Bid and Acceptance Form, progress payments shall be made based on the percent of work completed and accepted by the Departmental Representative at the time of the monthly progress payment (excluding Mobilization and Demobilization which is paid per Item 1.2 – Measurement and Payment Procedures of Section 01 25 20 – Mobilization and Demobilization). Survey may be required to verify the work is completed to the design requirements (thickness, length, grade, volume, area, etc.).

.5 The Contractor must support any claims for products purchased, manufactured, or delivered to the place of work but not yet incorporated into work. The support for such claims must include such evidence as may be required by the Departmental Representative to establish value and the percentage of the work completed. During or at the completion of the work any products purchased, manufactured, or delivered to the place of work but not incorporated into the work shall be removed from the site at the Contractor's cost and no payment (including adjustment to quantities on previous progress payments, see GC5.2 – Amount Payable) shall be made (excluding items resulting from changes to the work made by the Departmental Representative during the work and brought to the attention of the Departmental Representative by the Contractor at the time of the change).

.6 Any work called for in the Contract Specifications or shown on the Contract Drawings but not specifically mentioned as an item for which payment will be made, will be considered incidental to the items of work listed. No additional payment will be made for this incidental work.

.7 All equipment, materials, and labour necessary to complete any item of work shall be included in the cost of that work.

.8 Materials shall be excavated or placed within the specified tolerances of the design lines and grades shown on the Contract Drawings but not uniformly high or low. Materials excavated or placed outside the specified tolerances will not be measured for payment unless preapproved by the Departmental Representative.

.9 Measurement for Payment will be at the Departmental Representative's discretion using one or more of the following methods:

.1 Based upon the survey data collected by the Contractor – when the materials have been excavated or placed within the specified tolerances of the design lines and grades shown on the Contract Drawings but not uniformly high or low.

.2 Based upon the survey data collected by the Contractor – when the Contractor's or Departmental Representative's survey data indicates that less materials were excavated or placed than called for by the design lines and grades on the Contract Drawings.

.3 By the design grade / design drawing neat lines – when the Contractor's or Departmental Representative's survey data indicates that materials were excavated or placed outside / beyond the specified tolerances of the design lines and grades on the Contract Drawings.

.10 At any point throughout the project, the Departmental Representative may compile and review the survey data (individual surveys or multiple surveys of particular items of work) to reconcile the total quantities of items of work to date on the project. Adjustments to quantities on future progress payments may then be made per GC5.2 – Amount Payable.

1.3 Survey

.1 Surveys shall be undertaken by the Contractor to verify quantities for payment purposes or in the case of lump sum items to verify that work has been completed to the design requirements (thickness, length, grade, volume, area, etc.). Survey shall be considered incidental to the work and not measured for payment.

.2 All quantity surveys, quantity calculations for the purposes of progress payments, and surveys to verify the work is completed to the design requirements shall be completed by a Professional Engineer, an Applied Science Technologist or Certified Engineering Technician, or other qualified surveyor, with the knowledge, skills and abilities acceptable to the Departmental Representative. The surveyor or person(s) used for these tasks shall have a minimum of 5 years' experience working on projects of similar size, scope and cost. A resume detailing this experience shall be provided to the Departmental Representative for review and acceptance if requested.

.3 Survey data collected shall be of sufficient density to fully characterize the work. Survey methods and the location of surveyed cross sections is subject to prior approval from the Departmental Representative. At a minimum, the Contractor shall survey all features at 10 m station intervals (may be reduced to 5 m in locations with grade changes at the discretion of Departmental Representative) and the location of all treatment boundaries including changes in material type / placement, changes in surface treatment, and changes in the terrain.

.4 A survey of the existing ground surfaces, stream banks, stream bed, stream channels, other topographic features and existing infrastructure shall be undertaken by the Contractor prior to initiation of construction, but in areas designated for Clearing and Grubbing after the Clearing and Grubbing has been completed to the satisfaction of the Departmental Representative. The survey shall be provided to the Departmental Representative for review and acceptance. During construction no material shall be placed unless the applicable surveys on the completed surfaces have been carried out and the data accepted by the Departmental Representative, and the completed surface has been inspected and accepted by the Departmental Representative. At the Departmental Representative's sole discretion, payment for work completed and measured by survey may not be made should the Contractor fail to complete necessary surveys, or the surveys be of insufficient quality or detail.

.5 Survey data shall be collected at an accuracy of +/-0.02 m horizontal and +/-0.02 m vertical or better and shall be referenced / tie into the PSPC's monument / coordinate system as shown on the Contract Drawings.

.6 Survey data for each payment line item in the unit price table and area of work shall be provided to the Departmental Representative as follows:

.1 Digital .csv files with the .xyz data and an appropriate descriptor code as to the type of material surface or feature being surveyed.

.2 Breaklines for all survey data in DXF file formation or another format preapproved by the Departmental Representative.

.3 A list of all point descriptors used in the survey data.

.7 Where surveys of an item of work or location of work have been completed multiple times (ex. multiple progress payments), compile individual survey point files into one complete survey file free of overlapping points and other inconsistencies resulting from the completion of individual surveys.

.8 The Contractor shall complete detailed volume calculations using average end area determination or electronic surface to surface comparisons. Details of volume calculations shall be provided to the Departmental Representative for review upon request.

.9 Surveys may be subject to verification by the Departmental Representative. In case of discrepancy, the Departmental Representative's survey will govern.

END OF SECTION

Part 1 General

1.1 Preconstruction Meeting

.1 Following tender closing and prior to the construction start, attend in person or via teleconference a pre-construction meeting organized by the Departmental Representative.

.2 Departmental Representatives and senior representatives of the Contractor, including but not necessarily limited to the Project Superintendent, Deputy Project Superintendent, Health and Safety Coordinator, Surveyor, Quality Control Manager, and Environmental Monitor, and major subcontractors shall attend in person or via teleconference.

.3 The Departmental Representative shall establish a time, location, and teleconference number for the meeting and notify the Contractor a minimum of three (3) days prior to the meeting. The Contractor shall notify all concerned parties of the meeting.

.4 Agenda to include but is not limited to the following:

- .1 Appointment of the official representative of participants in the work and lines of communication.
- .2 Schedule of Work: in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.
- .3 Contractor submissions (requirements and submissions schedule).
- .4 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .5 Permitting and environmental requirements.
- .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .7 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .8 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .9 Monthly progress claims, administrative procedures, photographs, hold backs.
- .10 Contractor’s Quality Management and Quality Assurance undertaken by the Departmental Representative.
- .11 Insurances, transcript of policies.
- .12 Contractor’s Project Specific Health and Safety Plan.
- .13 Maintenance in accordance with Section 01 78 00 – Closeout Submittals.
- .14 Other business as required by the Departmental Representative or Contractor.

.5 Within fourteen (14) days of the pre-construction meeting, the Departmental Representative shall distribute meeting minutes to the Contractor. The Contractor shall review the meeting minutes and provide any comments within five (5) work days.

1.2 On-Site Documents

.1 Maintain at job site, one copy each of the following:

- .1 Contract Drawings.
- .2 Specifications.

.3 Addenda.

.4 Reviewed and Accepted Submittals.

.5 Change Orders

.6 Other modifications to Contract.

.7 Field test reports.

.8 Copy of approved work schedule.

.9 Manufacture's installation and application instructions (if applicable).

.10 All permits required for the project.

.11 Meeting minutes.

.12 Contractor's project specific health and safety plan.

.13 Contractor's Environmental Protection Plan (EPP).

.14 Contractor's Traffic Management Plan.

.15 Current construction standards of workmanship listed in the Contract Specifications.

.16 One set of "Issued for Construction" Contract Drawings (or "Issued for Tender" if being used for construction), Contract Specifications, and Shop Drawings for as-built purposes.

1.3 Schedules

.1 Submit preliminary construction progress schedule in accordance with Section 01 32 16.19 – Construction Progress Schedules – Bar (Gantt) Chart to the Departmental Representative.

.2 After review by Departmental Representative, revise project schedule to comply with comments given.

.3 During progress of work, provide schedule with original tasks shown as the baseline and actual work progress updated with each submission (see Section 01 32 16.19 – Construction Progress Schedules – Bar (Gantt) Chart, Subsection 1.4).

1.4 Construction Progress Meetings

.1 During the course of work, the Departmental Representative may schedule construction progress meetings approximately every week or every two (2) weeks.

.2 Departmental Representatives and senior representatives of the Contractor, including but not necessarily limited to the Project Superintendent, Deputy Project Superintendent, Health and Safety Coordinator, Quality Control Manager, Surveyor, and Environmental Monitor and major subcontractors shall attend in person or via teleconference.

.3 The Departmental Representative shall establish a time, location, and teleconference number for the meeting and notify the Contractor a minimum of three (3) days prior to the meeting. The Contractor shall notify all concerned parties of the meeting.

.4 The meetings may be held onsite provided teleconference capabilities are available. If held on site, the Contractor shall provide physical space and make arrangements for the meetings.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.
.2 Health and Safety Incidents and Concerns
.3 Review of Work progress since previous meeting.
.4 Field observations, problems, conflicts.
.5 Problems which impede construction schedule.
.6 Review of off-site fabrication delivery schedules (if applicable).
.7 Corrective measures and procedures to regain projected schedule.
.8 Revision to construction schedule.
.9 Progress schedule, during succeeding work period.
.10 Review submittal schedules: expedite as required.
.11 Maintenance of quality standards.
.12 Review proposed changes for affect on construction schedule and on completion date.
.13 Other business.

.6 Within fourteen (14) days of the construction progress meeting, the Departmental Representative shall distribute meeting minutes to the Contractor. The Contractor shall review the meeting minutes and provide any comments within five (5) work days.

1.5 Written Communication/Document Management

.1 Written communication and document management shall be completed per the Written Communication / Document Management Protocol prepared by the Departmental Representative following award of the contract. The Written Communication / Document Management Protocol will resemble the template provided in Appendix A.

1.6 Submittals

.1 Provide submittals, Shop Drawings, product data and samples in accordance with Section 01 33 00 – Submittal Procedures for review for compliance with Contract Documents, field dimensions and clearances, compatibility and available space, and for relation to work of other contracts. If requested, after receipt of Departmental Representative comments, revise and resubmit.

.2 Submit requests for payment through the Departmental Representative via email or if requested by the Departmental Representative or if desired by the Contractor PSPC's cloud-based document filing system "CentralCollab". Support claims for payment with survey data and other evidence as required by the Departmental Representative.

.3 Submit requests for information (RFI) of Contract Documents and obtain instructions through Departmental Representative via PSPC's cloud-based document filling system "CentralCollab". If required by the Departmental Representative, provide supporting documents for proposed substitutions via PSPC's cloud-based document filing system "CentralCollab".

.4 Process substitutions through Departmental Representative. If required by the Departmental Representative, provide supporting documents for proposed substitutions via PSPC's cloud-based document filing system "CentralCollab".

.5 Process change orders through Departmental Representative via PSPC's cloud-based document filing system "CentralCollab".

.6 Deliver closeout submittals for review and preliminary inspections, for transmittal to Departmental Representative via PSPC's cloud-based document filing system "CentralCollab".

1.7 Close-Out Procedures

.1 Close-out procedures in accordance with Section 01 77 00 – Closeout Procedures.

END OF SECTION

Part 1 General

1.1 Project Schedule

.1 Develop detailed Project Schedule conforming to the project completion dates found in Section 01 11 00 – Summary of Work and the Construction Staging requirements outlined in Section 01 14 00 – Work Restrictions, Access Development, Construction Staging, and Restoration.

.2 Ensure detailed Project Schedule includes as a minimum all relevant milestone activity types as follows:

- .1 Project Award.
- .2 Receipt of Necessary Permits.
- .3 Submittal Schedule:
  - .1 Pre-construction survey.
  - .2 Environmental Protection Plan.
  - .3 Traffic Management Plan.
  - .4 Quality Management Plan.
  - .5 Project Specific Health and Safety Plan including MSDS sheets.
  - .6 Hazardous Materials Management Plan (if requested by the Departmental Representative).
  - .7 Shop Drawings and Product Samples (if applicable).
  - .8 As-Built Survey and As-Built Drawings Mark-Ups.
  - .9 Test Results.
  - .10 Mobilization.
  - .11 Work activities and material purchases by segment / locations (unless accepted otherwise, at a minimum each line item of work identified in the unit price table shall be identified separately on the project schedule).
  - .12 Interim inspections.
  - .13 Site Clean-up / De-mobilization.
  - .14 Project Substantial Completion and Project Completion dates.
- .4 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.
- .5 Include dates when reviewed submittals will be required from the Departmental Representative.

1.2 Schedule Format

.1 Prepare schedule in form of a horizontal Gantt bar chart.

.2 Provide a separate bar for each item of work identified on the Unit Price Table or, if acceptable to the Departmental Representative, each operation.

.3 Provide horizontal time scale identifying first work day of each week.

.4 Format for listings: the chronological order of start of each item of work.

.5 Include complete sequence of construction activities and identify critical path and critical path work items in identifying colour.

.6 Include dates for commencement and completion of each major element of construction.

1.3 Submission of Schedules

.1 Submit initial format of schedules within 15 days after award of Contract, but in all cases prior to starting onsite work.

.2 Submit schedules in electronic format via PSPC's cloud-based document filing system "CentralCollab" (login details to be provided by Departmental Representative at time of submission following contract award). Provide schedules as a single PDF file format document (multiple files will not be accepted) and native file format (e.g. Microsoft Project format) if requested by the Departmental Representative.

.3 If requested submit two (2) hardcopies to be retained by the Departmental Representative.

.4 The Departmental Representative will review the schedule and return any comments within 10 days after receipt.

.5 Resubmit finalized schedule within seven (7) days after return of review copy. Once accepted by the Departmental Representative, the accepted schedule shall form a baseline which all schedule updates shall be compared against.

.6 Distribute copies of revised schedule to:

.1 The Contractor's team including Project Super-intendent, Deputy Project Superintendent, and others as required.

.2 Subcontractors.

.3 Other concerned parties.

.7 Instruct recipients to report to Contractor within seven (7) days any problems anticipated by timetable shown in the schedule.

1.4 Project Schedule Reporting during the Work

.1 Update project schedule monthly or with each progress payment (whichever is more frequent) reflecting activity changes and completions, as well as activities in progress.

.2 Include as a baseline each line item and details from the initial project schedule accepted by the Departmental Representative at the start of the project. On an adjacent line indicate progress of each activity started and completed to the date of schedule submission by including actual start date / end date / percent complete.

.3 Show changes occurring since previous submission of schedule including:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.4 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.

.2 Corrective action recommended and its effect.

.3 Effect of changes on schedules of other Prime Contractors.

.5 Discuss project schedule at Construction Progress Meetings, identify activities that are behind schedule and provide measures to regain slippage. If requested by the Departmental Representative, provide a schedule recovery plan with details of the approach and changes the Contractor is planning on implementing to bring the project back on schedule.

END OF SECTION

Part 1 General

1.1 General Requirements

.1 Submit to the Departmental Representative submittals listed for review. Submit with reasonable promptness (per the timelines indicated, if applicable) and in an orderly sequence so as to not cause delay in work. Failure to submit in ample time is not considered sufficient reason for an extension of contract Substantial Completion Date, and no claim for extension by reason of such default will be allowed.

.2 Unless specified otherwise or requested by the Departmental Representative, submittals shall be submitted to the Departmental Representative in electronic format via PSPC's cloud-based document filing system "CentralCollab" (login details to be provided by Departmental Representative at time of submission following contract award). Submittals shall be named and filed on "CentralCollab" in accordance with the Written Communication / Document Management Protocol (see template Appendix A). Each submittal shall be compiled into a single PDF document (multiple files will not be accepted).

.3 The Departmental Representative will review the project submittals for accuracy against the appropriate project specifications and contract requirements, and endeavor to complete the reviews within the review time specified for each particular submittal, however a longer review period may be required. If a longer review period is required, the Contractor will be notified prior to the passing of the specified review period. Upon completion of the submittal reviews by the Departmental Representative, comments and or acceptance of the submittals will be given. Upon review by the Departmental Representative, should comments be provided, the Contractor shall revise the submittal as required and re-submit the complete revised submittal back to the Departmental Representative for review within one (1) week (or within a time preapproved by the Departmental Representative). The submittals will not be accepted until all comments from all reviews have been addressed to the satisfaction of the Departmental Representative. Despite acceptance of a particular submittal, the Departmental Representative reserves the right to provide additional comments to ensure the correction of any deficiencies with particular submittals at any time during the project.

.4 Work affected by a submittal shall not proceed until the submittal is completed, reviewed, and accepted by the Departmental Representative.

.5 Present all necessary drawings, Shop Drawings, product data, samples, and mock-ups in SI Metric units.

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

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

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

.9 Prior to any submission, verify field measurements and affected adjacent work included on the submission are coordinated.

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

.11 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

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

.13 Comments made from review of submittals are intended to ensure conformance with contract requirements and not intended to change contract price. If the Contractor feels the comments include requirements not required by the contract, the Contractor shall respond in writing to the Departmental Representative prior to undertaking the work.

1.2 Shop Drawings and Product Data

.1 The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data that are to be provided by the Contractor to illustrate details of a portion of work.

.2 Indicate materials, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of work or as indicated elsewhere in the specifications. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the section under which adjacent items will be supplied and installed. Indicate cross-references to design drawings and specifications.

.3 Adjustments made on Shop Drawings by the Departmental Representative are not intended to change the Contract Price. Should the Contractor feel that the adjustments affect the value of work and are outside the contract requirements, the Contractor shall state such in writing to the Departmental Representative prior to proceeding with the work.

.4 Make changes in Shop Drawings as the Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify the Departmental Representative in writing of any revisions other than those requested.

.5 Accompany submissions with a transmittal letter, in duplicate, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each Shop Drawing, product data, and sample.
- .5 Other pertinent data.

.6 Submissions shall include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Contractor/Subcontractor.
  - .2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents and requirements.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Single line and schematic diagrams.

.9 Relationship to adjacent work.

.6 Professional seal and signature of the engineer certifying approval of the work (if required).

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

.8 Submit an electronic copy of the Shop Drawing for each requested within the specification sections. Submit hardcopies as requested by the Departmental Representative.

.9 Submit electronic copies of product data sheets or brochures for requirements requested in specification sections and as requested by the Departmental Representative where Shop Drawings will not be prepared due to standardized manufacture of product.

.10 Delete information not applicable to project.

.11 Supplement standard information to provide details applicable to the project.

.12 If upon review by the Departmental Representative no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of work may proceed. If Shop Drawings are rejected, noted copy will be returned. Resubmission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of work may proceed.

.13 The review of Shop Drawings by the Departmental Representative is for the sole purpose of ascertaining conformance with general concept. This review shall not mean the Departmental Representative approves the detail design inherent in Shop Drawings. Responsibility for detail design in Shop Drawings shall remain with the Contractor, and as such, reviews by the Departmental Representative shall not relieve the Contractor of responsibility for errors or omissions in Shop Drawings, or of responsibility for meeting all requirements of construction and Contract Documents. Without restricting generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of work of all sub-trades.

.14 Work affected by Shop Drawing shall not proceed until the Shop Drawing is reviewed and accepted by the Departmental Representative.

1.3 Samples

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

.2 Deliver samples prepaid to Departmental Representative's site office or to a location as directed by the Departmental Representative.

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

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

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

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

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

.8 Work affected by the sample shall not proceed until the sample is reviewed and accepted by the Departmental Representative.

1.4 Photographic Documentation

.1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement and as directed by Departmental Representative.

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

.3 Number of viewpoints: 4 locations.

.1 Viewpoints and their location as determined by Construction Manager or Departmental Representative.

.4 Frequency of photographic documentation: weekly as directed by Departmental Representative.

.1 Upon completion of Work, and as directed by Departmental Representative

END OF SECTION

Part 1 General

1.1 References

.1 Government of Canada.

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

.2 National Building Code of Canada (NBC) as amended:

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

.3 Canadian Electrical Code (CE Code) as amended.

.4 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.
- .4 CSA Z1006-10 Management of Work in Confined Spaces.
- .5 CSA Z462-19 Workplace Electrical Safety Standard.

.5 National Fire Code of Canada 2015 as amended:

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

.6 Fire Protection Engineering Services, HRSDC:

- .1 FCC No. 301, Standard for Construction Operations.
- .2 FCC No. 302, Standard for Welding and Cutting.

.7 American National Standards Institute (ANSI):

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

.8 Province of British Columbia:

- .1 Workers Compensation Act Part 3-Occupational Health and Safety as amended.
- .2 Occupational Health and Safety Regulation (as amended).

.9 Project Specific Health and Safety Plan Template (Appendix B)

.10 Canadian Construction Association, COVID-19 – Standardized Protocols for All Canadian Construction Sites, Version 5, May 26, 2020.

.11 WorkSafeBC Construction and COVID-19 Safety.

1.2 Worker’s Compensation Coverage

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

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

1.3 Compliance with Regulations

.1 PSPC may terminate the Contract without liability to PSPC where the Contractor, in the opinion of PSPC, 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.

1.4 Definitions

.1 Workplace: As defined by WorkSafeBC Occupational Health and Safety Guidelines. The project shall be considered as having separate workplaces should the WorkSafeBC Occupational Health and Safety Guidelines - Location Factors provide “Yes” to “Indication of Separate Workplaces” including but not limited to “Locations of one employer are more than 20 minutes apart from each other”.

.2 Hot Work: Includes cutting/melting with use of a torch, flame, or other flame devices and grinding equipment which produces a spark.

1.5 Submittals

.1 The Contractor’s Project Specific Health and Safety Plan shall be submitted to the Departmental Representative as a single PDF document (multiple files will not be accepted) for review and acceptance in accordance with the procedures outlined in Section 01 33 00 – Submittal Procedures. The Departmental Representative will review the plan (first submission and if required all subsequent re-submissions) within fourteen (14) days of submission. Upon review of the plan the Departmental Representative will do one of the following:

.1 Accept the plan.

.2 Accept portions of the plan and provide comments outlining required changes or additional information in other sections. Following completion of edits by the Contractor, the Contractor shall re-submit the complete plan for review.

.3 Reject the plan and provide comments outlining required changes or additional information needed before the plan will be reviewed in detail. Following completion of edits by the Contractor, the Contractor shall re-submit the complete plan for review.

.2 Submit the following to the Departmental Representative in accordance with the procedures outlined in Section 01 33 00 – Submittal Procedures:

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

.2 Copies of incident and accident reports.

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

.4 Emergency Procedures.

.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 If requested, complete versions of the Contractor's corporate Health and Safety Policies / Procedures manual.

.3 The Contractor shall allow time in the schedule for the reviews, and subsequent edits / re-submission.

.4 Work affected by the submittal (as determined by the Departmental Representative) shall not proceed until acceptance of the submittal by the Departmental Representative.

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

.1 Be construed 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.

.6 Should deficiencies in the Contractor's Project Specific Health and Safety Plan be noted following acceptance of the submittal by the Departmental Representative but during the project work, the Departmental Representative reserves the right to provide additional comments to the Contractor and require re-submission of the Project Specific Health and Safety Plan to ensure the correction of any deficiencies.

1.6 Project Specific Health and Safety Plan

.1 The Contractor shall prepare and comply with the Project Specific Health and Safety Plan. The preparation and details of the Project Specific Health and Safety Plan shall include conducting a site-specific hazard assessment based on review of Contract Documents, required work, and project site(s). The Project Specific Health and Safety Plan shall address all concerns / requirements identified in the Contract Documents and identify any known and potential health risks and safety hazards.

.2 The Project Specific Health and Safety Plan shall, at a minimum include all headings, sub-headings, details, and presentation format as provided in the template found in Appendix B (provided to the Contractor as a Word file upon award of contract). The Contractor shall add additional headings and content to the Project Specific Health and Safety Plan as deemed necessary. PSPC has the right to reject the Project Specific Health and Safety Plan if the headings from this document are not used in the Contractor's Project Specific Health and Safety Plan.

Minimum requirements for the Project Specific Health and Safety Plan includes:

.1 Contractor's safety policy / statement.

.2 Identification of applicable compliance obligations.

.3 Identify personnel and alternates responsible for project site safety and health. List of health and safety responsibilities for all personnel listed.

.4 General safety rules for project and actions which will be taken by the Contractor should these safety rules be broken by the any workers on the project (includes workers employed by the General Contractor, sub-contractor, or sub-consultants).

.5 Identify health and safety risks / hazards and engineering and administrative control measures to be implemented at each "workplace" for managing identified risks / hazards including:

.1 Summary of health risks and safety hazards resulting from hazard assessment analysis with respect to site tasks and operations which must be performed as part of the work and hazard rating assignment (low, moderate, or high) for each "workplace" as defined by WorkSafeBC and applicable to the application of G3.16 of WorkSafeBC Occupational Health and Safety Regulations.

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

.3 Job-specific safe work procedures that are not already included in the Contractor's corporate Health and Safety Polices / Procedures manual.

.4 Identify personal protective equipment (PPE) to be used by workers.

.5 Identify personnel training requirements and training plan, including site orientation for new workers and personnel designated by the Departmental Representative as needing to visit the site.

.6 Identification of the first aid requirements for each "workplace" on the project including:

.1 Estimated travel time from the "workplace" to the nearest hospital.

.2 Maximum numbers of workers at any time per "workplace".

.3 The first aid supplies, equipment, and facilities which will be available at each "workplace".

.4 The first aid attendant certificate level onsite at each "workplace".

.5 The first aid transportation which will be used on the project (i.e. ETV), if required by Contractor or WorkSafeBC requirements. Details of where the ETV will be located/parked relative to the location of the first aid attendant(s) during the work.

.7 Inspection policy and procedures.

.8 Incident reporting and investigation policy and procedures.

.9 Occupational Health and Safety Committee/Representative procedures.

.10 Occupational Health and Safety communications and record keeping procedures.

.11 Emergency contact information including PSPC project personnel (including Consultants), Contractor office and field staff, fire, police, ambulance, air ambulance, and forest fire reporting.

.12 Identify employee training plans for wildlife encounters and prevention.

.13 Identify fire safety, fire reporting, and fire evacuation procedures.

.14 Confirmation through the review and signatures from the Contractor's Project Manager, Superintendent, Health and Safety Manager, Quality Control Manager, representatives from all major Sub-Contractor's, and other project roles that may be applicable, that they have reviewed the Project Specific Health and Safety plan, agree with its contents, and will be enforced by them for the duration of the project.

.15 Completed "Preliminary Hazard Assessment Form" (see Appendix 1 of the Project Specific Health and Safety Plan template).

.16 Completed "Confirmation of Prime Contractor's Main Responsibilities Under the WorkSafeBC Occupational Health and Safety Regulations and Worker's Compensation Act" form (see Appendix 2 of the Project Specific Health and Safety Plan template).

.17 Blank copy of Contractor's daily toolbox meeting Form.

.18 Blank copy of the Contractor's Site Safety Orientation Form.

.19 Blank copy of the Contractor's Incident/Accident Report template.

.20 Resume(s) or certification(s) of Health and Safety Coordinator(s) responsible for site safety and onsite First Aid Attendants.

.21 Maps identifying the location of the nearest hospital(s) to the project site. The maps shall be of appropriate scale and sufficient detail allowing for their use to navigate to the hospital(s) in the event of an emergency.

.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 Should health and safety requirements change throughout the project and require information not included in the Project Specific Health and Safety Plan, revise and update Project Specific Health and Safety Plan as required and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of the Project Specific Health and Safety Plan by Public Services and Procurement Canada (PSPC) shall not relieve the Contractor of responsibility for errors or omissions in final Project Specific Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract Documents.

.6 Contractor's COVID-19 Safe Work plan, describing the protocols and procedures the Contractor shall implement throughout the duration of the work to mitigate the spread and risk of exposure to COVID-19, in accordance with Federal and Provincial COVID-19 guidelines, WorkSafeBC and Canadian Construction Association.

.7 Should Federal and/or Provincial guidelines change during the project, the Contractor shall update the Project Specific Health and Safety Plan and the Contractor's COVID-19 Safe Work Plan accordingly and submit to the Departmental Representative for review and acceptance.

1.7 Contractor's Responsibility

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

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

.3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with Project Specific Health and Safety Plan.

.4 The protection of persons off-site and the environment such that they may be affected by the conduct of the work.

1.8 Health and Safety Coordinator

.1 Employ and assign to work, a competent and authorized representative as Health and Safety Coordinator. The Health and Safety Coordinator shall:

.1 Be responsible for completing all health and safety training, site orientations, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

.2 Be responsible for implementing, daily enforcing, and monitoring the Project Specific Health and Safety Plan.

.3 Be on site during execution of critical elements of the work or as required by the Contractor.

.4 Have a minimum of two (2) years site-related working experience specific to activities associated with Construction.

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

.6 Attend pre-construction and construction progress meetings as required or as requested by the Departmental Representative.

1.9 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 persons, and temporary lighting as required.

.2 Secure site during non-work hours at night time or provide security guard as deemed necessary to protect site against entry.

.3 Conduct daily safety meetings and task specific meetings (toolbox) as required by special work. At a minimum, meetings shall include refresher training for existing equipment and protocols, review ongoing safety issues and protocols, and examine new site conditions as encountered. Keep records of meetings and post to PSPC’s cloud-based document filing system “CentralCollab” on a weekly or more frequent basis.:

.4 Design and construct falsework in accordance with CSA S269.1-1975 (R2003) as amended.

.5 Carry out work in confined spaces in accordance with current Provincial requirements.

.6 Use powder-actuated devices in accordance with ANSI A10.3 (as amended) only after receipt of written permission from the Departmental Representative.

1.10 Project Site Conditions

.1 Work at the site will, at a minimum, involve contact with:

.1 Utilities.

.2 General public (including large transport trucks) and PSPC maintenance personnel travelling the highway.

.3 Local wildlife.

.4 Unpredictable and adverse weather conditions.

.5 Hazards, see “Preliminary Hazard Assessment Form” in the appendices of the Project Specific Health and Safety Plan template in Appendix B.

.6 Working from heights.

1.11 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 provisions 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.

1.12 Work Permits

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

1.13 Filing of Notice

.1 The Contractor is to complete and submit an Advance Notice of Project as required by the Worker’s Compensation Board and any other authority in effect at the place or work.

.2 Provide copies of all notices to the Departmental Representative.

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 Contractor’s company.

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

.3 Local emergency resources.

.4 Departmental Representative.

.2 Include the following provisions in the emergency procedures:

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

.2 Evacuate all workers safely.

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

.4 Notify the fire department or other emergency responders.

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

.6 Notify Departmental Representative.

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

.1 Work at high angles.

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

.3 Work with hazardous substances.

.4 Underground work.

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

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

.7 Work in areas where sudden movement of native or placed materials may occur.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

.5 Emergency drills must be held at least once each year for all projects lasting longer than one year. The purpose of these drills is to ensure awareness and effectiveness of emergency exit routes and procedures. A record of the drills must be kept by the Contractor.

.6 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 materials, and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canadian 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. If requested, submit applicable MSDS and WHMIS documents as per Section 01 33 00 – Submittal Procedures. Keep documents available for review on the project site as close as practical to where the hazardous and toxic product is being used.

.2 Provide adequate means of ventilation acceptable to the Departmental Representative and suitable for the hazard.

.3 The Contractor shall ensure that the product is applied as per manufacturers' recommendations and ensure only pre-approved products are brought are onto the work site in an adequate quantity to complete the work.

.3 All asbestos-containing materials are prohibited from use and shall not be incorporated into the work by the Contractor.

.4 All explosive materials (if required) shall be stored, handled, and used as per Natural Resources Canada Explosives Act.

1.16 Overloading

.1 Ensure no part of the work is subject to a load which will endanger its safety or will cause permanent deformation.

1.17 Hot Works and Fire Safety Requirements

.1 Obtain Departmental Representative's authorization before undertaking any welding, cutting or other hot work operations on site. If requested by the Departmental Representative, provide hot works permits for any hot works activities.

.2 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.

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

.4 Obtain approval from the Departmental Representative prior to bringing any portable gas and/or diesel fuel tanks on site.

1.18 Unforeseen 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.

.2 Should contaminated site conditions be encountered when completing the work, refer to GC4.4 – Contaminated Site Conditions for procedures which the Contractor shall undertake.

1.19 Posted Documents

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

.1 Project Specific Health and Safety Plan.

.2 Sequence of work.

.3 Emergency procedures.

.4 Corporate Health and Safety Policies and Procedures manual(s).

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

.6 Notice of Project.

.7 Floor plans or site plans.

.8 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.

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

.10 Material Safety Data Sheets (MSDS).

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

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

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

1.20 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".

1.21 Medical

.1 Provide and maintain first aid facilities for all workers as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 Provide the appropriate first aid kit, based on the number of workers, in accordance with the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.3 Establish an emergency response plan acceptable to Departmental Representative, for the removal of any injured person to medical facilities or a doctor's care in accordance with applicable legislative and regulatory requirements.

.4 Provide proof of First Aid credentials to Departmental Representative prior to the start of construction. Provide the appropriate number of first aid attendants on site in accordance with Workers' Compensation Act or the Occupational Health and Safety Regulations.

.5 Emergency and First Aid Equipment:

.1 Locate and maintain emergency and first aid equipment in appropriate location on site including first aid kit to accommodate number of site personnel; portable emergency eye wash; fire protection equipment as required by legislation.

.2 Locate sufficient blankets and towels, stretcher, and one hand held emergency siren in all confined access locations.

.3 Provide a minimum of one qualified first aid attendant as per Workers' Compensation Act or the Occupational Health and Safety Regulations on site at all times when Work activities are in progress; duties of first aid attendant may be shared with other light duty Work related activities.

1.22 Accidents and Accident Reports

.1 Immediately report, verbally, followed by a written report within 24 hours, to Departmental Representative, all accidents of any sort arising out of or in connection with the performance of the Work, giving full details and statements of witnesses. If death or serious injuries or damages are caused, report the accident promptly to Departmental Representative by telephone in addition to any report required under federal and territorial laws and regulations.

.2 If a claim is made by anyone against Contractor or Sub-Contractor on account of any accident, promptly report the facts in writing to Departmental Representative, giving full details of the claim.

1.23 COVID-19

.1 The Contractor shall keep informed with the latest Federal and Provincial recommendations and protocols regarding COVID-19 at all times during construction and shall modify their construction approach accordingly to ensure adherence to these recommendations and protocols.

.2 Federal and/or Provincial recommendations require that the project work be stopped, the Contractor shall consult with the Departmental Representative and the Departmental Representative will advise as to the course of action the contractor shall take.

Part 2 Products

2.1 Nor Used

.1 Not Used

Part 3 Execution

3.1 Not Used

.1 Not Used

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Payment for Environmental Monitoring will be made on the basis of the Price per Unit Bid for Environmental Monitoring and shall include environmental monitoring, water management including staging of the work, necessary pumps and berms, and all other items necessary for the successful completion of the task.

.2 Measurement for Payment for completion of the Environmental Monitoring and Water Management will be made by Lump Sum based on the percentage of the work completed and accepted by the Departmental Representative.

.3 Payment for the cost of Pre-Mobilization Submittals will be incidental to the Price per Unit Bid for Pre-Mobilization Submittals in the Bid and Acceptance Form (Line Item 01 33 00 – Pre-Mobilization Submittals). The Price per Unit Bid shall include the preparation of the Environmental Protection Plan, preparation of the Chance Find Management Plan, and all other items necessary for the successful completion of the task.

.4 Measurement for Payment for completion of the Pre-Mobilization Submittals will be made by Lump Sum based on the percentage of the work completed and accepted by the Departmental Representative.

1.2 Definitions

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

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

.3 Wetted Perimeter: area of stream where water is currently running or pooled.

.4 In-stream Work: any work performed below the high-water mark, either within or above the Wetted Perimeter of any Fisheries Sensitive Zone.

.5 Fisheries Sensitive Zone: in-stream aquatic habitats and out of stream habitat features such as side channels, wetlands, and riparian areas.

.6 Invasive plants: are any alien plant species that have the potential to pose undesirable or detrimental impacts on humans, animals or ecosystems. Invasive plants have the capacity to establish quickly and easily on both disturbed and un-disturbed sites, and can cause widespread negative economic, social and environmental impacts.

.7 Noxious weeds: are invasive plants that have been designated under the BC Weed Control Act. This legislation imposes a duty on all land occupiers to control a set list of identified invasive plants.
https://www.for.gov.bc.ca/hra/plants/legislation.htm

1.3 References

.1 Standards and Best Practices for Instream Works, British Columbia Ministry of Land and Air Protection Ecosystem Standards and Planning Biodiversity Branch – March 2004.

.2 Land Development Guidelines for the Protection of Aquatic Habitat, Fisheries and Oceans – September 1993.

.3 Environmental Protection Plan (EPP) – Checklist (Appendix F).

.4 Responsibility Checklist for Authorizations /Approvals / Notifications / Permitting (Appendix G).

.5 Relevant Environmental Publications (Appendix H).

1.4 Regulatory Overview

.1 Notification of Instream Work under Section 11 of the *Water Sustainability Act* has been submitted for this project. Should there be any conditions or requirements based on the Notification of Instream Work, the information will be passed on to the Contractor upon award for incorporation into the Contractor's Environmental Protection Plan (EPP).

.2 Comply with all applicable environmental laws, regulations and requirements of Federal, Provincial, and other regional authorities, and acquire and comply with such permits, approvals and authorizations as may be required.

.3 Comply with and be subject to those permits and approvals obtained from the Departmental Representative to conduct the Work.

.4 Pay specific attention to the provincial BC Land Use Permit, Water License and Quarry Permit.

.5 Pay specific attention to the Migratory Birds Convention Act, as amended in 1994.

.6 Pay specific attention to the provincial BC guidelines under Peace Region Least Risk Timing Windows: Biological Rational (2009).

.7 Pay specific attention to provincial standards for instream works, refer to British Columbia Ministry of Land and Air Protection Ecosystem Standards and Planning Diversity Branch publication, Standard and Best Practices for Instream Works – March 2004 (see Reference Documentation – Table of Contents).

1.5 Submittals

.1 The Contractor's EPP and Environmental Site Inspection Memos, shall be submitted to the Departmental Representative. Each plan / memo / report shall be submitted as a single PDF documents (multiple files will not be accepted) for review and acceptance in accordance with the procedures outlined in Section 01 33 00 – Submittal Procedures. The Departmental Representative will review the EPP, and Environmental Site Inspection Memos, (first submission and if required all subsequent re-submissions) within 14 days of submission. Upon review of the plan / memo / report, the Departmental Representative will do one of the following:

.1 Accept the plan / memo / report.

.2 Accept portions of the plan / memo / report and provide comments outlining required changes or additional information in other sections. Following completion of edits by the Contractor, the Contractor shall re-submit the complete plan / memo / report for review.

.3 Reject the plan / memo / report and provide comments outlining required changes or additional information needed before the plan / memo / report will be reviewed in detail. Following completion of edits by the Contractor, the Contractor shall re-submit the complete plan / memo / report for review.

.2 The Contractor shall allow time in the schedule for the reviews, and subsequent edits / re-submission.

.3 Work affected by the submittal (as determined by the Departmental Representative) shall not proceed until acceptance of the EPP by the Departmental Representative.

.4 The review of the EPP and Environmental Site Inspection Memos, by the Departmental Representative shall not relieve the Contractor of responsibility for errors or omissions in the accepted submittals or of responsibility for meeting all requirements of the Contract Documents.

.5 Should deficiencies in the Contractor's EPP be noted following acceptance of the submittal by the Departmental Representative but during the project work, the Departmental Representative reserves the right to provide additional comments to the Contractor and require re-submission of the EPP to ensure the correction of any deficiencies.

1.6 Environmental Protection Plan (EPP)

.1 The Contractor is required to prepare an EPP. The EPP shall include and address all relevant environmental impacts/issues at the site as indicated by the EPP checklist (Appendix F), environmental permitting approvals, and as identified in this Section of the specifications. The EPP will require the Contractor to carefully think through the entire project, including identifying what activities and works will be occurring, both generally and at specific sites, and by what methods. The EPP shall be completed by a P.Biol. or RPBio., or other qualified professional, and shall, at a minimum include the following:

.1 The specifics of a detailed environmental monitoring program (to be completed by the Contractor). This includes details and rationale concerning sampling locations, timing, duration, and methods, and identification of the person(s) who will be carrying out the monitoring program. Include resumes of proposed environmental monitors and personnel responsible for the preparation of the EPP. See Item 3.1 – Environmental Monitoring of this specification for further details of the required environmental monitoring.

.2 The specifics of an archaeological Chance Find Management Plan (to be completed by the Contractor). This includes details of the protocols and procedures and identification of the person(s) who will be responsible for the Chance Find Management Plan. Include a resume(s) of proposed archaeological personnel.

.3 The process and protocol for ensuring that supervisors and individual staff employed by the Contractor are very clear on which environmental standards need to be achieved, how they will be achieved, and establishing how the Contractor will ensure that this is successfully occurring.

.4 Erosion, drainage, and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with provincial regulatory requirements, and all other applicable regulations including the requirements of these specifications. The Contractor may utilize marked-up contract drawings within the EPP to show the locations of the proposed activities.

.5 Drawings showing the locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of any excess or spoil materials including methods to control runoff and to contain materials on site (including concrete from entering waterway). The Contractor may utilize marked-up contract drawings within the EPP to show the locations of the proposed activities.

.6 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.

.7 Spill Control Plan including procedures, instructions, and reports to be used in the event of unforeseen spill of regulated substance.

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

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

.10 Outline the avoidance and mitigate measures which the Contractor will undertake and implement to ensure compliance with the environmental regulations applicable to the project and these Contract Specifications.

.11 The procedures for stopping the work and implementing changes to the construction methods should the Contractor not be achieving the environmental requirements as outlined in these specifications.

.12 The procedures for stopping work should the Contractor encounter archaeological anomalies or human remains.

1.7 Environmental Site Inspection Memo

.1 The Contractor shall submit an Environmental Site Inspection Memo within three (3) weekdays of each site visit or week of full-time site inspections by the P.Bio. or RPBio. or other Qualified Professional. The Environmental Site Inspection Memo shall include the following:

.1 Date and times when Environmental Monitor was onsite.

.2 General site conditions and construction activities ongoing at the time of the inspection.

.3 Findings, non-conformances with EPP, and items requiring correction by the Contractor from the environmental monitor’s review and inspection of environmentally sensitive activities including but not limited to:

.1 Fuel and Oil Storage and Fueling Practices.

.2 Care and Maintenance of Construction Equipment.

.3 Spill Response Preparedness.

.4 Construction Activities and Construction Site Management.

.5 Erosion and Sediment Issues.

.6 Wildlife Observations / Mitigation and Sensitive Habitat.

.7 In-Stream Work.

.8 Other / Comments.

.4 Photos of any concerns, non-conformances with EPP, or items requiring attention.

1.8 Notification

.1 The Departmental Representative will notify the Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, etc.

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

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

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

.5 Submit Environmental Protection Plan (EPP) for review and approval by Departmental Representative before delivering materials to site or commencing construction activities.

.6 EPP shall include comprehensive overview of known or potential environmental issues to be addressed on site during construction.

.7 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.8 Include in Environmental Protection Plan (EPP):

.1 Names of persons responsible for ensuring adherence to EPP.

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

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Submit a site-specific Erosion and Sediment Control Plan (ESCP) identifying the type and location of erosion and sediment control measures to be provided on site. Include monitoring and reporting requirements to ensure that ESCP control measures are in compliance with erosion and sediment control plan, Federal and Provincial regulations, and Municipal by-laws.

.6 Submit drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.7 Submit a site-specific Traffic Control Plan (TCP) including measures to reduce erosion of existing roadbeds by construction traffic, especially during wet weather.

.1 TCP to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.

.8 Submit a Site Work Plan (SWP) showing work areas for proposed activities in each portion of area and identifying areas of limited use or non-use.

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

.9 Submit a Spill Control Plan (SCP) including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.10 Submit a Solid Waste Disposal Plan (SWDP) for non-hazardous solid wastes identifying methods and locations for solid waste disposal including clearing debris.

.11 Submit an Air Pollution Control Plan (APCP) detailing provisions to ensure that dust, debris, materials, and trash, are contained within the project site.

.12 Submit a Wastewater Management Plan (WMP) identifying methods and procedures for management and discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

1.9 Fires

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

1.10 Drainage

.1 Ensure that the ESCP measures are provided and that its recommendations are followed on site at all times during construction.

.2 Provide temporary drainage and pumping as required to keep excavations on site free of standing water.

.1 Obtain Departmental Representative approval before pumping standing water, which is free of suspended materials, into waterways, sewer or drainage systems.

.2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with the site-specific SPPP in compliance with the requirements of authorities having jurisdiction.

1.11 Site Clearing and Plant Protection

.1 Protect trees and plants on site and adjacent properties in accordance with the Canadian Landscape Standard -First Edition, Section 03 - Site Preparation and Protection of Existing Site Elements.

.2 Minimize stripping of topsoil and vegetation.

1.12 Work Adjacent to Waterways

.1 Construction equipment to be operated on land only.

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

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

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

1.13 Historical/Archaeological Control

.1 Refer to the site-specific Chance Find Management Plan for procedures in identifying and protecting historical and archaeological resources previously known to be on project site or discovered during construction.

.1 Plan to include methods to ensure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

Part 2 Products

2.1 Not Used

.1 Not Used.

Part 3 Execution

3.1 Environmental Monitoring

.1 At a minimum the environmental monitoring shall be completed by P.Biol, RPBio, or Qualified Environmental Professional (QEP). If a QEP completes the monitoring, the QEP must work under the direction of the P.Biol or RPBio who completes the Environmental Protection Plan.

.2 The monitoring program must be anticipatory and responsive to construction practices or environmental changes, reflecting the site-specific conditions, level of sensitivity of the receiving environment, potential adverse effects, and level of environmental risk. Submitted documents regarding the proposed monitoring program should clearly identify how monitoring will adhere to this approach.

.3 At a minimum, the Environmental Monitor shall be onsite and visit all areas of active construction as follows:

.1 Be onsite full-time during all stages of the project when work is being completed on the highway embankment slopes and work within 30 m of the watercourse.

3.2 Archaeological Monitoring

.1 A Chance Find Management Plan shall be completed by an Archaeologist registered to practice in the province of British Columbia.

3.3 Site Access and Parking

.1 The Contractor shall review both short and long-term access requirements with the Departmental Representative, both at the start-up and on an on-going basis. In consultation with the Departmental Representative, the Contractor shall formulate an agreement for worker transportation to and from the work site and where workers shall park their private vehicles. Generally, personal vehicles shall be parked at least ten (10) meters from any water course.

.2 The Contractor shall ensure that the environment beyond the work limits is not negatively impacted or damaged by workers' vehicles or construction machinery and shall instruct workers so that the "footprint" of the project is kept within defined boundaries.

3.4 Protection of Work Limits

.1 The Contractor shall include in the EPP details on the work limits, how these shall be marked and what procedures will be employed to ensure trespass outside these limits does not occur, to the satisfaction of the Departmental Representative.

3.5 Erosion Control

.1 Erosion control measures that prevent sediment from entering any waterway, water body or wetland in the vicinity of the construction site are a critical element of the project and shall be implemented by the Contractor.

.2 On-site sediment control measures shall be constructed and functional prior to initiating activities associated with the construction activities. The Contractor shall prepare an Erosion Control Plan, to be part of the EPP, to the satisfaction of the Departmental Representative.

.3 The regular monitoring and maintenance of all erosion control measures shall be the responsibility of the Contractor. If the design of the control measures is not functioning effectively they are to be repaired. The Departmental Representative will monitor the Contractor's erosion control performance.

.4 Erosion control measures must be in compliance with both Federal and Provincial legislation where required. Contractors should be referencing the provincial MoE Standards and Best Practices for Instream Works (2004).

3.6 Pollution Control

.1 The Contractor shall prevent any deleterious and objectionable materials from entering streams, rivers, wetlands, water bodies or watercourses that would result in damage to aquatic and riparian habitat. Hazardous or toxic products shall be stored no closer than 100 m to any surface water.

.2 A Spill Response Plan will be prepared as part of the EPP and shall detail the containment and storage, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products, to the satisfaction of the Departmental Representative, and in accordance with all applicable Federal and Provincial legislation. The EPP shall include a list of products and materials to be used or brought to the construction site that are considered or defined as hazardous or toxic to the environment. Such products include, but are not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement and sand blasting agents.

.3 The containment, storage, security, handling, use, unique spill response requirements and disposal of empty containers, surplus product or waste generated in the use of any hazardous or toxic products shall be in accordance with all applicable federal and provincial legislation. Hazardous products shall be stored no closer than 100 m from any surface water.

.4 An impervious berm shall be constructed around fuel tanks and any other potential spill area. The berms shall be capable of holding 110% of tank storage volumes and shall be to the satisfaction of the Departmental Representative. Measures such as collection / drip trays and berms lined with occlusive material such as plastic and a layer of sand, and double lined fuel tanks can prevent spills into the environment.

.5 The Contractor shall prevent blowing dust and debris by covering and/or providing dust control for temporary roads and on-site work such as rock drilling and blasting by methods that are approved by the Departmental Representative.

.6 The Contractor shall provide spill kits, to the satisfaction of the Departmental Representative, at refueling, lubrication and repair locations that will be capable of dealing with 110% of the largest potential spill and shall be maintained in good working order on the construction site. The Contractor and site staff shall be informed of the location of the spill response kit(s) and be trained in its use.

.7 Timely and effective actions shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. The Departmental Representative shall be notified immediately of any spill as well as the provincial authorities. Basic instructions and phone numbers shall be part of the Contractor's EPP.

.8 In the event of a major spill, the Contractor shall prioritize the cleanup and all other work shall be stopped, where appropriate, and personnel devoted to spill containment and cleanup.

.9 The costs involved in a major spill incident (control, clean up, disposal of contaminants, and site remediation to pre-spill conditions), shall be the responsibility of the Contractor. The site will be inspected to ensure completion to the pre-spill condition to the satisfaction of the Departmental Representative.

3.7 Equipment Maintenance, Fueling, and Operation

.1 The Contractor shall ensure that all soil, seeds and any debris attached to construction equipment to be used on the project site shall be removed (e.g. power washing) outside before delivery to the work site.

.2 Equipment fueling sites will be identified by the Contractor to the satisfaction of the Departmental Representative. Except for chain saws, any fueling closer than 100 m to any surface water (streams, wetlands, water bodies or watercourses) shall require discussion with the Departmental Representative. Regardless of fueling location, personnel shall maintain a presence during refueling with immediate attention to the fueling operations.

.3 Diesel and gasoline delivery vehicles, including bulk tankers shall be not be parked within 100 m from any surface water unless actively being used for refueling. Immediately following refueling bulk tankers shall be moved to a location 100 m or greater from any surface water. Gravity fed fuel systems are not allowed. Manual or electric pump delivery systems shall be used.

.4 Mobile fuel containers (e.g. slip tanks, small fuel carboys) shall remain in the service vehicle at all times. Protection and containment of approved fuel storage sites is addressed in Item 3.6 - Pollution Control, Subsection .4 of this specification.

.5 Equipment use on the project shall be fueled with E10, and low Sulphur diesel fuels where available, and shall conform to local emission requirements. The Contractor is to ensure that unnecessary idling of the vehicles is avoided.

.6 Oil changes, lubricant changes, greasing and machinery repairs shall be performed at locations satisfactory to the Departmental Representative. Waste lubrication product (e.g. oil filters, used containers, used oil, etc.) shall be secured in spill-proof containers and properly recycled or disposed of at an approved facility. No waste petroleum, lubricant products or related materials are to be discarded, buried or disposed of in borrow pits, turnouts, picnic areas, viewpoints, etc. or anywhere within the work area.

.7 The Contractor shall ensure that all equipment is inspected daily for fluid/fuel leaks and maintained in good working condition. Maintenance certificates or maintenance logs for all equipment shall be available on-site during work.

.8 Fuel containers and lubricant products shall be stored only in secure locations to the satisfaction of the Departmental Representative. Fuel tanks or other potential deleterious substance containers shall be secured to ensure they are tamperproof and cannot be drained by vandals when left overnight. Alternatively, the Contractor may hire a security person employed to prevent vandalism.

.9 Equipment shall use environmentally sensitive/biodegradable hydraulic fluid in case of accidental loss.

3.8 Operation of Equipment

.1 Equipment movements shall be restricted to the “footprint” of the construction area. The work limits shall be identified by stake and ribbon or other methods to the satisfaction of the Departmental Representative. No machinery will enter, work in or cross over streams, rivers, wetlands, waterbodies or watercourse, nor damage aquatic and riparian habitat or trees and plant communities outside the identified work limits if working in the water. Where construction activities require working close to surface water, the Contractor is required to stage the work and undertake other measures as deemed necessary by the Contractor to ensure fugitive materials (e.g. rocks, soil, branches) and especially deleterious substances (e.g. chemicals) do not enter any surface water areas.

.2 The Contractor shall instruct workers to prevent pushing, placement, raveling, storage or stockpiling of any materials (e.g. slash, rock, fill or top soils) in the trees bordering the right-of-way or into surface water.

.3 When, in the opinion of the Departmental Representative, negligence on the part of the Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond the designated work area, the Contractor shall be responsible, at his or her expense, for complete restoration including the replacement of trees, shrubs, topsoil, grass, etc. to the satisfaction of the Departmental Representative.

.4 Restrict vehicle movements to the work limits.

.5 Workers vehicles are to remain within the construction footprint.

3.9 Managing Invasive Plant Vegetation

.1 Keep equipment clean and avoid parking, turning around or staging equipment in known invasive species infested areas, or mow prior to use.

.2 Wash equipment prior to mobilization to site.

.3 Minimize unnecessary disturbance of roadside aggregates or soil and retain desirable roadside vegetation whenever possible.

.4 Where possible, begin mowing or brushing in “invasive plant free” areas and end in infested areas.

.5 Where possible, use only clean fill material from an “invasive plant free” source.

.6 Whenever possible, re-seed with grass mixtures that are free of weeds, locally adapted, non-invasive, and quick to establish. Spread seed in the early spring or late fall to ensure successful establishment.

3.10 Fires and Fire Prevention and Controls

.1 Fires or burning of waste materials is not permitted

.2 A fire extinguisher shall be carried and available for use on each of the Contractor’s construction equipment in the event of fire.

.3 Construction equipment shall be operated in a manner and with all original manufacturers’ safety devices to prevent ignition of flammable materials in the area.

.4 Care shall be taken while smoking on the construction site to ensure that the accidental ignition of any flammable material is prevented.

.5 In case of fire, the Contractor or worker shall take immediate action to extinguish the fire provided it is safe to do so. The Departmental Representative shall be notified of any fire immediately as well as the applicable Provincial Authorities. Basic instruction and phone numbers will be provided on site by the Contractor and will be discussed in the project pre-construction meeting.

.6 Where fires or burning is permitted, prevent staining or smoke damage to structures, materials or vegetation which is to be preserved. Restore, clean and return to new condition stained or damaged Work.

.7 Provide supervision, attendance and fire protection measures as directed by the Departmental Representative or other authorities.

3.11 Wildlife

.1 Avoid or terminate activities on site that attract or disturb wildlife and vacate the area and stay away from bears, cougars, wolves, elk, moose, or bison, or other animals that display aggressive behavior or persistent intrusion. Extra care to control materials that might attract wildlife (e.g. lunches and food scraps) must be exercised at all times.

.2 Notify the Departmental Representative immediately about dens, litters, nests, carcasses (road kills), bear activity or encounters on or around the site or crew accommodations. Other wildlife related encounters are to be reported within 24 hours.

3.12 Relics and Antiquities

.1 Artifacts, relics, antiquities, and items of historical interest such as cornerstones, commemorative plaques, inscribed tablets and any objects found on the work site that may be considered artifacts as defined by GC6.3 shall be reported to the Departmental Representative immediately. The Contractor and workers shall wait for instruction before proceeding with their work as per GC6.3.

.2 All historical or archaeological objects found in the project site are protected under Federal and Provincial Acts and regulations. The Contractor and workers shall protect any articles found and request direction from the Departmental Representative as per GC6.3.

.3 Human remains must be reported immediately to the local RCMP and Departmental Representative per GC6.3.

3.13 Waste Material Storage and Removal

.1 The Contractor and workers shall dispose of hazardous wastes in conformance with the applicable Federal and Provincial regulations and should be part of the EPP. All waste materials shall be disposed of at a disposal facility acceptable to the Departmental Representative. No waste materials shall be buried onsite.

.2 All wastes originating from construction, trade, hazardous and domestic sources, shall not be mixed, but will be kept separate.

.3 Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried, or discarded at the construction site. These wastes shall be contained and removed in a timely and approved manner by the Contractor and workers and disposed of at an appropriate waste landfill site located outside the work area.

.4 A concerted effort shall be made by the Contractor and workers to reduce, reuse and recycle materials where possible.

.5 Sanitary facilities, such as portable container toilets, shall be provided by the Contractor and maintained in a clean condition.

3.14 Wastewater Discharge Criteria

.1 Wash water, meltwater collection, rinse water resulting from the cleaning of fuel tanks and pipelines, contaminated groundwater, and/or any other liquid effluent stream will be released onto the ground at a location that is a minimum of 30 m from natural drainage courses and 100 m from fish bearing waters and will conform to the discharge requirements set out in Provincial regulations.

.2 Contractor must obtain approval from the Provincial Water Act Officer prior to discharging any treated wastewater.

3.15 Drainage

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water. Stage the work and complete excavation work and placement of all erosion protection materials in the dry. Drainage plans shall be part of the EPP.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements such as the provincial Water Act.

.4 Provide an erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.5 As part of the EPP, submit details of proposed erosion, sediment and drainage control to Departmental Representative for review and approval prior to commencing work in fisheries sensitive areas or in areas that may affect fisheries sensitive areas and specifically address the protection of water bodies, water courses, and the following:

.1 Details of grading Work to prevent surface drainage into or out of Work areas.

.2 Details of erosion control works and materials to be used, including the deployment of coir logs, floating silt curtains and containment booms during construction and excavation activities.

.3 Work schedule including the sequence and duration of all related Work activities.

.4 The treatment of site runoff to prevent siltation of watercourses.

.5 Dewatering procedures for excavated materials including silt removal procedures prior to discharge.

.6 Stabilizing procedures during excavation.

.7 Maintenance of filters and sedimentation traps.

.6 Any dewatering activities will be released onto the ground at a location that is a minimum 30 m from natural drainage courses and 100 m from fish bearing waters.

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

3.16 Site Clearing and Plant Protection

.1 Protect trees and plants on site and adjacent properties where indicated.

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

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil.

.5 Restrict tree removal to areas indicated or designated by Departmental Representative and shown on Contract Drawings.

3.17 Environmental Protection Supplies

.1 Comply with Federal and Provincial fisheries and environmental protection legislation, including minimizing the impact of sedimentation, siltation or otherwise causing a degradation in water quality.

.2 Provide a minimum of 30 m, and as required, of biodegradable coir logs, sized accordingly for use (minimum diameter of 0.3 m), and the necessary stakes (minimum 1 stake per 1 m of coir log) and material required by the manufacture's installation specification. Prior to purchase of coir logs, submit manufacturer's product data and installation instructions to the Departmental Representative for review and acceptance. Store and handle in strict compliance with the manufacturer's instructions and recommendations. This will be used as necessary to prevent sediment transport into water bodies.

.3 Provide a minimum of 50 lineal metres, and as required of 200 mm diameter hydrophobic, sorbent booms. This will be used as necessary to prevent the migration of hydrocarbons.

.4 Supply, transport, install and maintain erosion, sediment and drainage controls necessary to complete the Work in accordance with the requirements of Departmental Representative.

.5 At the completion of construction, leave coir logs in place if requested by the Departmental Representative.

.6 Unused Erosion, Sediment and Drainage Control supplies will remain the property of Departmental Representative until the completion of the Contract.

.7 Provide inventory of environmental protection supplies prior to mobilization.

END OF SECTION

Part 1 General

1.1 Measurement and Payment

.1 Payment for Quality Management will not be made and shall be considered incidental to the applicable payment item of work.

1.2 References

.1 British Columbia MoTI – 2016 Standard Specifications for Highway Construction.

.2 American Society for Testing and Materials (ASTM), latest edition.

.1 ASTM A252, Standard Specifications for Welded and Seamless Steel Pipe Products.

.2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.5 ASTM D5519, Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials.

.6 ASTM D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

.7 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 [600 kN-m/m3]).

.3 MMCD Platinum Edition

.4 Canadian Standards Association (CSA International), latest edition:

.1 CSA W59, Welded Steel Construction (metal arc welding).

.2 CSA W48, Filler metals and allied materials for metal arc welding.

1.3 Definitions

.1 Quality Control (QC): The process of independently checking specific product or services to determine if they comply with the contract documents and relevant quality standards and identifying ways to eliminate causes of unsatisfactory product or performance.

.2 Quality Assurance (QA): The process of ensuring that the Contractor's internal Quality Management Plan (QMP) (QC, non-conformances, etc.) are being followed. The results of the QA are provided as feedback to the QC team. Where required the Contractor shall implement changes to the project based on feedback received from the QA process.

.3 Quality Management Plan (QMP): The complete details of the Contractor's plans and processes to ensure quality on the project.

.4 Deficiency/Non-conformance: Work or product failing to meet the conditions or requirements of the contract (general conditions, specifications, drawings, or other sections forming the project contract).

1.4 Responsibilities

.1 The quality management responsibilities for this project are as follows:

.1 Quality Control: The Contractor's responsibility.

.2 Quality Assurance: The Departmental Representative's responsibility.

.3 Quality Management Plan: Prepared by the Contractor.

.4 Non-Conformance Report (NCR): Prepared by the Contractor's QC in conjunction with the Contractor and if necessary prepared by the Departmental Representative.

1.5 General

.1 The Contractor shall be responsible for ensuring the product meets the contractual quality requirements and that Quality Control measuring and documenting the quality of the work is completed by qualified person or persons from the Contractor's organization or hired by the Contractor. Quality Control work includes monitoring, inspecting, testing, and documenting the means, methods, materials, workmanship, processes and products of all aspects of the work as necessary to ensure conformance with the Contract.

.2 The Contractor shall provide unrestricted access to all Quality Control operations and documentation produced by or on behalf of the Contractor and shall allow the Departmental Representative full access at any time during working hours.

.3 The Departmental Representative will review the Contractor's performance of the work and determine the acceptability of the work based on the Departmental Representative's Quality Assurance results and, where deemed appropriate by the Departmental Representative, supplemented by the Contractor's Quality Control results. If needed, the Departmental Representative may request further testing.

.4 Work failing to meet the conditions of the Contract shall be considered a non-conformance. A Non-Conformance Report (NCR) will then be issued by the Contractor's Quality Manager. Non-conforming work shall be removed /replaced from the work unless an exception to the contract documents is accepted by the Owner.

.5 The Contractor shall not be entitled to payment for work that lacks the appropriate Quality Control documentation, verified by the Quality Control Manager, as required by the Contract or is subject to an unresolved Non-Conformance Report (NCR).

.6 The Contractor shall implement a well-coordinated approach to all operations related to the work and will organize its team and operations in keeping with the goal of doing things right the first time.

1.6 Submittals

.1 Quality Management Plan.

.1 The Contractor's Quality Management Plan shall be submitted to the Departmental Representative as a single PDF document (multiple files will not be accepted) for review and acceptance in accordance with the procedures outlined in Section 01 33 00 – Submittal Procedures. The Departmental Representative will review the plan (first submission and if required all subsequent re-submissions) within 14 days of submission. Upon review of the plan the Departmental Representative will do one of the following:

.1 Accept the plan.

.2 Accept portions of the plan and provide comments outlining required changes or additional information in other sections. Following completion of edits by the Contractor, re-submit the complete plan for review.

.3 Reject the plan and provide comments outlining required changes or additional information needed before the plan will be reviewed in detail. Following completion of edits by the Contractor, re-submit the complete plan for review.

.2 The Contractor shall allow time in the schedule for the reviews, and subsequent edits / re-submission.

.3 No work shall be undertaken on any element of Project Work (including payments, incidental work, or submittals for review) for which the applicable portions of the Quality Management Plan have not been accepted by the Departmental Representative.

.4 The review of the Quality Management Plan by the Departmental Representative shall not relieve the Contractor of responsibility for errors or omissions in the accepted Quality Management Plan or of responsibility for meeting all requirements of the Contract Documents.

.5 Should deficiencies in the Contractor's Quality Management Plan be noted following acceptance of the submittal by the Departmental Representative but during the project work, the Departmental Representative reserves the right to provide additional comments to the Contractor and require re-submission of the Quality Management Plan to ensure the correction of any deficiencies.

1.7 Quality Management Plan

.1 The Contractor shall prepare a Quality Management Plan. The purpose of the plan is to ensure the performance of the work in accordance with Contract requirements.

.2 The Quality Management Plan is required to cover the work in its entirety, including without limitation all materials the Contractor and Subcontractors are supplying, monitoring and testing of the construction, documentation, and all items and phases of construction on the Project. At a minimum this shall include:

.1 Testing and Survey (including minimum frequencies) to be completed by the Contractor (e.g. compaction, gradation, and tolerances of the work completed).

.2 Procedures for verifying and documenting conformance of the work to the Contract requirements including but not limited to review of the work and completion of check sheets and daily reports.

.3 The Quality Management Plan shall include the following information:

.1 The name and qualifications of the Quality Control Staff / Manager and their assigned roles and work scheduling in performing Quality Control duties.

.2 The name of Quality Control testing and survey agencies (if any) and details of their qualifications and relevant experience to provide the specific services required for the Project.

.3 A list of testing and survey equipment to be used for the work.

.4 The Contractor shall ensure that all workers are familiar with the Quality Management Plan, its goals, and their role under it, as well as the Contract Specifications associated with the work they are to undertake.

1.8 Qualifications

.1 Quality Control Personnel

.1 The Contractor shall appoint a qualified and experienced Quality Control Manager and if necessary other staff who are responsible for quality matters, and who will report regularly to the Contractor's management at a level which shall ensure that Quality Management requirements are not subordinated to manufacturing, construction or delivery. The Quality Control Manager shall be a qualified Professional Engineer, Certified Engineering Technician, or Applied Science Technologist, or other person with knowledge, skills and abilities acceptable to the Departmental Representative.

.2 The Quality Control Personnel (including Quality Control Manager) shall remain on site at all times the Contractor is performing work which must be tested or inspected in-process and must be readily accessible and able to return when off-site.

.3 The Quality Control Manager shall remain onsite at all times the Contractor is performing work which must be tested or inspected, and must be readily accessible and able to return onsite. Unless pre-approved by the Departmental Representative, the Quality Control Manager shall only be replaced by the designate replacement Quality Control Manager during scheduled breaks as outlined in the Quality Control Plan.

.4 At a minimum the Quality Control Manger shall:

.1 Be responsible to measure conformance of the work with the contract documents and ensure that the quality of work is not being compromised by production measures.

.2 Be empowered by the Contractor to resolve Quality Control matters.

.3 Direct and monitor Quality Control work completed by Quality Control testing agencies and Quality Control staff.

.4 Review, sign and be responsible for all reports (material and testing results).

.5 Immediately notify Contractor management so work can be stopped and corrective action taken when material, product, processes or submittals are deficient or non-compliant with the contract requirements.

.6 Complete internal Non-Conformance Reports (NCRs)

.7 Respond to NCRs issued by the Departmental Representative.

.8 Attend pre-construction and construction progress meetings.

.5 PSPC reserves the right to reject one or more of the Contractor's Quality Control Personnel and require the Contractor to find alternative Quality Control Personnel prior to or during the work should the Quality Control Personnel not have the necessary qualifications as listed in this specification or not provide quality control services as required by this specification during the work. Should Quality Control Personnel be rejected, any work which cannot undergo complete quality control as outlined in these specifications shall stop while the Contractor finds replacement Quality Control Personnel.

1.9 Check Sheets

.1 Check sheets to verify and document conformance of the work to the quality requirements of the Contract are fundamental to the Quality Control process. The check sheets prepared as part of the Quality Management Plan shall include all components of the project work and all checks required to ensure the components of the work are completed in conformance with the requirements of the Contract Documents. The check sheets shall be prepared assuming the Departmental Representative will only be providing spot checks of the work throughout the project and thus Quality Control shall check all elements of the work for conformance with the requirements of the Contract Documents. Where the Contract Documents provide a requirement but then also indicate that the Departmental Representative may also accept an alternative (ex. "as approved by the Departmental Representative"), the check sheets shall assume that the requirement listed governs and the Quality Control process shall check these requirements unless directed otherwise during the project by the Departmental Representative.

.2 The frequency of check sheets completed by the Quality Control Staff to verify and document conformance of the work to the quality requirements of the contract shall be established by the Quality Control Manager to ensure the quality of the work is thoroughly documented. At a minimum, the frequency of check sheets shall achieve the following:

.1 Daily (relative to the work being performed).

.3 All check sheets shall be reviewed and signed by the Quality Control Manager prior to submission to the Departmental Representative.

1.10 QC Testing /Survey Inspection

.1 QC testing and survey inspection required to assure that the work strictly complies with the Contract requirements shall be completed by the Contractor as follows:

.1 Be completed using a fully equipped laboratory (a field laboratory may be used at the Contractor's discretion) during times of construction activity and gravel manufacturing.

.2 Include all testing and survey inspection specified in the Contract Documents.

.3 Any other testing or survey inspection required as a condition for deviation from the specified Contract procedures.

.2 The frequency of testing / survey inspections shall be outlined in the Quality Management Plan. At a minimum the Contractor shall achieve the most stringent Quality Control testing / survey inspection frequencies as follows:

.1 The specific frequencies defined elsewhere in these specifications.

.2 The minimum QC testing / survey inspection frequencies as defined in Table 01 45 00 – 01.

Table 01 45 00 -01: Minimum QC Testing Frequencies

Activity	Test/Inspection	Frequency
Placement/Site Tolerance – 75 mm Pit Run	Survey	Final lift, one (1) survey point every 2 m^2
Placement/Site Tolerance – 25 mm IGB	Survey	Final lift, one (1) survey point every $2m^2$.
Compaction – 75 mm Pit Run	In-Place Density	Count number of passes with compaction equipment each lift. Note: Based on Pit run gradation, testing using a portable nuclear gauge may not be feasible and performance specification may be required.
Compaction – 25 mm IGB	In Place Density ASTM D 6938	One (2) test every 25 m^2
Gradation – 75 mm Pit Run	ASTM C 136	Two (2) per source at discretion of Departmental Representative.
Moisture Content – 75 mm Pit Run and 25 mm IGB	ASTM D2216	Two (2) per source or as required by the Departmental Representative should a change in material properties be detected.

Gradation – 25 mm IGB	ASTM C 136	One (1) per source at discretion of Departmental Representative.
Grade/Site Tolerance/Ditching	Survey	Final grade prior to rip rap placement – minimum 5 points every 5 m Station and at each change in ditch dimension.
Screening/Sorting/Manufacture – Rip Rap	ASTM D 5519	One (1) test per every one (1) day of production.
Placement/Site Tolerance/Rip Rap	Survey	Minimum five (5) survey points every 5 m Station or design change in grade or Class of Rip Rap material.

.3 As defined in the BC MoTI 2016 Standard Specifications for Highway Construction (Volumes 1 and 2, and applicable Amendments available at time of tender closing). Should one of these specifications be silent on a particular testing frequency the testing frequencies shall be as defined in the Alberta Transportation Standard Specification for Highway Construction (latest edition and applicable Amendments available at time of tender closing). Wherever these standard specifications refer to standards (e.g. CSA, ASTM, and others) the minimum testing frequencies in these standards shall be utilized.

.3 Quality Control testing agencies, their inspectors, and their representatives are not authorized to revoke, alter, relax or release any of the requirements of the Contract documents or approve or accept any part of the work.

.4 The Contractor shall complete testing in the following manner:

.1 Provide testing facilities and personnel for the tests and inform the Departmental Representative in advance to enable the Departmental Representative to witness the tests if so desired.

.2 Notify the Departmental Representative when sampling will be conducted.

.3 Submit the test results to the Departmental Representative in accordance with Item 1.6 – Submittals of this specification.

.4 Identify test reports with the name and address of the organization performing all tests, and the date of the tests.

.5 Immediately after completion of tests, provide all test results on Contractor-supplied forms acceptable to the Departmental Representative or on forms used by the BC Ministry of Transportation and Infrastructure.

.6 Initiate other Quality Control tests or procedures as necessary for ensuring production of a quality product and include them in the Quality Control Plan. Tests or procedures may also be introduced after the start of work as necessary as amendments to the Quality Control Plan.

1.11 Non-Conformance Reports (NCR)

.1 The Contractor shall, and the Departmental Representative may review the work to determine conformance with the Contract requirements.

.2 Should the Contractor's Quality Control reporting indicate that the work, product, or methodology is not in conformance with the contract requirements (including the Contractor's submitted plans (Project Specific Health and Safety Plan, Traffic Management Plan, Environmental Protection Plan, Quality Control Plan, etc.), the Quality Control Manager shall:

.1 Inform the Contractor of the deficiency. The Contractor shall then take appropriate action to correct the deficiency.

.2 Ensure that the action taken by the Contractor corrected the deficiency and any substandard product was eliminated from the work. If the deficiency was not immediately corrected and substandard product remains or becomes part of the work, an internal NCR shall be prepared by the Quality Control Manager and issued to the Contractor within 24 hrs. of the occurrence, with a copy to the Departmental Representative in accordance with Item 1.6 – Submittals of this specification. Included as part of the NCR will be a required response time.

The Contractor shall then respond to the NCR (within the specified response time) by notifying the Quality Control Manager and the Departmental Representative of the proposed resolutions and corrective actions. The Contractor and/or the Quality Control Manager may consult with the Departmental Representative on the resolutions but is not required to do so.

Payment for the work for which the NCR has been issued may be withheld until the NCR issue is resolved.

.3 Should the Contractor's Quality Control reporting indicate that an aspect of the Contractor's work is continually deficient (starting with the second similar occurrence) and not in conformance with the Contract requirements (including the Contractor's submitted plans (Project Specific Health and Safety Plan, Traffic Management Plan, Environmental Protection Plan, Quality Control Plan, etc.)), the Quality Control Manager shall issue an internal procedural NCR to the Contractor within 24 hrs. of the occurrence, with a copy to the Departmental Representative in accordance with Item 1.6 – Submittals of this specification. Included as part of the NCR will be a required response time.

The Contractor shall then respond to the NCR (within the specified response time) by notifying the Quality Control Manager and the Departmental Representative of the proposed resolutions and corrective actions. The Contractor and/or the Quality Control Manager may consult with the Departmental Representative on the resolutions but is not required to do so.

Payment for the work for which the NCR has been issued may be withheld until the NCR issue is resolved.

.4 Should the Departmental Representative Quality Assurance reporting indicate that the work is not in conformance, the Departmental Representative may issue to the Contractor an NCR with a required response time or direct the Quality Control Manager to prepare an NCR.

The Contractor shall then respond to that NCR, within the specified response time, with proposed resolutions and corrective actions. The Departmental Representative will accept or reject the proposed resolution and corrective action proposal. If the proposed resolution is rejected by the Departmental Representative, the Contractor shall resubmit with an alternative response until a solution acceptable to the Departmental Representative is found.

Quality Assurance testing and inspection may be performed by the Departmental Representative to determine if the corrective action has provided an acceptable product. Acceptance and rejection will continue until the Departmental Representative determines that a quality product has been achieved.

Payment for the work for which the NCR has been issued may be withheld until the NCR issue is resolved.

.5 Should the Departmental Representative find that any component of the Contractor's submitted plans (Project Specific Health and Safety Plan, Traffic Management Plan, Environmental Protection Plan, Quality Control Plan, etc.) are not being adhered to by the Contractor or any member of the Contractor's team, the Departmental Representative may issue an NCR to the Contractor.

Payment for the work for which the NCR has been used may be withheld until the NCR issue is resolved.

.6 If in the opinion of the Departmental Representative it is not viable to correct non-conforming work or work not performed in accordance with Contract Documents, the Departmental Representative may deduct from the Contract Price the difference in value between work performed and that called for by Contract Documents, the amount of which shall be determined by the Departmental Representative.

1.12 Departmental Representative Inspection and Audits

.1 The Departmental Representative may perform quality assurance audits as desired. Such audits will not relax the responsibility of the Contractor to perform work in accordance with the Contract Documents.

.2 Allow the Departmental Representative access to work. If part of the work is in preparation at locations other than the place of work, allow access to such work whenever it is in progress.

.3 If Contractor covers, or permits to be covered, work that has been designated for Quality Assurance testing, inspections, or approvals before such is made, uncover such work, have inspections or tests satisfactorily completed, and make good such work.

.4 Independent Inspection / Testing Agencies may be engaged by the Departmental Representative for the purpose of Quality Assurance inspection and/or testing portions of the work. Costs of such services will be borne by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Payment for the cost of Traffic Management and Access Development will be made on the basis of the Price per Unit Bid for Traffic Management in the Bid and Acceptance Form. The Price per Unit Bid shall include the completion of the Traffic Management Plan, construction signage, traffic flaggers, pilot vehicles (if required), temporary concrete barriers and privacy fence (if required), access development (including access points, roads, pads, etc.), restoration of all access development areas, detours (if required), and all other items necessary for the successful completion of the task.

.2 Measurement for Payment for completion of Traffic Management will be made based on the quantity of the work completed and accepted by the Departmental Representative.

1.2 References

.1 British Columbia Ministry of Transportation and Infrastructure.

- .1 Traffic Management Manual for Work on Roadways – 2020 Office Edition.
- .2 B.C. Supplement to TAC Geometric Design Guide for Canadian Roads (latest edition).

.2 Transportation Association Canada.

- .1 Geometric Design Guide for Canadian Roads (latest edition).

1.3 General

.1 The traffic management standards and requirements included in these specifications shall be considered the minimum requirements which shall be achieved. The Contractor in conjunction with the Professional Engineer whom seals the Traffic Management Plan shall be responsible for ensuring the traffic management used on the project achieves these Traffic Management specifications, is appropriate for the project requirements, and achieves the requirements of WorkSafeBC OHS Regulation Part 18: Traffic Control.

1.4 Definitions

.1 Delay: The total amount of time vehicles are stopped by all flaggers or automated traffic control devices due to the contractor’s operations while driving through the limits of the work. The delay time includes the time for a vehicle to come to a stop position behind a queue of vehicles and then start moving again following a long queue of vehicles. The maximum allowable delay on this project is defined below in Section 3.2.1.7 – Traffic Management (10 minutes).

.2 Limits of Work: The limits of work for this project are defined as Km 155+000 and Km 156+000.

.3 Drop-off: An abrupt change in elevation created by construction activity such as milling, paving, or excavation that is steeper than 3H:1V.

.4 Long-Duration Work: For Traffic Management purposes and applicable signage requirements, all work on the project shall be considered Long Duration as defined by the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition.

1.5 Submittals

.1 Traffic Management Plan.

.1 Submit to the Departmental Representative for review and acceptance a Traffic Management Plan. The Traffic Management Plan shall function as a standalone document, be signed / sealed by a P.Eng. and provide a complete and unambiguous plan of the traffic accommodation strategies proposed for use during the work and incorporate the following requirements:

.1 Fully integrated with the Contactor's plan and schedule.

.2 Shall provide a complete and unambiguous plan for the traffic accommodation strategies proposed for use during the work using the allowed products, strategies, layouts, and management techniques as described in Part 2 – Products and Part 3 – Execution of this specification.

.3 Shall be in accordance with Section 3: Traffic Management Plans of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition.

.4 Developed and conform to the standards for Category 3 Traffic Management Plans as defined in Section 3: Traffic Management Plans of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition. As defined by Section 3.4.2, the Category 3 Traffic Management Plan shall be signed and sealed by a Professional Engineer who is licensed in British Columbia and qualified and experienced in traffic management.

.5 Shall, at a minimum, include all headings, sub-headings, details, and presentation format as provided in the Traffic Management Plan template found in Appendix C (provided to the Contractor as a Word file upon award of contract). The Contractor shall add additional headings and content to the Traffic Management Plan as deemed necessary. PSPC has the right to reject the Traffic Management Plan if the headings from this document are not used in the Contractor's Traffic Management Plan.

.6 Shall include procedures for the review and analysis of work zone incidents and near misses per the requirements of Section 3.6 – Analysis of Work Zone Incidents and Near Misses and for the documentation of traffic control records per the requirements of Section 3.7 – Traffic Control Records as provided in the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition.

.7 Shall include traffic signage to be used on side access roads within the limits of the work.

.8 If DMS message signs are required or used by the Contractor, include in an appendix of the Traffic Management Plan a list of DMS messages which will be displayed on the DMS throughout the project. Messages used on the DMS shall be per Section 4 – Temporary Traffic Control Devices (Table 4.5 and Table 4.2) of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition plus other messages required or anticipated to be required on the project.

.9 Shall include details of the procedures, processes, and sequencing used to determine the layout of the signs in the field and the order of installation and order of removal of the signs in the field. Refer to Section 6: Traffic Control Layouts – General Instructions of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition for further details. At a minimum the text and figures included in Item 6.7.4 – Two-Lane, Two-Way Roadways shall be included within the Contractor's Traffic Management Plan for reference during the work (in main body of the plan or in Appendices of the plan with reference to applicable Appendix in main body of the plan). The Contractor shall customize the details of the steps for the project as required.

.10 Shall include a table or list of each element of work on the project and the applicable traffic accommodation strategies and layout drawing(s) which will be used during that element of work throughout all project locations. Example elements of work are to include but are not limited to unloading of equipment and materials, loading materials for offsite disposal, culvert installation, etc. The table or list of each element of work on the project shall also include the applicable traffic accommodation strategies and layout drawing(s) to be used during non-work hours.

.11 If using Traffic Control Persons (TCP) during non-daylight hours (i.e. before sunrise, after sunset), shall include details of the overhead lighting which will be used at each TCP location. Details to include the location, direction, height, brightness, and use of shields on the lights to suitably illuminate the TCP but not obstruct the visibility of drivers approaching the TCP.

.12 Shall include graphical representation of the sign supports planned for use on the project; Post Mounted Supports found in Figure 01 35 00 – 01 and or the Wind Resistant Sign Stand found in Figure 01 35 00 – 02.

.13 Shall include a copy of the "Daily Sign Check Form" as found in the appendices of the Traffic Management Plan template (Appendix C of the specifications).

.2 The Contractor's Traffic Management Plan shall be submitted to the Departmental Representative as a single PDF document (multiple files will not be accepted) for review and acceptance in accordance with the procedures outlined in Section 01 33 00 – Submittal Procedures. The Departmental Representative will review the plan (first submission and if required all subsequent re-submissions) within 14 days of submission. Upon review of the plan the Departmental Representative will do one of the following:

.1 Accept the plan.

.2 Accept portions of the plan and provide comments outlining required changes or additional information in other sections. Following completion of edits by the Contractor, the Contractor shall re-submit the complete plan for review.

.3 Reject the plan and provide comments outlining required changes or additional information needed before the plan will be reviewed in detail. Following completion of edits by the Contractor, the Contractor shall re-submit the complete plan for review.

.3 The Contractor shall allow time in the schedule for the reviews, and subsequent edits / re-submission.

.4 Work affected by the Traffic Management Plan (as determined by the Departmental Representative) shall not proceed until acceptance of the Traffic Management Plan by the Departmental Representative.

.5 The review of the Traffic Management Plan by the Departmental Representative shall not relieve the Contractor of responsibility for errors or omissions in the accepted Traffic Management Plan or of responsibility for meeting all requirements of construction and Contract Documents or for ensuring safe and appropriate traffic management.

.6 Should deficiencies in the Contractor's Traffic Management Plan be noted following acceptance of the submittal by the Departmental Representative but during the project work, the Departmental Representative reserves the right to provide additional comments to the Contractor and require re-submission of the Traffic Management Plan to ensure the correction of any deficiencies.

.2 Daily Sign Check Form.

.1 Submit to the Departmental Representative for review the "Daily Sign Check Form" as found in Appendix C: Templates for Traffic Management Plans in the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition. Submit via CentralCollab in accordance with the procedures outlined in Section 01 33 00 – Submittal Procedures.

.3 Other Submittals.

.1 Any other traffic control related documents such as incident reports, daily check sheets, daily reports, etc. shall be distributed to the Departmental Representative in electronic format via "CentralCollab" as discussed in Section 01 33 00 – Submittal Procedures of these specifications.

Part 2 Products

2.1 Temporary Traffic Control Devices

.1 Temporary Traffic Control Devices shall be in accordance with Section 4: Temporary Traffic Control Devices of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition and the following requirements:

.1 Unless preapproved by the Departmental Representative, where 45 cm, 70 cm, or 90 cm cones are called for by the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition, 100 cm tubular markers shall be used.

.2 Automated Flagger Assistance Devices (AFAD) shall not be used on the project.

.3 All sign supports shall either be a post mounted support per the requirements of Figure 01 35 00 – 01 or Wind Resistance Sign Stand per the requirements of Figure 01 35 00 – 02.

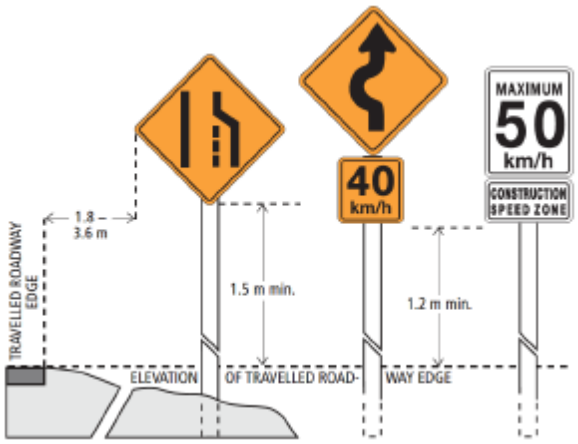


Figure 01 35 00 - 01: Post Mounted Supports

Figure 01 35 00 - 02: Wind Resistant Sign Stand

.4 Flags shall be used on the following signs:

.1 Traffic Control Person Ahead (C-001-1).

.2 Survey Crew Ahead (C-003).

.3 Crew Working Ahead (C-004).

.4 Accident Scene (C-058).

.5 Unless pre-approved by the Departmental Representative, one or more sand bags or weights shall be in used at all times to further stabilize all Wind Resistance Sign Stands.

.2 Where an option for a sign size is available, the sign size used shall be the larger dimension sign as listed in Appendix B.2: Sizes and Applications of Individual Signs of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition.

Part 3 Execution

3.1 General

.1 All traffic control on the project shall be undertaken in accordance with Section 1.1.3 – Applying the Principles in the Manual as defined in the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition.

.2 Responsibilities for traffic control shall be undertaken in accordance with Section 1.2.3 – Traffic Control Responsibilities of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition and as follows:

.1 Road Authority shall be Public Services and Procurement Canada (PSPC).

.2 Prime Contractor shall be the Contractor as defined by GC1.1.2 – Terminology.

.3 Management and site supervision shall be the responsibility of the Contractor including the:

.1 Site Supervisor/Foreman/Superintendent.

.2 Traffic Control Manager.

.3 Traffic Control Supervisors and Traffic Control Persons.

.3 PSPC will assist the Contractor with the Public Information Plan by notifying DriveBC of the work and posting notice of the project on PSPC's permanent variable message signs along the highway. All other requirements of the Public Information Plan (Section 3.2.3 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition shall be included in the Traffic Management Plan and by undertaken / implemented by the Contractor prior to commencing work.

.4 PSPC through their maintenance contractor will maintain "typical" snow plowing and sanding operations through the length of the project worksite for the duration of the project. "Typical" snow plowing and sanding will be completed to the level and standard that would be undertaken in this area should there not be an active ongoing construction project. Any additional snow clearing and sanding desired by the Contractor for safety or other reasons shall be the responsibility of the Contractor to undertake.

3.2 Traffic Management

.1 Traffic management shall be undertaken in accordance with the requirements of:

.1 The reviewed and accepted Traffic Management Plan prepared by the Contractor (see Section 1.5 - Submittals).

.2 Section 2: Fundamentals of Traffic Management and Traffic Control of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition and as follows.

.1 Section 2.5.3 – Road Authority Acceptance shall be replaced with the requirements of Section 1.5 – Submittals within this specification.

.2 References to Ministry shall be replaced with PSPC.

.3 Section 5: Traffic Control Persons of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition.

.4 Section 6: Traffic Control Layouts – General Instructions of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition and as follows:

.1 Per section 6.3 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition, traffic management shall be managed as one continuous work zone where the work is one kilometer apart or less.

.2 Drop-off's shall be treated in accordance with Section 6.5 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition whenever the drop-off is within 1.5 m of the edge of the travel lane. Additionally, the following requirements shall be achieved.

.1 Drop-offs ≥ 150 mm between 1.5 m and 3.0 m of the travel lane shall be signed with Low Shoulder (C-013) signs at least once every 1 Km for as long as the condition persists.

.2 A lane width of 3.7 m shall be used at all times.

.5 Section 7: Traffic Control Layouts – Two-Lane, Two-Way Roadways of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition. The traffic control layouts, revisions, and details as listed below shall be used in conjunction with 7.2 Typical Construction Speed Zone Signing – Two Lane, Two-Way Roadway (see Item 3.2 – Traffic Management, subsection .1.5 of this specification) within the Limits of Construction.

.1 Section 7: Legend, Table A, and Table B.

.2 7.1 General Information – Two-Lane, Two Way Roadways shall apply subject to the following:

.1 A buffer space shall be used for all traffic control layouts.

.2 The use of a buffer vehicle when workers are present shall be at the Contractor's discretion.

.3 If used by the Contractor, the portable dynamic message sign (DMS) shall be positioned in the location identified in 7.2 Typical Construction Speed Zone Signing – Two-Lane, Two-way Roadway (see Item 3.2 – Traffic Management, subsection .1.5.3 of this specification).

.3 7.2 Typical Construction Speed Zone Signing – Two-Lane, Two-way Roadway shall be used subject to the following:

.1 If used by the Contractor, a DMS shall be positioned approximately 300 m prior to the sign C-018-2A.

.2 The sign C-035 shall be replaced with signs C-035-C and C-035-CT with the Contractor's name and phone number. Signs C-035-C and C-035-CT shall be in accordance with Figure 01 35 00 – 3.

Sign Item Number	Dimensions (W x H) mm	Reflectivity ASTM Type	Approval	Comment
C-035-C	2440 x 610	1	-	
C-035-CT	2440 x 305	1	-	

Figure 01 35 00 – 03: Sign C-035-C and C-035-CT Details

.3 Any duplicate signage resulting from the use of Section 7.2 Typical Speed Zone Signing – Two-Lane, Two-Way Roadway and other Section 7 traffic control layouts shall be removed.

.4 7.5 Work on Shoulder – Short and Long Duration can be used during the following:

.1 When work activities on part or all of the shoulder area (including parked vehicles, equipment, and equipment with components within reach of the shoulder) are on one side of the highway and do not encroach onto the driving lane.

.2 When work activities do not include unloading or loading equipment or supplies on part or all of the shoulder area.

.3 The use of 7.5 Work on Shoulder – Short and Long Duration is subject to the following:

1. Advanced warning signs (Men Working [C-004] and Construction Ahead [C-018-1A]) shall be installed in the opposing direction of travel.
2. Tubular markers shall replace cones and tubular markers can be used as a replacement for drums.
3. The use of a vehicle-mounted DMS or flashing arrow board can be omitted at the Contractor's discretion should the work be within the "Work Activity Area" as defined by Figure 7.2 – Typical Construction Speed Zone Signing – Two Lane, Two Way Roadway of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition (see Item 3.2 – Traffic Management, subsection .1.5.3 of this specification).
4. The traffic control signage layout shall include the Men Working (C-004) sign in advance of the Construction Ahead (C-018-1A) sign using the applicable Construction Sign Spacing (Dimension A as defined in Table B of Section 7 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition) for the applicable speed (adjust all other sign spacings as required).

.5 7.8 Lane Closure with Traffic Control Persons – Single Lane Alternating Traffic – Short and Long Duration can be used. The traffic control signage layout shall include the Men Working (C-004) sign in advance of the Construction Ahead (C-018-1A) sign using the applicable Construction Sign Spacing (Dimension A as defined in Table B of Section 7 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways - 2020 Office Edition) for the applicable speed (adjust all other sign spacing as required).

.6 Existing conditions for traffic may be restricted for the following work:

.1 Work as preapproved by the Departmental Representative may be restricted to single-lane alternating traffic (3.5 m wide lane with 1.0 m shoulder each side) with a speed limit reduced to during these times to 30 km/h (or 50 km/h, at the Contractor's discretion).

.2 Maintain 3H:1V or flatter embankment and gravel side slopes within the highway clear zone on both sides of all two way or single lane traffic lanes. Should the Contractor choose to use temporary side slopes steeper than 3H:1V, temporary precast concrete barriers shall be installed with a minimum distance of 0.3 m from the back of the barrier to the top of the slope. All slopes shall be in conformance with WorkSafeBC regulations.

.3 During non-work hours, all construction hazards shall be removed from within the clear zone of the highway and access roads (cross streets) and the posted speed and all regular traffic movements shall be re-established.

.7 The Contractor may use the C-082 sign ("Minimum $196 Fine – Speeding in Work Zones" sign) as a speed management tool in areas where drivers have been failing to adjust speed or are failing to adhere to the regulatory or construction speed limit. When used in work zones in which a Construction Speed Zone exists, the C-082 sign should be posted in the advance warning area ahead of the work activity area. The C- 082 sign may also be installed ahead of TCP locations and/or used as standalone sign for speed management throughout the work zone, at the Contractor's discretion or as directed by the Departmental Representative.

.8 The maximum allowable delay to any individual motorist travelling through the project limits as a result of the Contractor's operations will be 10 minutes.

.9 Load limit restrictions will be in accordance with British Columbia Highway Traffic Act pertaining to registered weight limits and vehicle size both within and outside Contract Limits.

3.3 Protection of Public Traffic

.1 Ensure traffic control and other measures as necessary are in place for the duration of the works to protect and accommodate public traffic as follows:

.1 Contractor to complete and document checks of the signage using the "Daily Sign Check Form" found in Appendix C: Templates for Traffic Management Plans in the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition. Complete checks a minimum of 3 times a day (start of workday, midday, and at completion of workday). Documentation / sign-off shall be completed by the person who did the checks. Submit completed "Daily Sign Check Form" to the Departmental Representative weekly or more frequently as required by the Departmental Representative.

.2 Ensure that all vehicles can safely travel and traverse the entire length of the project (including detours) without damage to vehicles regardless of the material type placed and used as a driving surface.

.3 Protect passing vehicles from damage caused by extraneous materials from construction activities at the site.

.4 Keep travelled way and detours graded, free of potholes, and of sufficient width for required number of lanes of traffic.

.5 Provide well graded, signed, and maintained temporary traffic lanes and detours to facilitate passage of vehicles through limits of construction.

.6 Provide dust control, (if necessary).

.7 Provide and maintain reasonable access to property in vicinity of work under contract and in other area as indicated, unless other reasonable means of road access exist that meet approval of Departmental Representative.

END OF SECTION

Part 1 General

1.1 Installation and Removal

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

.2 Remove from site all such work after use.

1.2 Guiderails and Barricades

.1 Provide secure, rigid guiderails and barricades around deep excavations and open shafts.

.2 Provide as required by governing authorities.

1.3 Access to Site

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

1.4 Public Traffic Flow

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

1.5 Fire Routes

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

1.6 Protection for Off-Site and Public Property

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

.2 Be responsible for damage incurred.

END OF SECTION

Part 1 General

1.1 Project Cleanliness

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

.3 Decide with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.4 Provide wildlife resistant containers for collection of waste materials and debris

.5 Dispose of waste materials and debris off site.

.6 Clear snow and ice from areas of work.

.7 Ensure work site cleaning and worker hygiene practices are in accordance with the Contractor's COVID-19 Safe Work Plan.

1.2 Final Cleaning

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products, debris, and materials used in construction. Reinstate the work site to the conditions pre-existing and to the satisfaction of the Departmental Representative.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Inspect finishes and fitments and ensure specified workmanship and operation.

.6 Remove dirt and other disfiguration from exterior surfaces.

.7 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.8 Sweep and wash clean paved areas.

.9 Clean drainage systems.

END OF SECTION

Part 1 General

1.1 Substantial Performance

.1 Project "Substantial Performance" shall be attained through the following process:

.1 When the project work has achieved Substantial Performance as defined by GC1.1.4, the Contractor and all Sub-Contractors shall conduct an inspection of work, identify deficiencies and defects and repairs as required to conform to Contract Documents. Correct deficiencies and defects and complete repairs identified.

.2 Notify the Departmental Representative in writing of completion of the Contractor's Inspection, correction of deficiencies, defects, and repairs, and request the Departmental Representative's Substantial Performance inspection.

.3 Upon request from the Contractor, the Departmental Representative will complete a Substantial Performance inspection. If requested by the Departmental Representative, the Contractor shall accompany Departmental Representative during the Substantial Performance inspection.

.4 Unless stated otherwise by the Departmental Representative, the Contractor shall correct all deficiencies, defects, and repairs identified during the Substantial Performance inspection by the Departmental Representative prior to the preparation of the "Certificate of Substantial Performance".

.5 Should the Departmental Representative determine that Substantial Performance as defined by GC1.1.4 has been achieved, the Contractor shall prepare a "Request for Progress Payment" with the final project quantities and all Progress Payment submissions as outlined in Section 01 29 00 – Payment Procedures. The Departmental Representative will use the submitted "Request for Progress Payment" to prepare a "Certificate of Substantial Performance" in accordance with GC 5.5.

.6 Should the "Certificate of Substantial Performance" include remaining defects, faults, and incomplete work etc. the Contractor shall provide to the Departmental Representative a schedule for the completion / correction of each remaining defect, fault, and incomplete work etc. The "Certificate of Substantial Performance" will not be processed for payment until the Contractor's schedule has been provided, reviewed and accepted by the Departmental Representative. The Contractor's schedule shall be provided in writing as follows:

.1 Include the completion / correction dates for all items of defects, faults, incomplete work etc. identified by the Departmental Representative.

.2 Be provide in a letter with company letter head and be signed by an authorized representative of the Contractor.

1.2 Completion

.1 The project shall be deemed to have reached "Completion" when all requirements of GC1.1.5 have been achieved. The "Certificate of Completion" shall then be prepared by the Departmental Representative in accordance with GC5.6.

END OF SECTION

Part 1 General

1.1 Submissions

.1 Submit submissions for Departmental Representative review. Following each review, the submission will be returned with the Departmental Representative's comments. Revise and re-submit submission per the comments provided.

.2 Provide the following submissions to the Departmental Representative within two (2) weeks of substantial performance:

.1 As-built drawing and Shop Drawing mark-ups.

.2 As-built survey.

1.2 Recording Aa-Built Conditions (As-Built Drawings)

.1 The Departmental Representative will provide one set of Issued for Construction (or Issued for Tender) drawings for use by the Contractor to record as-built conditions and submit at the completion of the project as the "As-built Drawings".

.2 Record information concurrently with construction progress on the Issued for Construction (or Issued for Tender) drawings. Do not conceal work until the required information is recorded.

.3 Legibly mark each item on the Issued for Construction (or Issued for Tender) drawings and Shop Drawings in red ink to record actual construction conditions and any changes made by addenda and change orders.

.4 Maintain record documents in clean, dry, and legible condition.

.5 Keep record documents available for inspection by the Departmental Representative.

.6 Submit to the Departmental Representative one copy of Issued for Construction (or Issued for Tender) drawings which have been marked by the Contractor up to include all "as-built" conditions.

1.3 As-Built Survey

.1 At the completion of the work, complete an as-built survey of the works. At a minimum, the as-built survey shall include:

.1 Topo of all areas disturbed and modified during construction (between limits of clearing including cut and fill slopes, embankment and gravels placed).

.2 Edge of existing asphalt.

.3 Gravel Shoulder.

.4 Ditching.

.5 Riprap.

.6 Any other feature or elements of work incorporated into the project.

.2 The survey to include sufficient point density to adequately characterize the work. Survey methods and point density is subject to prior approval of the Departmental Representative. At a minimum, the Contractor shall survey all features at 10 m station intervals and the location of all treatment boundaries including changes in material type / placement, changes in surface treatment and changes in terrain.

.3 Survey data shall be collected at an accuracy of +/- 0.020 m horizontal and +/- 0.020 m vertical or better and shall reference / tie into PSPC's monument / coordinate system as shown on the Contract Drawings.

.4 The following files shall comprise the as-built survey provided to the Departmental Representative:

.1 Digital .csv file with the .xyz data and an appropriate descriptor code as to the type of material surface or feature being surveyed.

.2 Breaklines for all survey data in DXF file format or another format pre-approved by the Departmental Representative.

.3 A list of all point descriptors used in the survey data.

END OF SECTION

Part 1 General

1.1 Definitions

.1 Dangerous Goods: Product, substance, or organism that is specifically listed or meets the hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: Product, substance, or organism that is used for its original purpose and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: Any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment, or disposal.

.4 Workplace Hazardous Materials Information System (WHMIS): A Canada-wide system designed to give employers and workers information about hazardous materials used in the workplace. Under WHMIS, information on hazardous materials is to be provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by a combination of federal and provincial laws.

1.2 Submittals

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit to the Departmental Representative a current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.

.3 If requested by the Departmental Representative, submit a Hazardous Materials Management Plan to the Departmental Representative that identifies all hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.3 Storage and Handling

.1 Abide by internal requirements for labeling and storage of materials and wastes. If required, coordinate storage of hazardous materials with the Departmental Representative.

.2 Store and handle hazardous materials and wastes in accordance with applicable Federal and Provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.

.4 Store all flammable and combustible liquids in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Transfer of flammable and combustible liquids will not be carried out in the vicinity of open flames or any type of heat-producing devices.

.7 Flammable liquids having a flash point below 38°C, such as naphtha or gasoline, will not be used as solvents or cleaning agents.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in a safe, ventilated area. Keep quantities to a minimum.

.9 Observe smoking regulations at all times. Smoking is prohibited in any area where hazardous materials are stored, used, or handled.

.10 Abide by the following storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 L for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers that are in good condition.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes

.5 Ensure that different hazardous materials or hazardous wastes are not mixed.

.6 Store hazardous materials and wastes in a secure storage area with controlled access.

.7 Maintain a clear egress from storage area.

.8 Store hazardous materials and wastes in a manner and location which will prevent them from spilling into the environment.

.9 Have appropriate emergency spill response equipment available near the storage area, including personal protective equipment.

.10 Maintain an inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 Ensure personnel have been trained in accordance with WHMIS requirements.

.12 Report spills or accidents involving hazardous materials immediately to the Provincial Emergency Program 24-hour phone line at 1-800-663-3456, other local authority having jurisdiction, and the Departmental Representative. Submit a written spill report to the Departmental Representative within 24 hours of incident.

.13 Store and handle all hazardous materials away from any water course as outlined in Section 01 35 43 – Environmental Protection.

1.4 Transportation

.1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.2 If exporting hazardous waste to another country, ensure compliance with Federal Export and Import of Hazardous Waste Regulations.

Part 2 Products

2.1 Materials

.1 Only bring on site the quantity of hazardous materials required to perform work.

.2 Maintain MSDS in proximity to where the materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 Disposal

.1 Dispose of hazardous waste materials in accordance with applicable Federal and Provincial acts, regulations, and guidelines. Costs for disposal to be considered incidental to the work.

.2 Recycle hazardous wastes for which there is an approved, cost-effective recycling process available.

.3 Send hazardous wastes only to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in a timely fashion in accordance with applicable provincial regulations.

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Payment for aggregates will be made on the basis of Price per Unit Bid for aggregates (25 mm IGB and 75 mm Pit Run). The Price per Unit Bid shall include all costs associated with sourcing, delivery, placement, and compaction of aggregates.

.2 Backfilling to authorized design lines, grades and thicknesses will be measured in cubic metres compacted in place for each type of material specified (See Specification 31 23 33.01 – Excavation, Trenching and Backfilling), verified by survey, and accepted by the Departmental Representative.

.3 25 mm drain rock will be incidental to the applicable payment item under Specification 33 41 16 – 200 mm Perforated CSP Pipe.

1.2 References

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

- .1 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 ASTM C136 (latest edition), Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM C131-01, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- .4 ASTM D2216 (latest edition), Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

.2 BC Ministry of Transportation and Infrastructure (MoTI)

- .1 2016 Standard Specifications for Highway Construction Volume 1 and 2

.3 2009 MMCD Platinum Edition

1.3 Submittals

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

1.4 Quality Management

- .1 Quality Control and Quality Assurance in accordance with Section 01 45 00 – Quality Control.
- .2 In addition to the Quality Control undertaken by the Contractor, the Departmental Representative may undertake, through an independent testing firm, random sampling, inspection, and testing for the purpose of Quality Assurance.
- .3 Provide access to all portions of the work for sampling by the Departmental Representative.

Part 2 Products

2.1 Aggregate Source

.1 The Contractor shall provide their own source(s) for all aggregate materials for this project. The Contractor will be solely responsible for ensuring that the aggregate source(s) selected by the Contractor continuously achieves all aggregate material properties, quality, and gradation requirements as outlined in this contract specification for the materials' intended use.

.2 A minimum of seven (7) calendar days prior to supply or commencement of manufacture of materials from the Contractor's selected aggregate source(s), provide to the Departmental Representative for review and acceptance the location, name, and owner of material source.

2.2 Aggregates General

.1 All aggregate materials on the project shall at a minimum achieve the following requirements. Should more stringent requirements for a specific aggregate be provided elsewhere in this Contract Specification, the more stringent requirement shall apply.

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed 5 times least dimension.

2.3 25 mm Intermediate Graded Base (IGB)

.1 25 mm IGB (MoTI) crushed gravel shall be manufactured by the Contractor to ensure the material conforms with the following requirements:

.1 The material shall consist of hard durable particles free from clay lumps, frozen material, organic matter, and other deleterious materials.

.2 When tested in accordance to ASTM C136/C136M, the material shall have a gradation conforming to the gradation limits for 25 mm IGB as indicated in the BC Ministry of Transportation and Infrastructure's 2016 Standard Specifications for Highway Construction Volume 1 and 2 (Table 202C) and as shown in Table 31 05 16-01.

Table 31 05 16-01 Gradation Limits for 25 mm IGB

Sieve Designation (mm)	Percent Passing, by Weight
25	100
19	65 – 100
9.5	30 – 70
4.75	15 – 40

2.36	10 – 30
0.300	3 – 10
0.075	0 - 5

.3 Liquid limit when tested in accordance to ASTM D4318, maximum 25.

.4 Plasticity index when tested in accordance to ASTM D4318, maximum 6.

.5 Los Angeles degradation when tested in accordance to ASTM C131/C131M, maximum percent loss by weight 35.

.6 Fracture: at least 60% of particles by mass retained on 4.75 mm sieve to have at least one fractured face.

2.4 75 mm Pit Run

.1 75 mm Pit Run shall be manufactured by the Contractor to ensure the material conforms with the following requirements:

.1 The material shall consist of hard durable particles free from clay lumps, frozen material, organic matter, and other deleterious materials.

.2 When tested in accordance to ASTM C136/C136M, the material shall have a gradation conforming to the following gradation limits:

Table 31 05 16-02 Gradation Limits for 75 mm Pit Run	
Sieve Designation (mm)	Percent Passing, by Weight
75	100
50	70 – 100
25	50 – 100
4.75	22 – 100
2.36	10 – 85
0.075	2 - 8

.3 Liquid limit when tested in accordance to ASTM D4318, maximum 25. Plasticity index when tested in accordance to ASTM D4318, maximum 6.

.4 Los Angeles degradation when tested in accordance to ASTM C131/C131M, maximum percent loss by weight 35.

2.5 25 mm Drain Rock

.1 25 mm drain rock shall be manufactured by the Contractor to ensure the material conforms with the following requirements:

.2 The material shall consist of hard durable particles free from clay lumps, frozen material, organic matter, and other deleterious materials.

.3 When tested in accordance to ASTM C136/C136M, the material shall have a gradation conforming to the following gradation limits:

Table 31 05 16-02 Gradation Limits for 25 mm Drain Rock	
Sieve Designation (mm)	Percent Passing, by Weight
25	100
19	0 – 100
9.5	0 – 5
4.75	0

.4 Liquid limit when tested in accordance to ASTM D4318, maximum 25. Plasticity index when tested in accordance to ASTM D4318, maximum 6.

.5 Los Angeles degradation when tested in accordance to ASTM C131/C131M, maximum percent loss by weight 35.

Part 3 Execution

3.1 Preparation

.1 Prior to excavating materials for aggregate production, strip off and stockpile unsuitable surface material.

.2 Strip area ahead of quarrying of excavating operation sufficient to prevent contamination of aggregate by deleterious material.

3.2 Processing

.1 Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified in these Specifications. Use methods and equipment approved by Departmental Representative.

.3 Wash aggregates with clean water, if required, to achieve requirements of these specifications. Use only equipment approved by Departmental Representative.

.4 When operating in stratified deposits, use excavation equipment and methods that produce a uniform, homogeneous aggregate.

3.3 Stockpiling

.1 Should stockpiles on highway right-of-way or on PSPC property be required, stockpile aggregates in locations directed by Departmental Representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Stockpile sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted 75 mm Pit Run or 25 mm IGB not less than 300 mm in depth to prevent contamination of aggregate. Do not incorporate compacted base of pile into work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative.

.7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpiles as required to prevent segregation.

.8 Do not cone piles or spill material over edges of piles.

.9 Prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.4 Cleaning

.1 Any stockpiles temporarily placed on the highway right-of-way or on PSPC property will be completely removed and the site restored to its natural condition.

.2 The Contractor shall be responsible for any cleanup of aggregate sources.

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Excavated materials will be measured in cubic metres in their original location.

.1 Common excavation quantities measured will be actual volume removed within following limits:

.1 Width for trench excavation as indicated.

.2 Depth from ground elevation and surface of pavement or ground surface immediately prior to excavation, to elevation as indicated by Departmental Representative.

.2 Backfilling to authorized excavation limits, design lines, and grades will be measured in cubic metres compacted in place for each type of material specified.

.3 Drain rock for use in subdrain will be incidental to the applicable payment item under 33 41 16 – 200 mm Perforated CSP Pipe.

.4 Spreading of excavated southbound Right-of-Way ditch materials will be incidental to the applicable payment item under 31 23 33.01 – Excavation with onsite spreading.

.5 Disposal of remaining excavated material will be incidental to the applicable payment item under 31 23 33.01 Excavation with offsite disposal.

1.2 Reference Standards

.1 ASTM International (ASTM)

.1 ASTM C136 (latest edition), Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM D698 (latest edition), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ^{3}) (600 kN-m/m)

.3 ASTM D4318 (latest edition), Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 British Columbia Ministry of Transportation and Infrastructure

.1 2016 Standard Specifications for Highway Construction.

1.3 Definitions

.1 Excavation: removal of materials that are not rock excavation or stripping

.2 Stripping: excavation of organic material covering the original ground.

.3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.5 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1 or CAN/CGSB-8.2.

.2 Coarse grained soils containing more than 8 % by mass passing 0.075 mm sieve.

Part 2 Products

2.1 Materials

.1 Borrow Materials: properties to Section 31 05 16 - Aggregate Materials and the following requirements:

.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.

.3 See Table 31 23 33.01 – 01 for 25 mm IGB and 75 mm Pit Run gradations.

Table 31 23 33.01 - 01

Sieve Designation	% Passing	
	25 mm IGB Crush	75 mm Pit Run
75 mm	-	100
50 mm	-	70-100
37.5 mm	-	-
25 mm	100	50-100
19 mm	65-100	-
12.5 mm	-	-
9.5 mm	30-70	-
6.3 mm		
4.75 mm	15-40	22-100
2.36 mm		10-85
1.18 mm		-
0.600 mm		-
0.300 mm	5-15	-
0.075 mm	0-5	2-8

.4 See Table 31 23 33.01 – 02 for 25 mm Drain Rock gradation.

Table 31 23 33.01 - 02	
Sieve Designation	**% Passing**
	25 mm Drain Rock
25 mm	100
19 mm	0-100
12.5 mm	-
9.5 mm	0-5
4.75 mm	0

.2 Geogrid soil stabilization: to Section 31 32 19.13 – Geogrid Soil Stabilization.

.3 Geotextile soil stabilization: to Section 31 32 19.16 - Geotextile Soil Stabilization.

Part 3 Execution

3.1 Excavation – Embankment Buttress and Ditch

.1 Excavate to lines, grades, elevations and dimensions as indicated and as directed by Departmental Representative.

.2 Remove existing embankment drains and other obstructions encountered during excavation. At the Departmental Representative's discretion, embankment drains may be cut off to maintain functionality.

.3 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.4 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.5 Restrict vehicle operations directly adjacent to open trenches and excavations.

.6 Dispose of excavated material associated with the embankment buttress construction to an off site facility selected by the Contractor and pre-approved by the Departmental Representative.

.7 Ditch excavation material to be spread onsite as directed by the Departmental Representative.

.8 Do not obstruct flow of surface drainage or natural watercourses.

.9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.10 Notify Departmental Representative when bottom of excavation is reached.

.11 Obtain Departmental Representative approval of completed excavation.

.12 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.13 Correct unauthorized over-excavation as follows:

.1 Fill over-excavated areas using 75 mm pit run compacted to not less than 95 % of the corrected Standard Proctor maximum dry density.

.1 At the Departmental Representative's discretion, alternative materials may be used to backfill over-excavated areas.

.14 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.15 Install geotextiles in accordance with Section 31 32 19.16 - Geotextile soil stabilization.

3.2 Fill Types and Compaction

.1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.

.1 Embankment buttress fill 75 mm Pit Run. Compact to 95% of corrected maximum dry density.

.2 Embankment buttress fill: use 25 mm minus IGB from finished grade to 1 m depth. Compact to 100 % of corrected maximum dry density.

.3 Embankment buttress shear key fill: use 25 mm minus IGB within the shear key as shown on the Drawings. Compact to 95% of corrected maximum dry density.

3.3 Bedding and Surround of Underground Services

.1 Refer to Section 33 41 16 – Subdrainage Piping. Surround subdrain with 25 mm minus drain rock and fully encapsulate in non-woven geotextile to Section 31 32 19.16 – Geotextile Soil Stabilization.

.2 Place bedding and surround material in unfrozen condition.

3.4 Backfilling

.1 Vibratory compaction equipment: Smooth drum rollers and plate tampers as appropriate.

.2 Do not proceed with backfilling operations until completion of following:

.1 Departmental Representative has inspected and approved installations.

.2 Departmental Representative has inspected and approved of construction below finish grade.

.3 Inspection, testing, approval, and recording location of underground utilities.

.4 Removal of shoring; backfilling of voids with satisfactory soil material.

.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

.5 Place 75 mm Pit Run backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.6 Place 25 mm IGB backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer

.7 Finished surfaces of 75 mm Pit Run and 25 mm IGB to be within +/- 100 mm of the lines and grades shown in the Contract Drawings but not uniformly high or low.

.8 Should settlement of the of the 75 mm Pit Run or 25 mm IGB occur following placement and compaction (including if working during winter conditions), the resulting settlement is to be corrected under warranty to the tolerances noted in above section 3.4.7.

.9 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.10 Install drainage system in backfill as indicated.

.11 Install geogrid in accordance with Section 31 32 19.13 - Geogrid Soil Stabilization

3.5 Restoration

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

.2 Reinstate pavements disturbed by excavation to thickness, widths which existed before excavation or as indicated in the Drawings, and as approved by the Departmental Representative.

.3 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.4 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Payment for geogrid will be made on the basis of Price per Unit Bid for Geogrid. The Price per Unit Bid shall include all costs associated with delivery and installation of geogrid.

.2 Measurement for Payment for completion of the Geogrid Soil Stabilization will be made based on the square metres of surface covered by the geogrid as completed and accepted by the Departmental Representative. No allowance will be made for seams and overlaps.

1.2 Reference Standards

.1 ASTM International

.1 ASTM D1248 (latest edition), Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

.2 ASTM D4101 (latest edition), Standard Specification for Polypropylene Injection and Extrusion Materials.

.3 ASTM D4218 (latest edition), Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique.

.4 ASTM D5262 (latest edition), Standard Test Method for Evaluating the Unconfined Tension Creep Behaviour of Geosynthetics.

.5 ASTM D6637 (latest edition), Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.

.2 Drexel University - Geosynthetic Research Institute (GRI)

.1 GRI GG4, Geogrid Junction Strength.

Part 2 Products

2.1 Materials

.1 Geogrid: UX 1500 or approved equivalent - open grid polymer having uniaxial orientation, free of striations, roughness, pinholes, blisters, undispersed raw materials or any sign of contamination by foreign matter.

.1 Roll width: 1.33 m minimum.

.2 Roll length: 60 m minimum.

.3 Polymer: high density polyethylene: to ASTM D1248 with inhibitors added to resist deterioration by ultra-violet and heat exposure.

.2 Geogrid physical properties:

.1 Ultimate tensile strength: to ASTM D6637.

.1 Machine direction: minimum 114 kN/m.

.2 Tensile strength at 5% strain: to ASTM D6637

.1 Machine direction: minimum 52 kN/m

.3 Junction Strength: to ASTM D7737.

.1 Minimum 105 kN/m

.4 Maximum allowable strength 120-year design life: to GRI GG4

.1 Machine direction: minimum 41.8 kN/m

2.2 Submittals

.1 Provide manufacturer's instructions, printed product literature and data sheets for geogrid and include product characteristics, performance criteria, physical size, finish and limitations in accordance with Section 01 33 00 – Submittal Procedures for review and approval by the Departmental Representative.

Part 3 Execution

3.1 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 During delivery and storage, protect geogrids from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

3.2 Installation

.1 Place geogrid material by unrolling onto graded surface in manner and locations indicated and retain in position in accordance with manufacturer's written recommendations.

.2 Overlap each successive strip of geogrid 600 mm over previously laid strip.

.3 Join successive strips of geogrid by pinning as recommended by manufacturer].

.4 Protect geogrid from displacement, damage or deterioration before and during placement of overlaid aggregate, geotextiles and soil layers.

.5 After installation, cover with overlay layer within 2 days of placement.

.6 Replace damaged or deteriorated geogrid to approval of Departmental Representative.

.7 Place and compact soil layers in accordance with Section 31 23 33.01 – Excavation, Trenching and Backfilling.

3.3 Protection

.1 Vehicular traffic not permitted directly on geogrid.

.2 Do not overload soil or aggregate covering on geogrid.

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Payment for geotextile will be made on the basis of Price per Unit Bid for Geogrid. The Price per Unit Bid shall include all costs associated with delivery and installation of geotextile.

.1 Geotextile used for Subdrainage Piping will be incidental to the applicable payment item 33 41 16 – 200 mm Perforated CSP Pipe.

.2 Measurement for Payment for Geotextile Soil Stabilization for the Embankment Buttress and Ditch will be measured in square meters of surface covered by the geotextile as completed and accepted by the Departmental Representative. No allowance will be made for seams or overlaps.

1.2 Reference Standards

.1 ASTM International

.1 ASTM D4491-[99a(2009)], Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

.2 ASTM D4595-[09], Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

.3 ASTM D4716-[08], Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

.4 ASTM D4751-[04], Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2-[2004], Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.

.1 No.2-[M85], Methods of Testing Geosynthetics - Mass per Unit Area.

.2 No.3-[M85], Methods of Testing Geosynthetics - Thickness of Geotextiles.

.3 No.6.1-[93], Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.

.4 No.7.3-[92], Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.5 No. 10-[94], Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.3 Product Data:

.1 Provide manufacturer's instructions, printed product literature and data sheets for non-woven geotextile and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 Material

.1 Geotextile: Nilex 4551 non-woven synthetic fibre fabric, or approved equivalent, supplied in rolls.

.1 Width: 3.81 m minimum.

.2 Length: 109.8 m minimum.

.3 Composed of: polypropylene.

.2 Physical properties:

.1 Grab tensile strength and elongation: to ASTM D-4632.

.1 Breaking force: minimum 712 N, wet condition.

.2 Elongation at future: 50 %.

.2 CBR Puncture: to ASTM D6241, minimum 1824 N.

.3 Trapezoidal shear: to ASTM D4533, minimum 267 N.

.3 Hydraulic properties:

.1 Apparent opening size (AOS): to ASTM D4751, 0.212 mm.

.2 Permitivity: to ASTM D4491, 1.5 per s.

.4 Securing pins and washers: to CSA G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/$m^2$to ASTM A123/A123M.

.5 Factory seams: sewn in accordance with manufacturer's recommendations.

.6 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

2.2 Submittals

.1 Provide manufacturer's instructions, printed product literature and data sheets for non-woven geotextile and include product characteristics, performance criteria, physical size, finish and limitations in accordance with Section 01 33 00 – Submittal Procedures for review and approval by the Departmental Representative.

Part 3 Execution

3.1 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect geotextiles from direct sunlight and UV rays.

.3 Replace defective or damaged materials with new.

3.2 Installation

.1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with pins.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

.3 Overlap each successive strip of geotextile 600 mm over previously laid strip.

.4 Join successive strips of geotextile by sewing pinning.

.5 Pin successive strips of geotextile with securing pins at 500 mm interval at mid point of lap.

.6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.7 After installation, cover with overlying layer within 4 hours of placement.

.8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.

.9 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavation, Trenching and Backfilling.

3.3 Protection

.1 Vehicular traffic not permitted directly on geotextile.

.2 Do not overload soil or aggregate covering on geotextile.

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Measurement for Payment rip-rap will be made based on cubic meters placed and as accepted by the Departmental Representative. Survey to verify work is completed to design lines, grades and thicknesses.

.2 Payment for rip-rap will be made on the basis of the Price per Unit Bid for Rip-Rap in the Bid and Acceptance form. The Price per Unit Bid shall include all costs for supply, transport and placement of Rip-rap and all other items necessary for the successful completion of the work.

1.2 References

.1 American Society for Testing and Materials (ASTM), latest edition.

.1 ASTM D5519, Standard Test Methods for Particle Size Analysis of Natural and Man-Made Rip-rap Materials.

.2 BC Ministry of Transportation (BC MoTI 2016 Standard Specifications for Highway Construction)

Part 2 Products

2.1 Rip-Rap

.1 The Contractor shall provide their own source(s) for rip-rap. The Contractor will be solely responsible for ensuring that the rip-rap source(s) selected by the Contractor continuously achieves all rip-rap material properties, quality, and gradation requirements as outlined in this contract specification for the materials' intended use.

.2 Rip-rap shall conform with the following requirements.

.3 Crushed / blasted angular stone consisting of hard durable particles free from clay lumps, frozen material and other deleterious materials, and free from splits, seams or defects likely to impair its soundness during handling or under action of water with a relative density (formally specific gravity) not less than 2.65

.4 Is a graded material conforming with the following gradation limits:

.1 Class of Rip-Rap: **50 kg** to BC MoTI Table 205-A. BC MoTI Table 205-A is presented in Table 31 37 00 – 01.

Table 31 37 00 – 01				
Class of Rip-Rap (kg)	*Nominal Thickness of Rip-Rap (mm)	Rock Gradation Percentage Smaller than Given Rock Mass (kg)		
		15%	50%	85%
10	350	1	10	30
25	450	2.5	25	75
50	**550**	**5**	**50**	**150**
100	700	10	100	300
250	1000	25	250	750
500	1200	50	500	1500
1000	1500	100	1000	3000
2000	2000	200	2000	6000
4000	2500	400	4000	12000

*The thickness of rip-rap, measured at right angles to the slope for the class specified shall be the nominal thickness stated unless otherwise shown on the Drawings or required by the Departmental Representative

.2 Neither the breadth nor the thickness of any individual piece of rip-rap material is to be less than on third of its length. A maximum of 2.0 percent by weight of such pieces will be permitted.

Part 3 Execution

3.1 Placing

.1 Complete excavation work in accordance with Section 31 23 33.01 – Excavation, Trenching and Backfilling.

.2 Place non-woven geotextile in accordance with Section 31 32 19.16 and the relevant Drawings.

.3 The rip-rap material shall be loaded, transported, and placed with care to ensure that material does not break or reduce in size smaller than the actual material size requirements when placed.

.4 Rip-rap materials shall be placed to the lines and thickness shown on the Contract Drawings. The finished surface of the rip-rap shall be within +200 mm / -100 mm of the finished design grades but not uniformly high or low.

.5 Place rip-rap material using methods that do not lead to segregation or degradation of aggregate. Do not place by end dumping from haul units.

.6 Do not drop rip-rap from a height greater than 0.5 m vertically from its final position.

.7 Place rip-rap commencing at the base of the ditch and toe of the ditch slope and proceeding up the slope. Material shall be densely placed and individual stones shall be worked with placement equipment to form a well-keyed surface.

.8 Rip-rap not conforming to the requirements of this section shall be removed from the project site with the expense of the removal borne by the Contractor.

.9 The Contractor shall ensure that the construction methods adopted produces a finished surface that is comprised of the full spectrum of particle sizes continuously throughout its length and breadth.

.10 Dress all rip-rap voids so that the final surface is well keyed, densely placed, and uniform. The Departmental Representative will require that all surface voids be filled into which a rock having a mass equal or greater than 25% of the maximum stone mass can be placed.

.11 Construction equipment is not permitted on the rip-rap at any stage of construction.

.12 Maintain finished material surfaces in a condition conforming to these specifications until acceptance.

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Measurement and payment for Hydraulic Seeding will be incidental to the work and no separate payment will be made for Hydraulic Seeding.

1.2 Product Data

.1 Provide product data, prior to seeding for:

- .1 Seed.
  - .1 Shipping Bill: issued by supplier of material, identifying manufacturer and supplier, material, and net mass or volume in each container.
- .2 Biotic Soil Media.
  - .1 Shipping Bill: issued by supplier of material, identifying manufacturer and supplier, material, and net dry-air mass in each container.
- .3 Hydraulic Erosion Control Product (HECP).
  - .1 Shipping Bill: issued by supplier of material, identifying manufacturer and supplier, material, and net dry-air mass in each container.
- .4 Fertilizer.
  - .1 Shipping Bill: issued by supplier of material, identifying manufacturer and supplier, material, and net dry-air mass in each container.
- .5 Guarantees.
- .6 Chemical Analysis.

.2 Unless advised otherwise in advance of the work by the Departmental Representative, submit in writing to the Departmental Representative 14 days prior to commencing work:

- .1 Volume capacity of hydraulic seeder in litres.
- .2 Amount of material to be used per tank based on volume.
- .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.3 Scheduling

.1 Schedule Hydraulic Seeding to coincide with the completion of surface on which the hydraulic seeding shall be applied and Construction Staging requirements as outlined in Section 01 14 00 - Work Restrictions, Access Development, Construction Staging, and Restoration.

1.4 Product Handling and Storage

.1 Deliver and store seed in original containers individually labeled in accordance with “Seeds Regulations” and indicating name of supplier.

.2 Deliver and store seed and fertilizer out of adverse weather.

.3 Protect all product as required during transportation and storage.

.4 Remove from project area, product that has become wet or otherwise damaged during transportation or storage, or does not meet requirements specified.

Part 2 Products

2.1 Materials

.1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.

.1 Grass Mixture: "Certified", Canada No. 1 seed for common cultivars in accordance with Government of Canada Seeds Act and Regulations and shall conform to the following seed mix:

Table 32 92 19.16 – 01 Grass Seed Mix

% by Weight	Species
30 %	Creeping Red Fescue
20 %	Slender Wheatgrass
10 %	Alsike Clover
10 %	Timothy
10 %	Canada Bluegrass
15 %	Smooth Brome Grass
5 %	Sheep Fescue

.2 Fall rye.

.2 Biotic Soil Media shall be a Wood Fibre Based Product certified for use in Canada containing the following ingredients:

.1 Renewable Thermally Refined Bark and Wood Fibers.

.2 Biochar.

.3 Cross-Linked Polysaccharide Biopolymers

.4 Soil Building Components Containing Seaweed Extract, Humic Acid, and Endomycorrhizae.

.3 Hydraulic Erosion Control Product (HECP) shall be a Wood Fibre Product certified for use in Canada with the following properties as detailed in Table 32 92 19.16 – 02:

Table 32 92 19.16 -02 HECP		
Physical Properties [1]	**Test Method**	**Test Value**
Thickness	ASTM D6525 [2]	≥ 4 mm
Ground Cover	ASTM D6567 [2]	≥ 98%
Mass/Unit Area	ASTM D6566 [2]	≥ 390 g/m^2
Water Holding Capacity	ASTM D7367	≥ 1,400%
Material Colour	Observed	Green
Cover Factor (3)	Large Scale [5]	≤ 0.05
Percent Effectiveness (4)	Large Scale [5]	≥ 95%
Cure Time	Observed	4 – 24 Hours
Vegetation Establishment	ASTM D7322 [2]	≥ 600%
Functional Longevity [6]	ASTM 5338	≤ 12 Months
Environmental Properties [1]	**Test Method**	**Test Value**
Ecotoxicity	EPA 2021.0	48-hr LC_{50}> 100%
Biodegradability	ASTM D5338	Yes
Product Composition		**Typical Value**
Thermally Processed [7] (within a pressurized vessel) Virgin Wood Fiber		77%
Wetting Agents - including high-viscosity, colloidal polysaccharides, crossed-linked biopolymers and water absorbents (>10% of total formulation)		18%
Crimped, Biodegradable Interlocking Fibers		2.5%
Micro-Pore Granules		2.5%

Notes:
[1] When uniformly applied at a rate of 3,500 pounds per acre (kilograms/hectare) under laboratory conditions.
[2] ASTM methods developed for Rolled Erosion Control Products.
[3] Cover Factor is calculated as soil loss ratio of treated surface versus an untreated control surface.
[4] % Effectiveness = One minus Cover Factor multiplied by 100%.
[5] Large scale testing conducted at Utah Water Research Laboratory and Tex. as Transportation Institute. For specific testing information please contact a Profile technical service representative.
[6] Functional Longevity is the estimated time period, based on ASTM D5338 testing and field observations, that a material can be anticipated to provide erosion control and agronomic benefits as influenced by composition, as well as site-specific conditions, including; but not limited to — temperature, moisture, light conditions, soils, biological activity, vegetative establishment and other environmental factors.
[7] Heated to a temperature greater than 380 degrees Fahrenheit (193 degrees Celsius) for 5 minutes at a pressure greater than 50 psi (345 kPa) in order to be Thermally Refined®/Processed and to achieve phytosanitization.

.4 Water: free of impurities that would inhibit germination and growth.

.5 Fertilizer:

.1 To Canada Fertilizers Act and Regulations.

.2 Complete synthetic, ratio: 18:18:18.

2.2 Equipment

.1 Capable of mixing and evenly distributing seed, fertilizer, Biotic Soil Media, and HECP mixtures for efficient treatment of areas to be seeded.

.2 Agitation system:

.1 To be built-in.

.2 To have sufficient capacity to agitate, suspend and homogeneously mix slurry of materials in amounts specified using slurry recirculation or mechanical agitation method.

.3 To be capable of operating during seeding and charging of the tank.

.3 Slurry tank to have working capacity of at least 4,500 litres with pump capable of maintaining continuous, nonfluctuating stream of slurry. Distribution lines to be equipped with appropriate nozzles and of sufficient diameter to prevent blockage. Tank volume to be certified by certifying authority and identified by authorities with the Volume Certification Plate.

.4 Capable of seeding by 50 m hand operated hose or tower with appropriate nozzles.

Part 3 Execution

3.1 Workmanship

.1 Apply Hydraulic Seeding in all areas of topsoil, disturbed areas, exposed soil above ditch rip-rap, or other areas as detailed in these specifications or as directed by the Departmental Representative.

.2 Do not spray onto structures, signs, guiderails, plant material, finished riprap surfaces, and other than surfaces intended.

.3 Clean-up immediately, any material sprayed where not intended, to satisfaction of Departmental Representative.

.4 Do not perform work under adverse field conditions such as wind speeds that will carry product beyond area designed for hydraulic seeding or not uniformly applied, frozen ground or ground covered with snow, ice or standing water, or other adverse conditions unless otherwise pre-approved by the Departmental Representative.

.5 Protect seeded areas from trespass until plants are established.

3.2 Protection of Surfaces

.1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.

.2 Obtain Departmental Representative’s review of grade, finished surface, and topsoil depth before starting to seed.

3.3 Preparation of Slurry

.1 Measure quantities of materials by weight or weight-calibrated volume measurement. Supply equipment required for this work.

.2 Calculate amount of material to be used and area to be covered for each tank load utilizing size of slurry tank and carrying capacities of water.

.3 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize Biotic Soil Media and HECP and charge slowly into seeder. Use optimum carrying capacity of water relative to Biotic Soil Media, and HECP as follows:

.1 Biotic Soil Media: 55kg/1000 L.

.2 HECP: 43kg/1000 L.

.4 Mix thoroughly to complete the slurry once all other material is in the seeder.

3.4 Slurry Application

.1 Hydraulic seeding equipment:

.1 Slurry tank.

.2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and /or mechanical agitation method.

.3 Capable of seeding by 50 m hand operated hoses or tower with appropriate nozzles.

.2 The hydraulic seeding slurry mixture shall be applied in two separate applications. The second application shall be applied within 24 hours of the first application. The slurry mixture per hectare of each application shall be as follows:

.1 Application 1 (Biotic Soil Media and Seed):

.1 Biotic Soil Media: 3500 kg

.2 Fall rye: 110 kg.

.3 Fertilizer: 360 kg.

.2 Application 2 (HECP):

.1 HECP: 3900 kg.

.2 Grass Seed Mixture: 125 kg.

.3 Thoroughly mix and uniformly apply slurry, at optimum angle of application for adherence to surfaces and germination of seed over area to be seeded.

.1 Using correct nozzle for application.

.2 Using hoses for surfaces difficult to reach and to control application.

.4 Blend application 300 mm into adjacent grass areas previous applications to form uniform surfaces.

.5 Re-apply where application is not uniform.

.6 Immediately remove slurry from items and areas not designated to be sprayed.

.7 Protect seeded areas from trespass and damage.

.8 Remove protection devices.

3.5 Warranty and Maintenance

.1 The Contractor shall warranty the Hydraulic Seeding free of defects in accordance with General Conditions (GC3.13), for one full growing season or 12 months from the date of Substantial Performance whichever is greater.

.2 It is the responsibility of the Contractor to complete maintenance as the Contractor deems necessary on the Hydraulic Seeding such that a 90% survival rate is achieved at the end of the warranty period.

.3 If at the end or prior to the end of the warranty period a 90% survival rate is not achieved the Contractor shall at his own expense replace Hydraulic Seeding not surviving or in poor condition except when the loss or damage can be proven to be due to abnormal weather, or any causes beyond the control of the Contractor.

.4 An end-of-warranty inspection will be conducted by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 Measurement and Payment Procedures

.1 Excavation and backfill will be measured under Section 31 23 33.01 - Excavation, Trenching and Backfilling.

.2 Payment for the completion of Subdrainage Piping will be made on the basis of the Price per Unit Bid for 200 mm Perforated CSP Pipe in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for supply, placement, and installation of the 200 mm Perforated CSP Pipe. Drain rock and non-woven geotextile shall be incidental to the works.

.3 Measurement for Payment for completion of 200 mm Perforated CSP Pipe will be made by lineal meters of subdrain, including drain rock and geotextile surround, completed and accepted by the Departmental Representative.

Part 2 Products

2.1 Materials

.1 Perforated corrugated steel pipe:
To CAN/CSA-G401.

.2 Metal thickness shall be minimum 1.2 mm.

.2 Granular filter material in accordance with Section 31 05 16 – Aggregates for Earthworks and following requirements:

.1 Screened stone or gravel.

.2 Gradations to be within limits specified in Section 31 23 33.01 – Excavation, Trenching and Backfilling.

.3 Geotextile filter: In accordance with Section 31 32 19.16 - Geotextile Soil Stabilization.

2.2 Delivery Storage and Handling

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

Part 3 Execution.

3.1 Trenching

.1 Excavation, trenching and backfilling in accordance with Section 31 23 33.01 - Excavation, Trenching and Backfilling.

.2 Departmental Representative to review and approve trenching prior to placement of subdrains.

3.2 Installation of Pipe Subdrains

.1 Lay pipe drains on prepared bed in accordance with Drawings, true to line and grade with inverts smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with bed throughout full length.

.2 Begin laying at outlet and proceed in upstream direction.

.3 Lay perforated pipes with perforations downwards.

.4 Make joints tight in accordance with manufacturer's instructions.

.5 Plug open upstream ends of pipes with watertight concrete, steel or wood bulkheads.

.6 Wrap or sleeve perforated pipe and nominal 150 mm thick drain rock with geotextile filter as indicated.

.7 Do not place drain rock surround and backfill materials in frozen condition.

.8 Protect sub-drains against flotation during installation.

.9 Backfill remainder of trench to Section 31 23 33.01 - Excavation, Trenching and Backfilling and as directed by Departmental Representative.

END OF SECTION

R.109901.002
Appendix A

Written Communication / Document Management Protocol

Km 155 Slope Stabilization, Alaska Highway, BC Project: Written Communication / Document Management Protocol

Communication for the Km 155 Slope Stabilization, Alaska Highway, BC Project (R.109901.002) will occur using CentralCollab, email, telephone, and through the delivery of hardcopy documents (if requested by PSPC). CentralCollab will act as the primary communication and document management tool throughout the project. It will act as the central file storage location for all project documents, allows for retrieval of these documents at any time during the project by group members and is capable of storing and sharing large electronic files.

Email and telephone may be used for general communication, transitory information and other communications where a record is not considered necessary (e.g. day-to-day coordination, in-depth discussion of project elements, etc.). Email shall not be used for the submission of deliverables or other project documentations. Email contact information for project members is provided in the project contact list.

Hardcopy documents are to only be provided if specifically requested by PSPC. The Departmental Representative will provide the Contractor with the necessary address information at the time of the request. Material samples shall be provided directly to the testing lab specified by the Departmental Representative for Quality Assurance purposes or be delivered to the project site.

CentralCollab

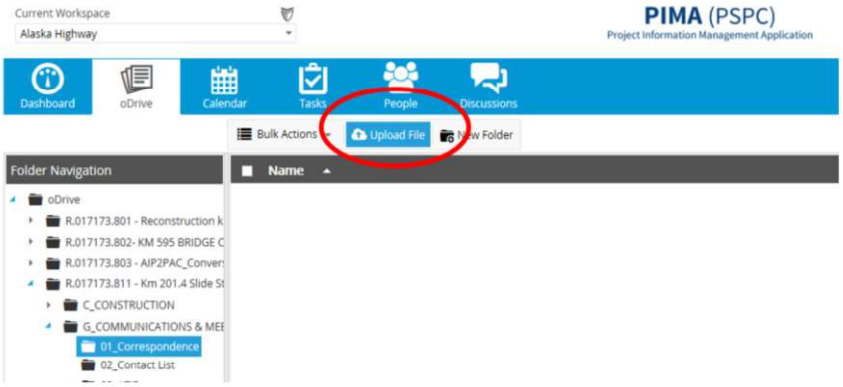
CentralCollab is a web-based collaborative platform that is used to submit and store project documentation. It is the responsibility of the submitting party to upload documents to CentralCollab in the correct folder and with the correct file naming convention.

CentralCollab can be accessed at the following address: https://app.centralcollab.com/
The contractor is encouraged to have CentralCollab accounts for project team members who are involved with accessing or posting project documentation. Accounts can be created by PSPC throughout the project by contacting the PSPC project team.

Project documentation includes but is not limited to: submittals, deliverables, drawings, reports, meeting minutes, project schedules, notifications, contemplated change notices, change orders, etc.

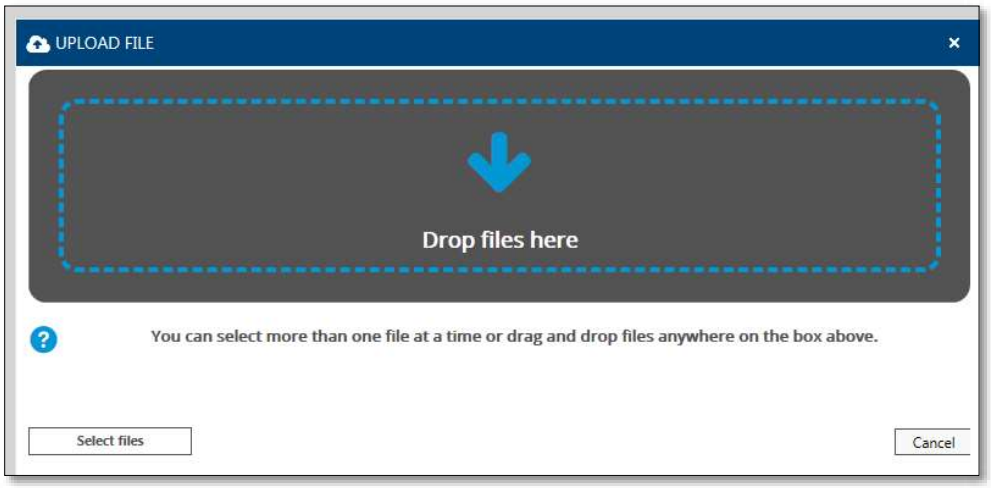
1 Uploading to CentralCollab

Upload individual documents to the appropriate folder on CentralCollab. For folder names, refer to Table 2 of this document. To add files, click on **Upload File**:

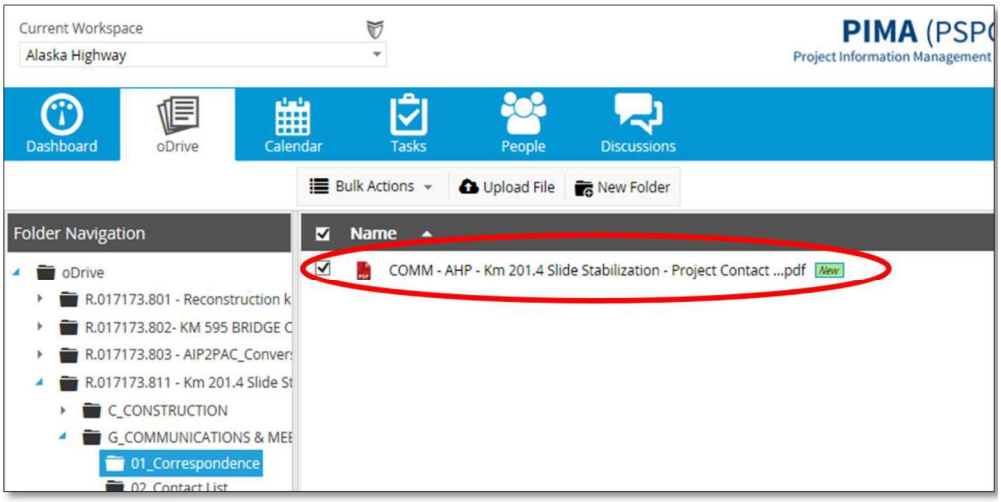


Drag and drop your document(s), then press Save.

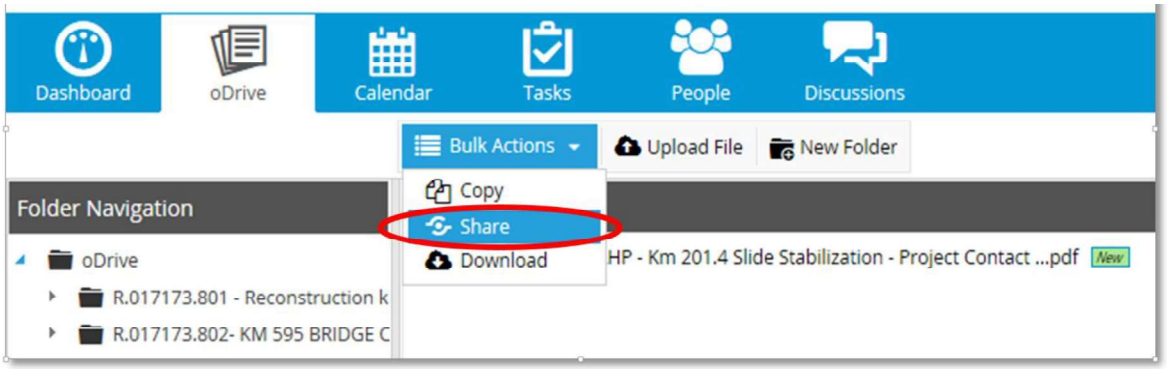
NOTE: Make sure you have named your document correctly, as explained in Section 2.2 CentralCollab File Naming Convention.



Once saved, you will see your new document (circled below), but no one else will be notified until you share it.

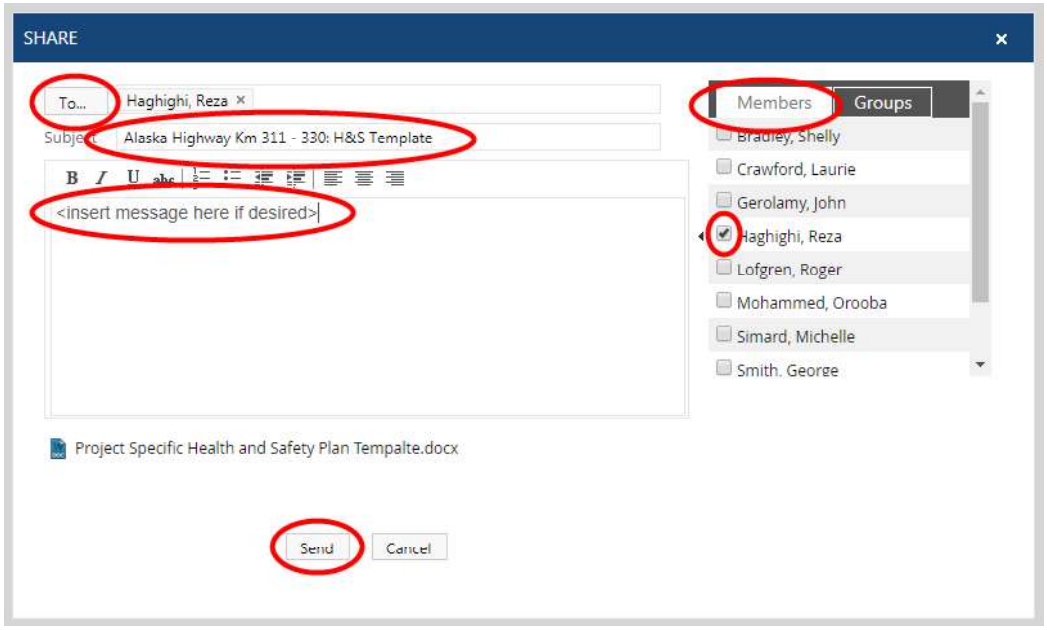


To **notify members** of the new document, check the box next to the document √ then click **Bulk Actions > Share** :

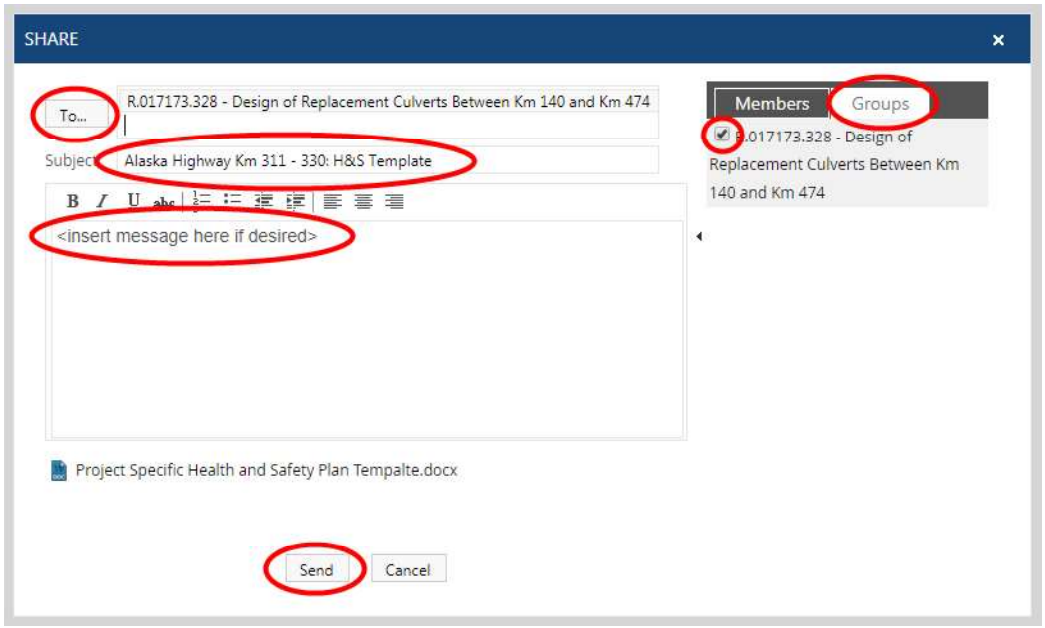


Once the new window opens, select **To,** and then select the **Members** tab and all Members from whom you wish to notify (as directed during the pre-constriction meeting or otherwise by PSPC) or select the **Groups** tab and select the pre-set group:

Example – Notification Members:



Example – Notification Pre-set Group (if available):



Insert a message related to the uploaded submittal in the subject line and if desired in the form before sending. Then press **Send**. An email with the link to the document will then provide to all individuals notified with a copy of this email provided to the sender.

2. CentralCollab File Naming Convention:

All CentralCollab users shall upload files named according to the following convention:

Doc Type – AHP – Km 155 Project – File Description or Document Name– YYYY MM DD

Example file names:

- Plan – AHP – Km 155 Project – Quality Management Plan – 2020 02 15
- Schedule – AHP – Km 155 Project –Project Schedule –2020 02 20
- Finance – AHP – Km 155 Project – Progress Payment 01– 2020 02 26

The file description should clearly identify the document. The Document type should be selected from the options provided in Table 1:

Table 1: Document Type Options

Document Type Acronym	Description
Comm	Communication related docs; correspondence, letters, memos, briefing notes, contact lists
Contract	Request for Information (RFI), Contemplated Change Notices (CCN), Change Orders (CO)
Email	Emails
Draw	Drawings and site plans
Finance	Project financial documentation
Image	All non-drawing images, photos etc.
Minutes	Meeting minutes, agendas, and associated documents
Plan	Planning documents, BMPs, SOPs, workplans
Report	Reports of all types- most frequently used for consultant deliverables
Schedule	Any project related schedules
Specs	Specs and terms of references
Other	Other document types, project specific, one-off documents

3. CentralCollab Folder Arrangement:

All files must be uploaded to the correct folder in CentralCollab. To aid in the filing of documents, a listing of common filing / folder locations has been prepared as shown in Table 2.

Table 2: Common Document Filing / Folder Locations	
Folder Names	**Description of Typical Documents**
CentralCollab folder: R.109901.002 – Km 155 Slope Stabilization > C_CONSTRUCTION >	
Contract > 01_Contract	Contract Documents (typically related to documents posted to Buyandsell.gc.ca)
02_Request for Information	Request for Information from Contractor
03_Permits	Permits obtained by Contactor or PSPC
04_Site Instructions	Site Instructions (typically generated by PSPC)
05_CCN	Contemplated Change Notice forms generated by PSPC and pricing responses from Contractor
06_Change Orders	Change Orders (typically generated by PSPC)
07_Progress Payments	Progress Payment documents (as instructed by PSPC)
08_Field Reviews	Field Review forms (typically generated by PSPC)
09_Health & Safety	Health and Safety related documentation including Project Specific Health and Safety Plan, Tailgate Safety Meeting documentation, and other Health and safety related submittals.
10_Testing Services	Testing Reports completed by Contractor's QC
11_Environmental Plan	Environmental Protection Plan and other environmental related documents
12_Environmental Reporting	Environmental monitoring reports generated by the Contractor's environmental monitor
13_Shop Drawings	Shop drawing submissions provided by the Contractor as required by the contract specifications
14_Deliverables	Contractor Deliverables as required by the contract specifications throughout the project including such items as: • Project Schedule • Traffic Management Plan • Construction Staging Drawings • Culvert Mill Certificates • Other supplier information as needed
15_Deficiency List	Deficiency lists (typically generated by PSPC)
16_Certificate of Substantial Performance	Certificate of Substantial Performance as generated by PSPC

Table 2: Common Document Filing / Folder Locations	
Folder Names	**Description of Typical Documents**
17_Certificate of Completion	Certificate of Completion as generated by PSPC
18_Claims	Documentation related to any claims on the project
19_Contract Close out	Documentation related to contract closeout including closeout submittals such as: • As-built Surveys • As-built Redline Drawing Mark-ups • Warranties • Instruction Manuals
20_Advisory	Advisories in response to RFIs or other notices as generated by PSPC.
21_Quality Management	Quality control and Quality Assurance documentation generated by the Contractor and PSPC • Quality Management Plan • Check Sheets • Daily Reports • NCR's
CentralCollab folder: R.109901.002 – Km 155 Slope Stabilization > G_COMMUNICATIONS & MEETINGS >	
01_Correspondence	Emails and other correspondence requiring posting to CentralCollab, generated by the Contractor or PSPC
02_Contact List	Project contact list generated by PSPC
03_ATIP	
04_Communications Plan	Communication plan generated by PSPC
05_Supporting Documents	
06_Meeting Minutes	Meeting minutes as generated by PSPC
07_Inquiries	
08_Public Notices	
09_Other	
CentralCollab folder: R.109901.002 – Km 155 Slope Stabilization > Z_BASE DATA>	
01_Base Data	Digital drawings and other documentation required by the Contractor (typically generated by PSPC)

Typical folders Users are encouraged to create sub-folders and categorize documents of similar or related data.

Example sub-folders:

- 09_Health & Safety > **Tailgate Meetings > February**
- 14_Deliverables > **Project Schedule**
- 21_Quality Management > **Check Sheets > February**

R.109901.002
Appendix B

Project Specific Health and Safety Plan Template

<insert company logo/information>

PROJECT SPECIFIC HEALTH AND SAFETY PLAN

<Name of Project>
<PROJECT No.>

<Date>

<Rev. Number>

Prepared for:

Public Services and Procurement Canada
Services publics et Approvisionnement Canada

The Contractor shall ensure that this document is available on site for the project duration and available to all workers.

<This template is provided to aid the Contractor in preparing their project specific health and safety plan according to the contract requirements. It is the responsibility of the Contractor to ensure that all required information is presented in their project specific health and safety plan to meet the requirements of the project specifications and WorkSafeBC's health and safety obligations. The Contractor shall review all aspects of this template and make changes and additions as needed to suit the project requirements.>

Table of Contents

Appendix 6: Incident/Accident Report Template

Appendix 7: Key Member Resumes and Safety Certifications

Appendix 8: Local Hospital Maps

Appendix 9: Safe Work Procedures

1. Contractor Safety Policy / Statement

<A statement about the Contracting companies policy regarding health and safety on the project site.>

2. Project Health and Safety Compliance Obligations

The submission of the Project Specific Health and Safety Plan indicates <*Contracting Company Name*> commitment to comply with all health and safety related obligations from the following:

- All procedures, rules and policies from this Project Specific Health and Safety Plan
- WorkSafeBC Requirements
- Project Specifications
- *<Other, add any other requirements that apply>*

3. Definition of Responsibilities

<A clear description of the health and safety related responsibilities for key members of the Contractor's project team. The table below is provide to assist with presenting this information.>

Position	Name(s)	Description of Health and Safety Responsibilities
Project Manager		
Project Superintendent		
Health and Safety Coordinator		
First Aid Attendant(s)		
Supervisors		
Workers		
Sub-Contractors		

4. General Project Safety Rules

<*A list of general construction safety rules and regulations that the company will adhere to. Additionally, a description of the disciplinary action procedure for disregard or negligence of the provide rules.****>***

5. Health and Safety Risks / Hazards and Engineering and Administrative Control Measures

5.1 Workplace Hazard Assessment – Health and Safety Risks Identified

<Summary of health risks and safety hazards resulting from hazard assessment analysis of the circumstances of each "workplace" including:

- *The number of workers who may require first aid at any time;*
- *The nature and extent of the risks and hazards in the workplace (including confined space entry);*
- *The types of injuries likely to occur;*
- *Any barriers to first aid being provided to an injured worker or member of the public; and*
- *The time that may be required to obtain transportation and to transport an injured worker to medical treatment>*

<Statement from the Contractor indicating the hazard rating assignment (low, moderate, or high) for each "workplace" as defined by WorkSafeBC and applicable to the application of G3.16 of WorkSafeBC Occupational Health and Safety Regulations>

5.2 Hazards Materials

<List of hazardous materials to be brought onsite as required by the work>

5.3 Job Specific Safe Work Procedures

<Review your company safe work procedures to ensure that there are procedures for all tasks relevant to the project (including confined space entry). In the case that your company does not have an existing safe work procedure for a specific task please provide this procedure in appendix 8.>

All job specific safe work procedures are available in <*Contracting Company Name*> corporate Health and Safety Plan and are available to all employees on site and the PSPC team upon request. Procedures that are not available in <Contracting Company Name> corporate Health and Safety Plan can be found in Appendix 8. *<remove last sentence if not required>.*

5.4 Required PPE and Training

<Identification of the PPE and description of the training required for any members of the contractor's project team and PSPC's team visiting the site.>

5.5 First Aid Requirements

<Identification of the First Aid Requirements for each "workplace" in compliance with WorkSafeBC and project requirements as follows:

.1 Estimated travel time from the "workplace" to the nearest hospital.

.2 Maximum numbers of workers at any time per "workplace".

.3 The first aid supplies, equipment, and facilities which will be available at each "workplace".

.4 The first aid attendant certificate level onsite at each "workplace".

.5 The first aid transportation which will be used on the project (ie. ETV), if required by Contractor or WorkSafeBC requirements. Details of were the ETV will be located / parked relative to the locations of the first aid attendant(s) during the work.>

6. Inspection Policy and Procedures

<*A description of the site inspection policy and procedure. The procedure should include identification of investigator, completion of a site inspection form and how the findings of the inspection will be presented to the remainder of the construction team.****>***

7. Incident Reporting and Investigation Policy

<*A description of the procedure completed following an incident occurring on site. The procedure should include the completion of an incident/accident report (template to be provided by the contractor in Appendix 5)****>***

8. Occupational Health and Safety

8.1 Representative/Committee Procedures

<*A description of the procedures that will be completed regularly throughout the project to keep the project site safe for all contractor's personnel, travelling public and PSPC's project team members.>*

8.2 Meetings

<*A description of the health and safety meetings that will be completed throughout the project. This section could include the frequency of meetings and the agenda that will be followed.****>***

8.3 Communications and Record Keeping Policies

<*A description of the policies related to health and safety communications and record keeping. This needs to include a description of the files that will be kept and how communication regarding health and safety will proceed with the entire project team, including the owner's team, the prime contractor's team and all sub-contractors.****>***

9. Emergency Contact Information

9.1 Key Project Contact Numbers

Contractor's Team			
Name and Position	**Office Number**	**Cell Phone Number**	**Sat Phone (If Used)**
Project Superintendent			
Health and Safety Coordinator			
First Aid Attendant(s)			
Key Sub-Contractor Representatives			
PSPC Team			
Name and Position	**Office Number**	**Cell Phone Number**	**Satellite Phone**
George Smith - Operations Manager, Alaska Highway	250.774.6956	250.321.0174	600.700.6263
T.B.D. – Onsite Inspection and QA Representative			

9.2 Emergency Response Agencies/Assistance

<Note: The contractor is responsible for verifying that all the numbers listed below are correct and up to date and that all required numbers are presented. Please remove any emergency numbers that are not in the project vicinity. ***911*** *is not available in the Fort Nelson Northern Rockies Regional Municipality. Contractor shall confirm if* ***911*** *is*

available in the project location. If not available in project location, make note in table as not available at project site>

Agency/Assistance	Contact
RCMP	911
Local Police – Fort Nelson (emergency)	250.774.2777
Local Police – Fort Nelson (non-emergency)	250.774.2700
Local Police – Fort St. John (emergency)	250.787.8100
Local Police – Fort St. John (non-emergency)	250.787.8140
Local Police – Watson Lake (emergency)	867.536.5555
Local Police – Watson Lake (non-emergency)	867.536.2677
BC Ambulance (BC Emergency Health Services)	911 / 1.800.461.9911 / 250.374.5937
Ambulance – Fort Nelson	250.774.2344
Ambulance – Fort St. John	250.785.5559
Ambulance – Watson Lake	867.536.4444
S.T.A.R.S Ambulance	1.888.888.4567
Hospitals	
Local Hospital – Fort Nelson	250.774.8100
Local Hospital – Fort St. John	250.262.5200
Local Hospital – Watson Lake	867.536.4444
Fire and Rescue	911
Fire and Rescue – Fort St. John	250.785.4333
Fire and Rescue – Fort Nelson (emergency)	250.774.2222
Fire and Rescue – Fort Nelson (non-emergency)	250.774.3955
Fire and Rescue – Watson Lake (emergency)	867.536.2222
Fire and Rescue – Watson Lake (non-emergency)	867.536.8008
BC Forest Fire Reporting	1.800.663.5555 / *5555 (Cell)
Yukon Forest Fire Reporting	1.888.798.3473
WorkSafeBC Work Site Emergency 24 hr	1.888.621.7233
WorkSafeBC Regional Office	1.800.663.4630 / 250.785.1283
HazMat 24 hr	1.800.663.3456
BC Environmental - PEP 24 hr	1.800.663.3456
BC Environmental Regional Office	250.787.3411
BC Hydro – Power (emergency) 24 hr	911
BC Hydro – Power (non-emergency)	1.800.224.9376
Fortis BC – Natural Gas Emergencies 24 hr	1.800.663.9911
NorthwesTel – Corporate Office (Whitehorse)	867.668.5300
BC One Call	1.800.474.6886 / *6868 (Cell)
Poison Control	1.800.567.8911 / *311 (Cell)
Commercial Vehicle Inspection and Standards (CVSE)	

Reporting Safety Violations 24 hr	1.888.775.8785
Peace River Regional Office	250.784.2363

10. Wildlife Management

<*Identify any training and processes for project members regarding wildlife encounters and prevention.*>

11. Fire Safety, Reporting and Evacuation

<*Identify any fire safety policies, project specific reporting and evacuation procedures.*>

12. Contractor's Team Review and Acceptance

This document has been prepared through discussions with the Contractor's entire project team *<including sub-contractors (if applicable)>*, and will be enforced by the contractor for the duration of the project. By signing this document, the signee confirms that they have reviewed the document and agree with its contents.

Project Manager

Name	Signature	Date

Site Superintendent

Name	Signature	Date

Health and Safety Manager

Name	Signature	Date

Quality Control Manager

Name	Signature	Date

<Major Sub-Contractor Representatives>

Name	Signature	Date

<Major Sub-Contractor Representatives>

Name	Signature	Date

Appendix 1: Preliminary Hazard Assessment Form

PRELIMINARY HAZARD ASSESSMENT FORM

Project Number:	R.109901.002
Location:	km 155 Slope Stabilization, Alaska Highway, BC
Date:	
Name of Departmental Representative:	
Name of Client:	PSPC
Name of Client Project Co-ordinator	George Smith PH: 250.774.6956

Site Specific Orientation Provided at Project Location **Yes** ☐ **No** ☐

Notice of Project Required **Yes** ☐ **No** ☐

NOTE:
PSPC REQUIRES A Notice of Project FOR ALL CONSTRUCTION WORK RELATED ACTIVITIES

NOTE:
OHS law is made up of many municipal, provincial, and federal acts, regulations, bylaws and codes. There are also many other pieces of legislation in British Columbia that impose OHS obligations.

Important Notice: This hazard assessment has been prepared by PSPC for its own project planning process, and to inform the service provider of actual and potential hazards that may be encountered in performance of the work. PSPC does not warrant the completeness or adequacy of this hazard assessment for the project and the paramount responsibility for project hazard assessment rests with the service provider.

TYPES OF HAZARDS TO CONSIDER	Potential Risk for:				COMMENTS
Examples: Chemical, Biological, Natural, Physical, and Ergonomic Listed below are common construction related hazards. Your project may include pre-existing hazards that are not listed. Contact the Regional Construction Safety Coordinator for assistance should this issue arise.	**PSPC, OGD's, or tenants**		**General Public or other contractors**		Note: When thinking about this pre-construction hazard assessment, remember a **hazard** is anything that may cause harm, such as chemicals, electricity, working from heights, etc.; the **risk** is the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.
	Yes	**No**	**Yes**	**No**	

Typical Construction Hazards					
Concealed/Buried Services (electrical, gas, water, sewer etc)					
Slip Hazards or Unsound Footing					
Working at Heights					
Working Over or Around Water					
Heavy overhead lifting operations, mobile cranes etc.					
Marine and/or Vehicular Traffic (site vehicles, public vehicles, etc.					

Fire and Explosion Hazards					
High Noise Levels					
Excavations					
Blasting					
Construction Equipment					
Pedestrian Traffic (site personnel, tenants, visitors, public)					
Multiple Employer Worksite					Example: Contractor working in an occupied Federal Employee space.

Electrical Hazards					**Comments**
Contact With Overhead Wires					
Live Electrical Systems or Equipment					
Other:					
Physical Hazards					
Equipment Slippage Due To Slopes/Ground Conditions					
Earthquake					
Tsunami					
Avalanche					
Forest Fires					
Fire and Explosion Hazards					
Working in Isolation					
Working Alone					
Violence in the Workplace					
High Noise Levels					
Inclement weather					
High Pressure Systems					
Other:					
Hazardous Work Environments					
Confined Spaces / Restricted Spaces					Review and provide confined space assessment(s) from PSPC or client confined space inventories. Refer to PSPC Standard on Entry into Confined Spaces. Contact the Regional Construction Safety Coordinator.
Suspended / Mobile Work Platforms					
Other:					
Biological Hazards					
Mould Proliferations					
Accumulation of Bird or Bat Guano					
Bacteria / Legionella in Cooling Towers / Process Water					
Rodent / Insect Infestation					
Poisonous Plants					
Sharp or Potentially Infectious Objects in Wastes					
Wildlife					
Chemical Hazards					

Asbestos Materials on Site					If "yes" a pre-project asbestos survey report is required. Provide Contractor with DP – 057 ELF Form 16 "Contractor Notification and Acknowledgement"
Designated Substance Present					If "yes" a pre-project designated substance survey report is required.
Chemicals Used in work					
Lead in paint					If "yes" a pre-project lead survey report is required.
Mercury in Thermostats or Switches					If "yes" a pre-project mercury survey report is required.
Application of Chemicals or Pesticides					
PCB Liquids in Electrical Equipment					
Radioactive Materials in Equipment					
Other:					
Contaminated Sites Hazards					
Hazardous Waste					
Hydrocarbons					
Metals					
Other:					

Security Hazards					**Comments**
Risk of Assault					
Other:					
Other Hazards					

Other Compliance and Permit Requirements[1]	**YES**	**NO**	**Notes / Comments**[2]
Is a Building Permit required?			
Is an Electrical permit required?			
Is a Plumbing Permit required?			
Is a Sewage Permit required?			
Is a Dumping Permit required?			
Is a Hot Work Permit required?			
Is a Permit to Work required?			Mandatory for ALL AFD managed work sites.
Is a Confined Space Entry Permit required?			Mandatory
Is a Confined Space Entry Log required			Mandatory for all Confined Spaces
Discharge Approval for treated water required			

Notes:

(1) Does not relieve Service Provider from complying with all applicable federal, provincial, and municipal laws and regulations.

(2) TBD means To Be Determined by Service Provider.

Service Provider Acknowledgement: We confirm receipt and review of this Pre-Project Hazard Assessment and acknowledge our responsibility for conducting our own assessment of project hazards, and taking all necessary protective measures (which may exceed those cited herein) for performance of the work.			
Service Provider Name			
Signatory for Service Provider		**Date Signed**	
RETURN EXECUTED DOCUMENT TO PSPC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING			

Appendix 2: Confirmation of Prime Contractor's Main Responsibilities Under WorkSafeBC Occupational Health and Safety Regulations and Worker's Compensation Act Form

Public Services and Procurement Canada | Services publics et Approvisionnement Canada

Confirmation of Prime Contractor's Main Responsibilities Under the WorkSafeBC Occupational Health and Safety Regulations *Worker's Compensation Act*

and Name of Project: Km 155 Slope Stabilization, Alaska Highway, BC

Owner: Public Services and Procurement Canada

Contractor: _____

Consulting Engineer: Golder Associates Ltd.

	YES	NO
1.The Contractor acknowledges appointment as Prime Contractor on the construction project noted below	☐	☐
2. The name of the Prime Contractor's Qualified Coordinator of occupational health and safety activities for this project has been submitted to the Owner and is as shown below.	☐	☐
3. The Prime Contractor understands that in any conflict of directions, WCB OH&S Regulations and/or the Worker's Compensation Act shall prevail.	☐	☐
4. The Prime Contractor understands and will direct that all supervisors/coordinators must immediately report any apparent conflict as described above.	☐	☐
5. The Prime Contractor agrees that their supervisor shall immediately notify the consulting Engineer's representative of any reported conflict.	☐	☐
6. The Prime Contractor has requested and received information from the Owner regarding any known hazards to the health and safety of persons pre-existing at the workplace.	☐	☐
7. The Prime Contractor has conducted an inspection of the workplace to verify the presence of any hazards.	☐	☐
8. The Prime Contractor will communicate hazards information to any persons who may be affected and ensure that appropriate measures are taken to effectively control or eliminate the hazards.	☐	☐
9. The Prime Contractor accepts that written documentation such as notes, records, inspections, meeting minutes, etc., on all health and safety issues must be available upon request to the PSPC departmental representatives and/or to a WCB officer at the workplace.	☐	☐
10. The Prime Contractor will confirm that all workers are suitably trained and competent to perform the duties for which they have been assigned.	☐	☐
11. The Prime Contractor confirms that safety orientation of all new workers will be conducted.	☐	☐
12. The Prime Contractor's written Safety Program has been provided to the Owner's representative.	☐	☐
13. The Prime Contractor confirms that meetings to exchange information on any safety issues, concerns, hazards or safety directives will be conducted weekly or more often if required.	☐	☐
14. The Prime Contractor confirms that before the commencement of work, crews will attend a daily crew safety meeting.	☐	☐
15. The Prime Contractor confirms that their supervisor has assessed and will coordinate the workplace first-aid requirements	☐	☐
16. The Prime Contractor confirms that the procedure to transport injured workers is established	☐	☐

Prime Contractor Representative's

Name:_____

Title:_____ Signature:_____

Date:_____

Prime Contractor's OH&S Coordinator

Name:_____

Title:_____ Signature:_____

Date:_____

Canada

Appendix 3: Contractor's COVID-19 Safe Work Plan

Appendix 4: Contractor Daily Toolbox Meeting Form

<provided by the Contractor>

Appendix 5: Site Safety Orientation Form

<provided by the Contractor>

Appendix 6: Incident/Accident Report Template

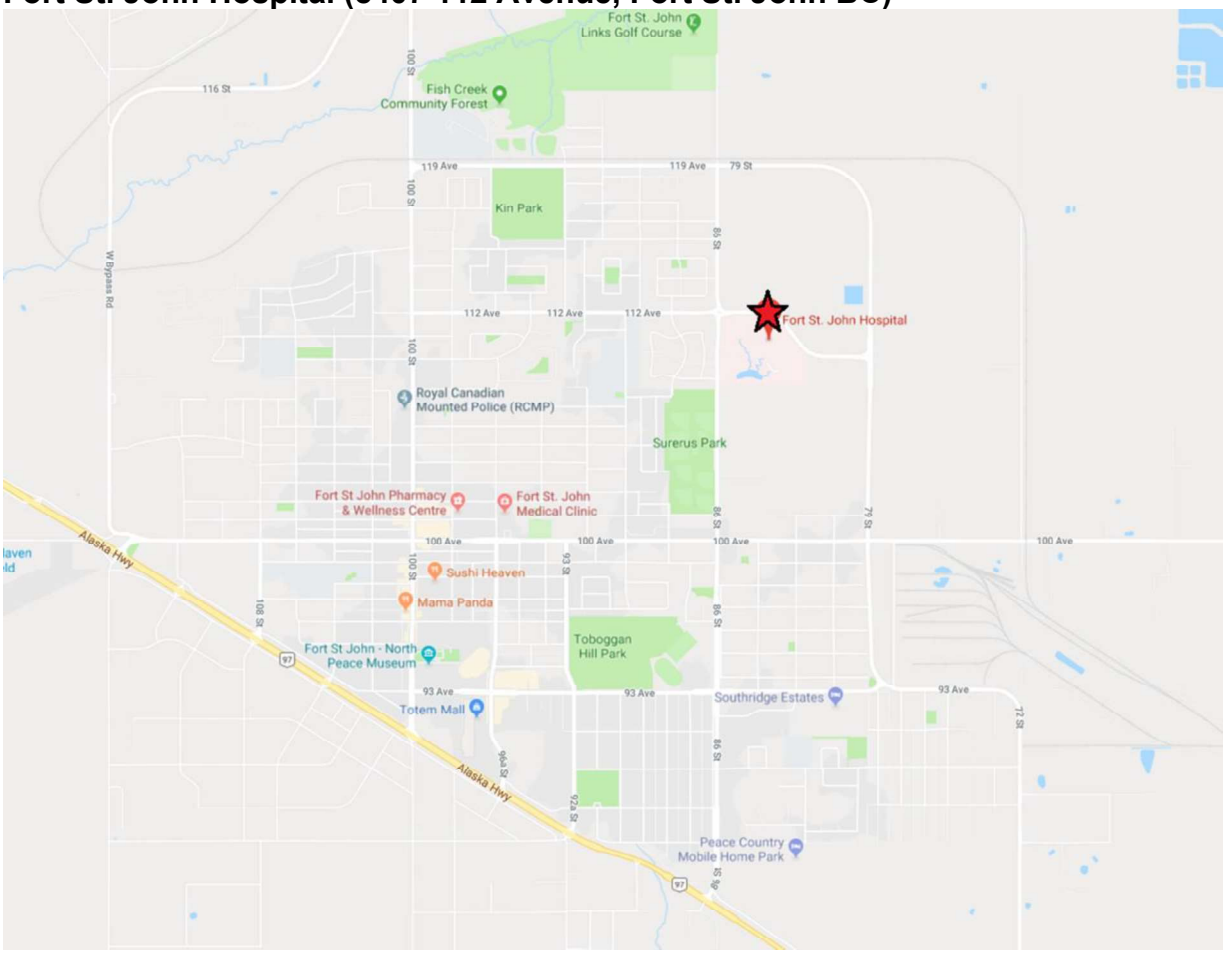
<*provided by the Contractor*>

Appendix 7: Key Member Resumes and Safety Certifications

<*provided by the Contractor*>

Appendix 8: Hospital Maps

Fort St. John Hospital (8407 112 Avenue, Fort St. John BC)



Directions

Head Southbound on the Alaska Highway

Turn Left onto 100 Ave.

Turn Left onto 86 St.

At the roundabout, take the 1st exit onto 112 Avenue

Turn Right toward Drop-off Loop

Continue straight onto Drop-off Loop

Appendix 9: Safe Work Procedures <*if required*>

R.109901.002
Appendix C

Category 3 Traffic Management Plan Template

<insert company logo/information>

Category <*2 or 3*>
Traffic Management Plan

<Name of Project>
<PSPC Project No.>

<Date>

Rev. <*Number*>

Prepared for:

Public Services and Procurement Canada | Services publics et Approvisionnement Canada

The Contractor shall ensure that this document is available on site to all workers for the project duration.

<This template is provided to aid the Contractor in preparing their traffic management plan according to the contract requirements. It is the responsibility of the Contractor to ensure that all required information is presented in their traffic management plan to meet the requirements of the project specifications and British Columbia Ministry of Transportation and Infrastructure's Traffic Management Manual for Work on Roadways – 2020 Office Edition. The Contractor shall review all aspects of this template and make changes and additions as needed to suit the project requirements.>

Table of Contents

1. Category Definition

Based on the steps outlined in Section 3.2: Project Category Determination in BC MoTI's Traffic Management Manual for Work on Roadways – 2020 Office Edition, the <Project Name> Project calls for at Category <#> Traffic Management Plan.

A Category <#> Traffic Management Plan is characterized by:

-
-
-
-

<Add as many points as deemed required for the project>

A Category <#> Traffic Management Plan consists of:

-
-
-
-

<Add as many points as deemed required for the project>

The aim of the Category <#> Traffic Management Plan is to minimize the site-specific risks that were identified for the project.

2. Traffic Control Plan

See also Appendix A: Traffic Control Plan Drawings in this Traffic Management Plan for the proposed layouts of the traffic control devices for the project. A list of the drawings is provided in Section 2.4 Drawing List.

Plan Date	*<Date when plan was initiated.>*
Latest Revision	*<Date of latest revision.>*
Site Name	*<Name of project.>*
Plan Developed By	*<Name of person who developed the plan.>*
Exact location, direction, and distance to nearest landmarks	*<Highway number and name of location, etc.>*
Project Supervisor	*<Name of Project Supervisor.>*
Prime Contractor	*<Name of Prime Contractor.>*
Traffic Control Manager	*<Name of Traffic Control Manager (if applicable).>*
Traffic Engineer	*<Name of Traffic Engineer (if applicable).>*
Traffic Control Supervisor	*<Name of Traffic Control Supervisor and company.>*
Traffic Control Persons	*<Names of TCPs and company.>*
Project Start Date	*<Date>*
Project Completion Date	*<Date>*

2.1 Traffic Control Provisions

Traffic Control Supervisor	<*Name of Traffic Control Supervisor and company.*>
Traffic Control Persons	<*Name of TCPs and company.*> Automated Flagger Assistance Devices will not be used on the project.
Off-Hours Traffic Control	<*Types of traffic control devices.*>
Illumination	Traffic Control Persons (TCPs) will be used during non-daylight hours (before sunrise after sunset). Details of the overhead lighting to be used at each TCP location are included in <*Report Section/Appendix*>. Details shown include the location, direction, height, brightness, and use of shields on the lights to suitably illuminate the TCP but not obstruct the visibility of drivers approaching the TCP.
Means of Communication	<*How will TCPs communicate?*>
Signage	<*Are signs installed for short-duration or long-duration work?*> <*Are the signs spaced in accordance with posted speed?*> <*Are details provided for the procedures, processes, and sequencing used to determine the layout of the signs in the field and the order of installation and order of removal of the signs in the field? Refer to Section 6: Traffic Control Layouts – General Instructions of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition for further details. At a minimum the text and figures included in Item 6.7.4 – Two-Lane, Two-Way Roadways shall be included within the Contractor's Traffic Management Plan for reference during the work (in main body of the plan or in Appendices of the plan with reference to applicable Appendix in main body of the plan). The Contractor shall customize the details of the steps for the project as required.*> <*Are graphical representation of the sign supports planned for use on the project shown; including Post Mounted Supports found in Figure 01 35 00 – 01 and or the Wind Resistant Sign Stand found in Figure 01 35 00 – 02 (both shown below)?*> All sign supports shall either be a post mounted support per the requirements of Figure 01 or Wind Resistance Sign Stand per the requirements of Figure 02.

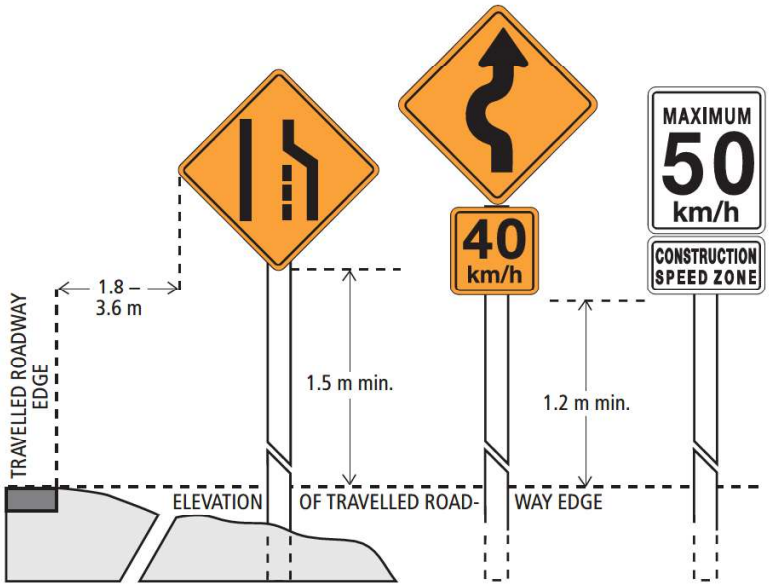


Figure 01: Post Mounted Supports

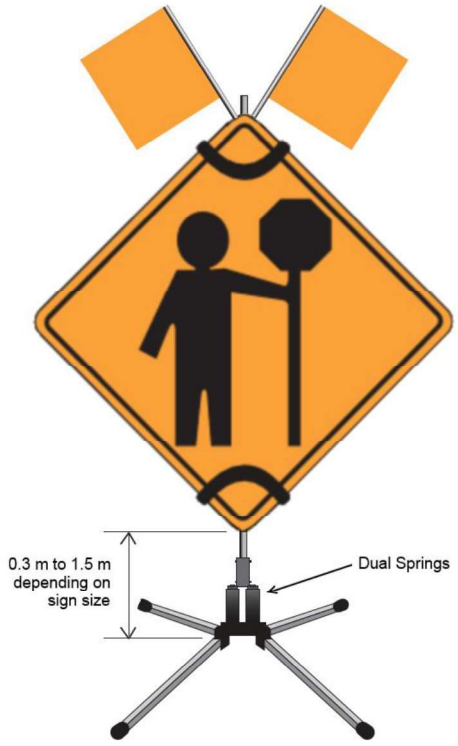


Figure 02: Wind Resistant Sign Stand

Flags will be used on the following signs:

.1 Traffic Control Person Ahead (C-001-1).

	.2 Survey Crew Ahead (C-003). .3 Crew Working Ahead (C-004). .4 Accident Scene (C-058). Unless pre-approved by the Departmental Representative, one or more sand bags or weights will be in used at all times to further stabilize all Wind Resistance Sign Stands. Where an option for a sign size is available, the sign size used will be the larger dimension sign as listed in Appendix B.2: Sizes and Applications of Individual Signs of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition. Signs will be positioned so that they do not block the sight lines of drivers entering a roadway from side roads or other access points.
Portable Dynamic Message Signs (DMS)	*<Are DMS required? Where will they be located?>* Two (2) portable dynamic message signs (DMS) will be used for the duration of the work. The DMS will have a minimum of 3 lines with 8 characters per line (minimum 450 mm character size) A portable dynamic message sign (DMS) will be used in the location identified in 7.2 Typical Construction Speed Zone Signing – Two-Lane, Two-way Roadway (Item 3.2 – Traffic Management, subsection .1.5.3 of the contract specification). A list of DMS messages which will be displayed on the DMS throughout the project is shown in Appendix D. Messages that will be used on the DMS are per Section 4 – Temporary Traffic Control Devices (Table 4.5 and Table 4.2) of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition plus other messages anticipated to be required on the project.
PSPC Permanent Variable Message Signs	PSPC will assist <*Name of Contractor*> with the Public Information Plan by notifying DriveBC of the work and posting notice of the project on PSPC's permanent variable message signs along the highway. <*Name of Contractor*> will inform PSPC a minimum 7 days in advance of any scheduled work to be posted. All other requirements of the Public Information Plan (Section 3.2.3 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition has been included in the Traffic Management Plan and will be undertaken / implemented <*Name of Contractor*> prior to commencing work.
Intersections affected by work zone or traffic control devices	*<Are intersections affected by the work zone or traffic control devices?>* *<If so, how will the intersections be controlled?>*

	<*Will additional traffic control devices be required?*>
Flexible Drums	<*Will flexible drums be used to delineate lane drops?*> <*Will they be used to identify construction accesses to the work activity area?*> Unless preapproved by the Departmental Representative, where 45 cm, 70 cm, or 90 cm cones are called for by the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition, 100 cm tubular markers will be used.
Traffic Stoppages	<*Are there any anticipated traffic stoppages?*> <*If so, for how long?*> <*Will there be single lane alternating traffic?*>
Layout of Devices	<*Identify spacing between traffic control devices.*>
Emergency Vehicles	<*Will emergency vehicles have clear, unobstructed access to the site.*> <*What procedures will be in place to ensure that emergency vehicles are able to access the site without delay?*>
Pilot Cars	Pilot cars will not be used on this project un pre-approved by the Departmental Representative.
Drop-offs	Drop-off's are defined as an abrupt change in elevation created by construction activity such as milling, paving, or excavation that is steeper than 3H:1V. Drop-off's will be treated in accordance with Section 6.5 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition whenever the drop-off is within 1.5 m of the edge of the travel lane. Additionally, drop-offs ≥ 150 mm between 1.5 m and 3.0 m of the travel lane will be signed with Low Shoulder (C-013) signs at least once every 1 kilometer for as long as the condition persists.

2.2 Work Activity Specific Risk Assessment and Traffic Plan

<A separate table and traffic control plan drawing (Table in Section 2.4 and drawings in Appendix A) is required for each unique element of work. Example elements of work are to include but are not limited to unloading of equipment, paving, line painting, rumble strip installation, excavation on highway, excavation off highway, culvert installation, etc. The Contractor is to add additional tables as necessary.>

Work Activity	*<Type of work: stationary, slow-moving, emergency, brief, short-duration, or long-duration work?>*
Station / Location	
Traffic Control Drawing	Appendix A – Drawing *<Drawing number of associated traffic control set-up>*
Identified Risks	*<What potential risks associated with the work have been identified?>*
Work On/Off Roadway	*<Is the work on or off the roadway?>*
Site Access/Egress	*<How will equipment access and exit from the site?>*
Intersections affected by work zone or traffic control devices	
Delays, Closures, Diversions, and Detours	*<Will delays, closures, diversions, and/or detours be in place?>* *<If so, illustrate in Appendix B: Detour Traffic Control Plan Drawing.>* *<What is the design speed for the detour?>* *<Can it withstand the traffic that will be using the road?>* *<For what duration will these be in place?>*
Hours of Work	*<The hours during which the work will occur.>* *<The time period during which the work will affect traffic.>*
Dump Site	*<Location of dump site and access/exit requirements.>*
Construction Equipment	*<How will construction equipment be protected during working hours? During off-hours?>*

2.3 Drawing List

Below is a table summarizing the of drawing(s) showing the applicable traffic accommodation strategies which will be used during specific elements of the work.

<Include a table or list of each element of work on the project and the applicable traffic accommodation strategies and layout drawing(s) which will be used during that element of work throughout all project locations. The table or list of each element of work on the project shall also include the applicable traffic accommodation strategies and layout drawing(s) to be used during non-work hours.>

Traffic Control Drawing(s)	Corresponding Tender Drawing(s)	Project Location(s)	Construction Element(s)
<Drawing No.>	*<Drawing No.>*	*<Station Range, ex.283+360 to 308+905>*	*<ex. Equipment loading / unloading within the clearzone, Loading trucks, Material delivery / hauling, Culvert Installation outside the clearzone, etc.>*

3. Incident Management Plan

The Incident Management Plan defines processes for responding to unplanned events or traffic incidents in the work zone so that incident response operations within the work site are managed effectively.

The Incident Management Plan requirements are partially determined by the project category (see Section 3.2: Traffic Management Plan Sub-Plans and Section 3.4: Traffic Management Plan Requirements by Category in the **Traffic Management Manual for Work on Roadways).**

Traffic Control Supervisor and Qualifications	*<Name and qualifications.>*
Traffic Control Manager and Qualifications	*<Name and qualifications.>*
Emergency Response Agencies and Contact Information	*<Name and contact information (may be listed in Section 6: Contact List).>*
Types of traffic incident that could occur within work zone	*<Motor vehicle incident, motor vehicle incident with injuries, vehicle stalls, emergency vehicle transit of work zone, dangerous goods incident, wide load passing, etc.>*
Procedures for responding to traffic incident that occurs within work zone	*<Will there be a radio announcement?>* *<Who will evaluate the incident?>* *<Who will call 911?>* *<Will traffic be stopped, or will there be single lane alternating traffic?>* *<Who will assist the emergency responders through the site, and how?>* *<Who will assist if it is necessary to clear vehicles, and how?>*
Procedures to restore traffic flow around incident site as quickly as possible	*<How will traffic movement be restored?>* *<Will traffic control devices be used?>* *<If so, how?>*
Procedures to clear incident and restore normal project traffic	*<How will the incident be cleared to restore traffic movement?>* *<How many TCPs are required?>*

operations as soon as possible	
Procedure to inform and update PSPC regarding incident in work zone	*<What is the procedure for advising the PSPC that an incident occurred, what response measures are being taken, what clearance measures are required, and what the estimated clearance time will be?>*
Procedure to inform travelling public of estimated duration of delay and alternative routes (if applicable)	*<Will DMS be used to display information?>*
Incident Reporting	*<Who will provide details to the PSPC?>* *<What is the process for incident follow-up?>*
Investigation Process	*<Who will lead the incident investigation?>* *<What investigation process will be used to assess the incident and those involved?>*
Review and Continuous Improvement Process	*<How incidents will be reviewed and followed up to reduce the severity and frequency of future incidents?>*

4. Public Information Plan

The Public Information Plan identifies actions and procedures for informing the travelling public, project stakeholders, and the PSPC of current traffic operations and planned changes to traffic operations.

PSPC will assist the Contractor with the Public Information Plan by notifying DriveBC of the work and posting notice of the project on PSPC's permanent variable message signs along the highway. All other requirements of the Public Information Plan (Section 3.2: Traffic Management Plan Sub-Plans and Section 3.4: Traffic Management Plan Requirements by Category in the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition) shall be included in the Traffic Management Plan and by undertaken / implemented by the Contractor prior to commencing work.

Process for routinely notifying PSPC of changes to scheduled work plans	<*Who will be responsible for the changes?*> <*What is the person's title?*>
Process for notifying travelling public of scheduled traffic delays and project duration	<*Identify the forms of communication to be used [radio, project signs, Permanent Dynamic Message Signs), Portable Dynamic Message Signs, public meetings, etc.].*>
Process for notifying travelling public of unscheduled traffic delays	<*Identify the forms of communication to be used [project signs, Permanent Dynamic Message Signs, Portable Dynamic Message Signs, public meetings, etc.].*>
Major user groups for alternating lane closures or road closures	<*Identify the major user groups (BC Trucking Association, BC Transit, emergency response agencies, school districts, etc.).*

5. Implementation Plan

The Implementation Plan identifies responsibilities and procedures for ensuring that traffic management sub-plans are developed and implemented in a coordinated manner.

It identifies the qualifications, responsibilities, and duties of supervisory and management personnel responsible for implementing the Traffic Management Plan and includes the designation of a Traffic Control Manager and a Traffic Control Supervisor.

See also Section 3.2: Traffic Management Plan Sub-Plans and Section 3.4: Traffic Management Plan Requirements by Category in the Traffic Management Manual for Work on Roadways.

Traffic Control Manager and Responsibilities	*<Name, qualifications, responsibilities, and duties.>*
Traffic Control Supervisor and Responsibilities	*<Name, qualifications, responsibilities, and duties.>*
Person who will manage emergency traffic control operations	*<Name and title.>*
Person who will maintain daily traffic control logs	*<Name and title.>*
Person who will manage Incident Management Plan	*<Name and title.>*
Person who will manage Public Information Plan	*<Name and title.>*
Person who will monitor inactive work site	*<Name, title, and responsibilities.>*

6. Contact List

6.1 Emergency Response Agencies/Assistance

Agency/Assistance		Contact 1	Contact 2
RCMP		**911**	
Local Police – Fort Nelson (emergency)		250.774.2777	
Local Police – Fort Nelson (non-emergency)		250.774.2700	
Local Police – Fort St. John (emergency)		250.787.8100	
Local Police – Fort St. John (non-emergency)		250.787.8140	
Local Police – Watson Lake (emergency)		867.536.5555	
Local Police – Watson Lake (non-emergency)		867.536.2677	
BC Ambulance			
Ambulance – Fort Nelson		250.774.2344	
Ambulance – Fort St. John		250.785.5559	
Ambulance – Watson Lake		867.536.4444	
S.T.A.R.S Ambulance		1.888.888.4567	
Fire and Rescue			
Fire and Rescue – Fort St. John		250.785.4333	
Fire and Rescue – Fort Nelson (emergency)		250.774.2222	
Fire and Rescue – Fort Nelson (non-emergency)		250.774.3955	
Fire and Rescue – Watson Lake (emergency)		867.536.2222	
Fire and Rescue – Watson Lake (non-emergency)		867.536.8008	
BC Forest Fire Reporting		1.800.663.5555	*5555 (Cell)
Yukon Forest Fire Reporting		1.888.798.3473	
WorkSafeBC Work Site Emergency	**24 hr**	1.888.621.7233	1.800.663.4630 250.785.1283 (Non-emergency)
HazMat	**24 hr**	1.800.663.3456	
BC Environmental Provincial Emergency Program	**24 hr**	1.800.663.3456	
BC Environmental Regional Office		250.787.3411	
BC Hydro – Power (Emergency)	**24 hr**	911	1.800.224.9376 (Non-emergency)
Fortis BC – Natural Gas Emergencies	**24 hr**	1.800.663.9911	
BC One Call		1.800.474.6886	*6868 (Cell)
NorthwesTel (Corporate Office Whitehorse)		1.867.668.5300	
Poison Control		1.800.567.8911	*311 (Cell)
Reporting Safety Violations	**24 hr**	1.888.775.8785	
Peace River Regional Office		250.784.2363	

Provincial Emergency Program **24 hr** (Ground Search & Rescue)	**1.800.663.3456**	
Commercial Vehicle Inspection and Standards (CVSE)	1.888.775.8785	
Towing Company	<Contact #>	
Road Maintenance Contractor – White Bear Industries	250.635.3169	
Other		
Northern Rockies Regional Municipality	250.774.2541	
School District 60	250.262.6000	
School District 81	250.774.2591	
Media		
Peace Sun / 101.5 The Bear	250.787.0669 (Studio)	250.785.6334 (Reception)
1001. Moose FM	250.787.2222 (Control Room)	250.787.100 (Office)
Alaska Highway News	250.785.5631	

6.2 Prime Contactor's Contact Numbers

Name and Position	Office Number	Cell Phone Number
<*Name*>, Project Superintendent	<Contact #>	<Contact #>
<*Name*>, Health and Safety Coordinator	<Contact #>	<Contact #>
<*Name*>, First Aid Attendant(s)	<Contact #>	<Contact #>
<*Name*>, Traffic Control Supervisor	<Contact #>	<Contact #>
<*Name*>, Traffic Control Company	<Contact #>	<Contact #>
<*Name*>, Key Subcontractor Representatives	<Contact #>	<Contact #>

6.3 PSPC Contact Numbers

Name and Position	Office Number	Cell Phone Number
George Smith – Operations Manager, Alaska Highway	250.774.6956	250.321.0174 600.700.0131 (Satellite Phone)
<*Name*> – Onsite Inspection and QA Representative	<Contact #>	<Contact #>

Appendix A: Traffic Control Plan Drawings

Appendix A: Traffic Control Plan Drawings

Site Diagram
<Use additional pages as necessary>

<Show all site factors affecting traffic control, traffic control devices, spacing, signs (including sizes), explanatory notes, North arrow, etc.>

<Per section 6.3 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition, traffic management shall be managed as one continuous work zone where the work is one kilometer apart or less.>

Appendix B: Detour Traffic Control Plan Drawings

Appendix B: Detour Traffic Control Plan Drawings

Site Diagram
<Use additional pages as necessary>

<Show all site factors affecting traffic control, traffic control devices, spacing, signs (including sizes), explanatory notes, North arrow, etc.>

<Per section 6.3 of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition, traffic management shall be managed as one continuous work zone where the work is one kilometer apart or less.>

Appendix C: Daily Sign Check Form

Daily Sign Check Form

Project Name and Number	**Project Location**
Type of Work	**Highway Location**

Date yyyy/mm/dd	Time of Inspection	Location and Deficiency Type	Comments	Initials

Date yyyy/mm/dd	Time of Inspection	Location and Deficiency Type	Comments	Initials

Appendix D: DMS Message Library

Appendix D: DMS Message Library

<Provide a list of DMS messages which will be displayed on the DMS throughout the project. Messages that will be used on the DMS shall be per Section 4 – Temporary Traffic Control Devices (Table 4.5 and Table 4.2) of the BC Ministry of Transportation Traffic Management Manual for Work on Roadways – 2020 Office Edition plus other messages anticipated to be required on the project.>

R.109901.002
Appendix D

Onsite Construction Start-Up Form

Public Services and Procurement Canada | Services publics et Approvisionnement Canada

On-site Construction Start-up Form

Project Name:	Km 155 Slope Stabilization, Alaska Highway, BC
Project Number:	R.109901.002
Departmental Representative:	Ph:
Contractor:	
Contractor Representative:	Ph:

The Contractor or its subcontractors shall not perform any on-site work until they receive a completed version of this form which has been signed by PSPC's Departmental Representative.
PSPC reserves the right to refuse payment for any on-site work performed prior to the receipt of the completed and signed form.
The list below is meant to be a guide and is not intended to be a comprehensive list of required submittal items for the project. Refer to Contract Documents and Contract Specifications for a Complete List.

Submission Item	**Reviewed & Accepted by PSPC**	**Date** (yyyy-mm-dd)	**Comments / Exclusions**
Contract, Bonding and Insurance	☐		
Health & Safety Plan	☐		
Traffic Management Plan	☐		
Environmental Protection Plan	☐		
Project Construction Schedule	☐		
Quality Management Plan	☐		
Construction Staging Plan	☐		
Construction Equipment List	☐		
Other:	☐		
Other:	☐		

Below to be completed by the Departmental Representative and returned to the Contractor

Has the Contractor submitted all required documents for construction work to commence? ☐ Yes ☐ No

Have all listed documents required prior to construction commencement been accepted by PSPC? ☐ Yes ☐ No

Comments: _____

_____

_____

_____

Name of Departmental Representative: _____

Signature: _____ Date: _____

R.109901.002
Appendix E

Progress Payment Request Form

Public Services and Procurement Canada | Services publics et Approvisionnement Canada

Progress Payment Submittal Form

Project Name:	Km 155 Slope Stabilization, Alaska Highway, BC
Progress Payment Number:	
Departmental Representative:	Ph:
Contractor:	
Contractor Representative:	Ph:

This form, completed and signed by the Contractor's Representative, shall be submitted with all documentation listed below for each progress payment request.
Upon receipt of this form and all documents, PSPC will commence review of the progress payment request in accordance with General Conditions 5 – Terms of Payment.
The list below is meant to be a guide and is not intended to be a comprehensive list of required submittal items for each progress payment. PSPC may request additional documentation not listed below.

Submission Item	Submitted	Comments
Progress Payment	☐	
Statutory Declaration	☐	
WorkSafeBC Clearance Letter	☐	
Project Schedule (with baseline tasks and updates showing completion dates and % complete)	☐	
Other:	☐	
Other:	☐	

Prime Contractor Representative:

Name:_____

Title:_____ Signature:_____

Date:_____

Canada

R.109901.002
Appendix F

Environmental Protection Plan (EPP) - Checklist

Environmental Protection Plan (EPP) — Checklist

Note: This checklist was developed to assist the Contractor in determining and mitigating environmental issues at site. It is considered a generic checklist and it is in the Contractor's best interest to review the PSPC Environmental Management Plan (EMP) or the Environmental Assessment (EA) as supporting documents in the completion of the site Environmental Protection Plan (EPP). This EPP Checklist does not need to be submitted for review by the Departmental Representative.

EPP Framework	Content Requirements	No	Yes	N/A
Project Setting and Site Activities				
Project Description	A brief description of the project and its location is provided.			
Environmental Sensitivities	Sensitive or protected features that could be impacted as a result of the Contractor's activities are described.			
Site Activities	A scope of work and a list of all construction or related activities to be undertaken during the project are provided.			
Project Schedule and Site Drawings				
Project Schedule	A project schedule is provided, including scheduled shut-downs and restricted work periods due to environmental requirements.			
Site Drawing	One or more site drawings(s) are provided, indicating the site location; site set-up and layout; erosion and sediment controls; in-stream work areas; and environmental sensitivities.			
Potential Environmental Impacts and Controls				
Potential Environmental Issues and Impacts	The potential environmental issues and impacts that may result from the construction activities are described. Environmental Reports (Environmental Assessments; Fish Habitat and Compensation, etc.) will be provided to the contractor especially with respect to any in-stream work procedures that will be required. For example, in-stream works will impact fish and fish habitat in the surrounding ecosystem. It is the Contractor's responsibility to ensure the work is completed in a manner that causes the least impact on the ecosystem (see section on Mitigation).			
Permits, Approvals, and Authorizations	List required permits, approvals and authorizations. As applicable, environmental mitigation measures prescribed by regulatory agencies and included in project permits, approvals and authorizations are described. NOTE: DFO, MoE and NWPA approvals and authorizations for in-stream works are PSPC's responsibility however, the Contractor must be aware of the requirements of these approvals/authorizations. Permitting for water withdrawal from the waterbody as part of construction activities is part of the Contractor's responsibility.			
Mitigation Strategies	Procedures, controls or best management practices (BMPs) to prevent or reduce adverse impacts on the environment are provided. All work in BC must adhere to the BC MoE "Standards and Best Practices for Instream Works".			
Erosion and Sediment	Erosion and sediment controls are provided, as appropriate for the jurisdiction.			

Waste Management and Hazardous Materials				
Waste Management and Hazardous Materials	Hazardous materials that will be used and/or stored on site are listed. Expected hazardous and non-hazardous waste materials along with proper handling, containment, storage, transportation and disposal methods are listed. As appropriate for the jurisdiction, estimated waste quantities and specific handling procedures are also provided. For example, refueling of equipment will be conducted at least 100m away from any active drainage courses.			
EPP Implementation				
Site Representative	Name(s) and contact details for the person(s) who will be the Contractor's Site Representative(s) are provided.			
Training and Communication	Training and communication details are provided.			
Monitoring and Reporting	Monitoring and inspection procedures, including a schedule of monitoring activities and reporting procedures are provided. For example, this would include downstream monitoring activities for increased siltation during in-stream works.			
Documentation	Information and/or records that will be maintained relating to the EPP and end environmental matters on the project site are described.			
EPP Update	EPP review and update procedures are provided.			
Environmental Emergency Response Procedures				
Environmental Emergency Response Procedures	Potential incidents that may impact the environment are identified, and emergency response procedures to prevent and respond to incidents are provided. An environmental emergency response contact list is also provided.			

R.109901.002
Appendix G

Responsibility Checklist for Authorizations / Approvals / Notifications / Permitting

Responsibility Checklist For Authorizations/Approvals/Notifications/Permitting

Project Title	
Project Description	
Project Type	
Comments	

Issued By	Document Type	Yes	No	N/A
PSPC Responsibility				
Federal				
DFO - Fisheries Act http://laws.justice.gc.ca/en/F-14/	Section 35(2) Authorization for Harmful Alteration Disruption or Destruction (HADD) to fish habitat (E.g. new bridges that are not clear span; erosion protection works that extend into the river channel).			
	Section 32 Authorization for Destruction of Fish (when explosives are used). Protects fish from being destroyed except by fishing or as Authorized by DFO.			
	Section 20 Approval – The Need for Safe Fish Passage – Every obstruction across or in any stream where DFO determines it necessary that a fish-pass should exist requires either a fish way or canal around the obstruction.			
	Notification process required for culverts and those works that fall under DFO Operational Statements. Stream Crossings by Roads: • Clear Span Bridges • Temporary Ford Stream Crossing • Ice Bridges and Snow Fills • Bridge Maintenance • Maintenance of Riparian Vegetation in Existing Rights-of Way			
	Section 36 – under this Section of the Fisheries Act the proponent can be FINED resulting from deposition of substances deleterious to fish in waters frequented by fish – this includes release of silt laden waters from construction activities.			

Transport Canada NWPA http://laws.justice.gc.ca/en/N-22/text.html	Section 5(1) Formal Approval for construction of new structures (new bridges, culverts, scour protection).			
	Section 5(2) Work Assessment for work resulting in insignificant impacts on navigability.			
	Section 6(4) Formal Approval for existing structures (existing bridges).			
	Minor Works and Waters Order – This is an amendment to the NWPA that streamlines the federal review process by establishing classes of waters and works (projects) that do not require an Application or Approval through the NWPP because they are "minor" in nature. These would include such "works" as repairs to riprap (no groynes) or "waters" that are not large enough for vessel traffic (i.e.. Contact Creek). http://www.tc.gc.ca/eng/marinesafety/oep-nwpp-minorworks-menu-1743.htm			
Indian and Northern Affairs Canada – Indian Act	Approval for activities on lands under their jurisdiction. This is addressed under the EA review process in most cases. If the project is exempt from an EA it must be addressed by the PM or ES personnel.			
Migratory Birds Convention Act (MBCA)	Environment Canada is responsible for implementing the *Migratory Birds Convention Act*, which provides for the protection of migratory birds through the *Migratory Birds Regulations*. This is addressed under the EA review process in most cases. If the project is exempt from and EA it must be addressed by the PM or ES personnel.			
ECMP	Has taken over for our old CEAA form. The ECMP Checklist and the Preliminary Identification of Environmental Support Required (PIESR) Form have been developed to ensure that applicable environmental legislation and relevant aspects are identified during a project. The ECMP Checklist replaces the PSPC CEAA Checklist, and will be the mechanism by which project information is submitted to PSPC Environmental Services to determine whether environmental support is required. The ECMP Checklist is located in ELF (Form 183_e). By completing and submitting the ECMP Checklist to Environmental Services, PSPC project managers1 will ensure that their projects are systematically evaluated for compliance with environmental			

[1] Project Manager refers to anyone who leads, manages or delivers a project

	legislation, policies and sustainable development requirements			
Species at Risk Act (SARA) http://www.sararegistry.gc.ca/default_e.cfm	A list of federally-listed species at risk likely to occur at a given subject site must be compiled in order to identify potential impacts & propose mitigation measures for minimizing impacts to these species as a result of project activities. In cases where suitable habitat for a given species exists at/near the project site, mitigation measures are recommended, including avoidance of areas containing said habitat and informing site workers of these issues to prevent incidents.			
First Nations Notifications and Consultations http://clss.nrcan.gc.ca/googledata-donneesgoogle-eng.php	Natural Resources Canada has developed an overlay to be used with Google Earth & Google Maps to identify First Nations lands throughout the country. Notifications of projects within 5 Km of such lands and/or directly upstream from such lands should be submitted to the relevant First Nations for a determination of their interest in a given project and/or to request any traditional knowledge they may have to offer.			
Provincial – **Note one submission package for instream works is sent to FrontCounterBC at MoE who then send off to the appropriate departments for approval/notification/permitting – this does not apply to the archeological.**				
Wildlife Act – WLAP – MoE http://www.qp.gov.bc.ca/statreg/stat/W/96488.01.htm	Wildlife Act – Section 34 – Birds, Nests and Eggs – vegetation clearing should not occur during critical bird nesting periods, which typically occur in the spring and summer. Contact the local WLAP for vegetation clearing timing windows.			
Water Act - Water Stewardship Division - Ministry of Forests, Lands, Natural Resource Operations, and Rural Development	Section 11 – regulates changes in or about a stream and ensure that water quality, riparian habitat, and the rights of licensed water users are not compromised. This is an approval process and takes approximately 140 days. An application fee is also required. Works requiring approval include channel realignment, retaining wall or bank protection stabilization etc.			
Environmental Stewardship Division - MoE	Notification process for such works as replacement and maintenance of culverts and outfalls; temporary stream diversions around a worksite and takes approximately 45 days to receive notification approval. In general, those works requiring a notification are those that do not involve any diversion of water.			
Fish Protection Act – MoE http://wlapwww.gov.bc.ca/habitat/fishprotectionact/	This Act was passed in 1997 and is reviewed as part of the Water Act under Section 11 when applying for approval.			

Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Archaeological http://www.for.gov.bc.ca/archaeology/requesting_archaeological_site_information/process_steps.htm *Contact: Hayley Bond (250) 953-3343*	When completing projects such as quarry pits and new highway alignments, a request is put into the archaeological branch of MFLNSO via the EA process to search the data base. An archaeological assessment may be required on those areas that are previously undisturbed or undeveloped.			
BC Parks	Various permits are required when completing construction activities within the Parks. Please note that all works within 150 feet of the centreline of the highway (Right-of-Way) are NOT subject to construction permitting. (this does not include permitting for fish surveys).			
Canada-British Columbia Agreement for Environmental Assessment Cooperation http://www.ceaa.gc.ca/default.asp?lang=En&n=04A20DBC-1	Most Alaska Highway Projects will not trigger this agreement, as both the Vancouver CEAA office and the Victoria BC Environmental Assessment Office (EAO) have confirmed that the types and scopes of the projects are not described in the BC Environmental Assessment Act – Reviewable Projects Regulation. However, for due diligence, it is recommended that notifications for all Alaska Highway projects be submitted to CEAA (info@ceaa-acee.gc.ca) for review and, if necessary, a determination of whether or not CEAA and/or the BC EAO should be involved.			
BC Ministry of Environment – BC Species and Ecosystems Explorer http://a100.gov.bc.ca/pub/eswp/	A list of provincially-listed species at risk likely to occur at a given subject site must be compiled in order to identify potential impacts & propose mitigation measures for minimizing impacts to these species as a result of project activities. This process involves conducting a search of the BC Species and Ecosystems Explorer inventory for the specific area of BC containing the proposed project site.			
Consultant Responsibility				
Provincial				
BC Parks ***Ministry of Forests, Lands, Natural Resource Operations, and Rural Development*** *http://www.env.gov.bc.ca/bcparks/permits/*	Permit to Collect Fish for a Scientific Purpose - Regulation Research activities in parks and protected areas, including: collection; monitoring; survey and inventory; and, other research trigger a Park Permit - Ministry of Forests, Lands, Natural Resource Operations, and Rural Development is responsible for the administration of fish and wildlife permits. Note that these permits are taking approx. 6 months to receive due to recent involvement and subsequent consultation with Treaty 8.			
Water Act – Regulation's Protection of Habitat - Section 42(1)	Permit to Collect Fish for a Scientific Purpose – Subsection 42(1)(e) – It is the responsibility of the salvage crew to obtain the necessary permit required to complete a fish and amphibian			

	salvage – in conjunction with the BC Parks permitting.			
Note: research projects and inventory projects are under the same Permit and are applied for under the "Application to Collect Fish for a Scientific Purpose". **http://www.env.gov.bc.ca/pasb/applications/process/scientific_fish_collect.html#a5**				
Contractor Responsibility				
Federal				
DFO – End of Pipe Guidelines	End-of- pipe guidelines for freshwater intake to avoid fish entrainment.			
Provincial				
Water Act - MoE	Schedule A – Water License Applications – use of water from waterbody for road maintenance.			

R.109901.002
Appendix H

Relevant Environmental Publications

Relevant Environmental Publications

The below list of documents are those commonly used when determining how to design and advance a project with the potential to impact a waterbody.

Agency	Publications	Summary
DFO	***Land Development Guidelines for the Protection of Aquatic Habitat - 1993***	This document is a good reference guide for any works that are occurring in or around the water.
	Canada's Fish Habitat Law	Document explaining the fish and fish habitat laws under the Fisheries Act.
	Riparian Revegetation	Information on minimizing, stabilizing and revegetating construction areas.
	Freshwater Intake End-of Pipe Fish Screen Guideline - 1995	Provides guidelines for the contractor to follow to ensure fish screens are used during freshwater intake operations at construction sites.
	Operational Statements Stream Crossings by Roads: • Clear Span Bridges • Temporary Ford Stream Crossing • Ice Bridges and Snow Fills • Bridge Maintenance • Maintenance of Riparian Vegetation in Existing Rights-of Way	Fisheries and Oceans Canada has developed a series of Operational Statements to streamline the undertaking of low risk activities. The Operational Statements outline conditions and measures for avoiding harmful alteration, disruption and destruction (HADD) of fish habitat, and applying them will ensure the project complies with subsection 35(1) of the *Fisheries Act*. You are NOT required to submit a proposal for review by Fisheries and Oceans Canada when you incorporate the measures and conditions outlined in an appropriate Operational Statement into your plans. http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/index-eng.htm
MoE	***Fish-stream Crossing Guidebook - 2002***	Guidelines in protection of fish and fish habitat and the safe passage of fish during construction at/on stream crossings.
	Standards and Best Practices for Instream Works - 2004	Guide to planning and carrying out the proposed construction activities to comply with relevant legislation, regulations and policies.
	A User's Guide to Working In and Around Water - 2005	Understanding the regulation under British Columbia's Water Act.
	Fish-Stream Identification Guidebook - 1998	Assists in providing information on determining fish streams.
	The Streamkeepers Handbook	A practical guide to stream and wetland care in regards to rehabilitation planting.

R.109901.002
Appendix I

Golder 2020 Report
Engineering Services for Slope Stabilization, km 155 of the Alaska Highway, near Wonowon, BC

REPORT

Engineering Services for Slope Stabilization km 155.5 of the Alaska Highway, near Wonowon, BC

PSPC Project Number R.109901.002

Submitted to:

Public Services and Procurement Canada
Attention: Alex Taheri
219 - 800 Burrard Street
Vancouver, BC V6Z 0B9

Submitted by:

Golder Associates Ltd.
10803 91st Ave Unit A Fort St John, BC V1J 6L3 Canada

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19129643-011-R-Rev0

23 September 2020

Distribution List

1 eCopy - Public Services and Procurement Canada

1 eCopy - Golder Associates Ltd.

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Public Services and Procurement Canada (PSPC) to provide consulting services as part of PSPC's Project No R.109901.001 Engineering Services for Slide Area Mitigation km 155.5 of the Alaska Highway, British Columbia.

Golder's services were provided under the terms and conditions of PSPC Standing Offer Agreement No. EZ899-181755/002/TPV for geotechnical services. Golder was provided with a Purchase Order (PO 700470664) to conduct an initial site visit and prepare a summary report (Golder Document No. 19129643-001-L-RevA dated 24 September 2019) (Golder 2019). PSPC subsequently prepared Terms of Reference and Call Up EZ899-202518-001-TPV was provided to Golder in an email dated 5 February 2020. An Amendment to the Call Up was issued on 9 March 2020 to extend the work beyond the 31 March 2020 fiscal year end.

The following presents the findings of Golder's geotechnical investigations of the site together with our interpretations and conceptual plan to mitigate slope related stability issues at km 155.5. This report will be included as part of the tender documents and is meant for the contractor's information only.

The following should be read in conjunction with the *Important Information and Limitations of this Report* presented in APPENDIX A as it is essential for the proper use and interpretation of the report.

2.0 BACKGROUND, TERMS OF REFERENCE AND SCOPE OF WORK

2.1 Background

A short segment of the Alaska Highway, at km 155.5, approximately 7 km south of Wonowon, BC (Figure 1), has been experiencing ongoing slope movement and failures of the existing highway embankment resulting in the development of a series of slides that have damaged a portion of the highway.

The Alaska Highway generally runs north-south between Fort St John and Fort Nelson, BC. Locally, within the area of interest, the Alaska Highway runs approximately east-west and the active slide area is located on the north side of the highway.

It is understood that this section of the Alaska Highway experienced historical movements in the 1990s and, in 2004, general drainage improvements were made along the south side of the Highway, which included the installation of embankment drains and culverts to improve surface drainage and re-sloping of the embankment to reduce slope angles. As-built drawings (McElhanney 2007) provided to Golder by PSPC include details of the embankment drains and culverts in plan, together with cross-sections of the embankment slope re-grading details.

Based on anecdotal information provided by PSPC, it is understood that the most recent slide began in 2018. Visual observations made during Golder's initial site visit in September 2020, indicated an approximately 45 m length of roadway embankment fill on the north side of the highway had been vertically and laterally displaced in the order of several metres, resulting in deposition of a large mound of slide debris adjacent to a steep head scarp within the existing road shoulder. The volume of slide debris is estimated to be in the order of 1,000 to 1,500 m^3, however, no detailed survey has been carried out of the debris mound and it is not known whether any slide debris material may have been removed from the site in connection with temporary stabilization works.

Efforts have been made by PSPC over the past year, since approximately August 2018, to temporarily stabilize the slide area, including placement of coarse rock over the slide debris and grooming of the disturbed portion of the embankment to relax the steep slope in the head scarp area. In 2018, Tetra Tech prepared a conceptual drawing for the proposed mitigation of the slide (Tetra Tech 2018). The mitigation concept consisted of constructing an earth-fill buttress against the failed slope, however, we understand that the concept was not advanced to a detailed design.

More recent slope movements have occurred in July 2019 and additional movements were observed in Spring 2020. There are also indications of ongoing or incipient slope movements in the form of toe bulges within the embankment slopes adjacent to the failed slopes on the north side of the highway.

Improvements to surface water drainage were made in 2004 along the south side of the embankment opposite the slide, however, Golder's fall 2019 and more recent spring 2020 observations indicate that drainage conditions continue to be is poor. The existing ditch, located near the edge of Right-of-Way (RoW) on the south side of the embankment, is discontinuous and poorly defined. In addition, water discharging from the embankment drains is not being effectively directed to the adjacent drainage ditch, resulting in local ponding of water.

2.2 Terms of Reference (TOR)

The Terms of Reference (TPR) associated with Call Up EZ899-202518-001-TPV outlined the requirements for providing a practical and economical solution for stabilization of the slide area. The TOR requirements comprised the following:

- Review the performance and condition of the existing culverts and drainage pipes.
- Provide drainage improvement recommendations including changes to existing grading and ditches.
- Temporary stabilization works to mitigate ongoing damage to the highway embankment resulting from slope failure (slides). Proposed stabilization works could include, for example, a buttress against the highway embankment slope, which has experienced a series of slope failures over the past several years.

Within the highway segment of interest, observed slope movements extend over a distance of approximately 45 m. Surface drainage conditions on the south side of the highway were reported as being poor based on the preliminary findings of Golder's site visit of 5 September 2019 (Golder 2019), with the south side of the highway exhibiting extremely wet conditions and sluggish drainage.

Additional considerations identified by PSPC in the TOR were as follows:

- Mitigative works to be performed during full operation of the highway.
- Implementation of proposed stabilization designs should endeavor to minimize disruption to the travelling public during construction.
- Current environment regulations shall be met during all phases of the work.
- Tailoring of the proposed scope of work to accommodate PSPC's budget and scheduling requirements.

2.3 Scope of Work

The following scope of work has been carried out by Golder in response to the services requested in the TOR:

- Conduct a detailed desktop review of available existing information.
- Conduct a field program comprising:
  - A limited topographic survey of the area of geotechnical interest where slope stability concerns have been identified as follows:
    - Survey to extend from approximately km 155 to km 156 along Alaska Hwy and extend laterally towards treeline (edges of RoW) along both sides of the highway.
    - Survey to capture drainage channels extending 100 m from the highway crossing culvert inlets and outlets.
  - Condition inspection of existing culverts on the south side of the highway and evaluation of the potential need to install additional culverts on both the south and north sides of the highway.
  - Assess hydraulic capacity of the existing culverts.
- Subsurface geotechnical investigations using borehole methods.
- Laboratory testing of soils obtained from boreholes and test pits.
- Fish habitat assessment.
- Prepare a summary report with recommended slide mitigation options and drainage improvements.
- Carry out a detailed design and prepare Tender documents for the selected mitigative option which will be focused on drainage improvements and temporary slide mitigation.

3.0 EXISTING INFORMATION REVIEW AND FIELD SURVEYS

Golder conducted a desktop review of existing information comprising the following:

- As-built drawings of “slide repair” works carried out in 2004 (McElhanney 2007).
- Proposed stabilization concept (Tetra Tech 2018) for the slide area.
- Recent and historical survey data and photographs.

The field surveys and geotechnical investigation consisted of the following:

- A subsurface geotechnical investigation consisting of geotechnical boreholes.
- A hydraulic capacity and condition assessment of existing culverts.
- A culvert inspection.

- A topographic survey tied into the Alaska Highway UTM coordinate system.
- Archeological review.

3.1 Geotechnical Site Investigation

Borehole Investigation

A geotechnical investigation using borehole methods was completed by Golder in March 2020. Golder initially proposed two options to PSCP for the geotechnical investigation: (1) a limited geotechnical investigation of the immediate area of the slide and (2) a more extensive investigation. Based on indications of apparent slope movements that extended beyond the area of the active slope failure (Golder 2019), it was identified that remedial measures would likely need to be implemented beyond the visibly active slide. As a result, PSPC elected to proceed with the more extensive geotechnical investigation.

Prior to commencing the geotechnical investigation, Golder retained the services of qualified utility locating contractor Underworld Line Locating Ltd. (Underworld) to conduct a BC One Call review and an on-site assessment of potential buried services and structures. Proposed borehole locations were assessed by Underworld on 16 March 2020, and the drilling subcontractor was subsequently mobilized to site.

The geotechnical investigation was conducted between 18 March 2020 and 22 March 2020 with a track mounted B54 drill rig owned and operated by Geotech Drilling Services Ltd (Geotech Drilling) using solid stem auger drilling methods. The investigation was conducted under winter conditions. Little or no snow cover was present along the highway shoulder and along the embankment toe, snow cover ranged from approximately 0.4 to 0.9 m in thickness.

Six (6) augerholes were advanced at the site, including the installation of four (4) vibrating wire piezometers (VWPs). Six (6) augerholes (AH20-02 to AH20-06) were advanced to depths of between 15.3 m and 15.7 m below ground surface, with the exception of AH20-02 which reached refusal at 9.6 m.

Augerholes were advanced within the immediate slide area and beyond the slide to assess the extent of potentially unstable embankment conditions. Three (3) augerholes were advanced along the shoulder of the highway in the area of the slide and three (3) augerholes were advanced near the toe of the embankment. The investigation allowed for the comparison of soil conditions within and adjacent to the active slide area. One pair of augerholes (AH20-03 and AH20-05) was located along the shoulder and toe of the active slide, and another pair (AH20-02 and AH20-04) was located in the area to the west of the active slide, where toe bulging was observed, and the third pair (AH20-01 and AH20-06) was located in an area where no movements had been visually observed. Following completion of drilling, the approximate locations of the augerholes were assessed using a hand-held GPS unit. A location accuracy of 5 m was assumed for the hand-held GPS. The approximate locations of the augerholes are indicated on Figure 2.

A member of Golder's geotechnical staff was on-site full time during the field investigation, and logged the subsurface soil and groundwater conditions at each augerhole and collected soil samples for visual classification and geotechnical testing. Representative soil samples were reviewed and selected samples were submitted for testing.

Standard Penetration Tests (SPTs) were conducted at regular depth intervals throughout the drilling process to assess the relative density/consistency of the subsurface soils and to obtain soil samples for testing using the SPT split-spoon sampler. Soils samples were also collected directly from the auger flights.

Where very soft to firm cohesive deposits were encountered when conducting standard penetration testing, a down hole Acker Vane test was conducted. It was periodically necessary to discontinue the vane testing due to concerns related to damaging and/or losing tooling down hole in situations where firm to stiff soils were encountered. In general, SPT samples were targeted at 1.5 m depth intervals, with samples from the auger flights collected between each SPT sample. Detailed descriptions of the subsurface soil conditions encountered at each augerhole location, together with the geotechnical index testing results, are presented in the Records of Augerholes provided in APPENDIX B.

Two (2) vibrating wire piezometers (VWPs) were installed in AH20-05 along the highway shoulder adjacent to the northbound lane fog line, and an additional two (2) VWPs were installed in AH20-03 near the toe of the embankment. The VWPs in AH20-05 (along the shoulder) were installed at depths of 5.2 m and 13.7 m below ground surface and were used to assess groundwater levels within both the embankment fills and the underlying native soils. The cabling from these two VWPs was extended to a well monument within the shoulder to protect the datalogger. The VWPs in AH20-03 (near the toe) were installed at depths of 2.3 m and 7.6 m below ground surface. The VWPs include data loggers to allow for collection of relatively continuous data. VWPs were secured in place using a grout mix for firm to stiff deposits. The VWP probes were affixed to the exterior of the tremie pipe to confirm depth of installation and grouted in place. The augerholes were grouted to ground surface using a tremie pipe system and topped up with bentonite chips.

Table 1: Summary of Augerholes

Augerhole No.	Augerhole Location	Northing (m)	Easting (m)	Approximate Elevation (Masl)	Termination Depth (mbgs)	VWP Install depth (mbgs)
AH20-01	Embankment toe. Area with no movement.	6285208	578840	830.9	15.7	-
AH20-02	Embankment toe. Toe bulging observed.	6285291	578698	840.3	9.6	-
AH20-03	Embankment toe. Active slide area.	6285246	578760	838.8	15.5	2.3 and 7.6
AH20-04	Shoulder. Toe bulging observed along embankment.	6285267	578698	845.8	15.3	-
AH20-05	Shoulder. Active slide area.	6285224	578751	842.7	15.7	5.2 and 13.7
AH20-06	Shoulder. Area with no movement.	6285192	578821	838.9	15.7	-

The coordinates referenced herein are from handheld GPS accurate to +/- 5 m, NAD83 Z10

Mbgs = metres below ground surface

Soil Testing Program

Soil samples collected during the geotechnical investigation were reviewed shipped to Golder's Canadian Council of Independent Laboratories (CCIL) certified Materials Testing Laboratory in Kelowna, BC where geotechnical index testing was conducted on selected representative samples. The soil testing program comprised fifty (50) natural moisture contents, eleven (11) Atterberg Limits and nine (9) particle size distribution tests. The testing results are presented in detail in APPENDIX C.

3.2 Hydrotechnical Survey

The hydrotechnical survey is presented in APPENDIX D, portions of which are summarized in subsequent sections of this report.

3.3 Culvert Condition Survey

Eco-Web Ecological Consulting Services Ltd. (Eco-Web) was retained by Golder to conduct a culvert condition survey. The survey was conducted on 20 May 2020. Eco-Web's scope of work was as follows:

- Document existing culvert and embankment drain conditions.
- Assess culvert and embankment drain functionality.
- Obtain video footage of the culverts and embankment drains as feasible.

Eco-Web's summary report is presented in APPENDIX E.

Eco-Web utilized the drawings (McElhanney 2007) to locate the culvert and embankment drain locations in the field. A pin finder was used to help locate the embankment drains and culverts which were not readily visible; however, several of the embankment drains could not be located.

Eco-Web noted that several of the outlets were damaged and some of the drains could not be located. In addition, Eco-Web noted that most of the inspected culvert embankment drains are functional.

3.4 Fish Habitat Assessment

The fish habitat assessment was conducted on 27 May 2020 and is presented in APPENDIX F.

3.5 Archaeological Review

An archaeological site visit was conducted on 15 June 2020. The preliminary assessment is included in APPENDIX G.

3.6 Topographic Survey

Vector Geomatics Land Surveying Ltd. was retained by Golder to conduct the topographic survey (Vector Geomatics 2020). The field survey was conducted on 27 May 2020. Golder representatives were present during the survey and were conducting fish habitat and hydrotechnical field reviews concurrently with the survey, which allowed for additional efficiency in the field as specific items identified by Golder's field crew could be discussed with the surveyors. The survey was extended to include the culvert at km 155.1 to facilitate hydraulic capacity analyses.

Vector's survey results are presented in APPENDIX H together with the McElhanney 2007 as-built drawings.

4.0 SUBSURFACE CONDITIONS

The soil descriptions provided in this report are based on accepted standard methods of classification and identification routinely used in current geotechnical state of practice. Detailed descriptions of the subsurface conditions encountered in each of the augerholes are presented on the Record of Augerhole Sheets in APPENDIX B. Stratigraphic contacts between the different soil units presented in the Record of Augerhole Sheets have been inferred from visual assessment of continuous auger flights, observations made during drilling and soil sampling, and SPT results. The inferred stratigraphic boundaries were estimated and represent transitions between different soil types rather than exact geologic contacts between soil units. Care should be exercised when extrapolating soil conditions based on augerhole data, as soil conditions can be expected to vary both laterally and with depth among augerholes.

In general, the subsurface conditions predominantly comprised silty clay fills, underlain by native silty clay and inferred bedrock. General subsurface conditions are discussed in the following subsections together with laboratory index test results.

Table 2 Summary of soil types encountered at augerhole locations

Table 2: Soil Type Summary

Augerhole	Asphalt (m)	Slide Debris (m)	Fill (m)	Organic Silt or Silt and Sand (m)	Silty Clay (m)	Silty Clay Till (m)	Inferred Weathered Sandstone / Mudstone (m)	End of Hole (m)
AH20-01	-		0 – 2.74	2.74 – 3.05	3.05 – 6.71	6.71 – 15.7	-	15.7
AH20-02	-		-	0 – 0.91	0.91 – 5.18	5.18 – 9.14	9.14 – 9.6	9.6 Refusal
AH20-03	-	0 – 1.68	1.68 – 3.05	-	3.05 – 9.14	9.14 – 15.24	15.24 – 15.5	15.5
AH20-04	-	-	0 – 5.94	-	5.94 – 11.58	11.58 – 12.62	12.62 – 15.3	15.3
AH20-05	0 – 0.23		0.23 – 6.71	-	6.71 – 15.24	15.24 – 15.7	-	15.7
AH20-06	-		0 – 6.1(1)	-	6.1 – 11.58	11.58 – 15.7	-	15.7

(1) Includes 0.9 m thick clayey sand and gravel from approx. 6.1 to 7 m

The following sections present a general summary and discussion on the soil types encountered at the augerhole locations.

4.1 Fill

Fill was encountered within the highway embankment in augerholes (AH20-04, AH20-05 and AH20-06) and at the two the augerholes (AH20-01 and AH20-03) located at the toe of the embankment slope. Fills are discussed below and are discussed separately based on whether the augerholes were advanced along the highway shoulder or the embankment toe.

4.1.1 Northbound Lane Shoulder Fills (AH20-04, AH20-05, and AH20-06)

Northbound lane fill generally comprised shoulder gravel overlying silty clay embankment fill as discussed in the following subsections.

4.1.1.1 Asphalt

Asphalt was encountered at surface at AH20-05, which was advanced adjacent to the fog line, and had a thickness of 0.23 m.

Augerholes (AH20-04 and AH20-06) were advanced within the gravel shoulder and therefore did not encounter asphalt.

4.1.1.2 Silty Sand and Gravel Fill

Silty sand and gravel fill was encountered beginning at ground surface in augerholes AH20-04 an AH20-06. At augerhole AH20-05, the silty sand and gravel was overlain by surficial asphalt. The silty sand and gravel fill is interpreted to represent gravel shoulder fill and at augerhole AH20-05, may represent the transition from highway road structure to shoulder fill. Based on drilling observations, the silty sand and gravel is brown in colour, non-cohesive, and dense.

The silty sand and gravel fill extended to a depth of approximately 0.6 m below ground surface at augerhole AH20-04 and approximately 0.8 m at augerholes AH20-04 and AH20-06.

4.1.1.3 Silty Clay Embankment Fill

Silty clay fill was encountered underlying the near surface granular fill at all three shoulder augerholes. The silty clay embankment fill extended to depths ranging from approximately 5.9 to 6.7 m below ground surface.

Ten SPTs were conducted within the silty clay embankment fills. At all three augerhole locations, the uppermost SPT yielded relatively high uncorrected SPT blow counts of 15, 26, and 73 blows per 0.3 m penetration, which decreased with depth. The remaining seven uncorrected SPT blow counts ranged from 4 to 10 blows per 0.3 m penetration with an average of 7 blow counts per 0.3 m penetration. Based on the SPT results, the silty clay embankment fill varied in relative consistency from very stiff to hard, becoming soft to firm with increasing depth.

Ten natural water content determinations were conducted on selected samples of the silty clay embankment fill. Natural water contents ranged from approximately 15 to 25 percent with an average natural water content of approximately 19 percent.

Three Atterberg Limits determinations were conducted on selected samples of the silty clay embankment fill from augerhole AH20-05. The results are summarized in Table 3.

Table 3: Augerhole Atterberg Limits Summary - Silty Clay Embankment Shoulder Fills

Augerhole / Sample ID	Depth (m)		Natural Water Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Classification
	Top	Bottom					
AH20-05 / AS1	0.91	1.22	15.4	17	34	17	CI
AH20-05 / AS3	2.44	2.74	19.8	15	39	24	CI
AH20-05 / SS6	4.57	5.03	16.4	15	35	20	CI

The Atterberg Limits results indicate the silty clays are clays of intermediate or medium plasticity. Two of the three natural water contents of the silty clays were above the plastic limit. The samples with natural water contents above the plastic limit were collected at depths greater than 2.4 m within augerhole AH20-05. The shallowest samples, AH20-05 /AS1, collected within approximately 1 m of the existing ground surface, had a natural water content that was below the plastic limit.

Three particle size distribution tests were conducted on selected samples of the silty clay embankment fill and the results are presented in Table 4.

Table 4: Augerhole Particle Size Distribution Summary - Shoulder Silty Clay Embankment Fills

Augerhole / Sample ID	Depth (m)		Gravel Content (%)	Sand Content (%)	Silt Size Particle Content (%)	Clay Size Particle Content (%)
	Top	Bottom				
AH20-04 / AS3	2.44	2.74	4	18	15	63
AH20-05 / AS5	3.96	4.27	1	22	18	59
AH20-05 / AS7	5.49	5.79	0	13	13	74

Note: All percentages are percent, by weight.

The results of the particle size distribution tests indicate the silty clay embankment fill is predominately fine-grained, contains trace to negligible amounts of gravel, and is sandy.

4.1.2 Embankment Toe Fill (AH20-01 and AH20-03)

Augerholes AH20-01, AH20-02, and AH20-03 were advanced along the toe of the northbound lane embankments within the Alaska Highway RoW. Surficial fill was encountered at augerholes AH20-01 and AH20-03 as discussed in the following subsections.

4.1.2.1 Sandy Silty Gravel – Slide Debris

At augerhole AH20-03, the surficial material comprised sandy silty gravel and represents slide debris. This material was absent at the remaining embankment toe augerholes which were advanced beyond the current slide limits.

A single natural water content of 7.6 percent was determined for a sample collected from the slide debris .

A single particle size distribution was conducted on a sample of the slide debris, the results are presented in Table 5.

Table 5: Embankment Toe Particle Size Distribution Summary – Slide Debris Sample

Augherhole / Sample ID	Depth (m)		Gravel (%)	Sand (%)	Fines (%)
	Top	Bottom			
AH20-03 / AS1	0.6	0.9	55	25	20

4.1.2.2 Silty Clay Fill

Silty clay fill was interpreted below the slide debris at augerhole AH20-03 and extends to a depth of approximately 3 m below ground surface. At augerhole AH20-01, the silty clay fill is present at ground surface and is interpreted to extend to a depth of approximately 2.7 m below ground surface.

Two SPTs were conducted within the silty clay fill at augerholes AH20-01 and AH20-03, and both uncorrected SPT blow counts were 5 blows per 0.3 m penetration indicating a firm relative consistency.

Two natural water content determinations were conducted within the silty clay fill and are associated with the corresponding Atterberg Limits determinations. The results are presented in Table 6.

Table 6: Atterberg Limits Summary – Embankment Toe Silty Clay Fills

Augerhole / Sample ID	Depth (m)		Natural Water Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Classification
	Top	Bottom					
AH20-01 / AS1	0.76	1.07	18.9	12	35	23	CI
AH20-03 / AS3	2.44	2.74	20.4	16	34	18	CI

The Atterberg Limits test results indicate the silty clay fill is of intermediate or medium plasticity and the natural water content exceeds the Plastic Limit by up to 7 percent.

4.2 Native Deposits

Native deposits were encountered beginning at ground surface at augerhole AH20-02 and underlying the fill at the remaining five augerhole locations. These deposits generally comprised silty clay, overlying silty clay till and bedrock, where present. The following subsections describe the native deposits encountered during the geotechnical drilling investigation.

4.2.1 Organic Silt

Organic silt was encountered in augerhole AH20-02, from surface to a depth of 0.9 m below ground surface. Some sand and woody debris was encountered within the deposit, and it was noted to be frozen at the time of drilling.

4.2.2 Silt and Sand

A silt and sand layer containing trace organics was encountered underlying the fill in augerhole AH20-01. The deposit is approximately 0.3 m thick and extends to a depth of approximately 3 m below ground surface. Based on drilling observations, the unit was wet and had a loose relative density.

4.2.3 Clayey Sand and Gravel

Clayey sand and gravel was encountered below the silty clay fill and extended to a depth of approximately 7 m below ground surface in augerhole AH 20-06. The approximately 0.9 m thick unit was observed to be wet.

A single SPT was conducted within the clayey sand and gravel and the uncorrected SPT blow count was 35 blows per 0.3 m penetration indicating the unit is dense.

A single natural water content determination was conducted on a sample of the clayey sand and gravel and the natural water content was measured to be 14.4 percent.

4.2.4 Silty Clay

Silty clay deposits, likely representing glaciolacustrine deposits, were encountered underlying the fill or the organic silt or silt and sand deposits.

At augerhole AH20-02, the silty clay underlies the silt and sand deposit and was observed to contain organics. The approximately 0.6 m thick unit may have been subject to a historic forest fire based on colour and composition observations. Otherwise, the silty clay underlying this unit and encountered within the other augerholes was observed to be generally free of organics.

The silty clay deposits extend to depths ranging from approximately 5.2 m (AH20-02) to 15.2 m (AH20-05) below ground surface.

A total of 22 SPTs were conducted within the silty clay deposits and uncorrected SPT blow counts ranged from 4 blows per 0.3 m penetration to 19 blows per 0.3 m penetration with an average uncorrected SPT blowcount of approximately 10 blows per 0.3 m penetration. The silty clay deposits ranged from soft to very stiff in relative consistency, however, on average, these deposits had a stiff relative consistency.

Nineteen natural water content determinations were conducted on selected samples of the silty clay deposits. The natural water content \ranged from approximately 16 percent to 37 percent with an average natural water content of approximately 25 percent.

Five Atterberg Limits determinations were conducted on selected samples of the silty clay deposits and the results are summarized in Table 7.

Table 7: Atterberg Limits Summary – Native Silty Clay

Augerhole / Sample ID	Depth (m)		Natural Water Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Classification
	Top	Bottom					
AH20-02 / SS4	3.05	3.66	27.3	18	42	24	CI
AH20-03 / AS7	5.49	5.79	25	17	44	27	CI
AH20-04 / AS13	10.06	10.36	26.6	16	41	25	CI
AH20-05 / SS12	9.14	9.60	19.8	17	41	24	CI
AH20-05 / AS19	14.63	14.94	16.3	15	34	19	CI

The Atterberg Limits test results indicated the silty clay deposits are silty clays of intermediate, or medium, plasticity and the associated natural water contents exceeded the Plastic Limit by as much as 11 percent.

Two particle size distribution tests were conducted on selected samples of the silty clay deposits and the results are presented in Table 8.

Table 8: Particle Size Distribution Summary – Native Silty Clay

Augerhole / Sample ID	Depth (m)		Gravel Content (%)	Sand Content (%)	Silt Size Particle Content (%)	Clay Size Particle Content (%)
	Top	Bottom				
AH20-01/ SS6	4.57	5.03	0	13	14	73
AH20-05 / SS16	12.19	12.65	0	3	9	88

The particle size distribution test results indicate the silty clays are predominately fine grained with sand contents ranging from trace to sandy.

Two shear vane tests were conducted within the native silty clay deposits and the results are presented in Table 9.

Table 9: Shear Vane Test Results - Native Silty Clay

Augerhole	Tip Depth (m)	Vane Shear Strength (kPa)	
		Peak	Remoulded
AH20-05	6.9	165	75
AH20-05	9.9	225	75

The shear vane results are sensitive to gravel and sand content and the results presented in Table 9 may have been affected by presence of sand and fine gravels.

4.2.5 Silty Clay Till

Silty clay till was encountered underlying the silty clay deposits in all six augerholes. Augerholes AH20-01, AH20-05, and AH20-06 were all terminated within the silty clay till at a depth of 15.7 m below ground surface. At the remaining augerholes, the silty clay till extended to depths ranging from approximately 9.1 to 15.2 m below ground surface.

The silty clay till deposits were generally described as sandy silty clay containing trace gravel; however, both the sand and gravel content were observed to vary. At augerhole AH20-01, the till deposit included an approximately 0.9 m thick layer of gravelly sandy silty clay.

Seventeen SPTs were conducted within the silty clay till deposits and uncorrected SPT blow counts ranged from 16 to 42 blows per 0.3 m penetration with one test result being terminated due to refusal at 51 blows per 210 mm penetration. The average uncorrected SPT blow count within the silty clay till deposits, excluding the result that was terminated due to refusal, is 23 blows per 0.3 m penetration. The results indicate the silty clay till had a very stiff to hard relative consistency.

Fifteen natural water content determinations were conducted on selected samples of the silty clay till and were measured to range from approximately 12 percent to 22 percent with an average natural water content of approximately 17 percent.

One Atterberg Limits determination was conducted on a selected sample of the silty clay till deposits. The result is presented in Table 10.

Table 10: Atterberg Limits Summary –Silty Clay Till

Augerhole / Sample ID	Depth (m)		Natural Water Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Classification
	Top	Bottom					
AH20-06 / SS18	13.72	14.17	17.7	16	33	17	CI

The Atterberg Limits test results indicated the tested silty clay till samples are silty clays of intermediate or medium plasticity and the associated natural water content exceeds the Plastic Limit by approximately 2 percent.

Three particle size distribution tests were conducted on selected samples of the silty clay till and the results are presented in Table 11.

Table 11: Particle Size Distribution Summary – Silty Clay Till

Augerhole / Sample ID	Depth (m)		Gravel Content (%)	Sand Content (%)	Silt Size Particle Content (%)	Clay Size Particle Content (%)
	Top	Bottom				
AH20-01 / AS9	7.01	7.32	27	34	11	28
AH20-02 / AS 9	7.01	7.32	17	37	20	26
AH20-06 / AS17	13.11	13.41	1	23	22	54

A single shear vane test was conducted within the silty clay till and the results are presented in Table 12 below.

Table 12: Embankment Toe Shear Vane Test Results – Silty Clay Till

Augerhole	Tip Depth (m)	Vane Shear Strength (kPa)	
		Peak	Remoulded
AH20-02	5.3	391	105

The shear vane results are sensitive to gravel and sand content and the results presented in Table 10 may have been affected by presence of sand and fine gravel.

4.2.6 Bedrock

Inferred bedrock comprising sandstone or mudstones was encountered in augerholes AH20-02, AH20-03, and AH20-04. These augerholes were all terminated within bedrock. The bedrock cuttings were light brown to brown in colour and comprised silty sand to silt and sand on the auger flights. The bedrock is interpreted to be weathered.

At augerhole AH20-02, inferred sandstone bedrock was encountered at approximately 9.1 m below ground surface and the augerhole was terminated at 9.6 m below ground surface due to effective refusal. At augerhole AH20-03, inferred sandstone bedrock was encountered at approximately 15.2 m below ground surface and the augerhole was terminated at approximately 15.5 m below ground surface due to effective refusal. At augerhole AH20-04, inferred interlayered mudstones and sandstones were encountered at 12.62 m below ground surface and the augerhole was terminated within the bedrock at 15.3 m below ground surface.

A total of four SPTs were conducted within the bedrock and three of the SPTs were terminated due to effective refusal. The uncorrected SPT blow counts were 34 blows per 0.3 m penetration, 69 blows per 250 mm penetration, 50 blows per 100 mm penetration, and 50 blows per 50 mm penetration.

Two natural water content determinations were conducted on selected samples of the bedrock. The natural water contents were approximately 20 percent and 23 percent.

4.3 Groundwater Observations

Groundwater levels in the open augerholes were measured after completion of drilling and prior to backfilling of the test holes. These levels were inferred to represent unstabilized groundwater conditions at the time of drilling. The results are summarized in Table 13.

Table 13: Open Augerhole Groundwater Levels

Augerhole	Depth to Water (m Below Ground Surface)
AH20-01	6.8
AH20-02	Not Observed
AH20-03	5.5
AH20-04	12.2
AH20-05	13.6
AH20-06	6.4

Two VWPs were installed in augerholes AH20-03 and in AH20-05; comprising 4 installations in total, to record groundwater levels. Groundwater level data was collected from the dataloggers on 27 May 2020. The dataloggers were set to record pore water pressures at 12-hour intervals and data was stored from 24 May 2020 through to the data acquisition date of 27 May 2020.

Augerhole AH20-03 is located along the embankment toe within the slide area and two VWP probes were installed at depths of 2.3 and 7.6 m, respectively. The probe at 2.3 m depth recorded negative pore pressures indicating the probe was installed above the groundwater table. The probe at 7.6 m depth was located below the groundwater table and depth to water is similar to that observed in the open augerhole.

Augerhole AH20-05 is located along the fog line near the northbound lane embankment crest. VWP probes were installed to depths of 5.2 and 13.7 m, respectively. The uppermost probe (5.2 m depth) was located within the embankment fill to evaluate pore water pressure near the base of the embankment and negative pore water pressures were recorded indicating the probe is situated above the groundwater table. The probe at 13.7 m depth is located below the ground water table and depth to water is similar to that observed in the open augerhole.

When plotting the results, the upper probes generally mirror the fluctuations and shape of the lower probes but appear to be offset. For example, when comparing depth to water, the upper probes and lower probes appear to be showing similar shape and fluctuations with the lower probes but the upper probes indicate depth to groundwater is 2 to 4 m shallower than the lower probes. Based on discussions with the manufacturer, RST Instruments, the upper probe results may not be as reliable due to being located above the water table but the data is useful in evaluating water level fluctuations. The purpose of installing the shallow VWP probes was to identify potential saturation of the embankment fills and near surface soils and their potential influence on slope stability.

The deeper probes indicated similar groundwater levels when taking into account the elevation change between augerhole locations. VWP results are shown in Table 14.

Table 14: Vibrating Wire Piezometer Groundwater Levels

Augerhole	Average Depth to Groundwater (m Below Ground Surface)	VWP Probe Depth (m Below Ground Surface)
AH20-03 (Shallow Installation)	3.5	2.3
AH20-03 (Deep Installation)	**4.9**	**7.6**
AH20-05 (Shallow Installation)	7.2	5.2
AH20-05 (Deep Installation)	**10.9**	**13.7**

Note: For shallow VWP installations, the probe is located above the water table and interpretation of depth to water may not be accurate.

Seasonal fluctuations in groundwater levels should be expected in response to sustained periods of seasonal wet weather, snow melt, or other weather events. Due to the relatively fine-grained nature of the subsurface soils, a perched water table may develop.

5.0 DISCUSSION

The following presents our comments and recommendations regarding proposed slide mitigation measures and drainage improvements based on our interpretation of the factual data and site observations.

Golder has developed a concept for mitigation of the slide affecting the embankment fills. The concept is presented in Figures 3 and 4. Figure 3 indicates the approximate physical extent of the proposed mitigation concept and associated ditching improvements, and culvert replacement. Figure 4 is a cross-section of the recommended slide mitigation concept.

5.1 Slide Mitigation

The current slide is some 45 m in length and appears to be limited to within the embankment of the northbound lane. Based on the as-built drawings prepared by McElhanney (2007), pre-failure embankment slope angles were approximately 2 Horizontal to 1 Vertical (2H:1V or approximately 27°) and the maximum embankment height was approximately 8 m. McElhanney as-builts also indicated the presence of pre-failure toe bulges in the currently failed area. Moreover, during Golder's fall 2019 and spring 2020 site visits, similar toe bulges were observed beyond the current slide limits and are interpreted to be indicators of the potential for future slope failures or slides to develop.

Discussion on slide mitigation concepts and the proposed slide mitigation concept is below.

Tetra Tech (2018) prepared a slide mitigation concept that included construction of an embankment buttress using granular, geogrid reinforced fill against the embankment to mitigate slope movements, improve drainage, and to decrease the overall embankment slope from the original 2:1 to 3H:1V.

Evaluation of potential slide mitigation measures included review of the Tetra Tech (2018) slide mitigation concept in addition to a sheet pile wall and a Cutter Soil Mixing (CSM) wall. The embankment buttress concept was selected as the slide mitigation concept.

Based on the soil conditions, a sheet pile wall is feasible; however, the wall would act as a barrier to subsurface water flows which could be problematic and require additional drainage considerations. Golder utilized CSM panels to address a slope failure along the Alaska highway at km 965. The CSM panels provided a shear key at depth to stabilize the failing slope; however, at km 155.5, the slope failure appears to be limited within the embankment fills and near surface soils, and the CSM wall concept does not appear to be fully applicable for the site.

The proposed mitigation concept is similar to the concept proposed by Tetra Tech (2018) and has been supplemented with a shear key and subdrain.

The mass of the buttress is intended to provide overall resistance to sliding of the embankment; the shear key will provide resistance against sliding below grade by extending into the native silty clay underlying the embankment fills. The geogrid reinforced buttress is proposed to be constructed with a relatively free draining 75 minus pit run core with 25 mm crushed gravel extending from finished grade to 1 m depth. The shear key would be constructed using 25 mm minus crushed gravel. The proposed subdrain is proposed to be located at the base of the shear key to intercept and direct shallow groundwater away from the toe of the slope. Incorporation of a subdrain within the shear key will reduce resistance somewhat; however, the use of compacted crushed gravel is expected to maintain a relatively high friction angle with the added benefit of reducing groundwater pore pressure. The shear key is also proposed to be lined with non-woven geotextile to mitigate migration of fines into the shear key should local water levels rise.

5.1.1 Slope Stability Analyses

Golder carried out slope stability analyses using GeoStudio's Slope/W software to evaluate the suitability of the embankment buttress concept. Slope profiles presented in McElhanney (2007) were used to develop a model for the pre-failure slopes; the results of Golder's geotechnical field investigation and soil testing were used to estimate soil parameters for use in the slope stability analysis. The slope stability analyses were conducted assuming drained soil parameters, which is considered appropriate for long-term slope stability analyses and allows for incorporation of groundwater levels in the evaluation.

In estimating suitable friction angles for the embankment fills, it was assumed that failure of the embankment slope, which resulted in the development of the observed slide, was restricted to deformation within the embankment fill material and that the slide did not significantly deform the underlying native soils. This assumption is based on Golder's field observations and the results of the geotechnical subsurface investigation. Nevertheless, we have considered the potential for a weak or residual layer to be present in the shallow subsurface within the native foundation soils and we have addressed this case in our slope stability analyses.

Consideration was also given to freeze-thaw cycles that would tend to soften the embankment resulting in progressive deterioration of strength of the soil and a presumed *in situ* friction angle that would have a value intermediate to the peak and residual friction angles. Consideration was also given to the presence of a potential weak layer within the native soils underlying the embankment fills and slide debris.

The value of the friction angle for the embankment fills was varied in the course of carrying out the slope stability analyses. Friction angles used in the analysis ranged between the peak and residual friction values to allow back analysis of the failure and to obtain a reasonable friction angle for use in analyzing the buttress concept. Groundwater levels incorporated into the model were based on interpretation of the VWP data. A visual assessment of the slide mechanism is difficult to develop, given that considerable re-grading of the slide area has been carried out subsequent to slope movements that took place in the period 2018-2019. These scenarios are presented in Figures H1 - failure along weak plane within fill, and H2 - failure within fill with no weak plane, in Appendix H. Factors of safety approaching 1 were targeted for these scenarios, so that the parameters were representative of the failure conditions. VWP groundwater levels were also increased to simulate worst-case conditions. Conservative friction angles were also used to check the robustness of the proposed slide mitigation concept. The analyzed model was simplified as soil properties were uniform across some of the subsurface soil layers.

Table 15 summarizes the properties used in the slope stability analyses.

Table 15: Soil Properties used in Slope Stability Analyses

Soil Unit	Unit Weight (kN/m^3)	Friction Angle Phi (^{o})	Cohesion (kPa)	Model
Gravel Fill	21	34	0	Mohr-Coulomb
Upper Silty Clay Fill	20	27	0	Mohr-Coulomb
Lower Silty Clay Fill	19	21	3	Mohr-Coulomb
Upper Silty Clay	19	25	0	Mohr-Coulomb
Lower Silty Clay	19	27	0	Mohr-Coulomb
Silty Clay Till	20	27	0	Mohr-Coulomb

Soil Unit	Unit Weight (kN/m^3)	Friction Angle Phi (°)	Cohesion (kPa)	Model
Inferred Sandstone	-	-	0	Bedrock (Impenetrable)
Imported Fill – Pit Run	21	36	0	Mohr-Coulomb
Imported Fill – 25 mm Crush	21	40	0	Mohr-Coulomb
Weak/Residual Layer	19	15	0	Mohr-Coulomb

Slope stability results are presented in APPENDIX H together with the McElhanney's (2007) as-built drawings and the Vector (2020) topographic survey drawing.

For analysis of the slide mitigation concept, several scenarios were reviewed as follows:

- Weak layer at fill – native soil contact and no subdrain (Figure H3) which resulted in a factor of safety of 1.49.
- Weak layer at fill – native soil contact with subdrain (Figure H4) which resulted in a factor of safety of 1.49.
- Although not considered likely based on current geotechnical data and slide observations, the case where a weak layer is present at shallow depth within the native deposits and below the shear key was reviewed, excluding any subdrain (Figure H5), which resulted in a factor of safety of 1.29.
  - The above case with subdrain (Figure H6) resulted in a factor of safety of 1.35.
- No weak layer with subdrain (Figure H7) resulted in a factor of safety of 1.6.

Based on the slope stability analyses, factors of safety for the slide mitigation concept range from 1.5 to 1.6. Although no evidence was identified in the field for a weak layer to be present at shallow depth within the native deposits, this scenario was checked and resulted in associated factors of safety that ranged from 1.3 to 1.4.

Based on the foregoing, it was identified that the proposed shear key should extend into the native deposits to a design depth of 2 m.

Based on slope stability analyses, geogrid lengths on the order of 3 m are considered adequate and can be optimized during detailed design for tendering. It is further recommended that non-woven geotextile be used to line the shear key trench prior to placing and compacting the 25 mm minus structural fill material.

5.1.2 Site Preparation

All deleterious materials such as organic soils and topsoil should be removed from the excavation footprint. Within the current slide area, slide debris should be removed in addition to any underlying organic soils. The slide debris is approximately 1.7 m thick based on a single augerhole and thickness is expected to vary across the slide area. The slide mitigation treatment will be extended into areas showing signs of slope distress and stripping depths are expected to be on the order of 0.3 m.

5.1.3 Excavations

All temporary excavations should be conducted in accordance with WorkSafe BC regulations. The shear key trench is on the order of 2 m depth and for installation of the subdrain, trench boxes or similar temporary shoring measures may be required.

5.1.4 Seepage Control

Groundwater or seepage may be encountered during excavation activities. Assuming late summer/early fall construction, relatively dry conditions are expected; however, the shear key trench excavation may encounter seepage. Conventional sump and pump methods are considered and adequate means of addressing potential seepage.

5.1.5 Imported Granular Fill

Imported granular fill for the slide mitigation concept is envisaged to include 25 mm minus crushed gravel and 75 mm minus pit run both having less than five percent passing the USS No. 200 sieve designation.

A qualified geotechnical engineer should review and approve the imported fill gradations prior to bringing the material to site. It should be recognized that gradations and materials test results provided by the supplier may be several months or years old and more recent data may be required in evaluating the suitability of the imported fill.

5.1.6 Backfilling and Compaction

Granular imported fill such as 75 mm pit run should be placed in loose lifts no thicker than 0.3 m and compacted to at least 95 percent of the Standard Proctor Maximum Dry Density (ASTM D-698) at a water content within 5 percent of the Optimum Moisture Content. The 25 mm crushed gravel fill should be placed in loose lifts no thicker than 200 mm and compacted to 100 percent of the Standard Proctor Maximum Dry Density (ASTM D-698) at a water content within 2 to 3 percent of the Optimum Moisture Content. Within the shear key, the 25 mm crushed gravel should be compacted to at least 95 percent of the Standard Proctor Maximum Dry Density (ASTM D-698) at a water content within 5 percent of the Optimum Moisture Content.

Compaction equipment for granular fills should comprise smooth wheeled vibrating drum rollers or similar. The use of vibrating plate tampers may also be considered; however, the loose lift thickness may need to be reduced to achieve the required level of compaction.

5.2 Drainage Improvements

Based on the hydrotechnical site visit and analyses, the ditching along the southbound lane embankment and RoW should be better defined, armoured, and extended to a total length of approximately 870 m to drain towards the km 155.1 cross highway culvert. The analyses noted that the 1.25 m diameter culvert at km 155.1 is undersized and should be replaced with a 2.2 m diameter culvert or twinned with a 2 m diameter culvert. Alternatively, a new culvert could be installed at km 155.4; however, the 1.25 m diameter culvert at km 155.1 would require replacement with a 1.8 m diameter culvert.

Considering the options, it may be cost effective to either twin or replace the 1.25 m diameter culvert at km 155.1 rather than install two new culverts.

As an additional consideration, based on analyses and review of the slide area, the drainage issues along the southbound lane embankments and RoW do not appear to have influenced the slide. Moreover, no visible signs of slope instability were observed along the southbound lane embankments. Consequently, if PSPC is solely concerned with slide mitigation, construction of the slide mitigation concept could proceed and culvert replacement could be considered at a later date. It should also be recognized that no investigation was conducted in the vicinity of the culvert at km 155.1. Although ground conditions are expected to be similar to that in the slide area, it would be prudent to confirm ground conditions, particularly as trenchless installation methods are preferred to maintain the Alaska Hwy for users and minimize disruptions to traffic.

6.0 CONSTRUCTION CONSIDERATIONS AND SUMMARY

Based on the archaeological and fish habitat field surveys, there does not appear to be significant environmental or cultural issues at the site.

Watercourses at km 155.1 and 155.4 were reviewed and we note the following:

- Neither of the watercourses were classified as fish bearing.
- If the culvert at km 155.1 is not replaced or twinned, a *Water Sustainability Act* Section 11 Change Approval or Notification of Instream Work is not required.
- If the culvert at km 155.1 is replaced or twinned, an application for a *Water Sustainability Act* Section 11 Notification of Instream Work will be required to meet comply with Part 3 of the Water Sustainability Regulations. The notification of proposed work must be submitted to FrontCounter BC a minimum of 45 days before the beginning work and it is recommended that it is submitted more than 45 days ahead of time (BCGov. 2020a).
- At high flow conditions, these watercourses may drain into Blueberry River, which is a known fish-bearing stream.
    - Works should be conducted in a manner that prevents erosion and sedimentation of exposed soils from entering the watercourses, including ephemeral streams.

The archaeological site visit and desktop review indicate:

- Cultural artifacts are not expected to be encountered during construction.
    - If cultural artifacts are encountered, work stoppage will be required for HCA permitting which may take up to 14 weeks.

Hydrotechnical field observations and analyses indicate the following:

- The southbound lane ditch is ill defined and new rip rap armoured ditch should be constructed. The estimated length for the new ditch is 870 m.
- The 1.25 m diameter highway cross culvert located at approximately km 155.1 is undersized for the 1:200-year design event.
  - The existing 1.25 m diameter culvert is estimated to have capacity for a 25-year historical peak flow at the watercourse, excluding ditch flows.
  - Options to address the culvert capacity issues include:
    - Replace the 1.25 m diameter culvert with an approximately 2.2 m diameter culvert.
    - Supplement the 1.25 m diameter culvert with a new approximately 2 m diameter culvert.
    - Add a cross-drain culvert at approximately km 155.41, near the damaged 600 mm diameter culvert and replace the 1.25 m diameter culvert with a 1.8 m diameter culvert. This would also reduce the ditch length.
  - Culvert installations should be conducted using trenchless methods to minimize disruptions to users.
    - No investigation has been conducted for the 1.25 m dimeter culvert and could pose a construction risk. It is likely that similar soil conditions are present but it would be prudent to verify the subsurface conditions.
- The northbound lane embankment slide does not appear to be impacted by the poor drainage along the southbound lane embankments and culvert replacement could be deferred to a later date to allow for additional investigation.

The culvert inspection noted the following:

- The 1.25 m diameter culvert at km 155.1 is in reasonable condition.
- The inlet for the 600 mm culvert at km 155.4 could not be located and is likely buried.
- In general, inspected embankment drains may have superficial damage at the outlets but appear to be in reasonable condition otherwise.

During construction of the slide mitigation concept, the following should also be considered:

- Traffic disruptions should be avoided as practical; however, single lane alternating traffic may be required under, but not exclusive to, the following situations:
  - Hauling and material delivery could result in the need for single lane alternating traffic.
  - During backfilling for the slide mitigation works, placement of backfill may require excavators and other equipment to work from the northbound lane resulting in single lane alternating traffic.

- Construction of the slide mitigation works may require working in discrete sections. Opening up the entire segment may result in construction and stability issues if wet weather/precipitation events occur while the entire segment is open.
- A Northwest Tel fibre cable is present within the RoW associated with the northbound lane and slide mitigation works will need to take the utility into account as the excavations may impact the fibre cable.
- Access from the pullout (staging area) to the slide area is accessible by tracked equipment. A temporary access could be utilized to allow for access by compaction equipment and/or rubber tire vehicles.

During construction of the drainage improvements along the southbound lane embankments and associated RoW, the following should be considered:

- An overhead power line is present and located between the existing discontinuous ditch and the southbound lane embankments.
  - Equipment should be sized to avoid conflicts with the overhead lines including maintaining minimum required distance under the power lines.
- Access is suitable for tracked equipment.
- Single lane alternating traffic may be required to bring materials to this section of the site.

Construction is expected to take place during fall 2020 when relatively dry conditions are expected together with low water levels. In addition, the ephemeral, non-fish bearing water course which flows through the km 155.1 culvert is similarly expected to be dry.

Should construction proceed under winter conditions, the following should be considered:

- All fills should be protected from snow and ice accumulation and freezing, as the presence of snow and ice within the fills will make achieving compaction difficult or impossible to achieve and may result in excessive settlements.
- Snow should not be allowed to accumulate within any excavations.
- Products such as geogrid and non-woven geotextiles should be protected from freezing.

7.0 CLOSURE

We trust the foregoing is sufficient for your review and look forward to receiving comments on the above.

Should you have any questions or require clarification on the contents of this report, please contact the undersigned.

Golder Associates Ltd.

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Geotechnical Engineer-in-Training

Ravi Jassal, PEng
Senior Geotechnical Engineer

Jeff Fillipone, PhD, PGeo
Principal, Senior Engineering Geologist

AM/RJ/JP/syd/lmk

https://golderassociates.sharepoint.com/sites/114909/project files/6 deliverables/issued to client_for wp/19129643-011-r-rev0/19129643-011-r-rev0-km155 akhwy slope stabilization-23sep_20.docx

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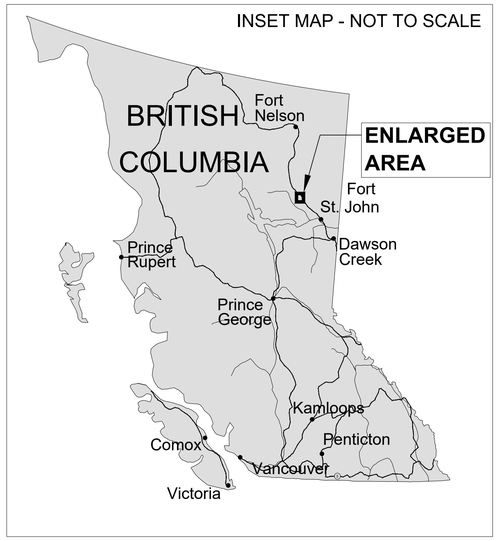

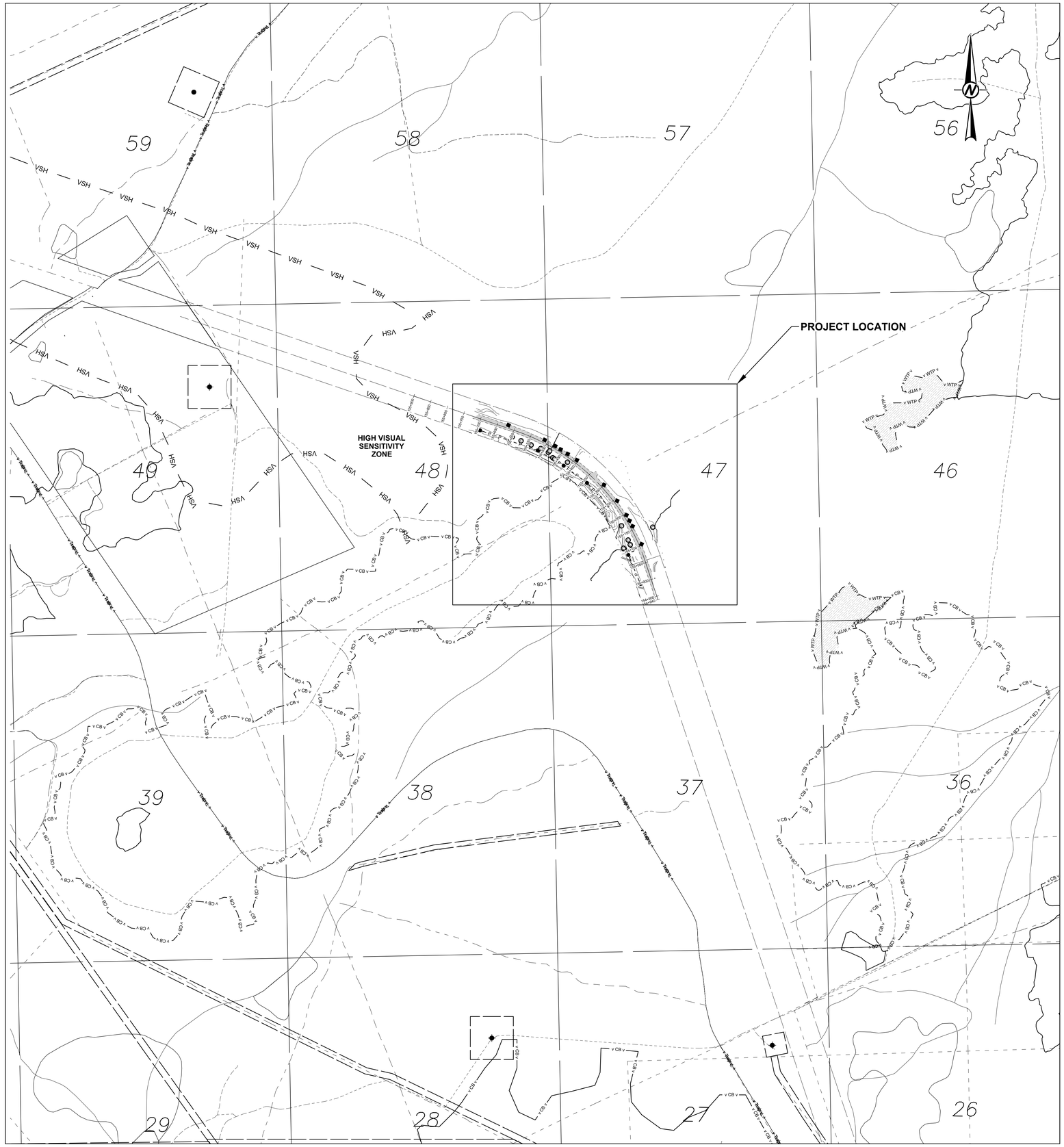

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LEGEND

- SEISMIC LINES
- TOP BANK
- BOTTOM BANK
- ROADS
- TREELINES
- CUTBLOCKS
- NON-CLASSIFIED DRAINAGE / NO EVIDENCE OF STREAM FOUND
- POWER LINES
- CULVERT
- ROAD SIGN

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0 100 200
1:5,000 METRES

NOTES

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3. ELEVATIONS SHOWN IN METRES, DATUM:CGVD28.

REFERENCE

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PUBLIC SERVICES AND PROCUREMENT CANADA

Project title/Titre du projet

ALASKA HIGHWAY KM 155 SLOPE STABILIZATION

Approved by/Approuve par
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Designed by/Concept par
R. JASSAL

Drawn by/Dessine par
J. FARAH

PWGSC Project Manager/Administrateur de Projets TPSGC
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PWGSC, Architectural and Engineering Resources Manager/ Ressources Architectural et de Directeur d'ingénierie, TPSGC
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Client/client
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PROJECT LOCATION PLAN

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
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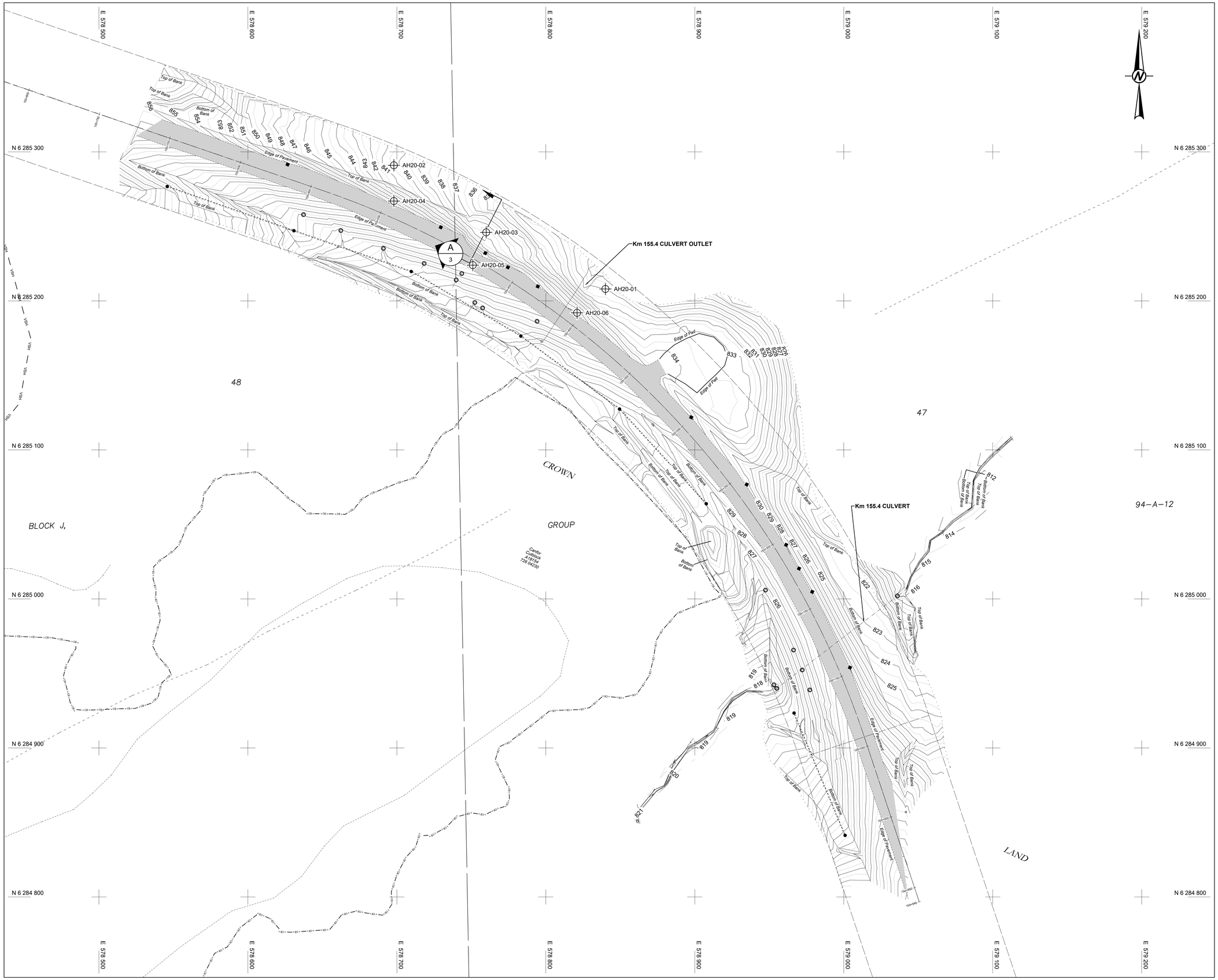

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LEGEND

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- TOP BANK
- BOTTOM BANK
- ROADS
- TREELINES
- CUTBLOCKS
- NON-CLASSIFIED DRAINAGE / NO EVIDENCE OF STREAM FOUND
- POWER LINES
- CULVERT
- ROAD SIGN
- BOREHOLE LOCATION
- TOPOGRAPHIC CONTOUR (INTERVAL = 0.5 m)

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PUBLIC SERVICES AND PROCUREMENT CANADA

Project title/Titre du projet

ALASKA HIGHWAY KM 155 SLOPE STABILIZATION

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SITE PLAN

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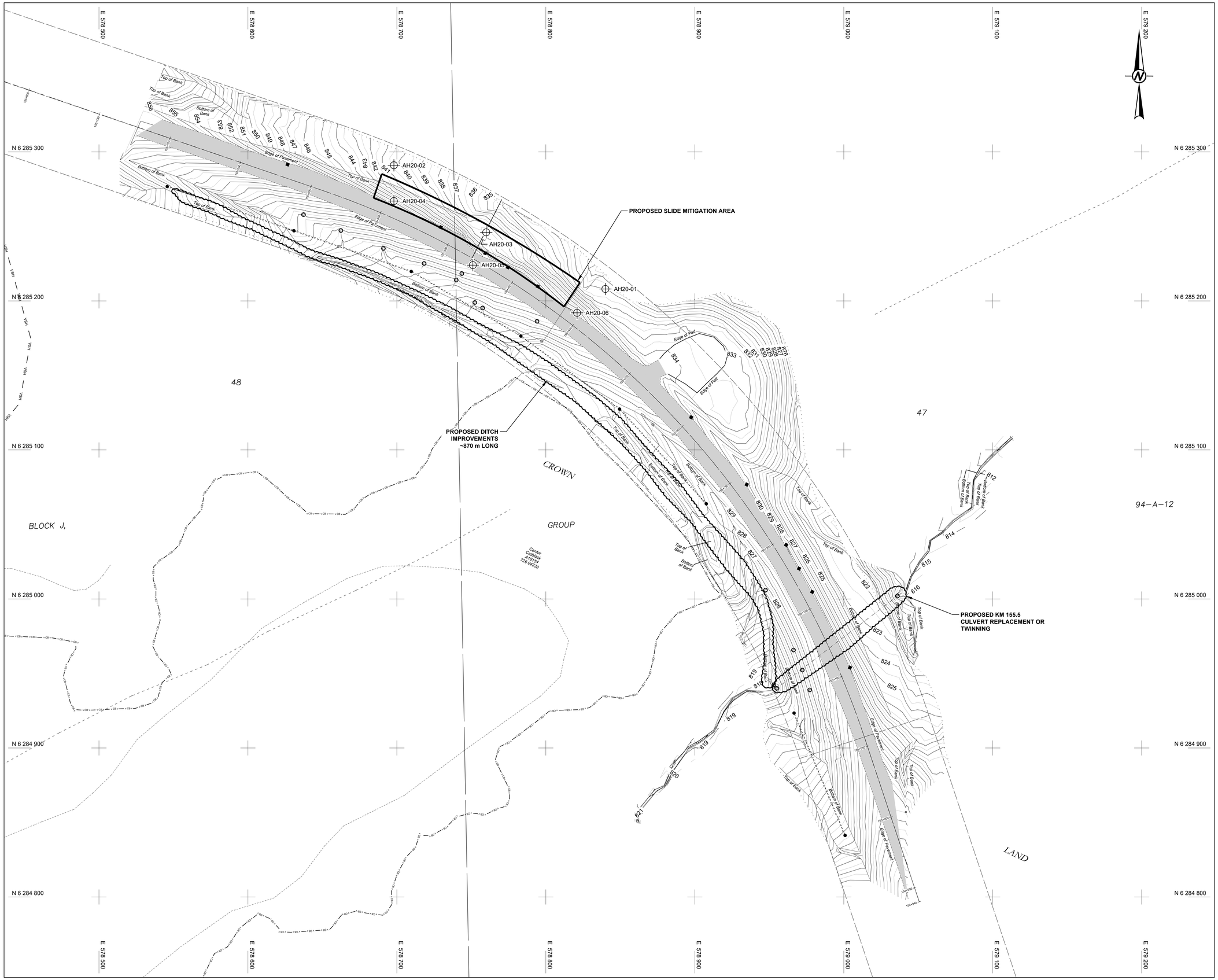

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- ROADS
- TREELINES
- CUTBLOCKS
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Revision/ Revision	Description/Description	Date/Date

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SLIDE MITIGATION CONCEPT PLAN VIEW

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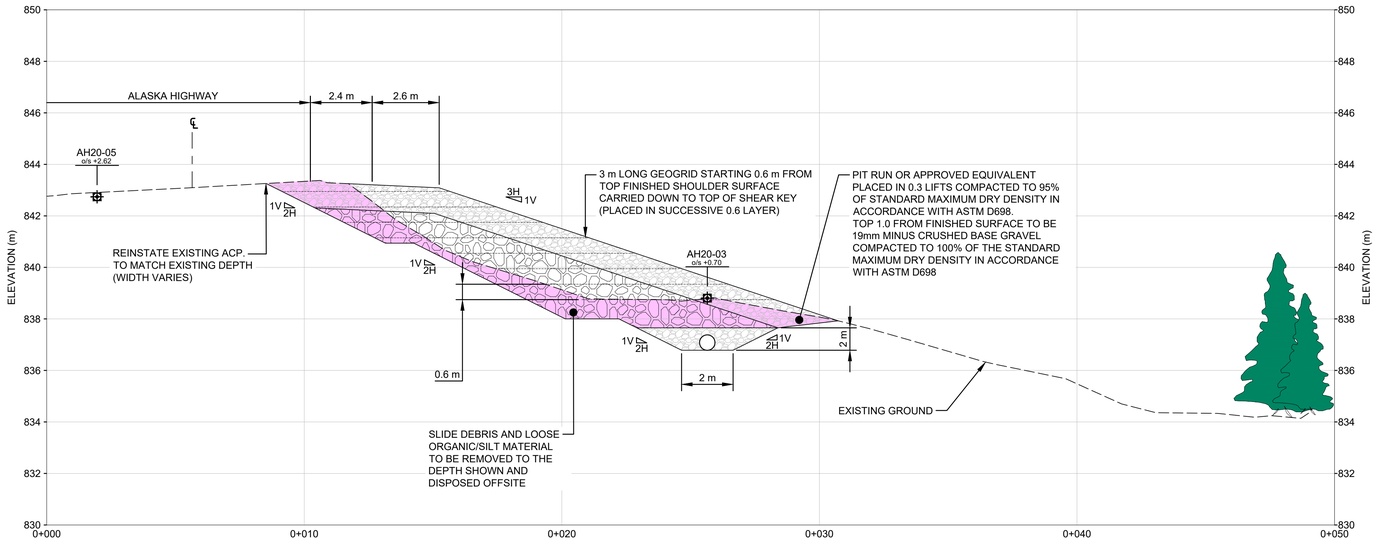

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LEGEND

- 19 mm CRUSH
- 3" PIT RUN GRAVEL
- REMOVE MATERIAL
- EXISTING SURFACE PROFILE
- GEOGRID

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CROSS SECTION 1

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19129643-7000-009-04

APPENDIX A

Important Information and Limitations of this Report

Important Information and Limitations of this Report

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

APPENDIX B

Record of Augerhole Sheets

RECORD OF BOREHOLE: AH20-01

CLIENT: Public Services and Procurement Can DATE: March 18, 2020
ELEVATION: Data Not Available
PROJECT: 155.5km Alaska Hwy Slope Stabilization
COORDINATES: N: 6285208.0 m E: 578840.0 m
PROJECT NO: 19129643 (6000)
COORD SYS: UTM zone 10N
LOCATION: Fort St. John, BC CONTRACTOR: Geotech Drilling
HORZ DATUM: NAD83

DRILL RIG: B-54 Track Mounted Auger Drill
DRILL METHOD: Solid Stem Auger

DEPTH (m)	DESCRIPTION	USCS	ELEV. - DEPTH (m)	SAMPLES NUMBER	TYPE	REC %	BLOWS	N-VALUE	GRAVEL	SAND	FINES	ORGANIC CONTENT %	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
0	FILL - (CI) SILTY CLAY, trace to some sand; brown; cohesive, w>PL, frozen.	CI	0.00	1	AS									0.00 - 0.61 m bgs: Bentonite
1	FILL - (CI) SILTY CLAY, trace sand, trace gravel; dark brown; cohesive, w>PL, firm.		1.52	2	SPT	100	1-2-3	5						
2	FILL - (CI) SILTY CLAY, trace sand, trace gravel; grey; cohesive, w>PL, firm.		2.13	3	AS									
3	(SM/ML) SILT and SAND, trace organics; brown; non-cohesive, wet.	SM/ML	2.74											
	(CI) SILTY CLAY, trace to some sand; mottled grey-brown-black; cohesive, w>PL, stiff.	CI	3.05	4	SPT	57	3-4-6	10						0.61 - 6.10 m bgs: Cuttings
4	(CI) sandy SILTY CLAY; grey; cohesive, w>PL, firm to stiff.		3.66	5	AS									
5				6	SPT	100	3-3-5	8		13	87			
	(CI) SILTY CLAY, trace to some sand, trace gravel; brown; cohesive, w>PL, stiff.		5.33	7	AS									
6				8	SPT	100	4-5-8	13						6.10 - 6.71 m bgs: Bentonite
	(CI) gravelly sandy SILTY CLAY; brown, TILL; cohesive, w>PL, stiff.		6.71										▽	
7				9	AS				27	34	39			
	(CI) SILTY CLAY, trace to some sand, trace gravel; mottle grey-brown becoming grey with depth, TILL; cohesive, w>PL,		7.62	10	SPT	100	7-8-14	22						
8	Continued on Next Page													

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
GRADATION %
ADDITIONAL LAB TESTING
SPT N Value: PENETRATION RESISTANCE BLOWS/300 MM; 20 40 60 80
CONSTRUCTION AND INSTALLATION DETAILS

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM DATE: Mar 18, 2020
CHECKED: RJ DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-01

CLIENT: Public Services and Procurement Can
PROJECT: 155.5km Alaska Hwy Slope Stabilization
PROJECT NO: 19129643 (6000)
LOCATION: Fort St. John, BC
DATE: March 18, 2020
CONTRACTOR: Geotech Drilling
ELEVATION: Data Not Available
COORDINATES: N: 6285208.0 m E: 578840.0 m
COORD SYS: UTM zone 10N
HORZ DATUM: NAD83

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. - DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT PERCENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	GRADATION % GRAVEL	SAND	FINES	ORGANIC CONTENT %	ADDITIONAL LAB TESTING	SPT N Value (PENETRATION RESISTANCE BLOWS/300 MM)	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
9	B-54 Track Mounted Auger Drill	Solid Stem Auger	(CI) SILTY CLAY, trace to some sand, trace gravel; mottle grey-brown becoming grey with depth, TILL; cohesive, w>PL, very stiff.	CI			11	AS												
10							12	SPT	100	5-7-13	20	○						▲		6.71 - 12.19 m bgs: Cuttings
11							13	AS												
12							14	SPT	67	4-7-11	18							▲		
13							15	AS												
14							16	SPT	100	6-7-13	20	○						▲		12.19 - 12.80 m bgs: Bentonite
15							17	AS												
16							18	SPT	100	4-7-9	16							▲		12.80 - 15.70 m bgs: Cuttings
							19	AS												
							20	SPT	100	4-6-12	18	○						▲		
			End of hole at 15.7 m.																	

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM
CHECKED: RJ

DATE: Mar 18, 2020
DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-02

CLIENT: Public Services and Procurement Can
PROJECT: 155.5km Alaska Hwy Slope Stabilization
PROJECT NO: 19129643 (6000)
LOCATION: Fort St. John, BC
DATE: March 19, 2020
CONTRACTOR: Geotech Drilling
ELEVATION: Data Not Available
COORDINATES: N: 6285291.0 m E: 578698.0 m
COORD SYS: UTM zone 10N
HORZ DATUM: NAD83

DRILL RIG: B-54 Track Mounted Auger Drill
DRILL METHOD: Solid Stem Auger

DEPTH (m)	DESCRIPTION	USCS	ELEV. - DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	GRAVEL	SAND	FINES
0	(OL) ORGANIC SILT, some sand, dark brown with woody debris; non-cohesive, wet, frozen.	OL	0.00								
1	(Cl) SILTY CLAY, trace to some sand; brown; cohesive, w>PL, firm.		0.91	1	AS						
2				2	SPT	54	0-2-3-5	5			
3				3	AS						
3	(Cl) SILTY CLAY, trace sand; brown; cohesive, w>PL, soft to firm.		3.05	4	SPT	92	0-2-2-2	4			
4				5	AS						
4	(Cl) SILTY CLAY, trace sand, trace gravel; brown, cohesive, w>PL, stiff.	Cl	4.57	6	SPT	100	3-4-6	10			
5	(Cl/SM) gravelly SILTY CLAY and SAND; light brown, TILL; non-cohesive, dry, dense to very dense.		5.18	7	AS						
6				8	SPT	56	0-1-33	34			
7				9	AS				17	37	46
7				10	SPT	100	2-1-50/60mm				
8	(Cl/SM) SILTY CLAY and SAND, trace gravel; brown, TILL; cohesive, w<PL, hard.		8.23	11	AS						
9	Inferred Weathered SANDSTONE		9.14	12	SPT	50	19-20-14	34			
9	End of hole at 9.6 m.										
10											

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
GRADATION %
ORGANIC CONTENT %
ADDITIONAL LAB TESTING
SPT N Value: PENETRATION RESISTANCE BLOWS/300 MM; 20 40 60 80
GROUNDWATER OBSERVATIONS
CONSTRUCTION AND INSTALLATION DETAILS

0.00 - 0.61 m bgs: Bentonite

0.61 - 9.60 m bgs: Cuttings

DEPTH SCALE: 1:50

REV: 0

LOGGED: DGM
CHECKED: RJ
DATE: Mar 19, 2020
DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-03

CLIENT: Public Services and Procurement Can
PROJECT: 155.5km Alaska Hwy Slope Stabilization
PROJECT NO: 19129643 (6000)
LOCATION: Fort St. John, BC
DATE: March 19, 2020
CONTRACTOR: Geotech Drilling
ELEVATION: Data Not Available
COORDINATES: N: 6285246.0 m E: 578760.0 m
COORD SYS: UTM zone 10N
HORZ DATUM: NAD83

DRILL RIG: B-54 Track Mounted Auger Drill
DRILL METHOD: Solid Stem Auger

DEPTH (m)	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. - DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	GRADATION % GRAVEL	SAND	FINES	ORGANIC CONTENT %	ADDITIONAL LAB TESTING	SPT N Value (PENETRATION RESISTANCE BLOWS/300 MM)	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
0	FILL - (GM) sandy SILTY GRAVEL; brown; non-cohesive, dry.	GM		0.00	1	AS					55	26	20					
1.68	FILL - (CI) SILTY CLAY, some sand to sandy, some gravel; brown; cohesive, w>PL, firm.			1.68	2	SPT	28	2-3-2	5									VWP 65 166
					3	AS												
3.05	(CI) SILTY CLAY, trace to some sand, trace gravel; brown; cohesive, w>PL, firm.	CI		3.05	4	SPT	72	3-2-4	6									
					5	AS												
					6	SPT	61	2-2-4	6									
					7	AS												
6.10	(CI) SILTY CLAY, trace sand; mottled grey-brown; cohesive, w>PL, stiff.			6.10	8	SPT	100	6-4-7	11									
					9	AS												
7.62	(CI) SILTY CLAY, trace sand; grey; cohesive, w>PL, firm.			7.62	10	SPT	100	3-3-4	7									VWP 65 165 0.00 - 15.49 m bgs: Grout

Continued on Next Page

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM
CHECKED: RJ

DATE: Mar 19, 2020
DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-03

CLIENT: Public Services and Procurement Can DATE: March 19, 2020 ELEVATION: Data Not Available

PROJECT: 155.5km Alaska Hwy Slope Stabilization COORDINATES: N: 6285246.0 m E: 578760.0 m

PROJECT NO: 19129643 (6000) COORD SYS: UTM zone 10N

LOCATION: Fort St. John, BC CONTRACTOR: Geotech Drilling HORZ DATUM: NAD83

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. - DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT PERCENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	GRADATION % GRAVEL	SAND	FINES	ORGANIC CONTENT %	ADDITIONAL LAB TESTING	SPT N Value (PENETRATION RESISTANCE BLOWS/300 MM)	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
9	B-54 Track Mounted Auger Drill	Solid Stem Auger	(CI) SILTY CLAY, trace sand; grey; cohesive, w>PL, firm.	CI			11	AS												
			(CI) SILTY CLAY, trace sand, trace gravel; grey, TILL; cohesive, w>PL, very stiff.			9.14	12	SPT	61	2-6-11	17									
10							13	AS												
11							14	SPT	28	3-7-11	18									
							15	AS												
12							16	SPT	100	6-8-12	20									
13							17	AS												
14							18	SPT	84	6-9-11	20									
							19	AS												
15			Inferred SANDSTONE			15.24	20	SPT	100	18-50/100mm										
			End of hole at 15.5 m.																	
16																				

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM DATE: Mar 19, 2020

CHECKED: RJ DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-04

CLIENT: Public Services and Procurement Can DATE: March 20, 2020
PROJECT: 155.5km Alaska Hwy Slope Stabilization
PROJECT NO: 19129643 (6000)
LOCATION: Fort St. John, BC CONTRACTOR: Geotech Drilling

ELEVATION: Data Not Available
COORDINATES: N: 6285267.0 m E: 578698.0 m
COORD SYS: UTM zone 10N
HORZ DATUM: NAD83

DRILL RIG: B-54 Track Mounted Auger Drill
DRILL METHOD: Solid Stem Auger

DEPTH (m)	DESCRIPTION	USCS	ELEV. - DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	GRAVEL	SAND	FINES
0	FILL - (GM) sandy SILTY GRAVEL; brown; non-cohesive, moist.	GM	0.00								
	FILL - (CI) SILTY CLAY and SAND, some gravel; cohesive, w~PL, hard.		0.61	1	AS						
1	FILL - (CI) sandy SILTY CLAY, trace gravel; brown; cohesive, w~PL, firm to very stiff.		1.52	2	SPT	100	14-12-14	26			
2											
				3	AS				4	18	78
3				4	SPT	28	2-3-3	6			
		CI									
4				5	AS						
	FILL - (CI) SILTY CLAY, trace sand, trace gravel; brown; cohesive, w>PL, stiff.		4.57	6	SPT	78	4-4-6	10			
5											
				7	AS						
6	(CI) SILTY CLAY, trace sand, trace gravel; mottled grey-brown and very thinly laminated; cohesive, w>PL, stiff.		5.94	8	SPT	78	4-4-8	12			
7				9	AS						
				10	SPT	100	2-5-7	12			
8	Continued on Next Page										

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
SPT N Value: PENETRATION RESISTANCE BLOWS/300 MM; 20 40 60 80
ORGANIC CONTENT %
ADDITIONAL LAB TESTING
GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS
- 0.00 - 0.61 m bgs: Bentonite
- 0.61 - 6.10 m bgs: Cuttings
- 6.10 - 6.71 m bgs: Bentonite

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM DATE: Mar 20, 2020
CHECKED: RJ DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-04

CLIENT: Public Services and Procurement Can DATE: March 20, 2020 ELEVATION: Data Not Available

PROJECT: 155.5km Alaska Hwy Slope Stabilization COORDINATES: N: 6285267.0 m E: 578698.0 m

PROJECT NO: 19129643 (6000) COORD SYS: UTM zone 10N

LOCATION: Fort St. John, BC CONTRACTOR: Geotech Drilling HORZ DATUM: NAD83

DRILL RIG: B-54 Track Mounted Auger Drill

DRILL METHOD: Solid Stem Auger

DEPTH (m)	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. - DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT PERCENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic; 0 20 40 60 80 100)	GRADATION % GRAVEL	SAND	FINES	ORGANIC CONTENT %	ADDITIONAL LAB TESTING	SPT N Value (PENETRATION RESISTANCE BLOWS/300 MM; 20 40 60 80)	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
9	(Cl) SILTY CLAY, trace sand, trace gravel; mottled grey-brown and very thinly laminated; cohesive, w>PL, stiff.	Cl			11	AS				○								
					12	SPT	100	2-4-7	11							▲		6.71 - 12.19 m bgs: Cuttings
10					13	AS				⊢○⊣								
11					14	SPT	28	6-3-7	10							▲		
12	(Cl) sandy SILTY CLAY, some gravel; brown, TILL; cohesive, w>PL, very stiff to hard.			11.58	15	AS				○								
					16A	SPT	100	6-5-25	30							▲	▽	12.19 - 12.80 m bgs: Bentonite
13	Inferred Inter-layered MUDSTONE and SANDSTONE			12.62	16B													
					17	AS				○								
14					18A	SPT	95	12-19-50/10 0mm								▲		12.80 - 15.29 m bgs: Cuttings
					18B													
15					19	AS												
					20	SPT	0	50/50mm		○						▲		
16	End of hole at 15.3 m.																	

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM DATE: Mar 20, 2020

CHECKED: RJ DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-05

CLIENT: Public Services and Procurement Can
PROJECT: 155.5km Alaska Hwy Slope Stabilization
PROJECT NO: 19129643 (6000)
LOCATION: Fort St. John, BC
DATE: March 21, 2020
CONTRACTOR: Geotech Drilling
ELEVATION: Data Not Available
COORDINATES: N: 6285224.0 m E: 578751.0 m
COORD SYS: UTM zone 10N
HORZ DATUM: NAD83

DRILL RIG: B-54 Track Mounted Auger Drill
DRILL METHOD: Solid Stem Auger

DEPTH (m)	DESCRIPTION	USCS	ELEV. - DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	GRAVEL	SAND	FINES
	ASPHALT		0.00								
	FILL - (GM) sandy SILTY GRAVEL; brown; non-cohesive, moist.	GM	0.23								
1	FILL - (CI) SILTY CLAY, some sand to sandy, trace to some gravel; brown; cohesive, w<PL, hard.	CI	0.76	1	AS						
2	FILL - (CI) SILTY CLAY, some sand, trace gravel; brown; cohesive, w>PL, hard.		1.52	2	SPT	100	12-30-43	73			
				3	AS						
3				4	SPT	39	2-3-4	7			
4	FILL - (CI) sandy SILTY CLAY, trace gravel; brown; non-cohesive, w>PL, soft to firm.		3.66	5	AS				1	22	77
5				6	SPT	61	0-1-3	4			
				7	AS				0	13	87
6				8	SPT	40	0-3-4	7			
	(CI) SILTY CLAY, trace sand, trace gravel; mottled grey-brown; cohesive, w>PL, firm to stiff.		6.71								
7				9	AS						
				10	SPT	89	1-4-6	10			
8	Continued on Next Page										

Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SPT N Value: PENETRATION RESISTANCE BLOWS/300 MM; 20 40 60 80

ORGANIC CONTENT %

ADDITIONAL LAB TESTING

GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS

VWP 65 167

0.00 - 15.70 m bgs: Grout

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM
CHECKED: RJ

DATE: Mar 21, 2020
DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-05

CLIENT: Public Services and Procurement Can DATE: March 21, 2020 ELEVATION: Data Not Available

PROJECT: 155.5km Alaska Hwy Slope Stabilization COORDINATES: N: 6285224.0 m E: 578751.0 m

PROJECT NO: 19129643 (6000) COORD SYS: UTM zone 10N

LOCATION: Fort St. John, BC CONTRACTOR: Geotech Drilling HORZ DATUM: NAD83

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. - DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT PERCENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	GRADATION %: GRAVEL	SAND	FINES	ORGANIC CONTENT %	ADDITIONAL LAB TESTING	SPT N Value (PENETRATION RESISTANCE BLOWS/300 MM)	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
9	B-54 Track Mounted Auger Drill	Solid Stem Auger	(Cl) SILTY CLAY, trace sand, trace gravel; mottled grey-brown; cohesive, w>PL, firm to stiff.	Cl			11	AS												
							12	SPT	78	1-3-5	8									
10							13	AS												
							14	SPT	100	3-4-5	9									
11							15	AS												
							16	SPT	100	3-4-5	9		0	3	97					
12							17	AS												
							18	SPT	9	2-9-9	11								▽	VWP 65 168
13							19	AS												
			(Cl) SILTY CLAY, some sand, trace to some gravel; grey, TILL; cohesive, w>PL, hard.			15.24	20	SPT	0	7-10-16	26									
14			End of hole at 15.7 m.																	
15																				
16																				

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM DATE: Mar 21, 2020

CHECKED: RJ DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-06

CLIENT: Public Services and Procurement Can
PROJECT: 155.5km Alaska Hwy Slope Stabilization
PROJECT NO: 19129643 (6000)
LOCATION: Fort St. John, BC
DATE: March 22, 2020
CONTRACTOR: Geotech Drilling
ELEVATION: Data Not Available
COORDINATES: N: 6285192.0 m E: 578821.0 m
COORD SYS: UTM zone 10N
HORZ DATUM: NAD83

DRILL RIG: B-54 Track Mounted Auger Drill
DRILL METHOD: Solid Stem Auger

DEPTH (m)	DESCRIPTION	USCS	ELEV. - DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
	FILL - (GM) sandy SILTY GRAVEL, some organics; brown with rootlets; non-cohesive, moist.	GM	0.00					
1	FILL - (CI/SM) SILTY CLAY and SAND, some gravel; brown; cohesive, w<PL, very stiff.	CI	0.76	1	AS			
2	FILL - (CI) SILTY CLAY, some sand, trace gravel; brown; sohesive, w<PL, firm to very stiff.		1.52	2	SPT	100	7-7-8	15
				3	AS			
3				4	SPT	39	4-3-5	8
4				5	AS			
5				6	SPT	61	4-5-5	10
				7	AS			
6	(SC/GC) CLAYEY SAND and GRAVEL; brown; non-cohesive, wet, dense.	SC/GC	6.10	8	SPT	33	46-27-8	35
7	(CI) SILTY CLAY, trace sand, trace gravel; mottled grey-brown; cohesive, w>PL, still to very stiff.	CI	7.01	9	AS			
8				10	SPT	100	3-4-7	11

Continued on Next Page

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
GRADATION %: GRAVEL, SAND, FINES
ORGANIC CONTENT %
ADDITIONAL LAB TESTING
SPT N Value: PENETRATION RESISTANCE BLOWS/300 MM; 20 40 60 80
GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS:
- 0.00 - 0.61 m bgs: Bentonite
- 0.61 - 6.10 m bgs: Cuttings
- 6.10 - 6.71 m bgs: Bentonite

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM
CHECKED: RJ
DATE: Mar 22, 2020
DATE: Sep 23, 2020

RECORD OF BOREHOLE: AH20-06

CLIENT: Public Services and Procurement Can DATE: March 22, 2020 ELEVATION: Data Not Available

PROJECT: 155.5km Alaska Hwy Slope Stabilization COORDINATES: N: 6285192.0 m E: 578821.0 m

PROJECT NO: 19129643 (6000) COORD SYS: UTM zone 10N

LOCATION: Fort St. John, BC CONTRACTOR: Geotech Drilling HORZ DATUM: NAD83

DEPTH (m)	DRILL RIG	DRILL METHOD	DESCRIPTION	USCS	ELEV. - DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	GRAVEL	SAND	FINES	ORGANIC CONTENT %
9	B-54 Track Mounted Auger Drill	Solid Stem Auger	(Cl) SILTY CLAY, trace sand, trace gravel; mottled grey-brown; cohesive, w>PL, still to very stiff.	Cl		11	AS							
						12	SPT	100	3-4-7	11				
10						13	AS							
11						14	SPT	100	3-7-12	19				
12			(Cl) SILTY CLAY, some sand to sandy; some gravel; brown, TILL; cohesive, w>PL, hard.		11.58	15	AS							
			(Cl) SILTY CLAY, trace sand, trace gravel; mottled grey-brown, TILL; cohesive, w>PL, hard.		12.24	16	SPT	100	15-16-26	42				
13			(Cl) sandy SILTY CLAY, trace gravel; grey, TIL; cohesive, w>PL, hard.		12.95	17	AS				1	23	76	
14						18	SPT	89	7-8-15	23				
15						19	AS							
						20	SPT	0	7-9-15	24				
16			End of hole at 15.7 m.											

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SPT N Value: PENETRATION RESISTANCE BLOWS/300 MM; 20 40 60 80

ADDITIONAL LAB TESTING

GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS

6.71 - 12.19 m bgs: Cuttings

12.19 - 12.80 m bgs: Bentonite

DEPTH SCALE: 1:41

REV: 0

LOGGED: DGM DATE: Mar 22, 2020

CHECKED: RJ DATE: Sep 23, 2020

APPENDIX C

Laboratory Test Results

GOLDER

Water Content Determination

Test Request #	K20-028	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada	Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km		

Location ID	Sample				Soil Description	Water Content %	Method	Remarks
	Ref	Top (m)	Base (m)	Type				
AH20-03	1	0.61	0.91	AS		7.6	ASTM D2216 Method B	
AH20-01	1	0.76	1.07	AS		18.9	ASTM D2216 Method B	
AH20-04	1	0.76	1.07	AS		16.4	ASTM D2216 Method B	
AH20-06	1	0.76	1.07	AS		20	ASTM D2216 Method B	
AH20-05	1	0.91	1.22	AS		15.4	ASTM D2216 Method B	
AH20-02	2	1.52	1.98	SS		27.3	ASTM D2216 Method B	
AH20-05	3	2.44	2.74	AS		19.8	ASTM D2216 Method B	
AH20-04	3	2.44	2.74	AS		24.5	ASTM D2216 Method B	
AH20-03	3	2.44	2.74	AS		20.4	ASTM D2216 Method B	
AH20-01	4	3.05	3.51	SS		33.8	ASTM D2216 Method B	
AH20-02	4	3.05	3.66	SS		27.3	ASTM D2216 Method B	
AH20-06	4	3.05	3.51	SS		16.9	ASTM D2216 Method B	
AH20-03	5	3.96	4.27	AS		22.6	ASTM D2216 Method B	
AH20-04	5	3.96	4.27	AS		22.2	ASTM D2216 Method B	
AH20-05	6	4.57	5.03	SS		16.4	ASTM D2216 Method B	
AH20-01	6	4.57	5.03	SS		21.6	ASTM D2216 Method B	
AH20-02	6	4.57	5.03	SS		23.4	ASTM D2216 Method B	
AH20-03	7	5.49	5.79	AS		25	ASTM D2216 Method B	
AH20-04	7	5.49	5.79	AS		23	ASTM D2216 Method B	
AH20-05	8	6.10	6.55	SS		19.4	ASTM D2216 Method B	

Notes:

Disclaimer:
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Tested by: ACianci **Date:** 4/30/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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GOLDER

Water Content Determination

Test Request #	K20-028	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada	Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km		

Location ID	Sample				Soil Description	Water Content %	Method	Remarks
	Ref	Top (m)	Base (m)	Type				
AH20-01	8	6.10	6.55	SS		17.1	ASTM D2216 Method B	
AH20-06	8	6.10	6.55	SS		14.4	ASTM D2216 Method B	
AH20-02	9	7.01	7.32	AS		12.2	ASTM D2216 Method B	
AH20-01	9	7.01	7.32	AS		21.9	ASTM D2216 Method B	
AH20-03	9	7.01	7.32	AS		29.6	ASTM D2216 Method B	
AH20-04	9	7.01	7.32	AS		23.9	ASTM D2216 Method B	
AH20-05	10	7.62	8.08	SS		24.4	ASTM D2216 Method B	
AH20-04	11	8.53	8.84	AS		32.7	ASTM D2216 Method B	
AH20-03	11	8.53	8.84	AS		36.7	ASTM D2216 Method B	
AH20-02	11	8.53	8.84	AS		13.3	ASTM D2216 Method B	
AH20-06	12	9.14	9.60	SS		26.9	ASTM D2216 Method B	
AH20-01	12	9.14	9.60	SS		16.4	ASTM D2216 Method B	
AH20-05	12	9.14	9.60	SS		19.8	ASTM D2216 Method B	
AH20-04	13	10.06	10.36	AS		26.6	ASTM D2216 Method B	
AH20-03	13	10.06	10.36	AS		18.2	ASTM D2216 Method B	
AH20-05	14	10.67	11.13	SS		24.1	ASTM D2216 Method B	
AH20-04	15	11.58	11.89	AS		22.2	ASTM D2216 Method B	
AH20-03	15	11.58	11.89	AS		21.2	ASTM D2216 Method B	
AH20-01	16	12.19	12.65	SS		16.5	ASTM D2216 Method B	
AH20-06	16	12.19	12.65	SS		14.6	ASTM D2216 Method B	

Notes:

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Tested by: ACianci **Date:** 4/30/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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Water Content Determination

Test Request #	K20-028	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada	Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km		

Location ID	Sample				Soil Description	Water Content %	Method	Remarks
	Ref	Top (m)	Base (m)	Type				
AH20-04	17	13.11	13.41	AS		22.9	ASTM D2216 Method B	
AH20-03	17	13.11	13.41	AS		18.2	ASTM D2216 Method B	
AH20-05	18	13.72	14.17	SS		17	ASTM D2216 Method B	
AH20-06	18	13.72	14.17	SS		17.7	ASTM D2216 Method B	
AH20-05	19	14.63	14.94	AS		16.3	ASTM D2216 Method B	
AH20-03	19	14.63	14.94	AS		20.1	ASTM D2216 Method B	
AH20-01	20	15.24	15.70	SS		18.2	ASTM D2216 Method B	
AH20-05	20	15.24	15.70	SS		14.1	ASTM D2216 Method B	
AH20-04	20	15.24	15.29	SS		20.4	ASTM D2216 Method B	
AH20-06	20	15.24	15.70	SS		15.6	ASTM D2216 Method B	

Notes:

Disclaimer:
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Tested by: ACianci **Date:** 4/30/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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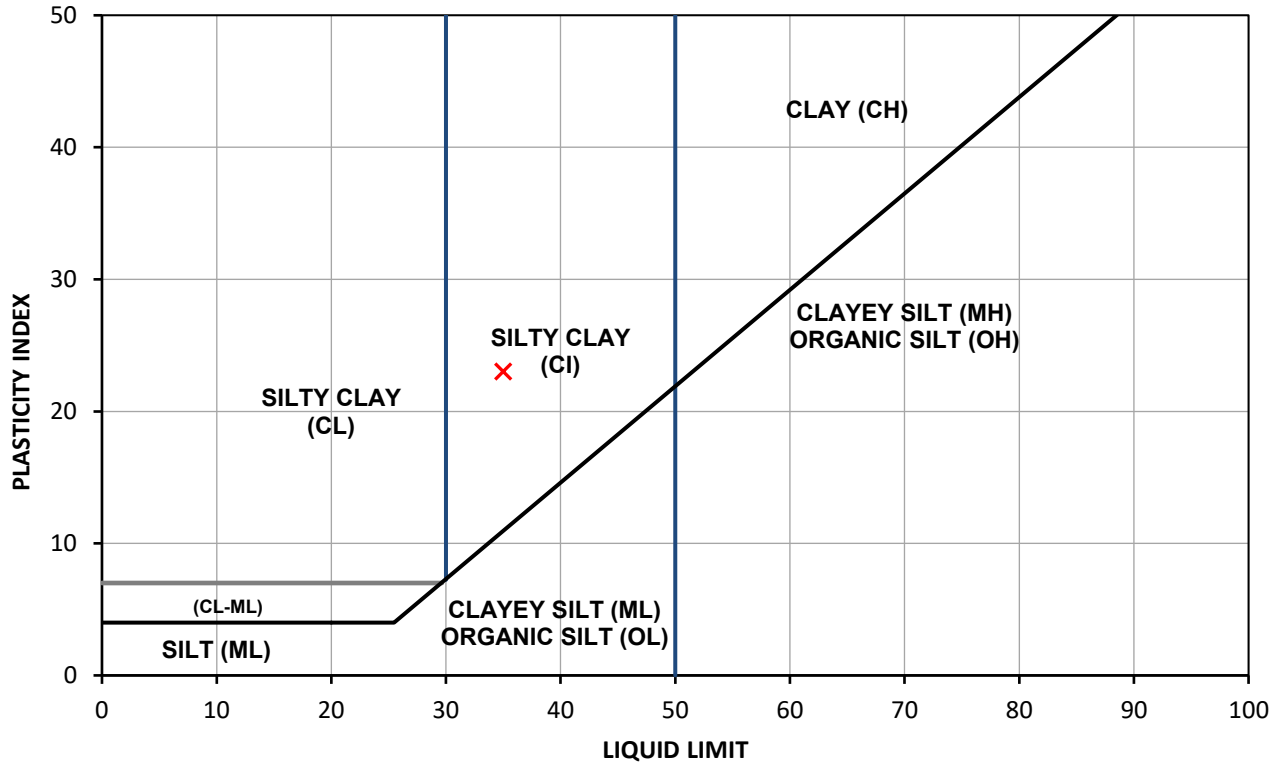
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO202004150	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-01
Source:				Sample No.:	1
Soil Description:				Type:	AS
				Depth (m):	0.76 - 1.07
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/22/2020
Specimen Description	NA				



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-01	1	0.76	1.07	ND	35	12	23	18.9	0.3

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

Tested by: ACianci **Date:** 4/22/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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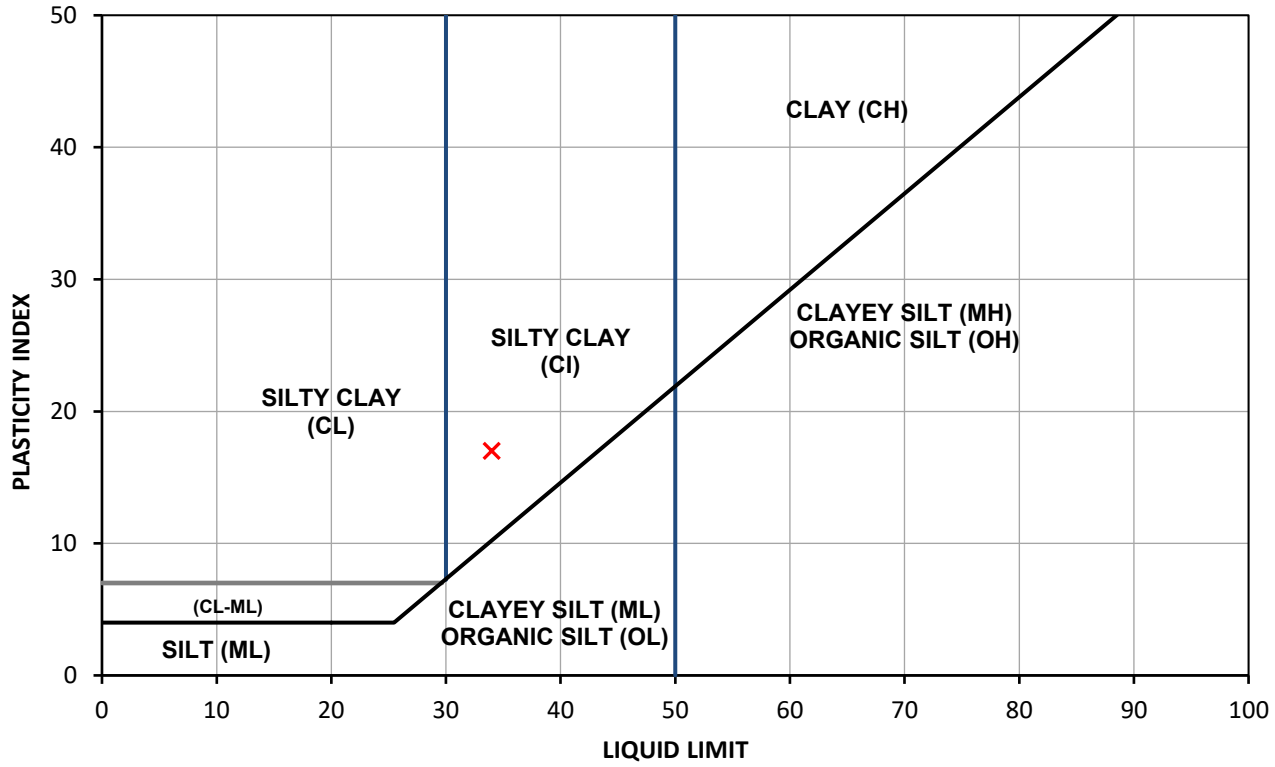
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041533	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-05		
Source:				Sample No.:	1		
Soil Description:				Type:	AS		
				Depth (m):	0.91	-	1.22
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/27/2020		
Specimen Description	NA						



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-05	1	0.91	1.22	ND	34	17	17	15.4	-0.09

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

Tested by: ACianci **Date:** 4/27/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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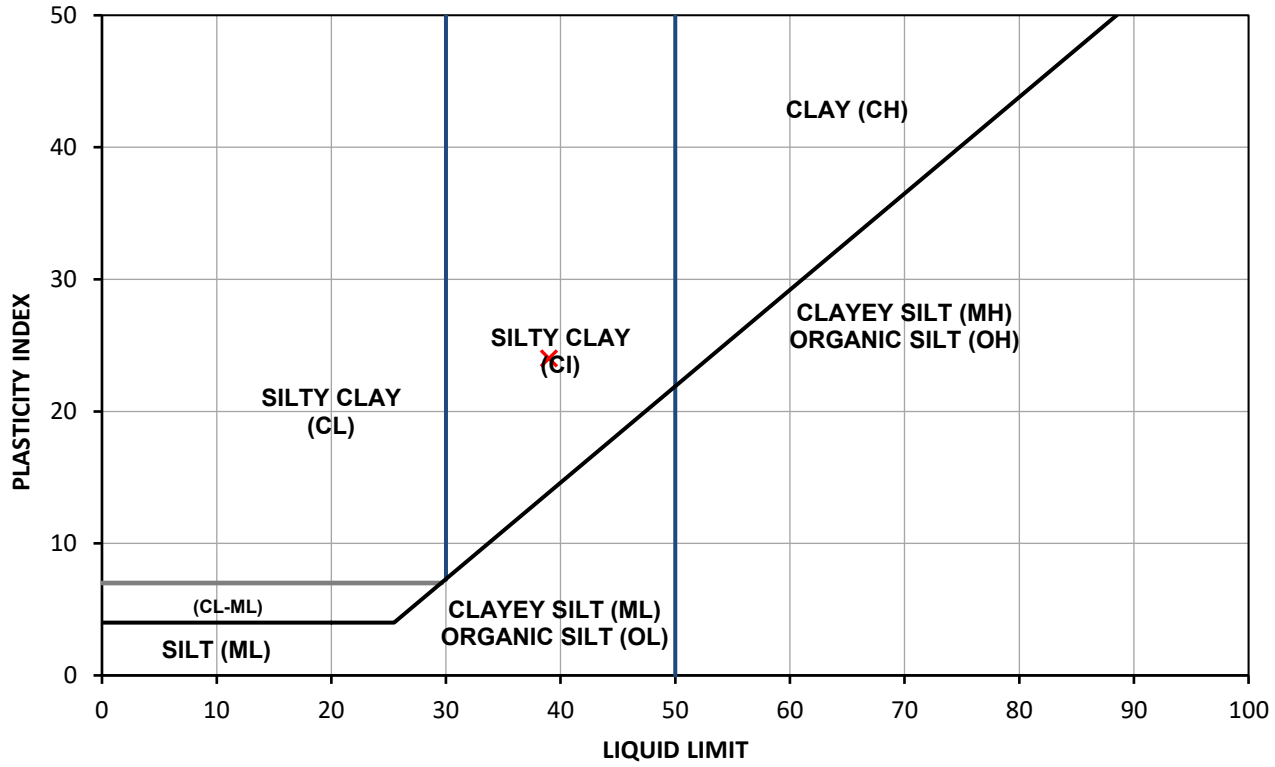
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041534	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-05
Source:				Sample No.:	3
Soil Description:				Type:	AS
				Depth (m):	2.44 - 2.74
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/28/2020
Specimen Description	NA				



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-05	3	2.44	2.74	ND	39	15	24	19.8	0.2

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

Tested by: ACianci **Date:** 4/28/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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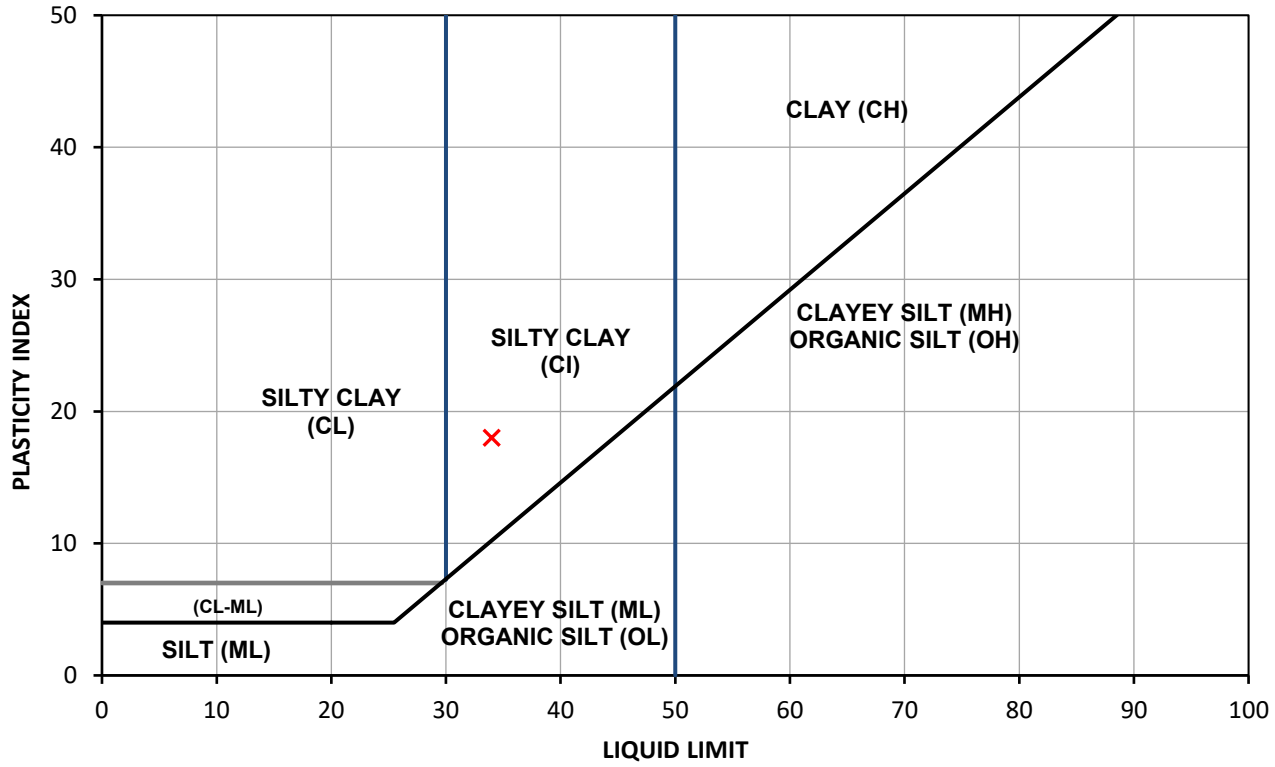
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041514	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-03
Source:				Sample No.:	3
Soil Description:				Type:	AS
				Depth (m):	2.44 - 2.74
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/24/2020
Specimen Description	NA				



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-03	3	2.44	2.74	ND	34	16	18	20.4	0.24

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

Tested by: ACianci **Date:** 4/24/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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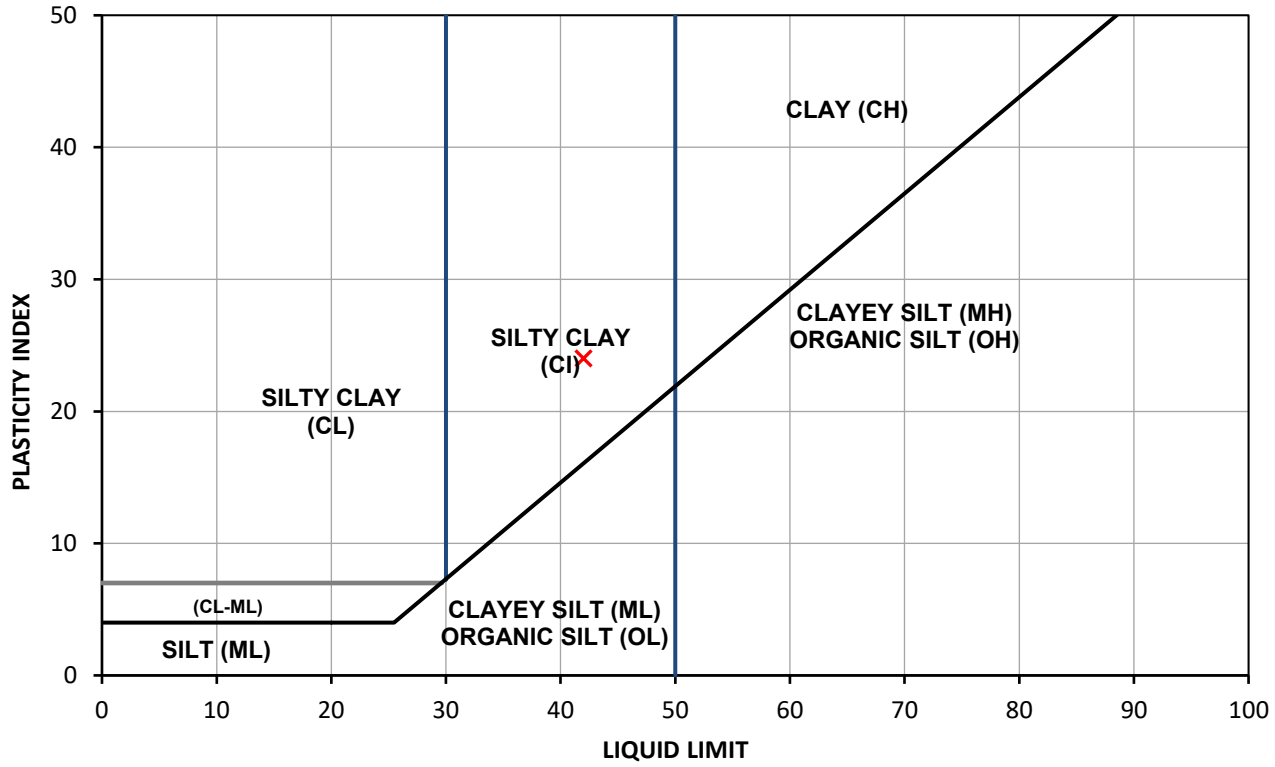
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO202004159	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-02
Source:				Sample No.:	4
Soil Description:				Type:	SS
				Depth (m):	3.05 - 3.66
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/24/2020
Specimen Description	NA				



Legend

A-Line

Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-02	4	3.05	3.66	ND	42	18	24	27.3	0.39

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

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Tested by: ACianci **Date:** 4/24/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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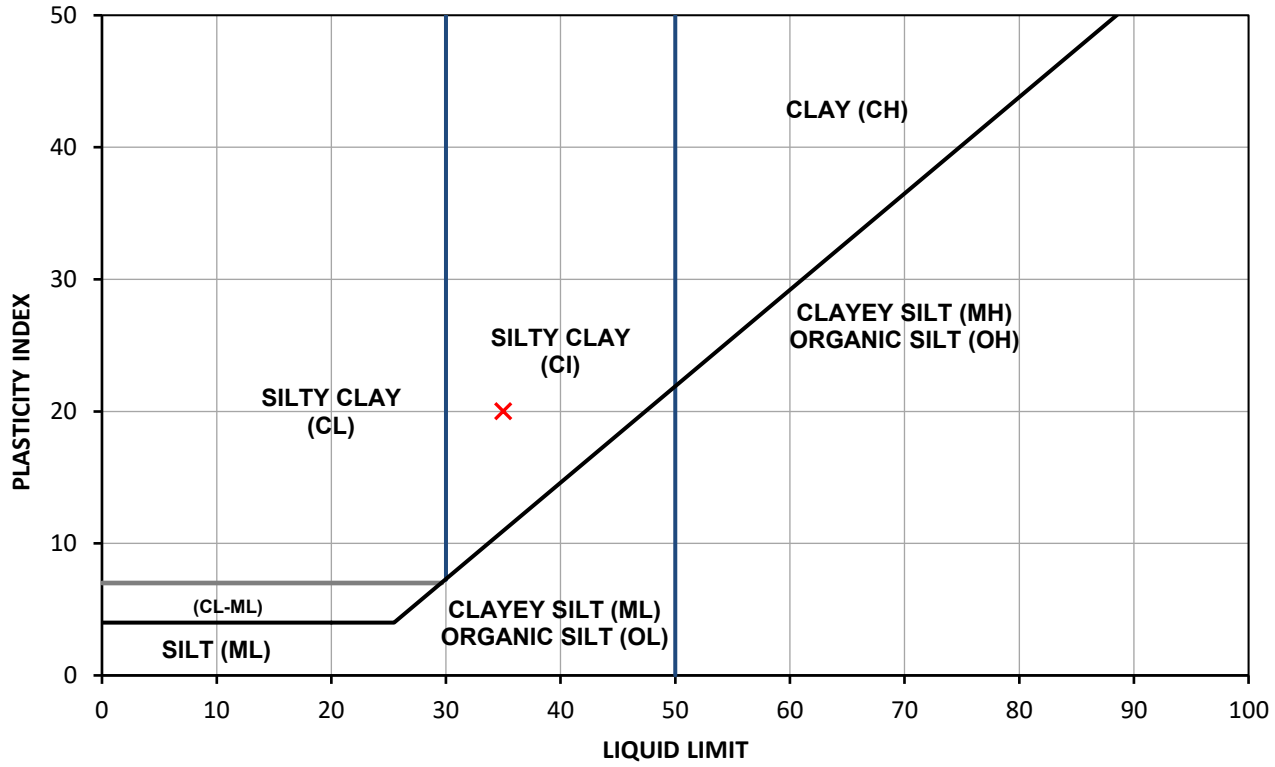
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041536	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-05
Source:				Sample No.:	6
Soil Description:				Type:	SS
				Depth (m):	4.57 - 5.03
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/28/2020
Specimen Description	NA				



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-05	6	4.57	5.03	ND	35	15	20	16.4	0.07

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

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Tested by: ACianci **Date:** 4/28/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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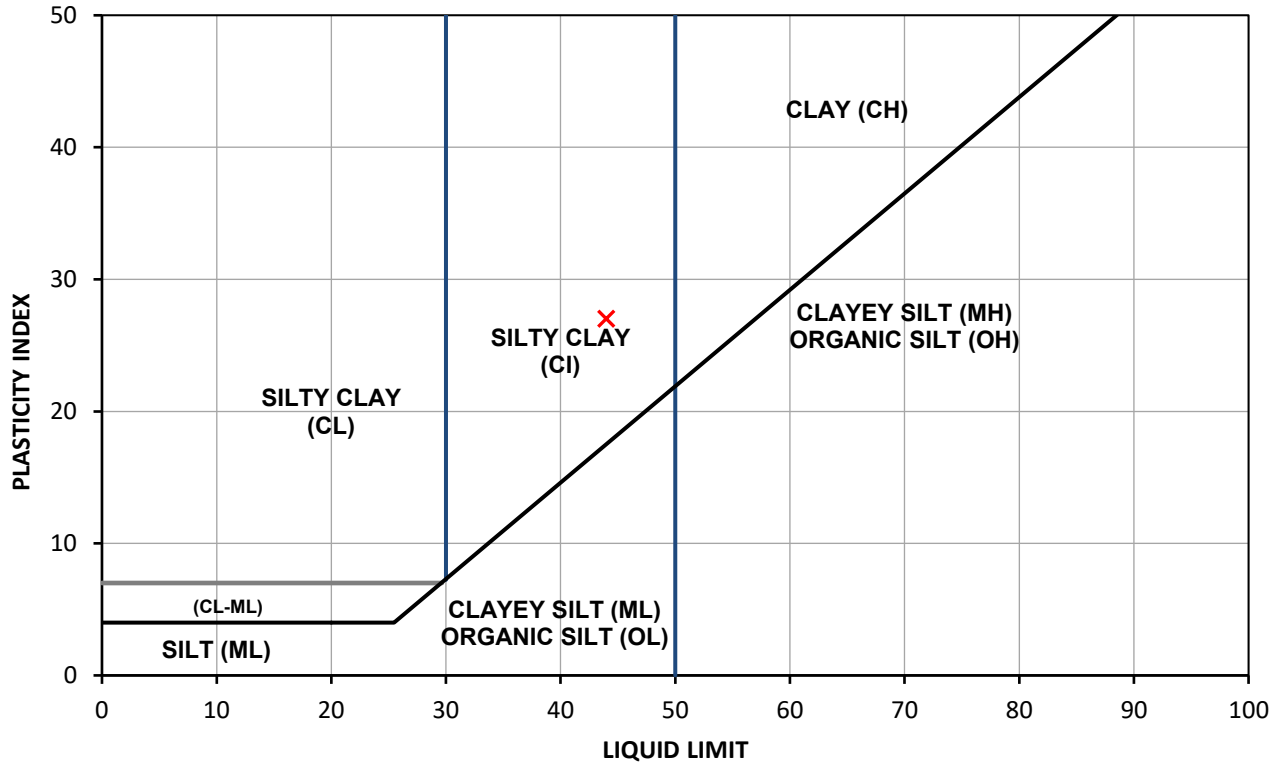
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041516	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-03
Source:				Sample No.:	7
Soil Description:				Type:	AS
				Depth (m):	5.49 - 5.79
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/24/2020
Specimen Description	NA				



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-03	7	5.49	5.79	ND	44	17	27	25	0.3

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

Tested by: ACianci **Date:** 4/24/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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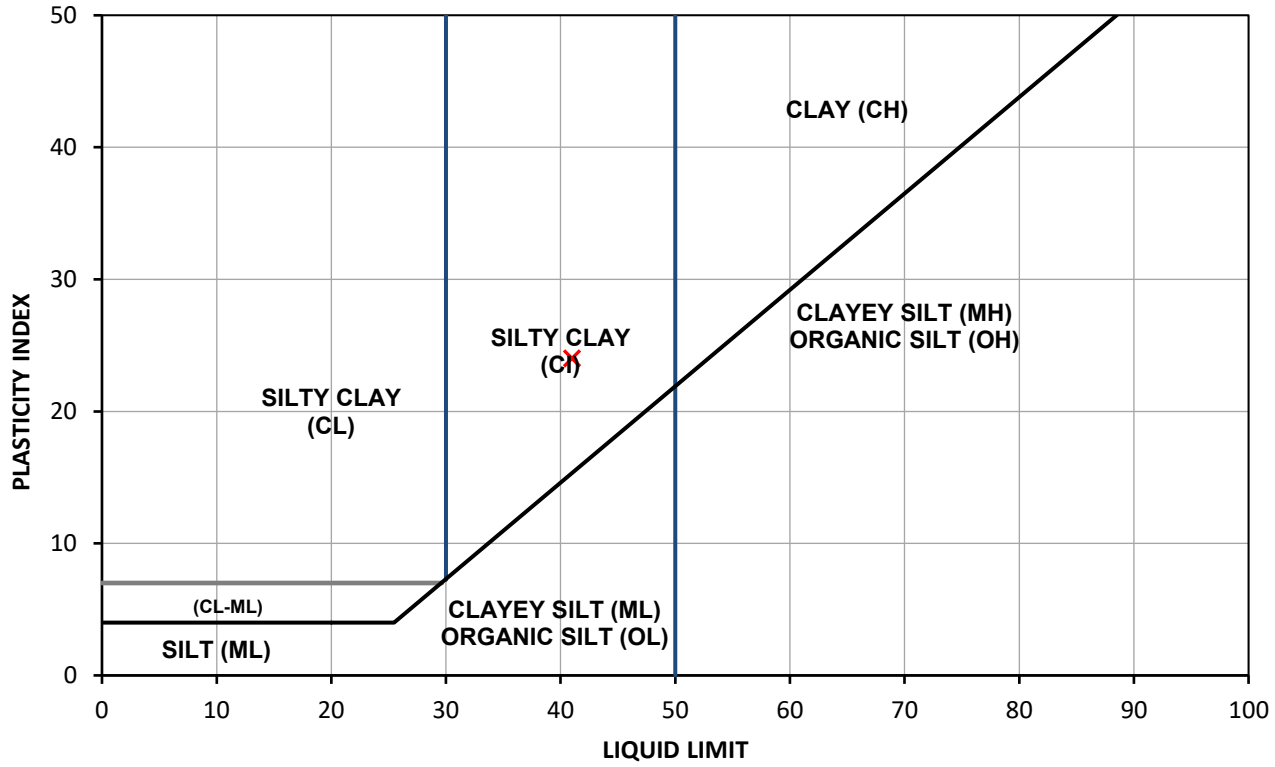
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041540	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-05		
Source:				Sample No.:	12		
Soil Description:				Type:	SS		
				Depth (m):	9.14	-	9.60
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/28/2020		
Specimen Description	NA						



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-05	12	9.14	9.6	ND	41	17	24	19.8	0.12

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

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Tested by: ACianci **Date:** 4/28/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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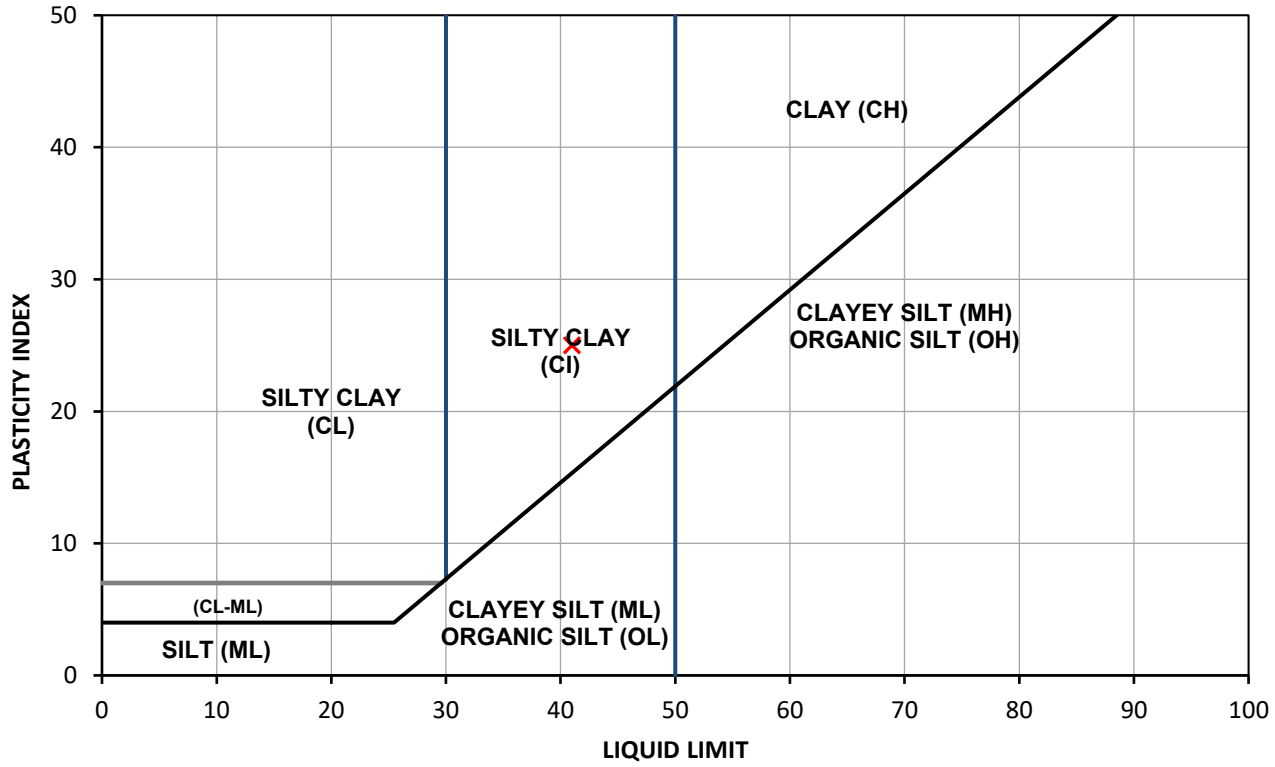
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041529	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-04		
Source:				Sample No.:	13		
Soil Description:				Type:	AS		
				Depth (m):	10.06	-	10.36
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/22/2020		
Specimen Description	NA						



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-04	13	10.06	10.36	ND	41	16	25	26.6	0.42

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

Tested by: ACianci **Date:** 4/22/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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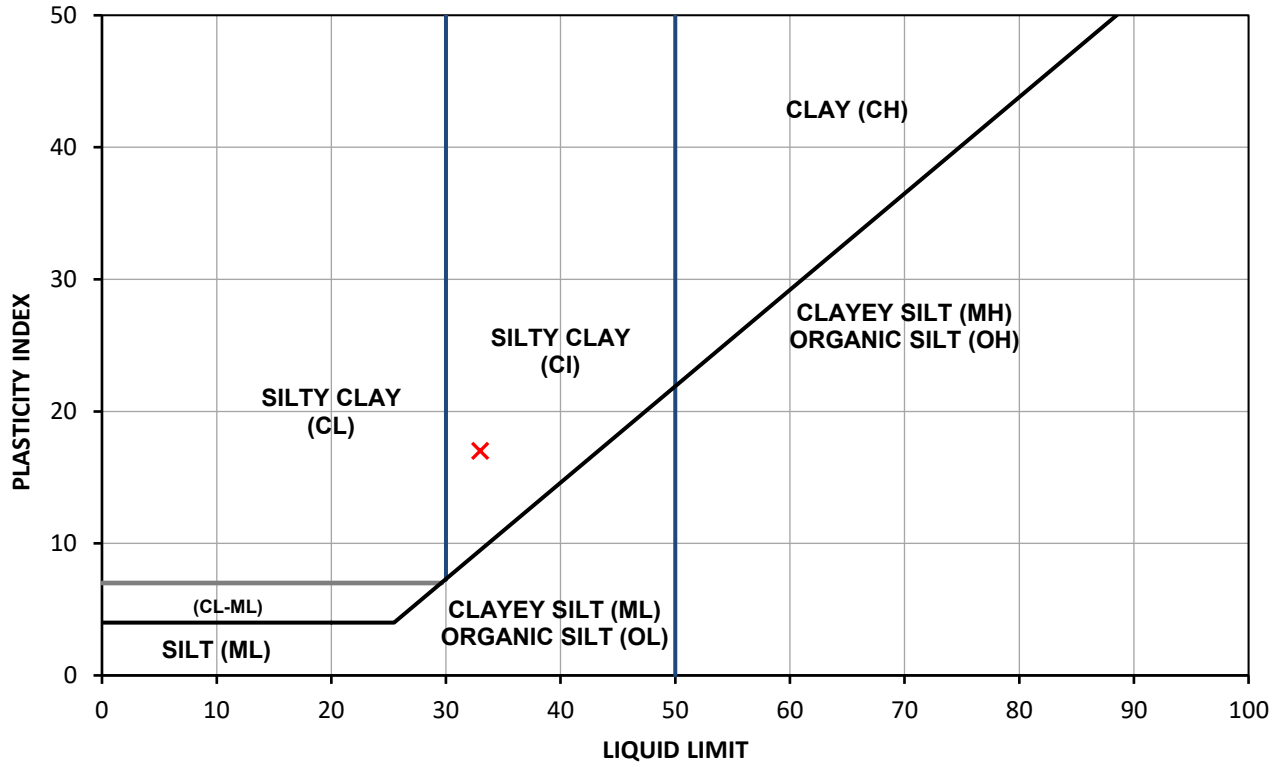
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041552	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-06
Source:				Sample No.:	18
Soil Description:				Type:	SS
				Depth (m):	13.72 - 14.17
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/29/2020
Specimen Description	NA				



Legend

A-Line

Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-06	18	13.72	14.17	ND	33	16	17	17.7	0.1

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

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Tested by: ACianci **Date:** 4/29/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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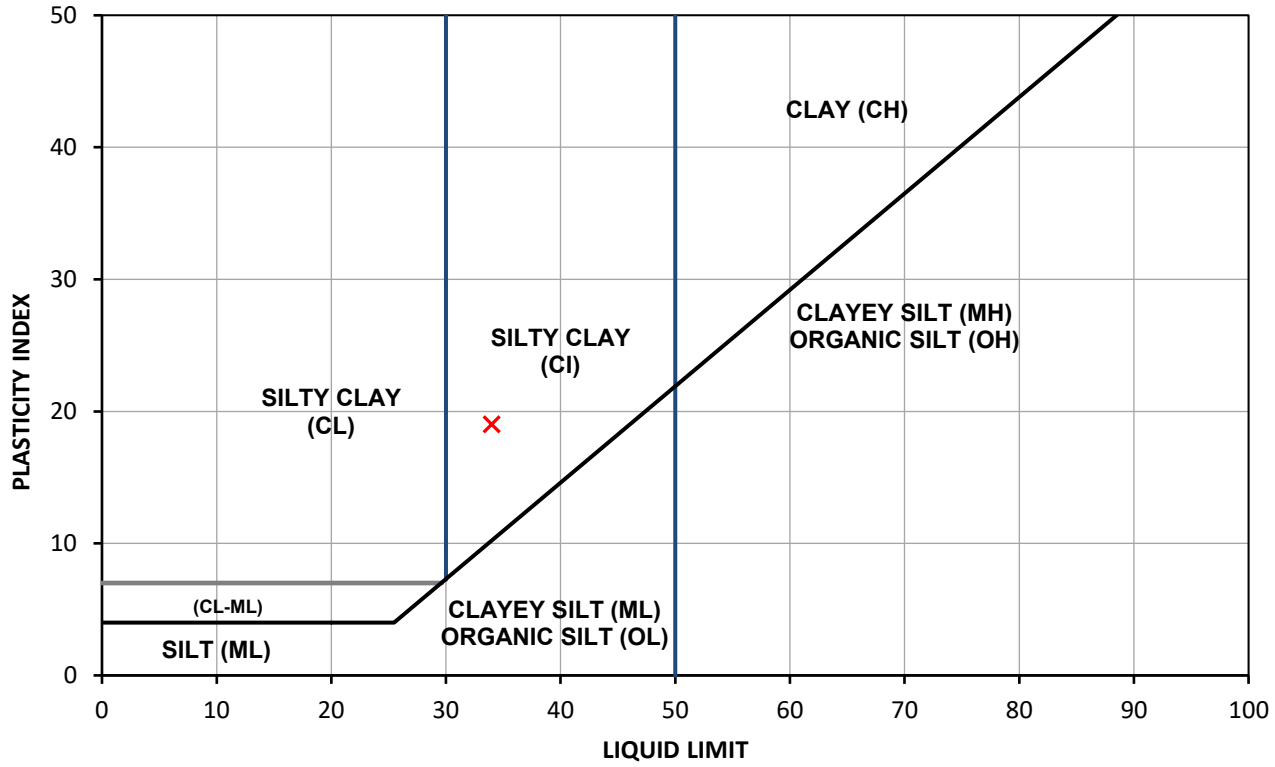
LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

ASTM D4318

Multipoint Test

Test Request #	K20-028	Lab Sample ID:	KELO2020041544	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.:	AH20-05		
Source:				Sample No.:	19		
Soil Description:				Type:	AS		
				Depth (m):	14.63	-	14.94
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/29/2020		
Specimen Description	NA						



Sample Location	Sample / Specimen Number	Top Depth (m)	Base Depth (m)	Percent Passing #40 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content	Liquidity Index
AH20-05	19	14.63	14.94	ND	34	15	19	16.3	0.07

Preparation Method

Tested after >425um removed by hand

Notes:

Disclaimer:

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Tested by: ACianci **Date:** 4/29/2020

Checked by: BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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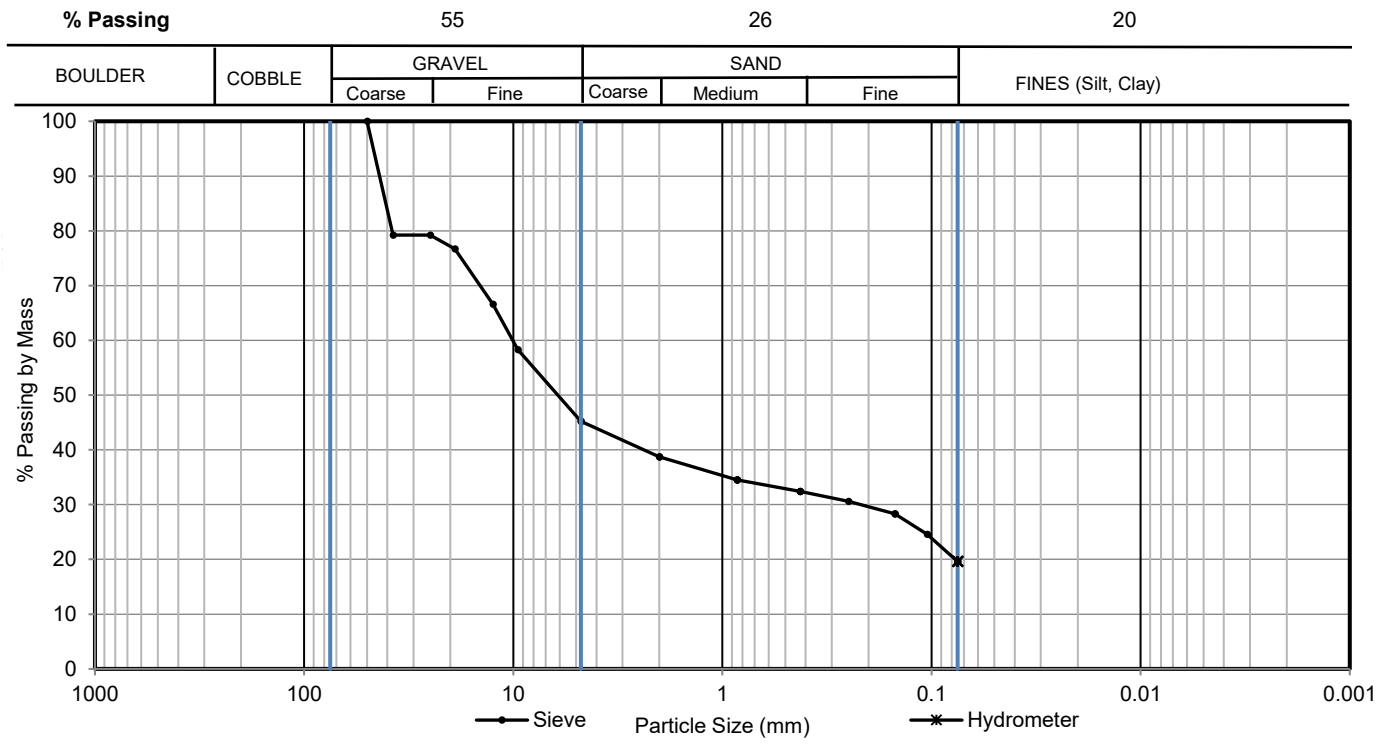
PARTICLE SIZE DISTRIBUTION

ASTM D6913

Method B

Test Request #	K20-028	Lab Sample ID:	KELO2020041513	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-03		
Source:				Sample No.	1		
Soil Description:				Type:	AS		
				Depth (m):	0.61	-	0.91
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/17/2020		
Specimen Description	NA						



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
2"	50	100.0		
1 1/2"	37.5	79.2		
1"	25	79.2		
3/4"	19	76.7		
1/2"	12.5	66.6		
3/8"	9.5	58.3		
#4	4.75	45.2		
#10	2	38.7		
#20	0.85	34.5		
#40	0.425	32.4		
#60	0.25	30.6		
#100	0.15	28.3		
#140	0.105	24.6		
#200	0.075	19.6		
			D60	10.00
			D30	0.22
			D10	
			CU	
			CC	

Notes:

Disclaimer:

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Tested by: ACianci **Date:** 4/17/2020 **Checked by:** BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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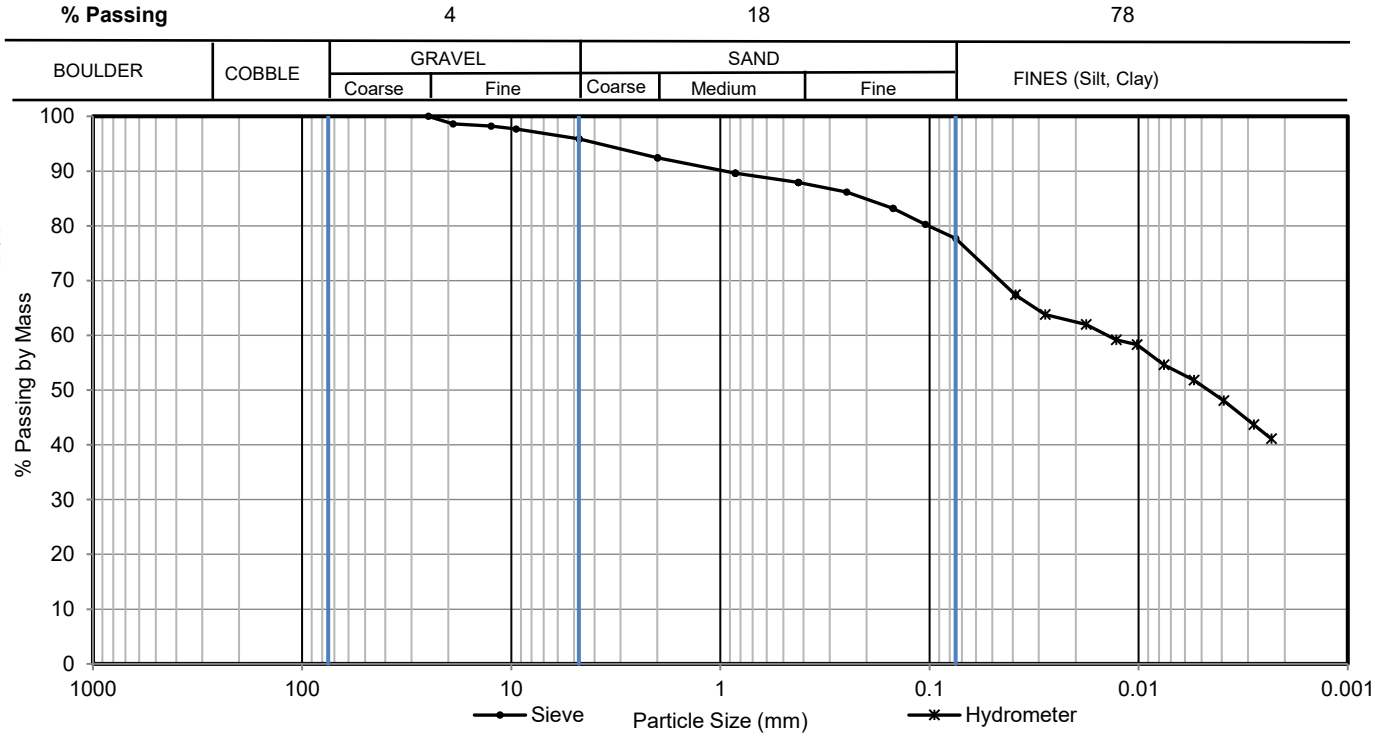
PARTICLE SIZE DISTRIBUTION
ASTM D6913 and ASTM D422
Method B

Test Request #	K20-028	Lab Sample ID:	KELO2020041524	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-04
Source:				Sample No.	3
Soil Description:				Type:	AS
				Depth (m):	2.44 - 2.74
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/23/2020
Specimen Description	NA				



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
1"	25	100.0	0.0389	67
3/4"	19	98.6	0.0280	64
1/2"	12.5	98.2	0.0179	62
3/8"	9.5	97.7	0.0128	59
#4	4.75	95.9	0.0102	58
#10	2	92.4	0.0076	55
#20	0.85	89.6	0.0054	52
#40	0.425	87.9	0.0039	48
#60	0.25	86.2	0.0028	44
#100	0.15	83.2	0.0023	41
#140	0.105	80.3		
#200	0.075	77.7		
			D60	0.01
			D30	
			D10	
			CU	
			CC	

Notes:

Disclaimer:
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Tested by: ACianci **Date:** 4/23/2020 **Checked by:** BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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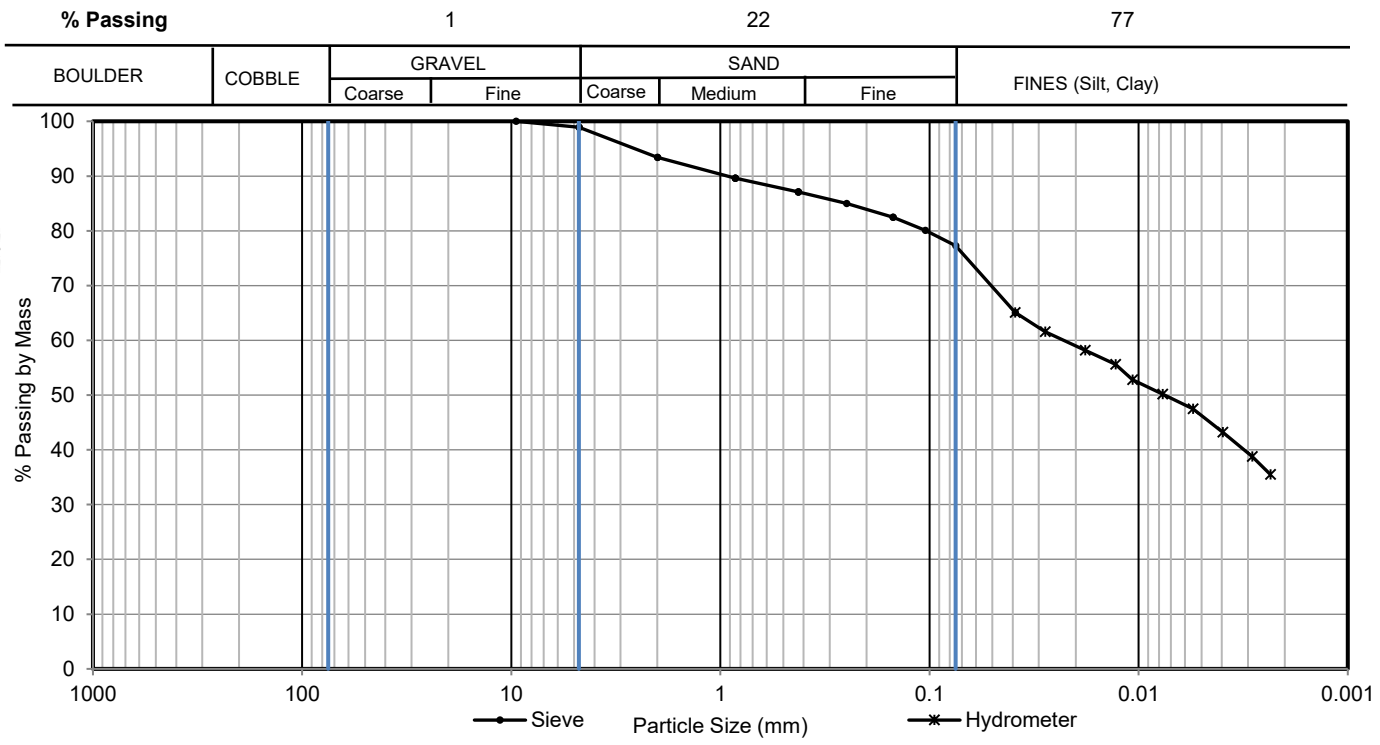
PARTICLE SIZE DISTRIBUTION
ASTM D6913 and ASTM D422
Method B

Test Request #	K20-028	Lab Sample ID:	KELO2020041535	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-05		
Source:				Sample No.	5		
Soil Description:				Type:	AS		
				Depth (m):	3.96	-	4.27
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/23/2020		
Specimen Description	NA						



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
3/8"	9.5	100.0	0.0390	65
#4	4.75	98.9	0.0280	62
#10	2	93.4	0.0180	58
#20	0.85	89.6	0.0129	56
#40	0.425	87.1	0.0107	53
#60	0.25	85.0	0.0077	50
#100	0.15	82.5	0.0055	48
#140	0.105	80.1	0.0040	43
#200	0.075	77.3	0.0029	39
			0.0023	36
			D60	0.02
			D30	
			D10	
			CU	
			CC	

Notes:

Disclaimer:
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Tested by: ACianci **Date:** 4/23/2020 **Checked by:** BRush **Date:** 4/28/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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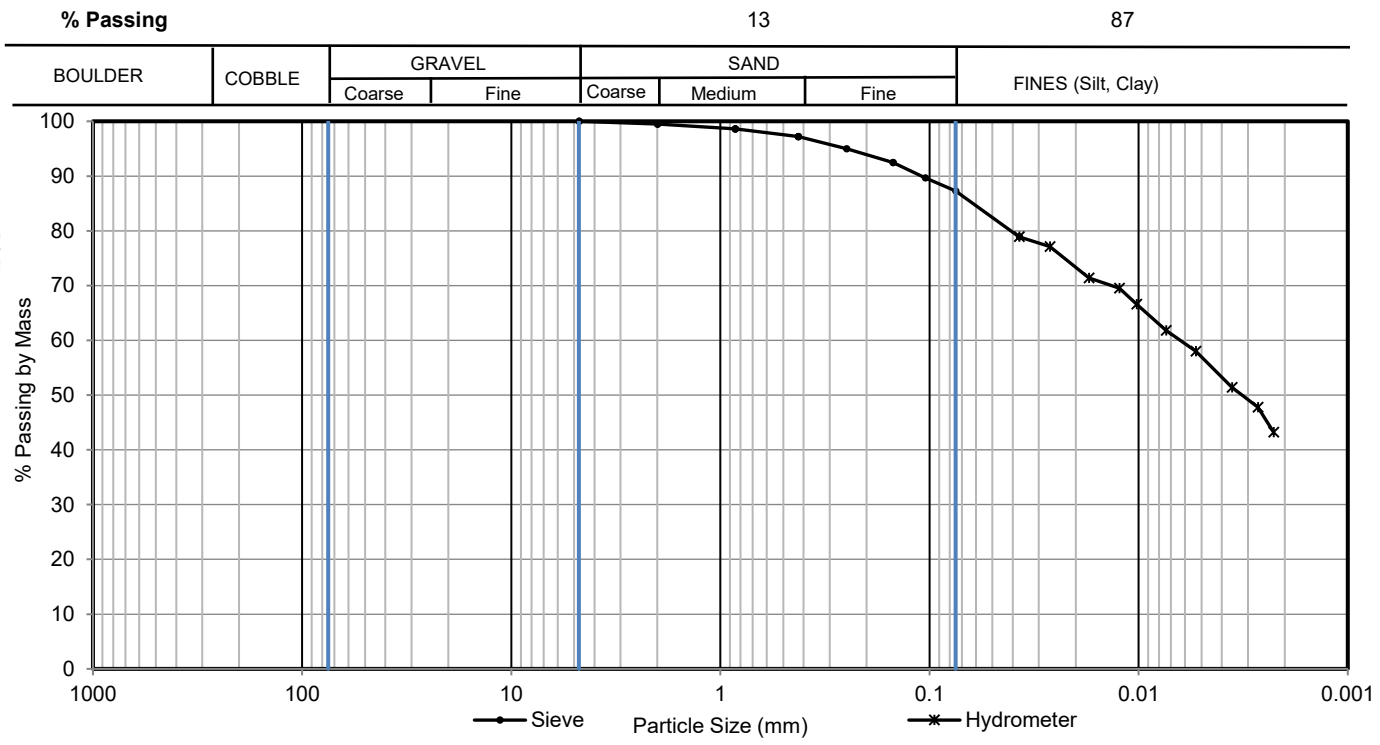
PARTICLE SIZE DISTRIBUTION
ASTM D6913 and ASTM D422
Method B

Test Request #	K20-028	Lab Sample ID:	KELO202004152	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-01		
Source:				Sample No.	6		
Soil Description:				Type:	SS		
				Depth (m):	4.57	-	5.03
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/21/2020		
Specimen Description	NA						



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
#4	4.75	100.0	0.0373	79
#10	2	99.5	0.0266	77
#20	0.85	98.6	0.0173	71
#40	0.425	97.2	0.0124	70
#60	0.25	95.0	0.0102	67
#100	0.15	92.5	0.0074	62
#140	0.105	89.7	0.0053	58
#200	0.075	87.3	0.0036	51
			0.0027	48
			0.0023	43
			D60	0.01
			D30	
			D10	
			CU	
			CC	

Notes:

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Tested by: ACianci **Date:** 4/21/2020 **Checked by:** BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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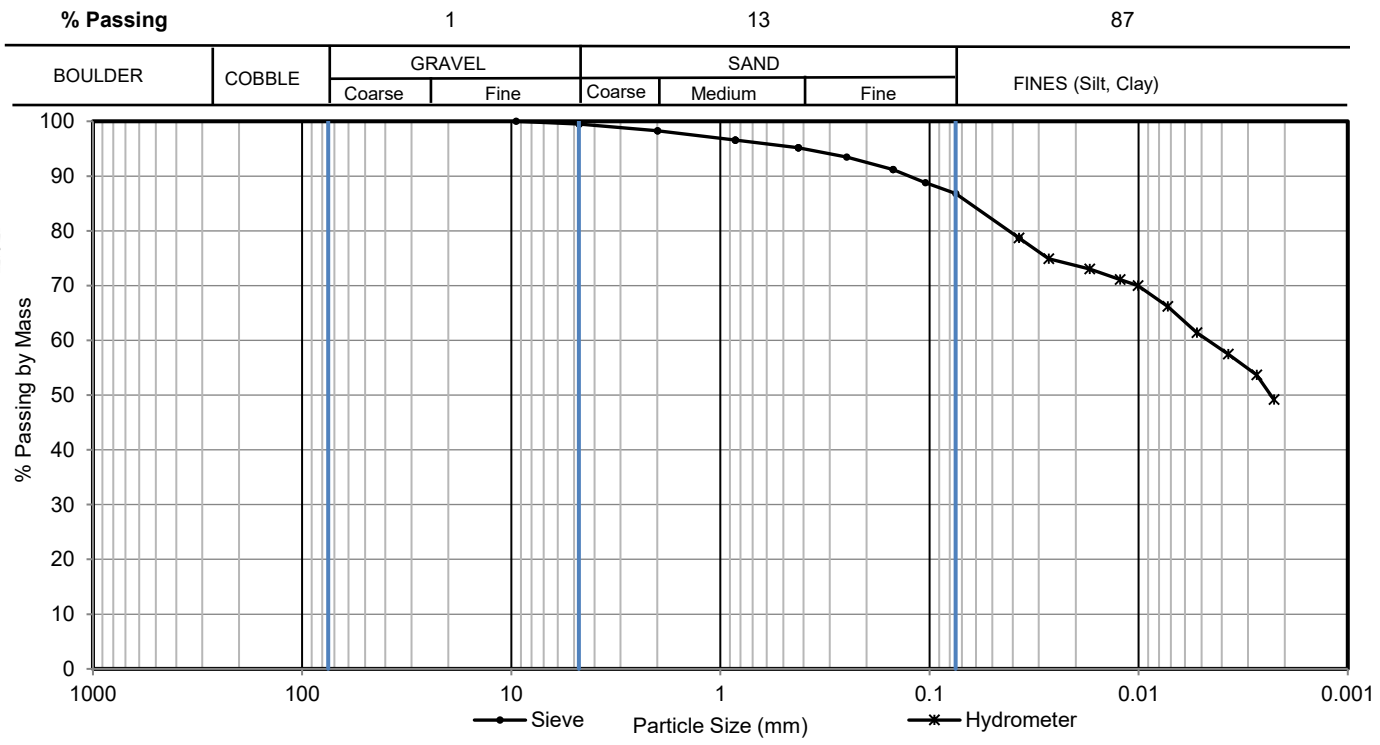
PARTICLE SIZE DISTRIBUTION
ASTM D6913 and ASTM D422
Method B

Test Request #	K20-028	Lab Sample ID:	KELO2020041537	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-05		
Source:				Sample No.	7		
Soil Description:				Type:	AS		
				Depth (m):	5.49	-	5.79
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/23/2020		
Specimen Description	NA						



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
3/8"	9.5	100.0	0.0374	79
#4	4.75	99.5	0.0269	75
#10	2	98.3	0.0172	73
#20	0.85	96.6	0.0123	71
#40	0.425	95.2	0.0101	70
#60	0.25	93.5	0.0073	66
#100	0.15	91.2	0.0053	61
#140	0.105	88.8	0.0037	58
#200	0.075	86.8	0.0027	54
			0.0023	49
			D60	
			D30	
			D10	
			CU	
			CC	

Notes:

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Tested by: ACianci **Date:** 4/23/2020 **Checked by:** BRush **Date:** 4/28/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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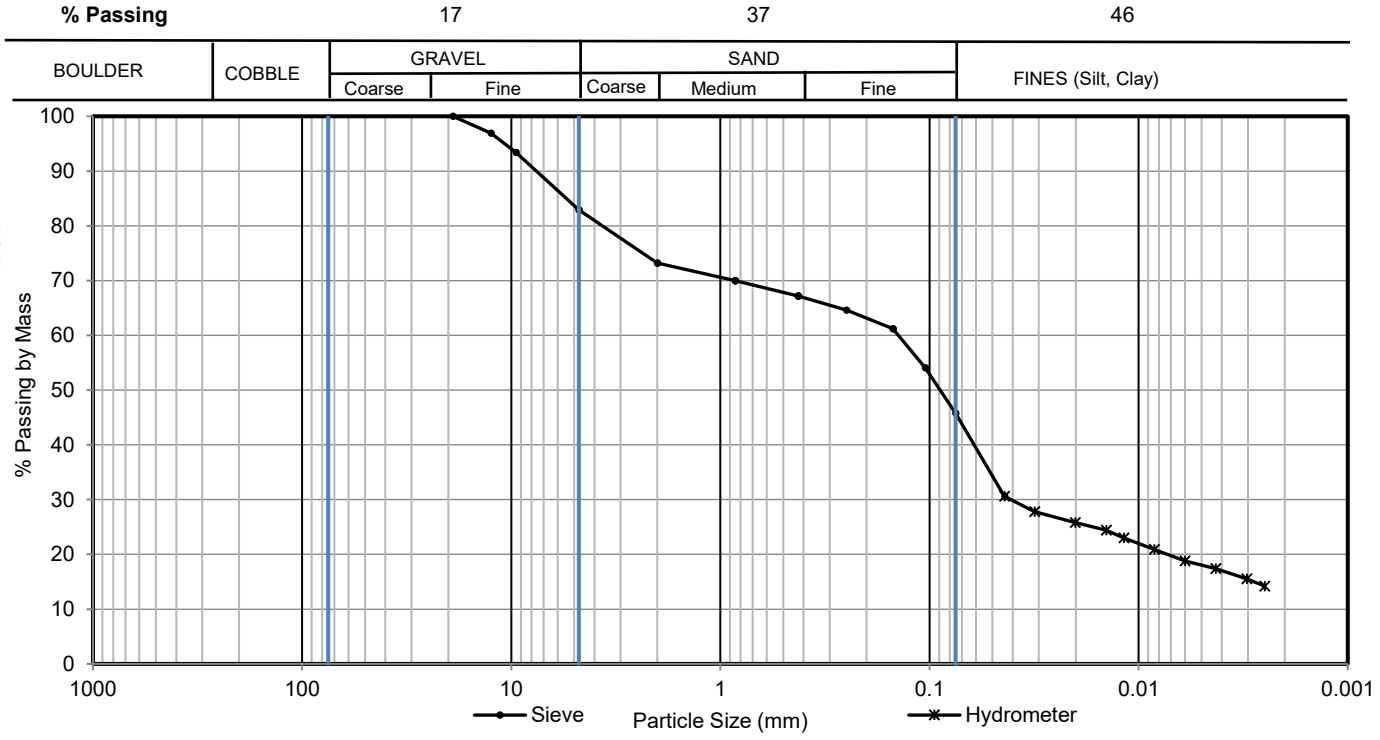
PARTICLE SIZE DISTRIBUTION
ASTM D6913 and ASTM D422
Method B

Test Request #	K20-028	Lab Sample ID:	KELO2020041511	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-02
Source:				Sample No.	9
Soil Description:				Type:	AS
				Depth (m):	7.01 - 7.32
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/21/2020
Specimen Description	NA				



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
3/4"	19	100.0	0.0439	31
1/2"	12.5	96.9	0.0315	28
3/8"	9.5	93.4	0.0201	26
#4	4.75	82.9	0.0143	24
#10	2	73.2	0.0118	23
#20	0.85	70.0	0.0084	21
#40	0.425	67.2	0.0060	19
#60	0.25	64.6	0.0043	17
#100	0.15	61.2	0.0030	16
#140	0.105	54.1	0.0025	14
#200	0.075	45.8		
			D60	0.14
			D30	0.04
			D10	
			CU	
			CC	

Notes:

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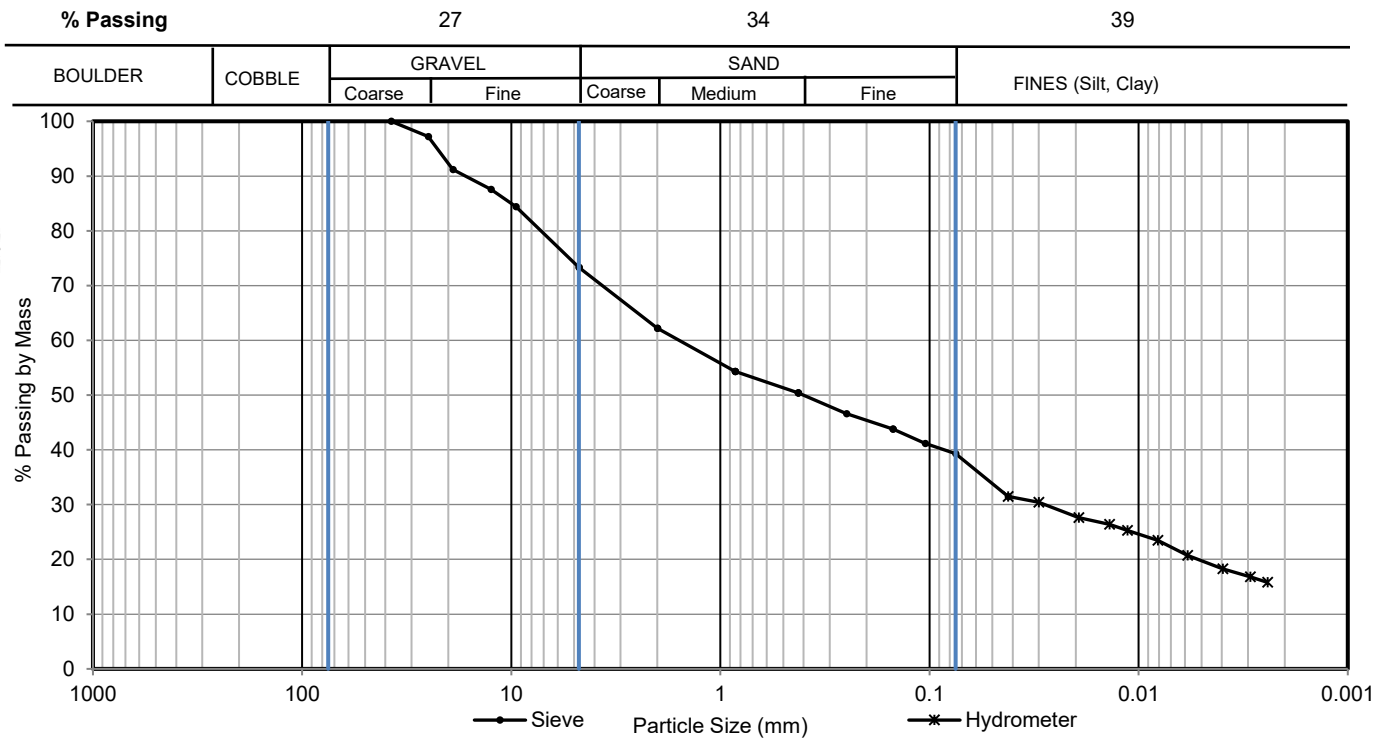
PARTICLE SIZE DISTRIBUTION
ASTM D6913 and ASTM D422
Method B

Test Request #	K20-028	Lab Sample ID:	KELO202004154	Project Number:	19129643 (6000)		
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC		
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-01		
Source:				Sample No.	9		
Soil Description:				Type:	AS		
				Depth (m):	7.01	-	7.32
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/21/2020		
Specimen Description	NA						



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
1 1/2"	37.5	100.0	0.0421	32
1"	25	97.2	0.0300	30
3/4"	19	91.2	0.0193	28
1/2"	12.5	87.6	0.0138	26
3/8"	9.5	84.4	0.0113	25
#4	4.75	73.3	0.0081	24
#10	2	62.2	0.0058	21
#20	0.85	54.3	0.0040	18
#40	0.425	50.4	0.0029	17
#60	0.25	46.6	0.0024	16
#100	0.15	43.8		
#140	0.105	41.2		
#200	0.075	39.3		
			D60	1.58
			D30	0.03
			D10	
			CU	
			CC	

Notes:

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Tested by: ACianci **Date:** 4/21/2020 **Checked by:** BRush **Date:** 4/30/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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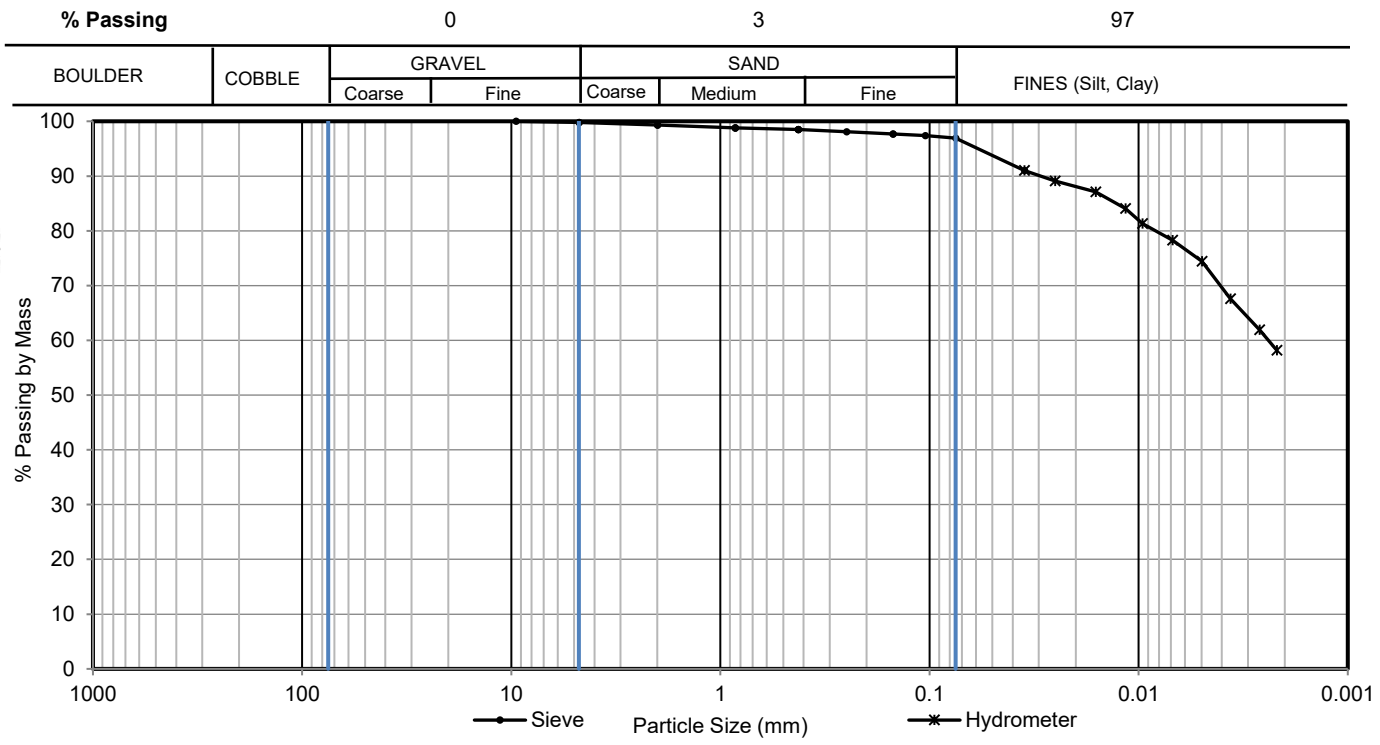
PARTICLE SIZE DISTRIBUTION
ASTM D6913 and ASTM D422
Method B

Test Request #	K20-028	Lab Sample ID:	KELO2020041542	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-05
Source:				Sample No.	16
Soil Description:				Type:	SS
				Depth (m):	12.19 - 12.65
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/23/2020
Specimen Description	NA				



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
3/8"	9.5	100.0	0.0351	91
#4	4.75	99.8	0.0251	89
#10	2	99.3	0.0161	87
#20	0.85	98.8	0.0116	84
#40	0.425	98.5	0.0096	81
#60	0.25	98.1	0.0069	78
#100	0.15	97.7	0.0050	74
#140	0.105	97.4	0.0036	68
#200	0.075	96.9	0.0026	62
			0.0022	58
			D60	
			D30	
			D10	
			CU	
			CC	

Notes:

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Tested by: ACianci **Date:** 4/23/2020 **Checked by:** BRush **Date:** 4/28/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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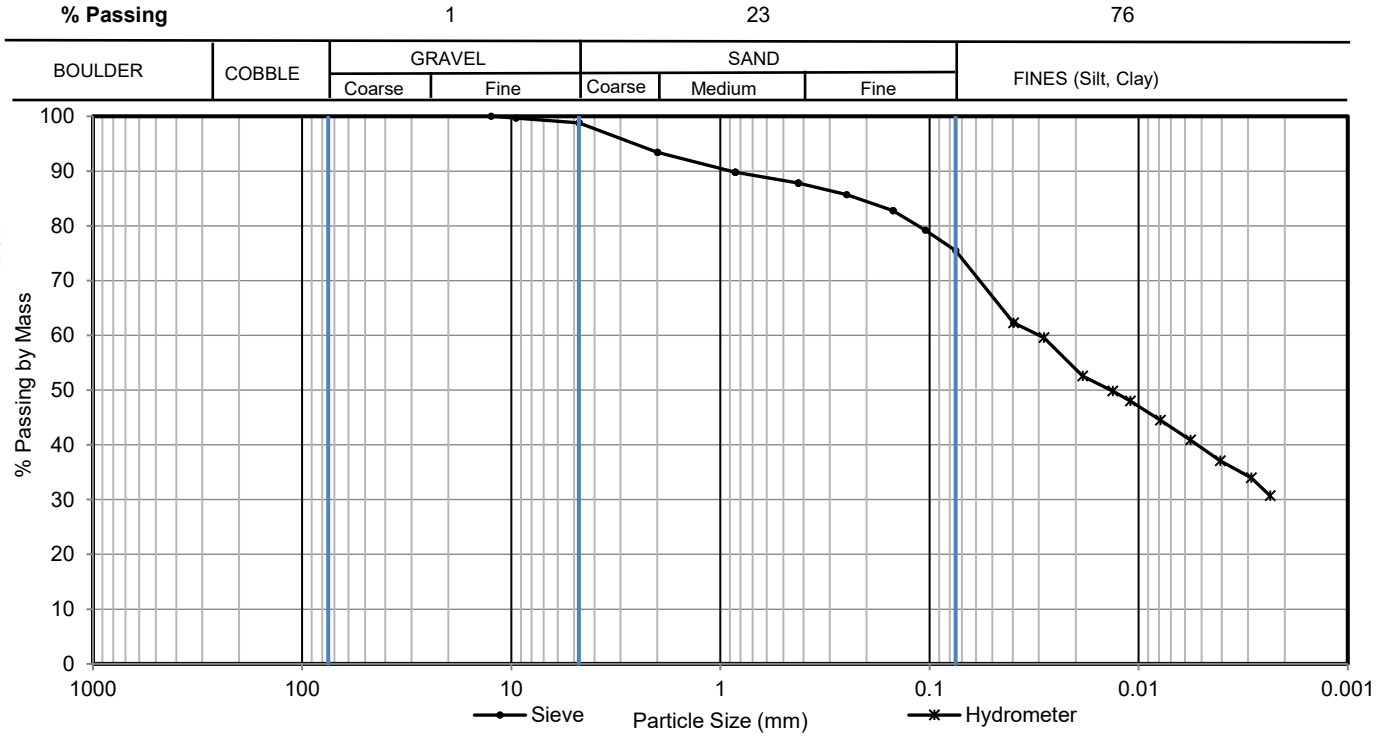
PARTICLE SIZE DISTRIBUTION
ASTM D6913 and ASTM D422
Method B

Test Request #	K20-028	Lab Sample ID:	KELO2020041551	Project Number:	19129643 (6000)
Client:	Public Services and Procurement Canada			Location:	Fort St. John, BC
Project Name:	Alaska Hwy Slide Mitigation 155.5km			Borehole/Pit No.	AH20-06
Source:				Sample No.	17
Soil Description:				Type:	AS
				Depth (m):	13.11 - 13.41
Specimen Reference	NA	Specimen Depth	NA	Date of Test	4/21/2020
Specimen Description	NA				



Sieve			Hydrometer Sedimentation	
Sieve No.	Particle Size mm	% Passing	Particle Size mm	% Passing
1/2"	12.5	100.0	0.0397	62
3/8"	9.5	99.7	0.0284	60
#4	4.75	98.8	0.0186	53
#10	2	93.4	0.0133	50
#20	0.85	89.8	0.0110	48
#40	0.425	87.8	0.0079	45
#60	0.25	85.7	0.0057	41
#100	0.15	82.8	0.0041	37
#140	0.105	79.2	0.0029	34
#200	0.075	75.5	0.0024	31
			D60	0.03
			D30	
			D10	
			CU	
			CC	

Notes:

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Tested by: ACianci **Date:** 4/21/2020 **Checked by:** BRush **Date:** 4/28/2020 **Reviewed by:** JStotz **Date:** 4/30/2020

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APPENDIX D

Hydrotechnical

TECHNICAL MEMORANDUM

DATE 18 September 2020 **Reference No.** 19129643-013-TM-Rev0

TO Reza Haghighi
Public Services and Procurement Canada

CC

FROM Jocelyn Ramsey, Chris Coles **EMAIL jramsey@golder.com, ccoles@golder.com**

HYDROTECHNICAL ASSESSMENT

ENGINEERING SERVICES FOR SLOPE STABILIZATION KM 155.5 OF THE ALASKA HIGHWAY

NEAR WONOWON, BC

Golder Associates Ltd. (Golder) has been retained by Public Services and Procurement Canada (PSPC) to provide consulting services as part of PSPC's Project No R.109901.002 Engineering Services for a Slide Area Mitigation km 155.5 of the Alaska Highway. The Project Area extends along the Highway approximately from approximately Km 155+120 to 155+600 (see Figure D-1).

1.0 SITE RECONNAISSANCE

Golder hydrotechnical and geotechnical engineers and fisheries biologist undertook a visual inspection of the Alaska Highway Project Area on May 27, 2020.

Several corrugated steel pipe (CSP) culverts were observed protruding from the highway fill along the Project Area on both sides of the highway. Exposed portions of these culverts are shown on the topographical survey undertaken by Vector Geomatics (Vector 2020). The following culverts were observed during the site reconnaissance:

- A 600 mm (approximately) dimeter CSP outlet at approximately Km 155+410 on the northeast side of the highway fill (see Photograph D-1), discharging into a shallow swale (approximately 1.5 m to 2.0 m wide and up to 0.5 m deep) that runs down the fill and then into a small ditch (approximately 0.3 wide and 0.3 m to 0.5 m deep) running in southeasterly direction. Although signs of recent water flows were observed, the culvert was not flowing at the time of the Golder reconnaissance. Damage at the culvert outlet was observed, and the inlet was not identified in the field.
- Several 300 mm (approximately) diameter CSP outlets protruding from the southwest highway fill (see Photograph D-2). Based on the exposed portions of the pipes, these appear to have been perforated along the lower half of the pipe. No flows were observed on any of these pipes during Golder reconnaissance. No evidence of past flows was observed.

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- A 1.2 m (approximately) diameter culvert protruding from the highway fill on both the northeast and southwest sides at approximately km 155+120. The culvert appears unobstructed and in relatively good condition. The inlet (Photograph D-3) and outlet (Photograph D-4) are armoured with round boulders with some voids observed between the culvert and the highway fill. The culvert was flowing during Golder reconnaissance at a depth of about 10 to 15 cm. This culvert conveys a mapped (TRIM mapping) watercourse across the highway, which is a tributary to Blueberry River.
- Two 600 mm (approximately) culvert crossings, which are understood to be outside the current scope of work, were identified approximately 1.15 Km to the southeast and 1.45 Km to the northwest of the 1.2 m culvert crossing.

Several discontinuous ditches were observed on the southwest side of the highway, adjacent to but on the opposite side of the highway from the slide section, and generally flowing towards the 1.2 m diameter culvert crossing at km 155+120. Ditches varied in geometry and setback distance from the highway, as described below.

- Segments of the discontinued ditch to the north of the Project Area (approximately km 156+350) were approximately 1.0 m wide and 0.6 to 0.8 m deep and were ponding water during Golder renaissance (see Photograph D-5).
- At approximately km 156+010, the ditch becomes ill defined (appears to have been created by spring melt water) and runs closer to the highway (see Photograph D-6).
- The segment of ditch at approximately km 155+580 to 155+410 is further setback from the Highway and is approximately 1.2 m wide and 1.2 m deep. This segment of the ditch appears to have been excavated, but is ill defined and actively eroding (see Photograph D-7).
- Further towards the south (starting at approximately 155+340) the ditch runs closer to the highway. Portions of the ditch where heavy erosion and downcutting appear to have been occurring, have been temporarily stabilized with a geotextile weighted down with a few boulders (refer to Photograph D-8 and D-9).
- Approximately 50 to 70 m upgradient (north) from the 1.2 m culvert crossing at km 155+120, flows from the ditch loose confinement and flow overland towards the watercourse to the south (see Photograph D-10 and Photograph D-11).
- The roadside ditch south of km 155+120 is grassed, has a variable geometry, is approximately 0.83 km long and has an approximate longitudinal slope of 7.0%.
- The roadside ditch to the north km 155+120 on the southbound side of the highway (currently discontinuous) is partially grassed, has a variable geometry, is approximately 2.37 km long and has an approximate overall average longitudinal slope of 3%.

2.0 HYDROLOGY

The Project Area is located within the Southern Interior Plains hydrologic zone and receives approximately 444 mm of annual precipitation, with approximately 136 mm (UBC 2020) falling as snow, and an average annual runoff between 100 mm and 200 mm (Province of BC 2020).

The Project Area ranges in elevation from approximately 830 masl to 860 masl, and the areas draining towards the Project Area extend up to an elevation of approximately 900 masl.

2.1 Historical Climate Data

The Environment and Climate Change Canada (ECCC) meteorological station located closest to the Project Area is located at Wonowon, BC, approximately 8 km north of the Project Area. This station has approximately 19 years of daily precipitation records (1973 to 1991) and about 11 years (1980 to 1991) of snow on the ground records. The closest ECCC stations with Intensity-Duration-Frequency (IDF) data are at Fort St. John Airport, located approximately 100 km south of the Project Area and Sikanni Chief Station located approximately 111 km to the North of the Project Area. Table D-1 summarizes the location and data available for these 3 stations.

Table D-1: Climate Data Summary

Station No.	Station Name	Distance (km)	Elevation (masl)	Available Data
1188973	Wonowon	8 North	914	Daily temperature and precipitation (1973 to 1991), snow on ground (1980 to 1991).
1183000	Fort St John Airport	100 South	694	IDF data (26 yrs), hourly temperature and precipitation (1953 to present), snow on ground (1954 to present).
1187335	Sikanni Chief	111 North	937	IDF data (16 yrs), hourly temperature and precipitation (1994 to 2018), snow on ground (1994 to 2018)

2.1.1 Climate Normal

Climate Normals are available for the Fort St. John Airport through the ECCC (2020) website. Table D-2 summarizes data relevant for this analysis.

Table D-2: Fort St John A Climate Normals (1981 to 2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily Avg Temperature (ºC)	-12.8	-9.6	-4.6	3.9	9.8	14.1	16.2	14.9	10.1	3.6	-6.6	-11.4
Rainfall (mm)	0.4	0.4	0.7	9.7	31.9	65.6	75.2	51.1	40.0	13.3	3.4	0.7
Precipitation (mm)	25.4	19.0	23.7	20.0	37.9	65.6	75.2	51.2	44.7	30.8	29.2	22.0
Average Snow Depth (cm)	28	30	25	6	0	0	0	0	0	1	11	20
Snow Depth at Month-end (cm)	30	25	14	0	0	0	0	0	0	4	15	22
Extreme Daily Rainfall (mm)	8.1	4.0	6.6	28.9	49.8	**80.3**	60.2	58.4	37.3	15.2	12.7	5.8
Extreme Snow Depth (cm)	99	107	**112**	99	23	0	0	5	25	61	67	90

Based on historical hydrometric data recorded at the Blueberry River below Aitken Creek (approximately 30 Km east of the Project Area), historical regional peak annual flows generally occur between April and September, but most frequently within the months of May and June. As shown on Table D-2, extreme daily rainfall at Fort St John has been highest between May and August, with the highest peak in the month of June. Usually, snow on the ground melts entirely by the end of April, but extreme years have been recorded when snow on the ground remained until the month of May. Comparison of snow-on-the-ground records at Fort St John and Wonowon suggest Wonowon would tend to have higher snow depths, and snow cover could potentially last longer into the spring.

2.1.2 Short Duration Rainfall Data

IDF Data for two nearby ECCC stations, Fort St. John Airport and Sikanni Chief were compared. It was found that both stations had data available for short-term durations (less than 1 hour) and that rainfall estimates were comparable even though Sikanni Chief Station is located at an elevation 243 m higher. Fort St John Airport Station IDF Data (**Table D-3**) was selected for this analysis because it had a longer period of records, and was statistically extended to a 200-year return period for the purposes of this analysis.

Table D-3: Return Period Rainfall Amounts (mm) for Fort St John Station

Duration (hrs)	Return Period (years)					
	2	5	10	25	50	100
0.083	52.8	77.2	93.3	113.7	128.8	143.8
0.167	37.5	53	63.3	76.2	85.8	95.4
0.25	30.5	42.9	51.2	61.6	69.4	77.1
0.50	20.2	29.0	34.8	42.2	47.6	53.0
1	11.9	16.9	20.2	24.5	27.6	30.7
2	6.9	9.7	11.6	13.9	15.7	17.4
6	3.4	4.5	5.2	6.1	6.7	7.4
12	2.3	3.0	3.4	3.9	4.3	4.7
24	1.5	1.9	2.1	2.4	2.6	2.9

Source – EC IDF Data (EC 2020)

Daily and seasonal comparison of historical rainfall data at Wonowon and Fort St John Airport suggest Wonowon, on average, receives higher precipitation. Data from ClimateBC (UBC 2020) suggests Wonowon receives about 5% and 15% more precipitation annually and in the summer months, respectively. Since no data was available to compare short-duration events at these two locations, potential differences between Fort St John and Wonowon short duration events could not be evaluated. For the purposes of this assessment, it has been assumed that IDF data at Fort St John is representative of the Project Area.

2.2 Climate Change Considerations

Consideration was given to potential increases in rainfall as a result of climate change. Potential changes to total seasonal rainfall (PCIC 2020) and short duration rainfall intensity (University of Western Ontario 2020) were considered. For all sources, changes were estimated for a moderate-change scenario (RCP 4.5) for the 2080s period 2070 to 2099.

In the Peace Region, annual precipitation is expected to increase by 14% with a 26% decrease in annual snowfall (PCIC 2020). Short duration rainfall intensity is projected to increase by an average of 7% estimated for Fort St John Station (University of Western Ontario, 2020).

2.3 Watershed Characteristics

Readily available TRIM mapping shows a single watercourse crossing along within the Project Area, with two branches joining together just upstream of the crossing under the highway. One of the mapped branches appears to correspond to the original natural channel and flows northeast towards the Highway. The second branch runs approximately in southeasterly direction parallel to the Highway, similar to the path of the existing discontinuous roadside ditch. Data provided in iMapBC (Province of BC 2020) was used to estimate the characteristics of the catchment area reporting to the Highway crossing.

Table D-4: Highway Crossing Catchment Area Characteristics

Component	Estimated Catchment Area (Km^2)
Tributary to Blueberry River	0.55
South Roadside Ditch (not mapped)	0.36
North Roadside Ditch	0.87
Total	**1.78**

2.4 Estimation of Peak Flows

The Rational Method was used to estimate peak flows for the Tributary to Blueberry River and the roadside ditches flowing into this watercourse just upstream of the highway culvert crossing at km 155+120. Rainfall intensity data was obtained from the Fort St John Airport IDF and adjusted for climate change (7% increase). Similar to theoretical values suggested in literature for pasture/range and forest/woodland for return periods of 100 years and higher (Chow et al.1988), a runoff coefficient of 0.5 was used for all catchments, and increased by 0.1 to account for potential snowmelt during extreme events.

As suggested by MOTI (2019) the following return periods were considered to estimate the design period for drainage infrastructure:

- 100-year to 200-year return period for culverts of less than 3 m diameter at a natural watercourse crossing;
- 100-year for culverts of less than 3 m diameter for ditch drainage network; and,
- 25-year return period for roadside ditches.

Results are summarised in Table D-5.

Table D-5: Estimated Peak Flows

Peak flow Estimate Point	Design Flow Return Period (yrs)	Estimated Design Flow (m^3/s)[1]
Tributary to Blueberry River at Culvert Crossing (km 155+120)	200	6.6
North Roadside ditch at km 155+410	100	2.4
North Roadside ditch at Culvert Crossing (km 155+120)	25	2.5
South Roadside ditch at Culvert Crossing (km 155+120)	25	1.9

[1] Including climate change considerations

2.5 Discussion

The hydraulic capacity of the existing culvert at km 155+120 was analyzed using HY-8 culvert analysis software (FHWA 2016) and sized such that the ratio of headwater (HW) to the culvert diameter (D) does not exceed 1.0 at the design flow (MOTI 2019). The results of our analysis suggest that the existing 1.2 m culvert crossing does not have adequate capacity to convey flows which would be currently reporting to it during the 1:200-year design event. It is estimated that the current crossing has capacity to pass approximately 1.5 m^3/s, which is approximately the estimated 25-year historical peak flow at the watercourse (without the added flows from the roadside ditches). This is the only functional culvert crossing within an approximately 2.6 km segment of Highway.

The existing southbound lane roadside ditch channel is ill-defined, discontinuous and is currently eroding and downcutting at sections. It is recommended that a new riprap armoured ditch be constructed/refined along an approximately 870 m length along the southwest side of the highway.

In addition, consideration should be given to the following preliminary options to improve conveyance across the road fill within the Project Area:

- Replace or supplement the existing 1.2 m diameter single culvert such that adequate capacity to convey the 200-year peak flow including provision for climate change is provided. Preliminary analysis indicated that either a single 2.2 m diameter culvert or supplementing the existing 1.2 m diameter culvert with a new 2.0 m

diameter culvert, would provide the capacity to pass the estimated 1:200-year peak flow with provision for climate change.

- Add a cross drain culvert flowing from the roadside ditch on the southbound side of the highway to the east side at approximately Km 155+410 (near the existing damaged 600 mm culvert) and replace the existing 1.2 m diameter culvert with a 1.8 m diameter culvert. In addition to reducing the conveyance capacity required at the Tributary to Blueberry Creek, this option would also reduce the ditching requirements for the section of roadside ditch on the southbound side of the highway between the existing 600 mm culvert (approximately Km 155+410) and the existing 1.2 m culvert (Km 155+120).

Note that the culvert dimensions provided here have been evaluated at a preliminary conceptual level and will need to be refined during later stages of design.

3.0 FINAL REMARKS

Golder understand that after consideration of the preliminary conceptual options provided in this Technical Memorandum, PSPC has decided to construct a single drainage ditch running from the northwest boundary of the Project Area to the existing culvert at 155+120 and twin the existing culvert at 155+120 with a 2.0 m diameter culvert. Golder further understands that due to budgetary constraints, PSPC has decided to construct the proposed drainage works in two phases beginning with the roadside ditch construction in late 2020 and twinning the existing culvert in early 2021.

It is noted that constructing a roadside ditch without means to convey these flows to the other (east) side of the highway will result in concentration of flows and increase of peak flows at the existing culvert at 155+120 and may aggravate water ponding and erosion issues at this location until the second culvert has been installed at 155+120. It is understood PSPC will manage this risk by regularly monitoring water levels in the ditch and existing culvert inlet/outlet until the culvert twinning is completed.

4.0 CLOSURE

We trust that this report addresses your current requirements for the project. Should you have any questions, or require additional information, please do not hesitate to contact us.

Golder Associates Ltd.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
J. E. RAMSEY ALVAREZ-CALDERON
35360

18 Sep '20

Jocelyn Ramsey, PEng, PAg
Senior Water Resources Engineer

Chris Coles, PEng
Associate, Senior Water Resources Engineer

JR/CC/asd

Attachment: Figure 1

https://golderassociates.sharepoint.com/sites/114909/project files/6 deliverables/issued to client_for wp/19129643-013-tm-rev0/19129643-013-tm-rev0-hydrotechnical assessment 18sep_20.docx

5.0 REFERENCES

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University of Western Ontario IDF, 2020. Computerized Tool for the Development of Intensity-Duration-Frequency Curves Under a Changing Climate (IDC_CC Tool V4.0.) Released August 2019. Department of Civil and Environmental Engineering.

Vector Geomatics Land Surveying (Vector), 2020. As Built of Km 155 of Alaska Highway. Surveyed on May 27, 2020.

Description	Symbol
Photograph Location	3
Drainage Infrastructure	
Natural Watercourse	
Contour Lines (every 20 m)	

CLIENT
PSPC

CONSULTANT
GOLDER

YYYY-MM-DD	2020-02-12
PREPARED	CR
DESIGN	CR
REVIEW	VF
APPROVED	VF

PROJECT
Slide Mitigation KM 155.5 of the Alaska Highway

TITLE
HYDROTECHNICAL ASSESSMENT

PROJECT No. 19129643 | Rev **B** | FIGURE **D-1**

APPENDIX A

Photographs

Photograph D-1: Damaged culvert outlet and swale running East on Highway fill

Photograph D-2: CSP culvert on West Highway fill

Photograph D-3: Culvert crossing Inlet looking Northeast (approximately Km 155+120)

Photograph D-4: Culvert outlet looking southwest (Km 155+120)

Photograph D-5: Ditch on the southwestern side of Alaska Highway (looking southeast)

Photograph D-6: Ditch on the southwestern side of Alaska Highway (looking East)

Photograph D-7: Ditch on the southwestern side of Alaska Highway (looking west)

Photograph D-8: Ditch on the southwestern side of Alaska Highway (looking south)

Photograph D-9: Ditch on the southwestern side of Alaska Highway (looking south)

Photograph D-10: Southwestern side of Alaska Highway (looking south towards 1.2 m culvert)

Photograph D-11: Southwestern side of Alaska Highway (looking north towards 1.2 m culvert)

APPENDIX B

Report Limitations

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder

interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

APPENDIX E

Culvert Condition Assessment

Eco-Web Ecological Consulting Ltd.
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www.eco-web.ca

8211 93rd Street,
Fort St. John. BC
V1J6X1

May 26, 2020

ECO-WEB PROJECT #: H1-2183

ATTENTION: RAVI JASSAL
GOLDER ASSOCIATES LTD.
10803 91 Avenue,
Fort St. John, BC

KM 155.5 Alaska Highway Culvert Inspections

At the request of Golder Associates (Golder) on behalf of their client Public Services and Procurement Canada (PSPC), Eco-Web Ecological Consulting Ltd. (Eco-Web) completed an overview assessment of the culverts at km 155.5 on the Alaska highway, on May 20, 2020. Eco-Web's technical staff, Steve Holtmann and Valerie Schmidt completed the culvert inspections to document existing conditions, culvert conditions and functionality, GPS the culvert locations and obtain video footage of the culvert status for use by Golder in preparing mitigation of potential slide repair work.

The crew utilized the survey plans provided by Golder to determine culvert locations and a pin finder to locate the culvert structures. An endoscope was utilized along with a telescopic pole to obtain the video footage once the culverts were located. Some culverts had crushed ends and entry was gained with a cat bar where necessary to open it enough to get the equipment through. Table 1 documents the culvert locations, status and observations and figure 1 provides a site plan of the relative locations of the culvert observations. Photoplates of the culverts and video footage (attached USB drive) have also been provided as requested.

As per Table 1, most of the culverts are functional, with the culvert at waypoint 9 being crushed and several that could not be located.

If there are any questions or comments with regards to the contents of this letter, please do not hesitate to contact the undersigned at your earliest convenience (250-787-1110). Thank you for your time and consideration in this matter.

Sincerely,

Prepared by:

Steve Holtmann, EP
Senior Technologist III
Eco-Web Ecological Consulting

Reviewed by:

Dan Webster, B.Sc., P.Ag., R.P.Bio., P.Biol.
Professional Biologist

Table 1 – Culvert Locations, status and observations

WPT		Easting	Northing	Description	Diameter (mm)	Length (m)	Status	Observations
1	10V	578682	6285291	Corrugated Steel	370	45	Functional	Crushed outlet. Lower outlet 9.6 m clear, no obstructions
2A	10V	578635	6285257	Corrugated Steel	300	12	Functional	9.6 m clear from west side of the Highway, no obstructions
2	10V	578660	6285246	Corrugated Steel	300	12		9.6 m clear from west side of the Highway, no obstructions, water at 4m, slope failure on east side of highway
3	10V	578692	6285232	Corrugated Steel	400	12		Water and sediment present at 0.5 m, no obstructions to 9.6 m, although possible kink at 5.8m ?
4	10V	578720	6285224	Corrugated Steel	170	6	?	Connects under road fill could not locate
5	10V	578717	6285223	Corrugated Steel	400	12	Functional	No water or obstructions noted to 9.6 m
6	10V	578739	6285214	Corrugated Steel	400	12	Functional	No water or obstructions noted to 9.6 m
7	10V	578767	6285203	Corrugated Steel	170	6	?	Connects under road fill could not locate
8	10V	578751	6285199	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
8A	10V	578756	6285196	Corrugated Steel	400	12	Functional	8m south of 8 crushed end but functioning, no obstructions noted to 9.6m
9	10V	578793	6285187	Corrugated Steel	170	6?	Crushed	Crushed and twisted at outlet, only fished in camera to 3.0 m
10	10V	578778	6285186	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
13	10V	578823	6285209	Corrugated Steel	600			Crushed on east side of highway but somewhat functional, stagnent water, sludge high in iron some resistence at 9.0 m, twisted? Could not find the west side, buried in road fill?
14	10V	578804	6285153	Corrugated Steel	400	165		Buried and not located
15	10V	578812	6285152	Corrugated Steel	600	?		Buried and not located
16	10V	578947	6284965	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
17	10V	578958	6285005	Corrugated Steel	170	6	?	Could not locate
18	10V	578967	6284965	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
19	10V	578951	6284940	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
20 Inlet	10V	578955	6284937	Corrugated Steel	1.25		Functional	Clear no obstructions, minor scour below inlet see pic. Sediment, cobbles and boulders with culvert up to 40 cm diameter. All joints in good condition
20 Outlet	10V	579035	6285003	Corrugated Steel	1.25		Functional	Armour in good condition
21	10V	578977	6284957	Corrugated Steel	170	6	?	Connects under road fill could not locate
22	10V	578972	6284951	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
23	10V	578977	6284937	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions

Photoplates

May 20, 2020

Photo 1:	**1.25 m Culvert Inlet.**	**Photo 2:**	**Small amount of scour below inlet 1.25m culvert.**

Photo 3:	**1.25 m culvert outlet.**	**Photo 4:**	**Crushed 370mm Culvert WPT 1 outlet, but not blocked.**

Photo 5:	**West side of highway culvert 13 600mm buried and not located.**	**Photo 6:**	**Drainage ditch culvert not located.**

Culvert Inspection Overview Map

GOLDER

Date:	May 26, 2020
Datum:	NAD 83 UTM ZONE 10
Client:	Golder Associates
Location:	km 155 Alaska Highway
Assessment Date:	May 20, 2020
Technician:	Steve Holtmann
Assistant:	Valerie Schmidt
Eco-Web File #:	H1-2183
Drawn by:	Lee Waddell

Eco-Web Ecological Consulting Ltd.
8711 99th Street
Fort St John, B.C. V1J 6X1
Phone: (250) 787-1130
Fax: (250) 787-1175

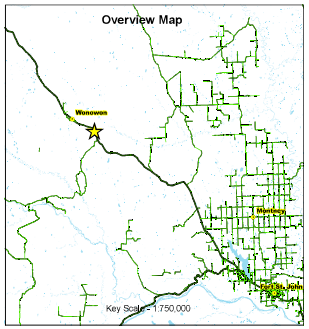
Map Scale: 1:750

0 0,0125 0,025 0,05 0,075
Kilometers

Legend

- Culvert Locations
- Culvert
- Streams
- Contours (Ft)

Overview Map



WPT		Easting	Northing	Description	Diameter (mm)	Length (m)	Status	Observations by SHVS
1	10V	518682	6285291	Corrugated Steel	370	45	Functional	Crushed outlet. Lower outlet 9.6 m dear, no obstructions
2A	10V	518635	6285257	Corrugated Steel	300	12	Functional	9.6 m clear from west side of the Highway, no obstructions
2	10V	518660	6285246	Corrugated Steel	300	12		9.6 m clear from west side of the Highway, no obstructions, water at 4m, slope failure on east side of highway
3	10V	518692	6285232	Corrugated Steel	400	12		Water and sediment present at 0.5 rn, no obstructions to 9.6 m, although possible kink at 5.8m ?
4	10V	518720	6285224	Corrugated Steel	170	6	?	Conrects under road fill could not lccate
5	10V	518717	6285223	Corrugated Steel	400	12	Functional	No water or obstructions noted to 9.6 m
6	10V	518739	6285214	Corrugated Steel	400	12	Functional	No water or obstructions noted to 9.6 m
7	10V	518767	6285203	Corrugated Steel	170	6	?	Conrects under road fill could not lccate
8	10V	518751	6285199	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
8A	10V	518756	6285196	Corrugated Steel	400	12	Functional	8m south of 8 crushed end but functioning, no obstuctions noted to 9.6m
9	10V	518793	6285187	Corrugated Steel	170	6?	Crushed	Crushed and twisted at outlet, only 'ished in camera to 3.0 m
10	10V	518778	6285186	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
13	10V	518823	6285209	Corrugated Steel	600			Crushed on east side of highway but somewhat functional, stagnent water, sludge high in iron some resistence at 9.0 m, twisted? Could not find the west sice, buried in road fill?
14	10V	518804	6285153	Corrugated Steel	400	165		Buried and not located
15	10V	518812	6285152	Corrugated Steel	600	?		Buried and not located
16	10V	518947	6284965	Corrugated Steel	400	12		9.6 m clear from west side of the Highway, no obstructions
17	10V	518958	6285005	Corrugated Steel	170	6	?	Could not locate
18	10V	518967	6284965	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
19	10V	518951	6284940	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
20 Inlet	10V	518955	6284937	Corrugated Steel	1.25		Functional	Clear no obstructions, minor scour below inlet see pic.
20 Outlet	10V	519035	6285003	Corrugated Steel	1.25		Functional	Armour in good condition
21	10V	518977	6284957	Corrugated Steel	170	6	?	Conrects under road fill could not lccate
22	10V	518972	6284951	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions
23	10V	518977	6284937	Corrugated Steel	400	12	Functional	9.6 m clear from west side of the Highway, no obstructions

APPENDIX F

Fish Habitat Assessment

MEMORANDUM

DATE 23 September 2020 **Reference No.** 19129642-008-M-Rev0

TO Ravi Jassal
Golder Associates Ltd.

FROM Demitria Burgoon, RPBio (Golder Associates Ltd.) **EMAIL demitria_burgoon@golder.com**

FISH HABITAT ASSESSMENT
R.109901.002 ALASKA HWY SLOPE STABILIZATION

Golder Associates Ltd. (Golder) has been retained by Public Services and Procurement Canada (PSPC) to provide consulting services as part of PSPC's Project No R.109901.002 Engineering Services for Slope Stabilization km 155.5 of the Alaska Highway, British Columbia. The following presents the results of the Fish Habitat Assessment conducted to support the project.

1.0 FISH HABITAT ASSESSMENT

Prior to conducting a fish habitat assessment, Golder reviewed the Fisheries Inventory Data Queries (FIDQ) for fish and fish habitat data in the vicinity of the site (BCGov 2020). The unnamed stream located at km 155.1 discharges into Blueberry River (Watershed Code 233-261300) approximately 3.9 km to the east. This unnamed stream is not considered a fish bearing stream and does not have reported observations of fish within the channel but there is seasonal connection to Blueberry River which is considered a fish bearing stream. The following fish species have been identified in Blueberry River: Flathead Chub (*Platygobio gracilis*), Lake Chub (*Couesius plumbeus*), Largescale Sucker (*Catostomus macrocheilus*), Longnose Dace (*Rhinichthys cataractae*), Longnose Sucker (*Catostomus catostomus*), Northern Pearl Dace (*Margariscus margarita*), Northern Pike (*Esox lucius*), Redside Shiner (*Richardsonius balteatus*), Slimy Sculpin (*Cottus cognatus*), Spoonhead Sculpin (*Cottus ricei*), Trout-perch (*Percopsis omiscomaycus*), and White Sucker (*Catostomus commersonii*). Fish inventory data are included in Attachment 1.

On 27 May 2020, Golder conducted a fish habitat assessment of two stream reaches of the unnamed stream located at approximately km 155.1. Each stream reach was approximately 100 m in length (one reach was downstream of the culvert and one reach was upstream of the culvert) and was assessed to document existing conditions, the potential for fish use and to characterize fish habitat that may be affected by any upstream construction. Golder also assessed an ephemeral stream located at km 155.4 and a swamp wetland area located on the west side of the highway approximately 270 m north of the unnamed stream culvert at km 155.1.

Selected site photographs and fish inventory data query is presented in Attachment 1.

Golder Associates Ltd.
10803 91st Ave Unit A Fort St John, BC V1J 6L3 Canada T: +1 250 785 9281 F: +1 250 785 7287

1.1 Methods

Collected information was recorded on Resources Information Standards Committee (RISC) Site Cards following the Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Site Card Field Guide (DFO 2012). Standard measurement tools were used during the habitat assessments, which included a metre stick, tape measure, clinometer, and hand-held Garmin GPS Unit. Representative site photos of the stream were taken during the assessment and are included in Attachment 1. Fish sampling was not conducted. Site-specific information that was collected to assess the physical characteristics of fish habitat included the following:

- Stream channel morphology
- Channel features (e.g., bankfull depth, channel width, wetted width, gradient)
- Composition of channel substrate (i.e., percent of silt, sand, gravel, cobble, and boulder)
- Bank features (e.g., vegetative cover, stability, composition)
- Habitat features (e.g., pools, riffles, aquatic vegetation, instream cover)

2.0 ASSESSMENT RESULTS

2.1 Unnamed Stream at km 155.1

Reach 1 was located approximately 100 m downstream of the highway culvert. The channel substrate in the area was predominately gravel and cobbles throughout with a layer of organic fines present. The area directly downstream of the culvert consisted of cobbles that had been placed around and near the culvert outfall during the installation (Attachment 1; Photo 1). During the site visit stream flow was characterized as a medium flow level based on evidence of higher flows (i.e., sediment and debris on either bank higher than the wetted channel) and the time of year that the visit was conducted (low flows are typically later in the summer and early fall). Dominant riparian vegetation on both stream banks was vegetated (shrub and grass and early stage pole sapling) and well-established vegetation (i.e., mature mixed forest) landward of the bank (Attachment 1; Photo 2).

The stream reach was characterized as confined and exhibited an irregular meandering channel morphology. At approximately 110 m downstream of the culvert the channel was no longer confined to a stream bed and water flowed overland through the grasses and shrubs (Attachment 1; Photo 3). The gradient of the stream channel was 1.0%. At the time of the assessment, the average water temperature was 3.0° C and conductivity was 200 µS/cm. The water was tannin colored with very little suspended sedimentation. Depth measurements were taken at six locations throughout the reach with a metre stick. The average wetted depth was 18 cm.

The average channel width was 11.3 m, the average wetted width was 0.64 m. Moderate amounts of instream cover were observed and consisted of undercut banks, overhanging terrestrial vegetation and woody debris.

Reach 2 was located approximately 100 m upstream of the highway culvert. Surface runoff was observed entering the stream from the northeast along drainage ditches (Attachment 1; Photo 4). The channel substrate in the area was predominately gravel and organic fines. As with the downstream side of the culvert, cobbles that had been placed around and near the culvert intake during the installation. The water near the culvert was moderately turbid and algae growth was evident on the cobbles. Ice was present over approximately ¼ of the reach and stream flow was characterized as a medium flow level based on evidence of higher flows (i.e., sediment and debris on either

bank higher than the wetted channel) and the time of year that the visit was conducted (low flows are typically later in the summer and early fall). Dominant riparian vegetation on both stream banks was well-established vegetation (i.e., mature mixed forest) and mosses.

The stream reach was characterized as confined and exhibited an irregular meandering channel morphology. At approximately 110 m upstream of the culvert the channel was classified as an ephemeral stream as it disappeared underground (Attachment 1; Photo 5). There was evidence of scoured pools and sediment accumulation within an incised streambed at this location. The gradient of the stream channel was 2.0%. At the time of the assessment, the average water temperature was 1.2° C and conductivity was 170 µS/cm. The water was tannin colored with very little suspended sedimentation. Depth measurements were taken at six locations throughout the reach with a metre stick. The average wetted depth was 18 cm.

The average channel width was 2.1 m, the average wetted width was 0.12 m. High amounts of instream cover were observed and consisted of undercut banks, overhanging terrestrial vegetation and woody debris (Attachment 1; Photo 6).

2.2 Unnamed Stream at km 155.4

One 100 m reach was assessed downstream of the second cross-highway culvert at km 155.4. The water from the drainage ditches and an area of seepage on the east side of the highway (rust colored staining was observed in the grass/moss) appeared to be where the stream began (Attachment 1; Photo 7). There was no evidence of this stream on the west side of the highway and it appeared to flow intermittently depending on the season and assumed to be all drainage from the highway. There was no flowing water in the stream at the time of the assessment, but small stagnant pools were present throughout the reach (Attachment 1; Photo 8). The stream bed consisted of moss and leaves which would indicate that when flowing there was very little water present. No evidence of scouring or bare substrate. No measurements were collected in this stream.

3.0 RECOMMENDATIONS

None of the watercourses surveyed during the assessment were considered fish bearing and a fish salvage will not be required. There is the potential for these watercourses to connect to a fish bearing watercourse (Blueberry River) depending on the time of year and the conditions during construction. Therefore, the following recommendation should be considered.

Works should be conducted in a manner that prevents erosion and sedimentation of exposed soils from entering the watercourses, including ephemeral streams. Erosion and sediment controls may include, but are not limited to:

- perimeter silt fencing and erosion protection over stockpiled spoils or disturbed areas
- armouring at inlet and outlet of culverts
- check dams or gravel berms in drainage channels
- temporary sediment control ponds

If the culvert at km 155.1 is replaced, the conditions outlined in Part 3 of the Water Sustainability Regulations under the *Water Sustainability Act* Section 11 Notification of Instream Work will be observed, which include the application of a Notification of Instream Work to the habitat officer.

Golder Associates Ltd.

Demitria Burgoon, BSc, RPBio
Fisheries Biologist

Dustin Ford
Associate, Senior Fisheries Biologist

DB/DF/syd/lmk

Attachment 1: Site Photos

https://golderassociates.sharepoint.com/sites/114909/project files/6 deliverables/issued to client_for wp/19129643-008-m-rev0/19129643-008-m-rev0-fish habitat-23sep_20.docx

ATTACHMENT 1

Site Photos

Photo 1: Upstream end of Reach 1 at culvert outlet, viewed downstream on 27 May 2020. Large cobble substrate placed as armouring during culvert installation and not the natural streambed substrate.

Photo 2: In Reach 1 the stream bank vegetation consisted of mixed shrubs and mature conifers. The undercut banks were moss covered silt/clay.

Photo 3: In Reach 1, approximately 110 m downstream of the culvert outlet, the stream was no longer contained within stream banks but flowed overland through grasses and moss.

Photo 4: Surface runoff on the west side of the highway enters the unnamed stream at the culvert inlet in Reach 2.

Photo 5: Stream flow disappears underground at the upstream end of Reach 2 (approximately 110 m upstream of the culvert intake).

Photo 6: Instream cover was high within Reach 2 and consisted of large and small woody debris, undercut banks and overhanging terrestrial vegetation.

Photo 7: The most upstream end of the ephemeral stream on the east side of the highway at culvert.

Photo 8: One of the pools that formed when the ephemeral stream was flowing (no continuous flow was evident at this water level).

APPENDIX G

Archaeological Assessment

TECHNICAL MEMORANDUM

DATE 23 September 2020 **Reference No.** 19129643-010-TM-Rev0

TO Reza Haghighi
Public Services and Procurement Canada 219-800

FROM Golder Associates Ltd. **EMAIL adowding@golder.com**

ARCHAEOLOGY REVIEW OF KM 155 ALASKA HIGHWAY SLOPE STABILIZATION

At the request of Public Services and Procurement Canada (PSPC), Golder Associates Ltd. (Golder) has conducted an archaeological review of the Km 155 Alaska Highway Slope Stabilization (the Project). It is understood that PSPC is planning to repair areas of the existing Alaska Highway (the Highway) that are prone to bank stabilization issues, such as slumping and sliding. Construction activities may include grading, cutting, filling, drilling, and culvert installation. The entire project area has been subject to construction activities associated with the original construction of the Highway during World War 2, and various upgrades through the years to present.

This review provides a high-level evaluation of the risk of the proposed Project to adversely affect recorded or unrecorded heritage resources. As defined here, a heritage resource could include any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance.

For the review, the following resources were consulted:

- Remote Access to Archaeological Data (RAAD)
- Provincial Heritage Register
- iMap BC Important Fossil Area map

In addition, a site visit was undertaken at the request of PSPC on 15 June 2020. First Nations were not contacted to provide input to this initial site visit and Indigenous traditional land use is not considered herein.

1.0 RESULTS

For some regions of British Columbia (BC), the province has digital mapping that identifies areas of high archaeological potential, found in the RAAD database. Northeast BC is one such area. The landscape is divided between high archaeological potential and low archaeological potential, depending on factors such as elevation in relation to the surrounding landscape, proximity to water, and degrees of slope, among others. A review of RAAD indicates that areas of high archaeological potential are present within the Project area.

Golder Associates Ltd.
10628 Peck Lane Mail to: Site 18, Comp 26, SS 2 Stn.Main Fort St. John, British Columbia, V1J 4M7 Canada
T: +1 250 785 9281 +1 250 785 7287

RAAD also allows for a search of previous projects undertaken within, or in close proximity to, the Project area. A search of RAAD did not identify any previous archaeological impact assessments (AIA) within, or in close proximity to, the Project area.

The Provincial Heritage Register (PHR) lists all registered archaeological and historical sites in BC. A check of the PHR on 15 June 2020 indicated no registered archaeological or historical sites within 2 km of the Project area.

The Important Fossil Areas layer of iMapBC does not identify the Project area as having high fossil potential.

During the site visit, no archaeological or historical objects, structures, fossils or materials were observed in surface exposures. The terrain surrounding the project area is generally flat and sloping with no distinct features and thick disturbance vegetation is present in the cleared Project area. Features within the Project area that RAAD identified as having high archaeological potential were observed to be the result of previous construction activities associated with the Highway (Photo 1). These include graded and levelled gravel pads for parking of construction equipment, and features associated with earthworks, such as ditch excavation for water control (Photo 2). Figure G-1 shows the approximate Photo locations.

2.0 RISK ASSESSMENT AND RECOMMENDATIONS

The proposed construction area is expected to be impacted by ground disturbance activities including, but not limited to, grading, filling, cutting, and drilling. The Project area has been heavily disturbed by past construction activities which has created anthropogenic features that are mistakenly modeled as having archaeological potential. Based on observations of the surrounding area, it is unlikely that natural, distinct landscape features with archaeological potential existed within the Project area prior to development.

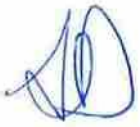
In Golder's opinion, the proposed Project is unlikely to disturb archaeological deposits. As a precautionary measure, we recommend the development and implementation of an Archaeological Chance Find Management Plan (CFMP) for the construction phase of the project. The CFMP would provide workers with basic information for the management of known or suspected archaeological or historical materials which may be unexpectedly encountered on a project site while an archaeologist is not present. These guidelines are designed to minimize disruption to project scheduling while promoting the preservation and proper management of archaeological materials.

In the unlikely event that archaeological deposits are encountered during ground disturbing activities, all work in the vicinity of the archaeological find may be required to cease while a HCA permit is obtained (~14 weeks).

3.0 CLOSURE

We trust the information contained in this letter report meets your requirements for an archaeological review of the Km 155 Alaska Highway Slide Remediation Project. Should you have any questions or wish to discuss this report, please contact Adam Dowding (250-785-9281) or Jeff Bailey (250-881-7372) at your earliest convenience.

Golder Associates Ltd.



Adam Dowding, BA
Archaeologist

Jeff Bailey, MA, RPCA
Senior Archaeologist, Principal

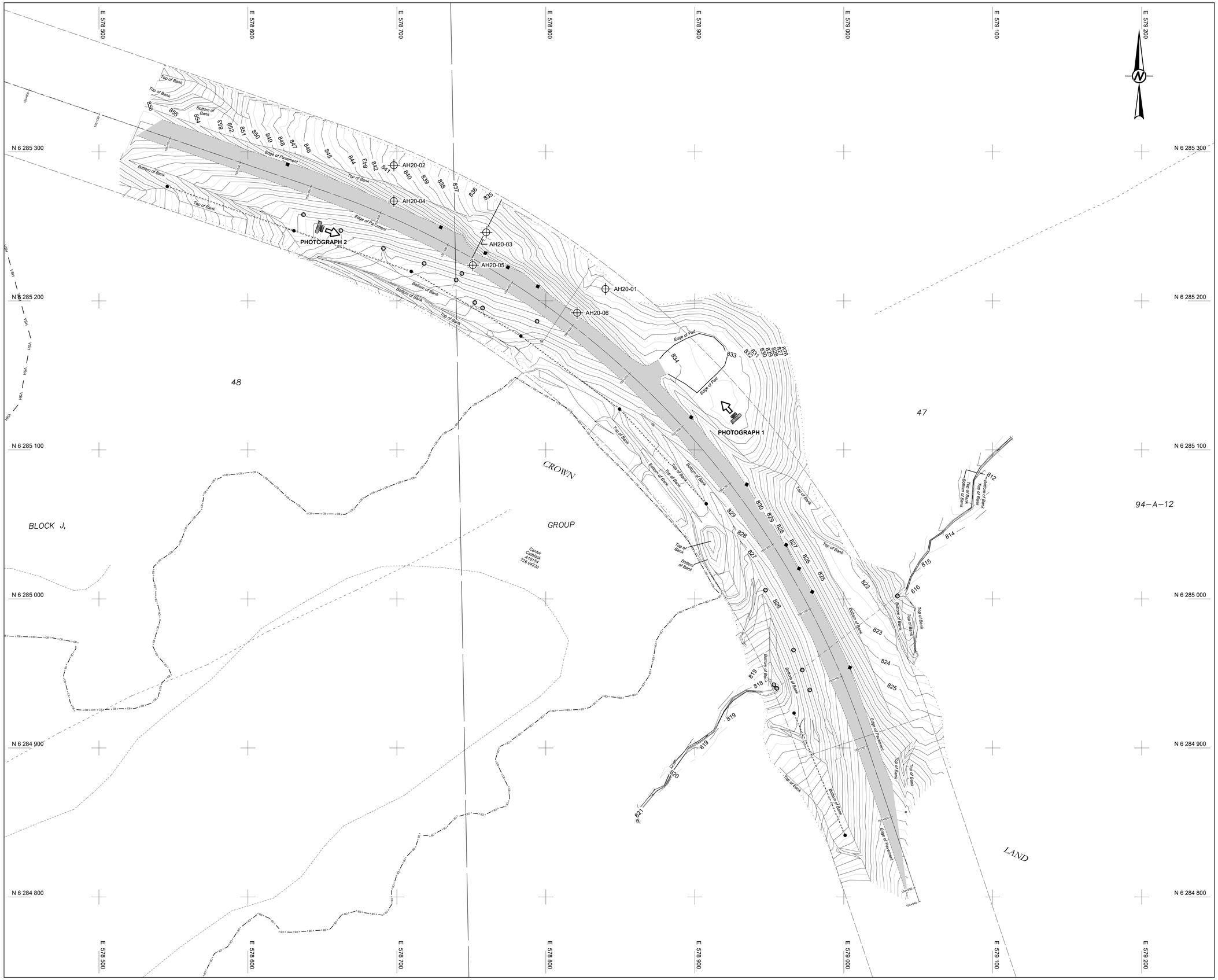
AD/JB/syd/lmk

Attachments: Photographs
Figure G-1

https://golderassociates.sharepoint.com/sites/114909/project files/6 deliverables/issued to client_for wp/19129643-010-tm-rev0/19129643-010-tm-rev0-archaeology review-23sep_20.docx

Photo 1: Looking northwest along north side of the Alaska Highway

Photo 2: Looking southeast along south side of the Alaska Highway



Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

PRELIMINARY
NOT FOR CONSTRUCTION

LEGEND

- SEISMIC LINES
- TOP BANK
- BOTTOM BANK
- ROADS
- TREELINES
- CUTBLOCKS
- NON-CLASSIFIED DRAINAGE / NO EVIDENCE OF STREAM FOUND
- POWER LINES
- CULVERT
- ROAD SIGN
- BOREHOLE LOCATION
- TOPOGRAPHIC CONTOUR (INTERVAL = 0.5 m)
- PHOTO LOCATION AND DIRECTION

DISCLAIMER

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0 20 40 60 80 100 METRES
1:1,000

NOTES

1. ALL UNITS DISPLAYED IN METRES UNLESS OTHERWISE NOTED.
2. GRID IS DISPLAYED IN NAD 83/UTM ZONE 11.
3. ELEVATIONS SHOWN IN METRES, DATUM:CGVD28.

REFERENCE

SURVEY PROVIDED BY VECTOR GEOMATICS LTD. TITLED: PROPOSED SKETCH OF PLAN SHOWING AS BUILT OF KM 155 OF ALASKA HIGHWAY B-47-J, 94-A-12 THROUGH UNSURVEYED CROWN LAND, PEACE RIVER DISTRICT BCGS: 94A.072. DATED 01JUN2020. FILENAME 2011966AB_R0.dwg. ORIGINAL SCALE 1:1,000.

DO NOT SCALE DRAWINGS

5		VALUE
4	VALUE	VALUE
3	VALUE	VALUE
2	VALUE	VALUE
1	VALUE	VALUE
0	INTERNAL REVIEW	VALUE
Revision/ Revision	Description/Description	Date/Date

Client/client

PUBLIC SERVICES AND PROCUREMENT CANADA

Project title/Titre du projet

ALASKA HIGHWAY
KM 155 SLIDE MITIGATION

Approved by/Approuve par
--

Designed by/Concept par
R. JASSAL

Drawn by/Dessine par
J. FARAH

PWGSC Project Manager/Administrateur de Projets TPSGC
--

PWGSC, Architectural and Engineering Resources Manager/ Ressources Architectural et de Directeur d'Ingénierie, TPSGC
--

Client/client
PSPC

Drawing title/Titre du dessin

SITE PLAN
PLAN VIEW

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
	G-1 OF 1	

PWGSC – B1 – 1000X707

0 10 20 30 40 50 60 70 80 90 100mm

19129643-7000-009-G1

APPENDIX H

Surveys and Slope Stability Results

TABLE OF REVISIONS							
No.	DESCRIPTION	SURV.	CALC.	DRAWN	CHK.	MM/DD/YY	OGC APPLICATION NO.
0	ORIGINAL PLAN PREPARED	TF	TJ	ROC	TJ	06/01/20	N/A

LEGEND:

- Seismic lines shown thus:
- Top Bank shown thus:
- Bottom Bank shown thus:
- Roads shown thus:
- Treelines shown thus:
- Cutblocks shown thus: v CB v — v CB v — v CB v
- Non-Classified Drainage / No Evidence Of Stream Found shown thus:
- Power lines shown thus: P – P – P – P – P – P – P – P
- Culvert shown thus: ©
- Road Sign shown thus: ■
- Contour interval = 0.5m

GOLDER ASSOCIATES LTD.

PROPOSED SKETCH PLAN SHOWING

AS BUILT OF KM 155 OF ALASKA HIGHWAY
b-47-J, 94-A-12

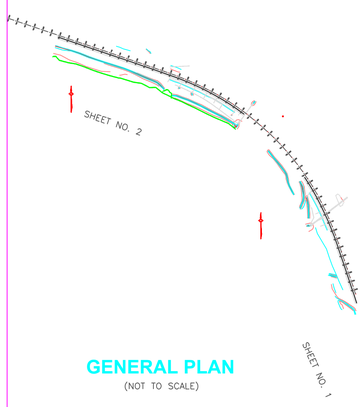
THROUGH UNSURVEYED CROWN LAND
PEACE RIVER DISTRICT
BCGS: 94A.072
SCALE 1:1000

0 10 20 40 60 80 100 Metres

SHEET NO.: 1 OF 1
C-FILE NO.:
JOB NO.: 20-11966
DWG. NO.: 2011966AB_R0

VECTOR
GEOMATICS LAND SURVEYING LTD.
6884 Airport Road, PO Box 6428
Fort St. John, B.C. V1J 4H8
Ph.: (250) 785-7474 Fax (250) 785-7454
www.vectorgeomatics.com

REV. No.
0



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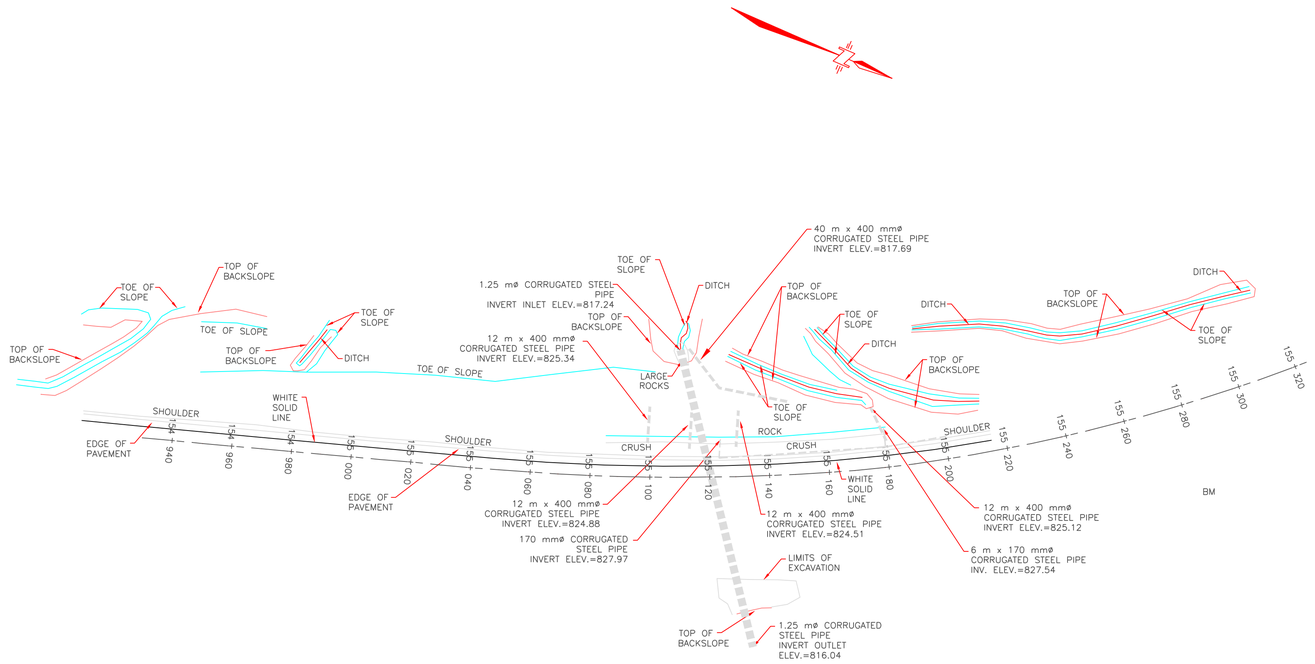
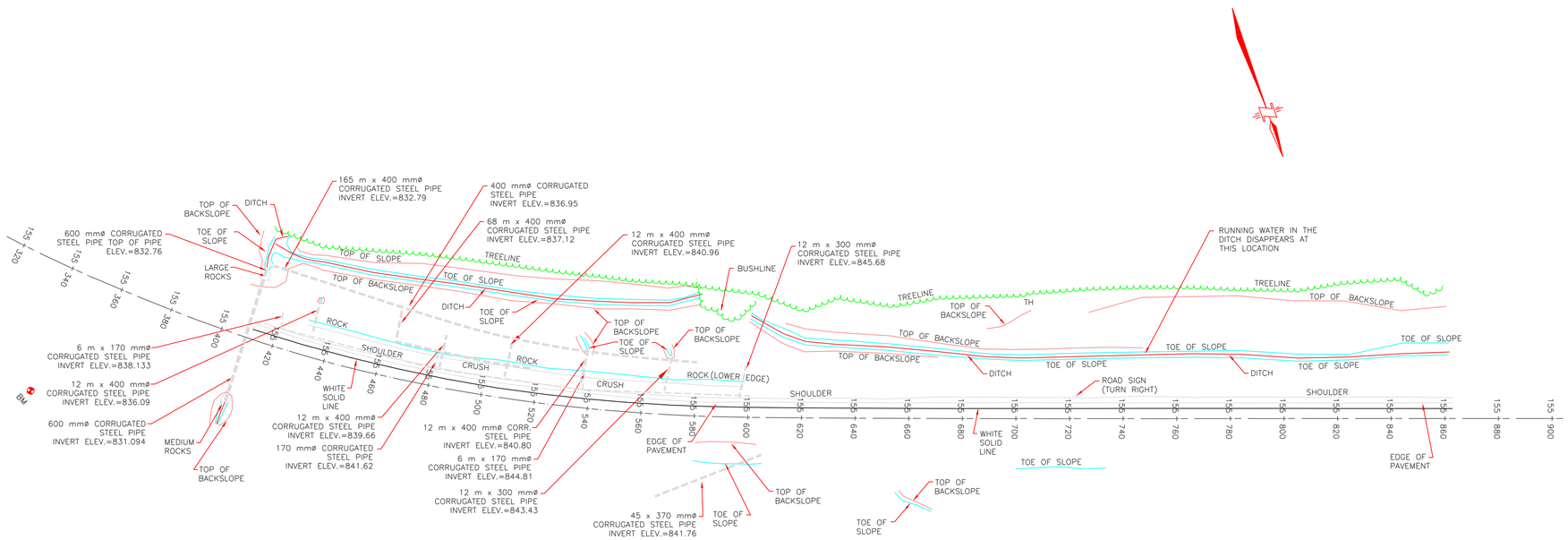


SHEET NO. 1



SHEET NO. 2

A1 841 x 594

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	REVISED TO AS BUILT	2007/06/26

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet

SLIDE REPAIR
ALASKA HIGHWAY
km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
PLAN
2004/10/28

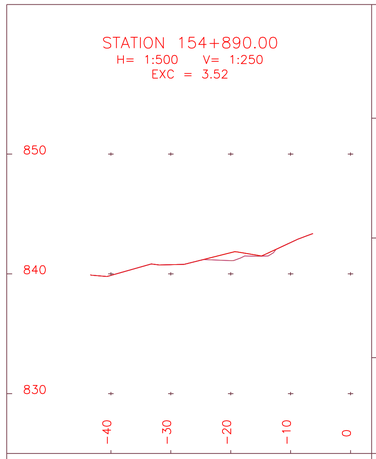
designed by / concu par

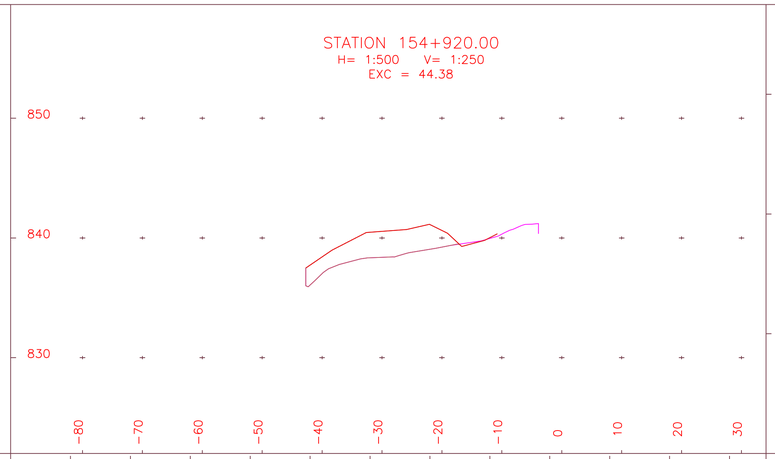
drawn by / dessine par
MCELHANNEY SURVEY / JG

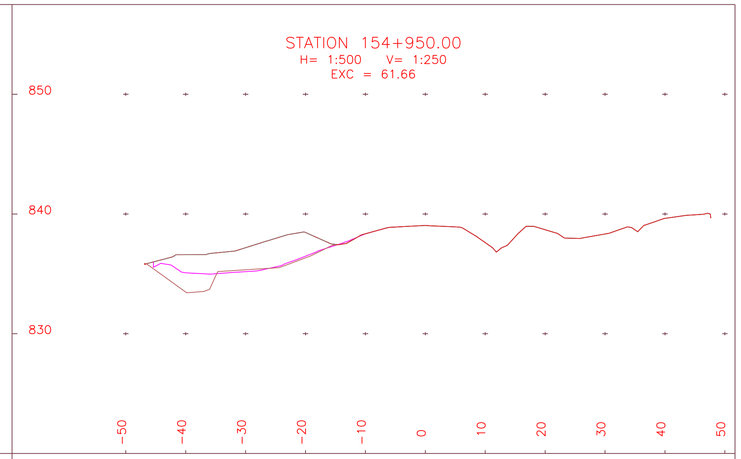
approved by / approuve par

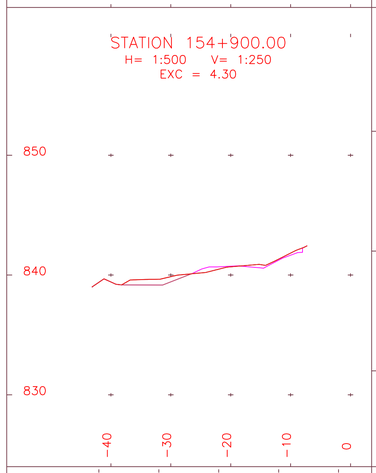
PWGSC Project Manager / Administrateur de Projets TPSGC

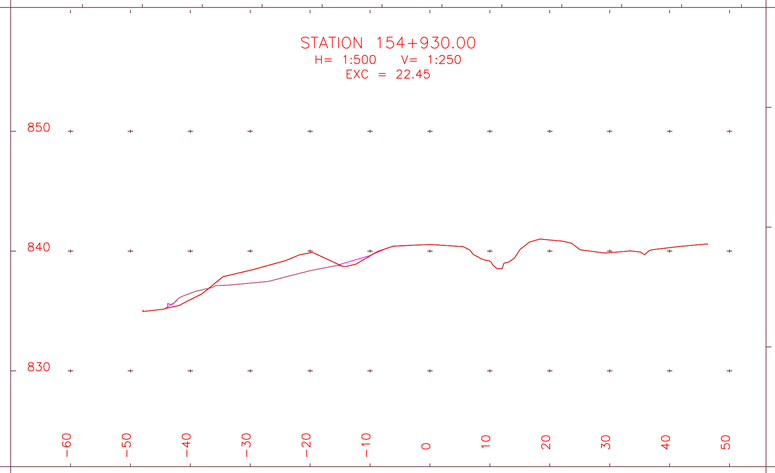
scale / echelle	sheet / feuille
1: 1000	C01
project no. / projet no.	OF 1
date / date	
26 JUNE 2007	

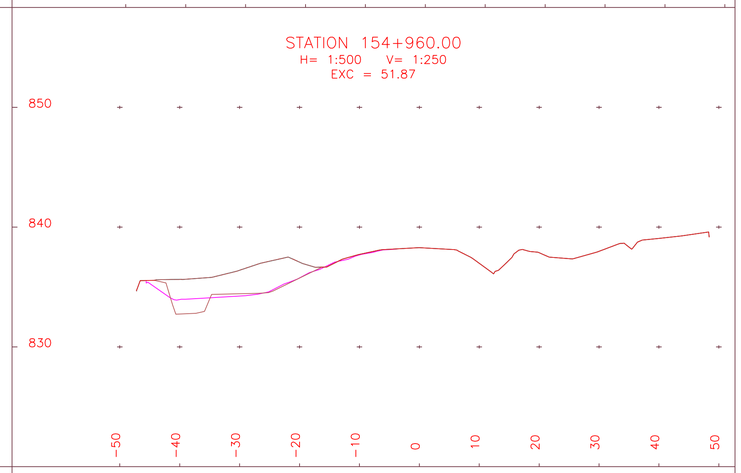


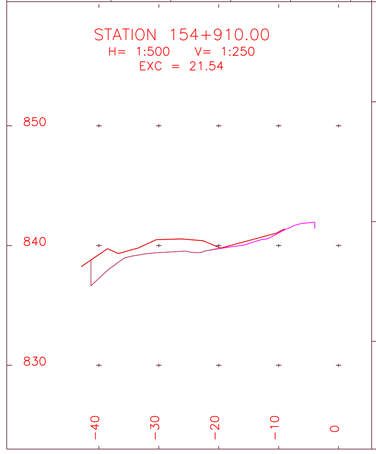


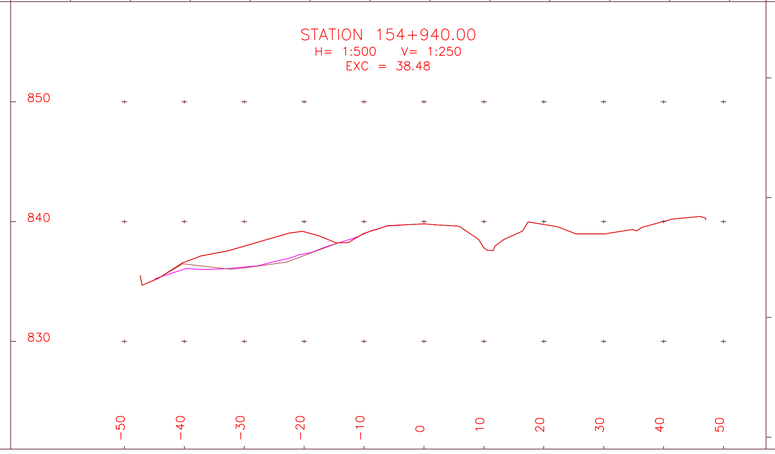


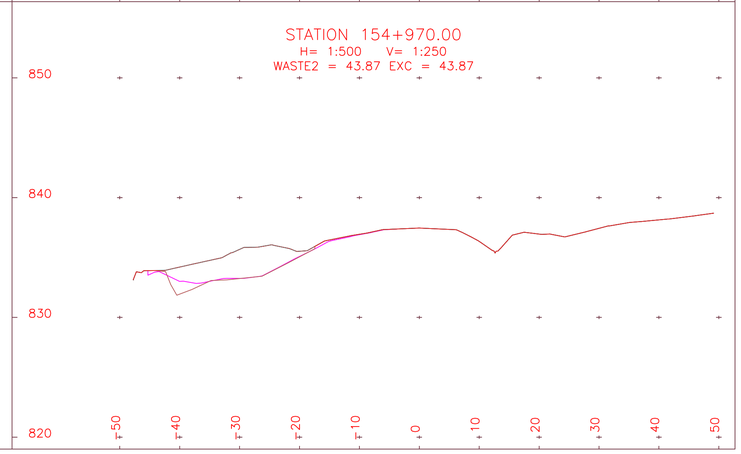












A1 841 x 594

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR
km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 154+890 TO STA 154+970
2004/10/28

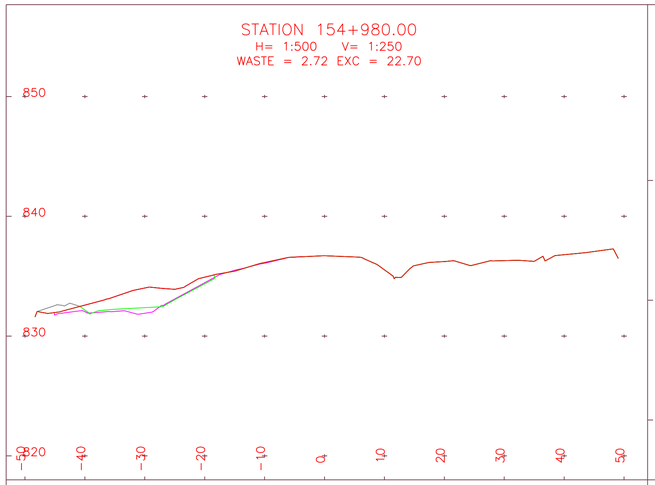
designed by / concu par

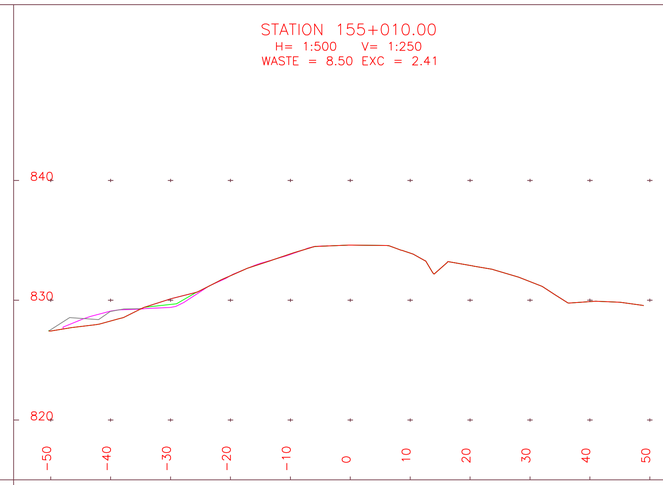
drawn by / dessine par
MCELHANNEY SURVEY / JG

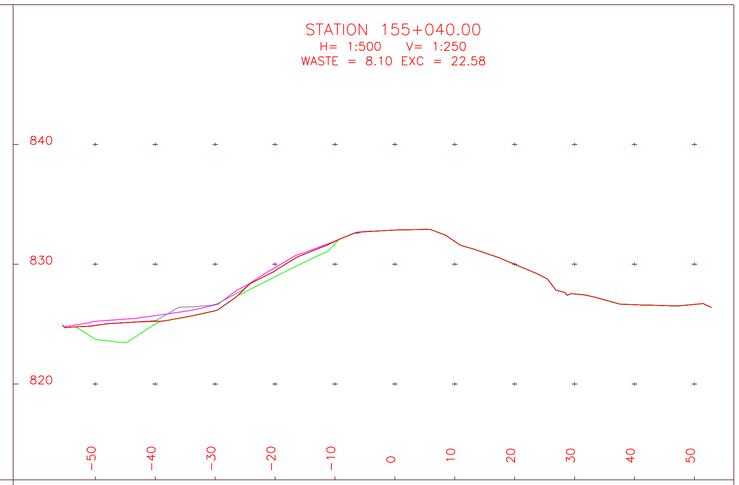
approved by / approuve par

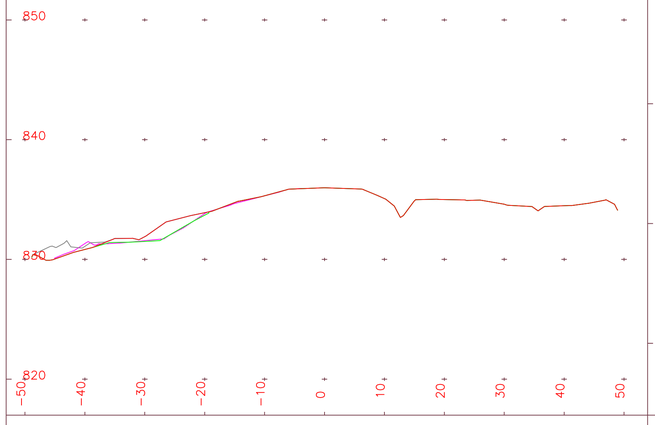
PWGSC Project Manager / Administrateur de Projets TPSGC

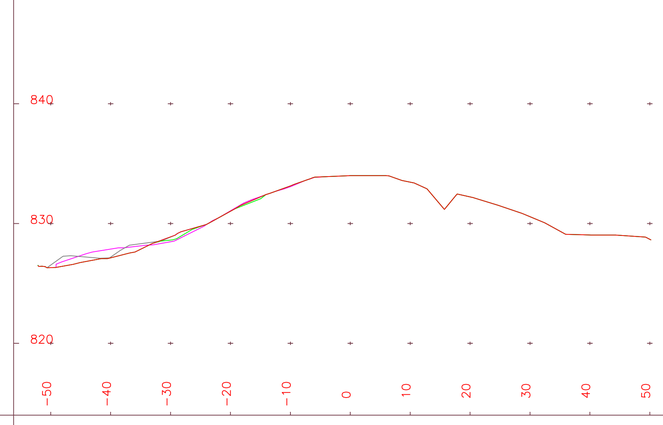
scale / echelle: **1: 1000**
sheet / feuille: **C02**
project no. / projet no.:
date / date: **08 JUNE 2007**
OF 1

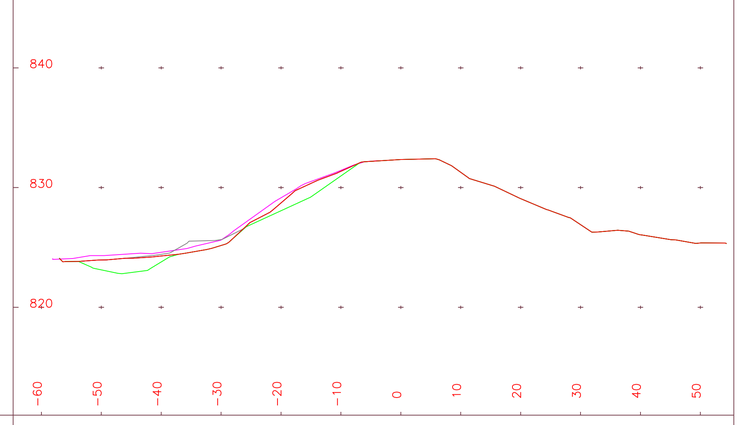


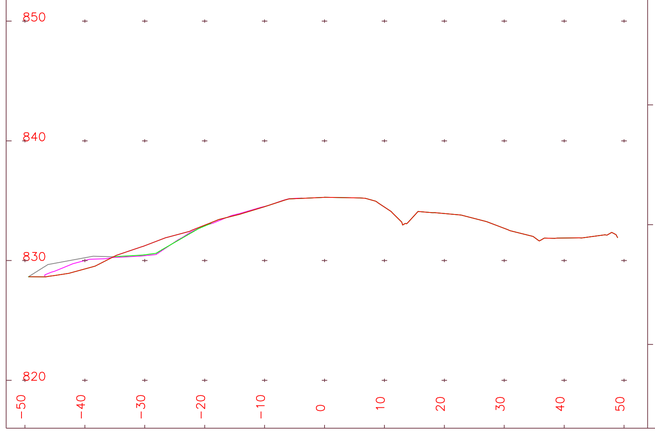


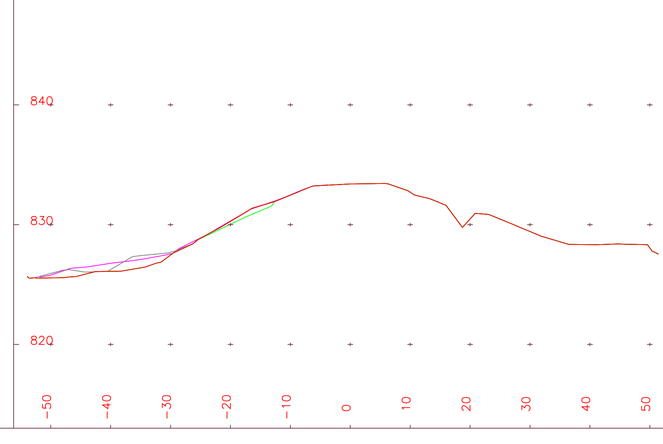


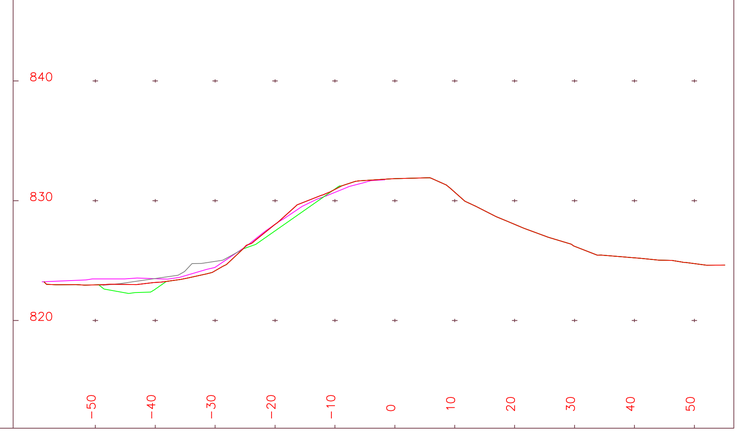












Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR

km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 154+980 TO STA 155+060
2004/10/28

designed by / concu par

drawn by / dessine par
MCELHANNEY SURVEY / JG

approved by / approuve par

PWGSC Project Manager / Administrateur de Projets TPSGC

scale / echelle	sheet / feuille
1: 1000	**C03**
project no. / projet no.	
date / date	OF
08 JUNE 2007	

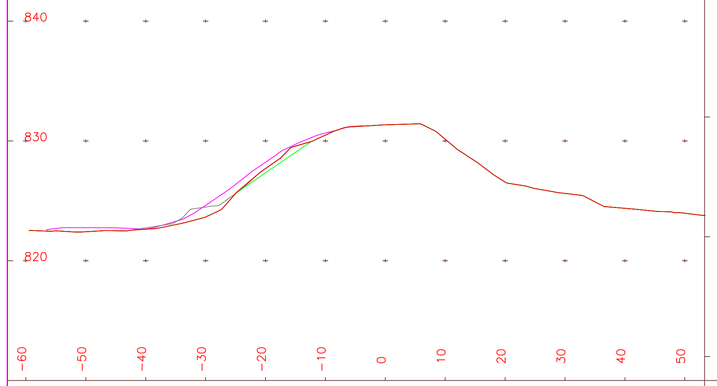
A1 841 x 594

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

STATION 155+070.00
H= 1:500 V= 1:250
WASTE = 6.84 EXC = 4.12



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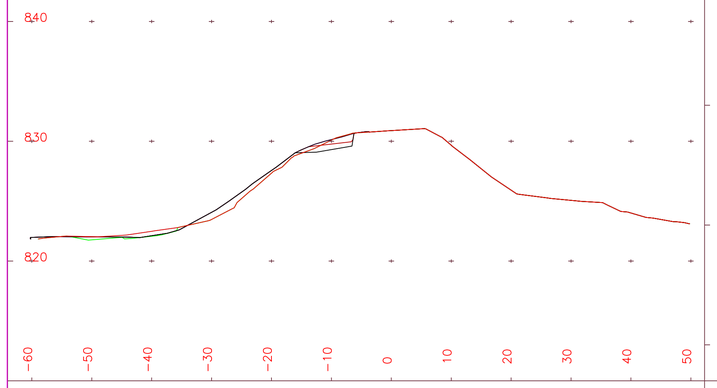
EXC = 4.95



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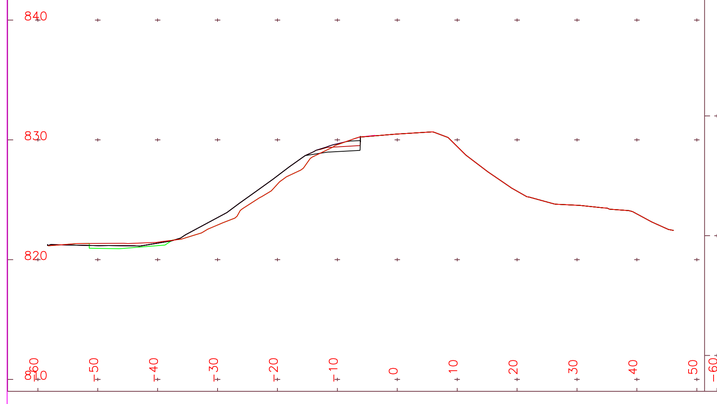

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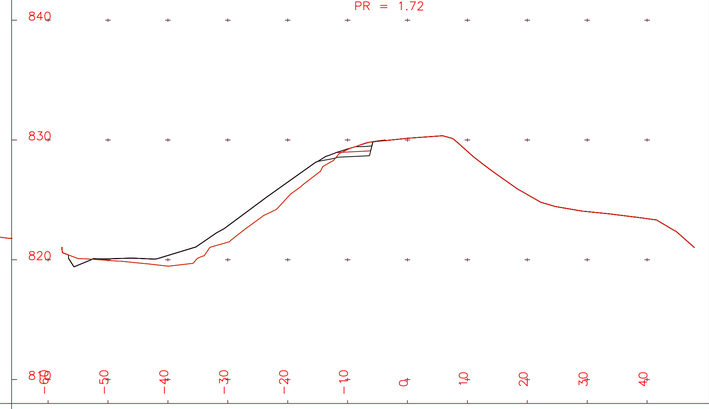
PR = 1.72



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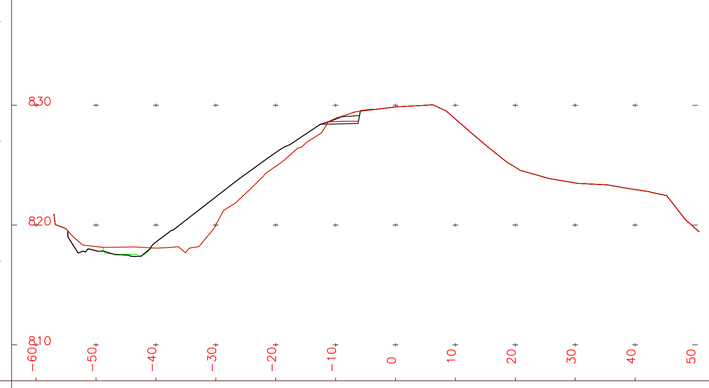
PR = 1.66 EXC = 4.48



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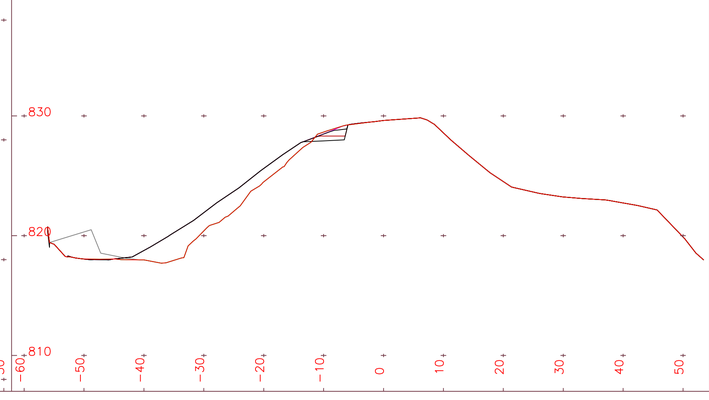
RK = 2.24 PR = 1.77



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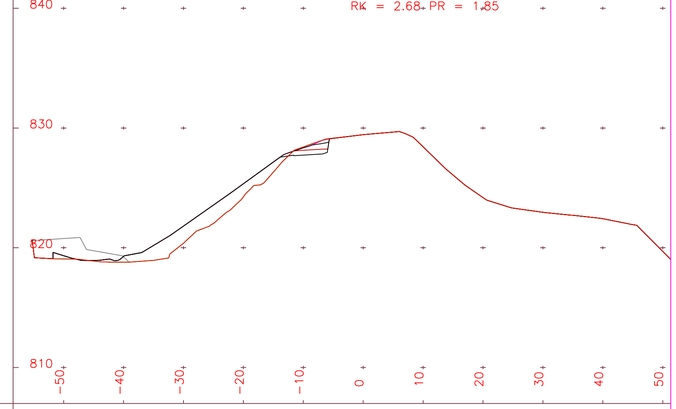

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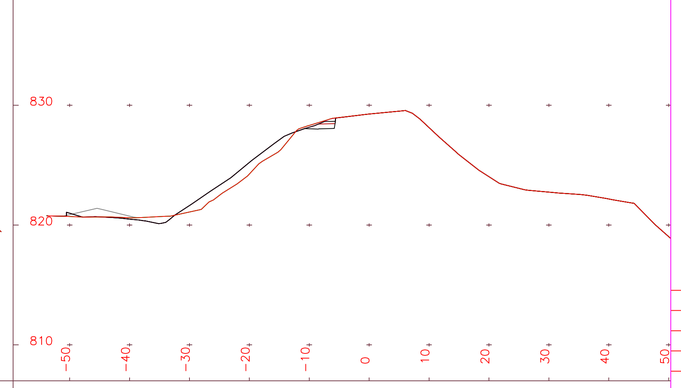

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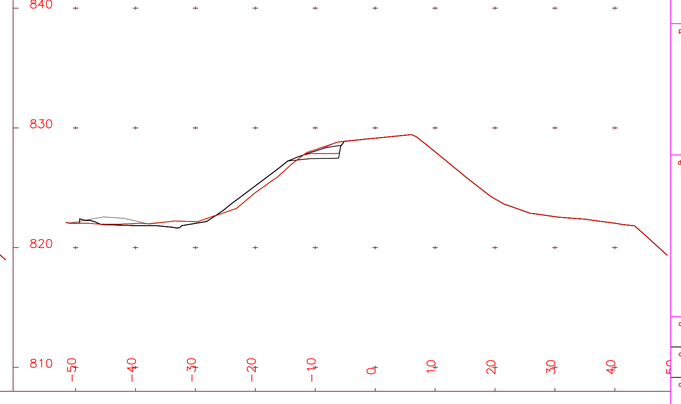
RK = 2.88 PR = 2.19



REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number
number du detail
B source drawing no.
de dessin no.
C detail on drawing no.
detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR

km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+070 TO STA 155+150
2004/10/28

designed by / concu par

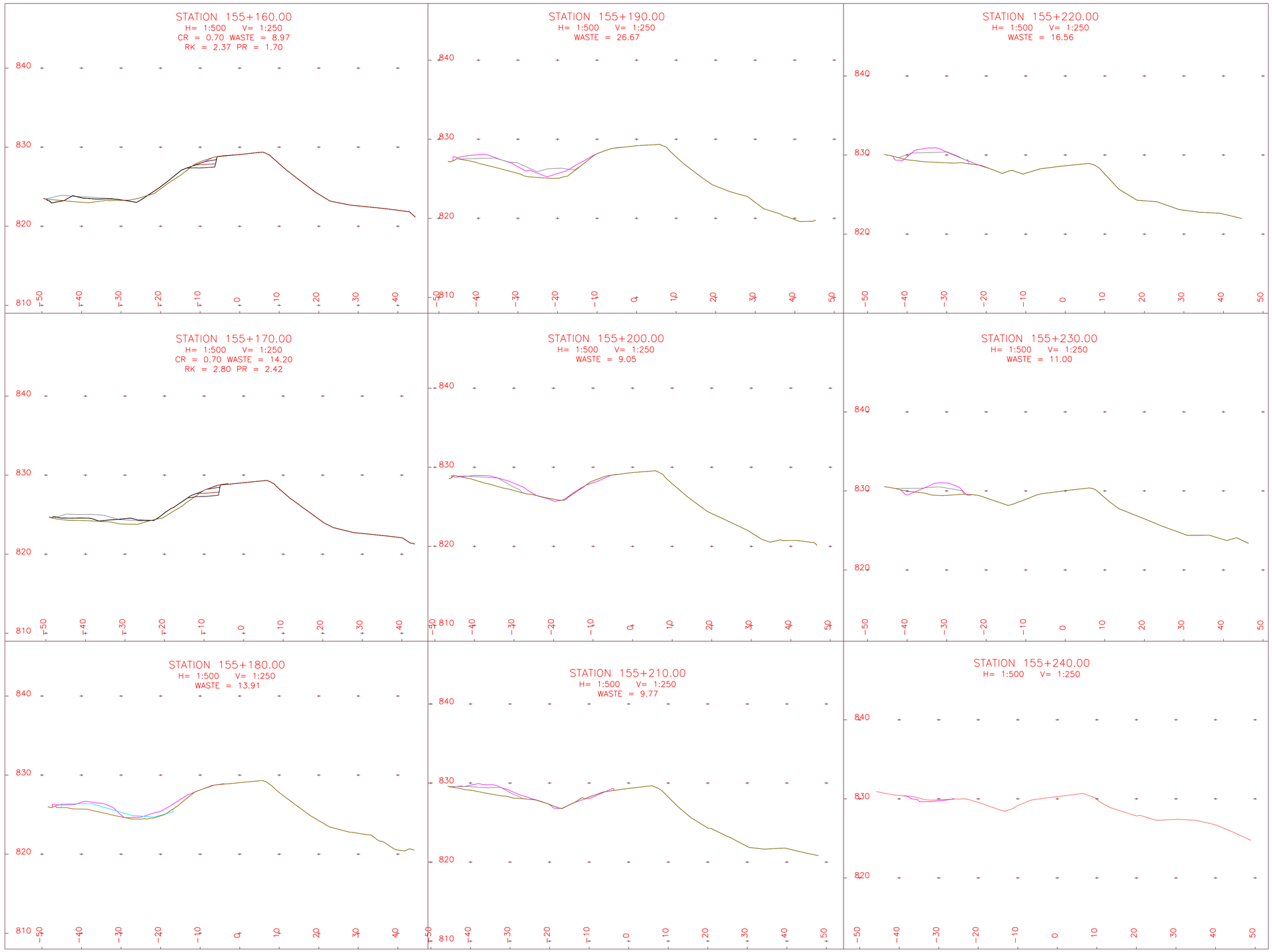
drawn by / dessine par
MCELHANNEY SURVEY / JG

approved by / approuve par

PWGSC Project Manager / Administrateur de Projets TPSGC

scale / echelle	sheet / feuille
1: 1000	**C04**
project no. / projet no.	OF
date / date	
08 JUNE 2007	

A1 841 x 594



Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number
number du detail
B source drawing no.
de dessin no.
C detail on drawing no.
detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR

km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+160 TO STA 155+240
2004/10/28

designed by / concu par

drawn by / dessine par
MCELHANNEY SURVEY / JG

approved by / approuve par

PWGSC Project Manager / Administrateur de Projets TPSGC

scale / echelle: **1: 1000**
sheet / feuille: **C05**
project no. / projet no.:
date / date: **08 JUNE 2007**
OF

A1 841 x 594

STATION 155+250.00
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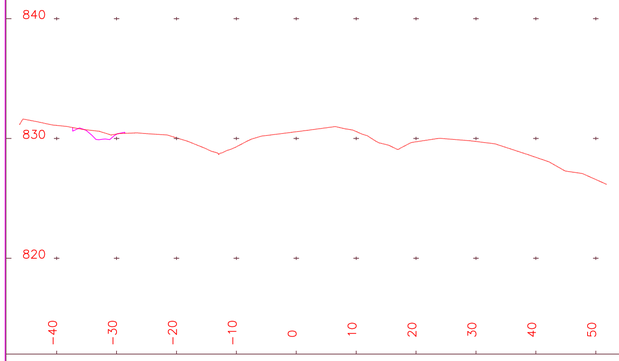

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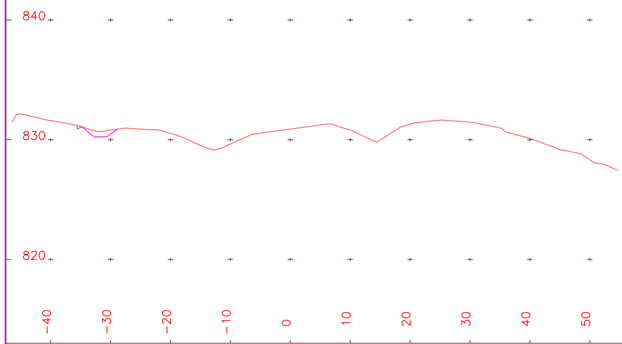

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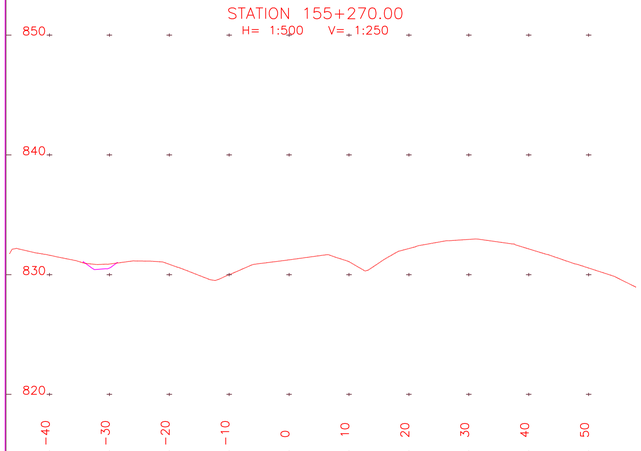

STATION 155+280.00
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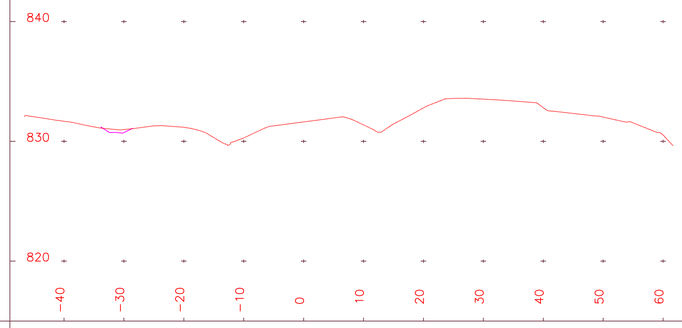

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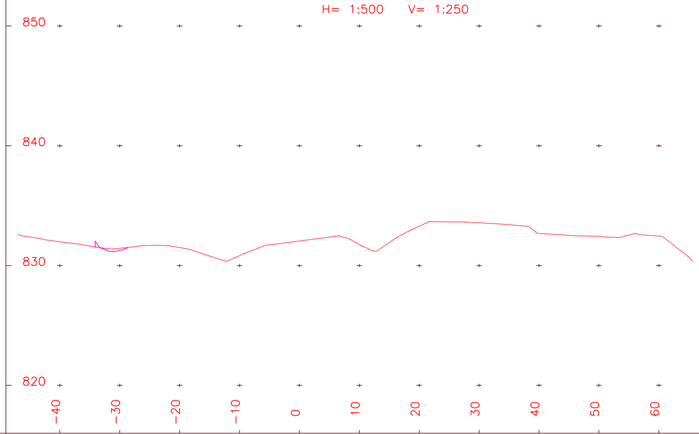

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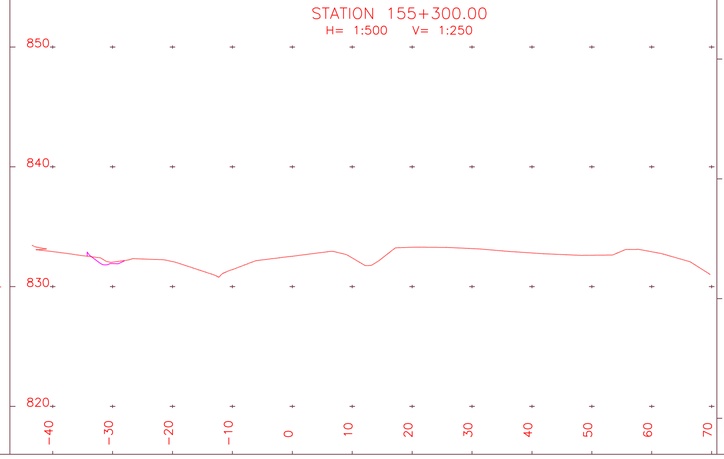

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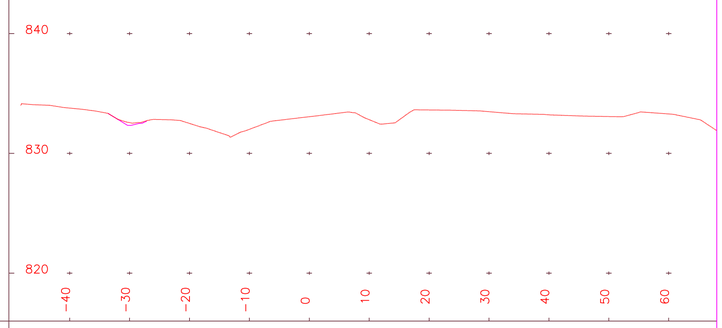

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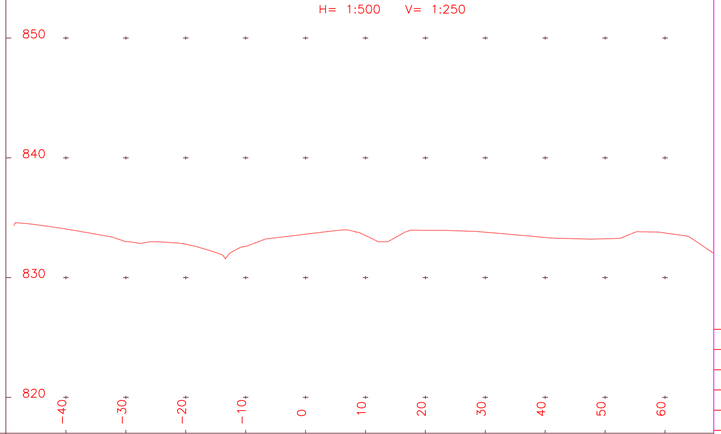

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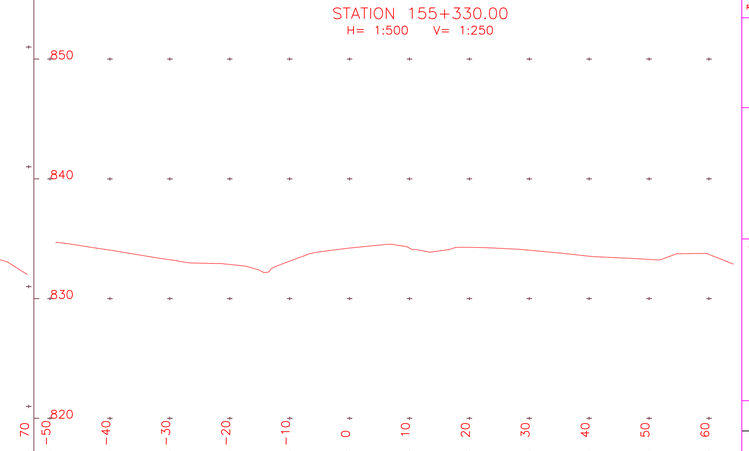


A1 841 x 594

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR

km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+250 TO STA 155+330
2004/10/28

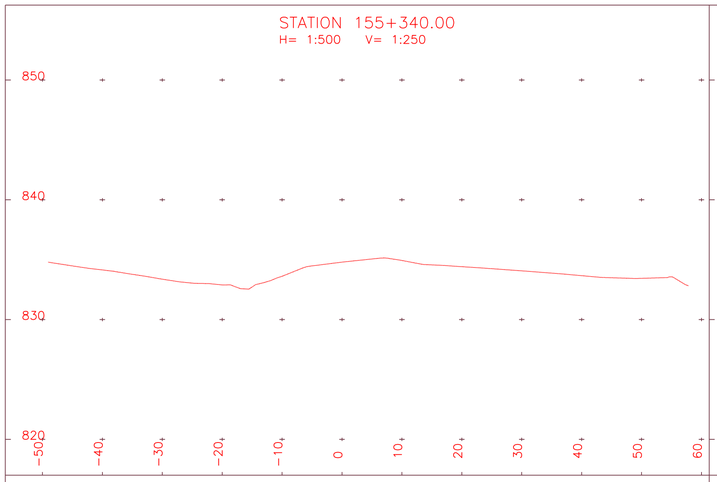
designed by / concu par

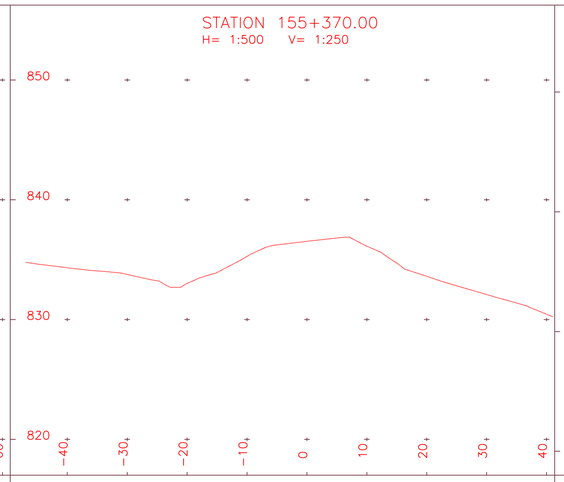
drawn by / dessine par
MCELHANNEY SURVEY / JG

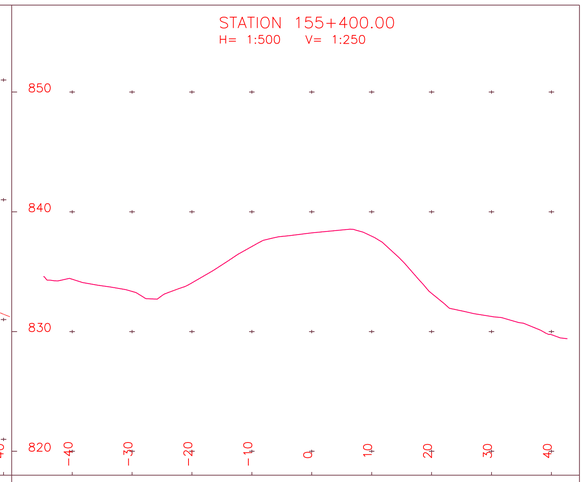
approved by / approuve par

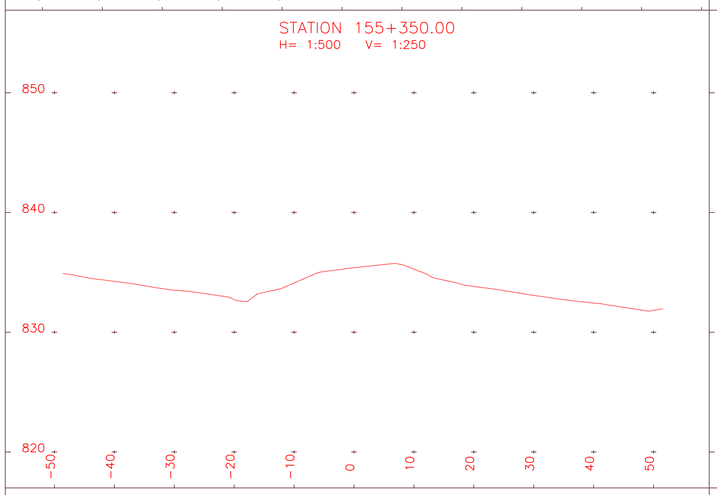
PWGSC Project Manager / Administrateur de Projets TPSGC

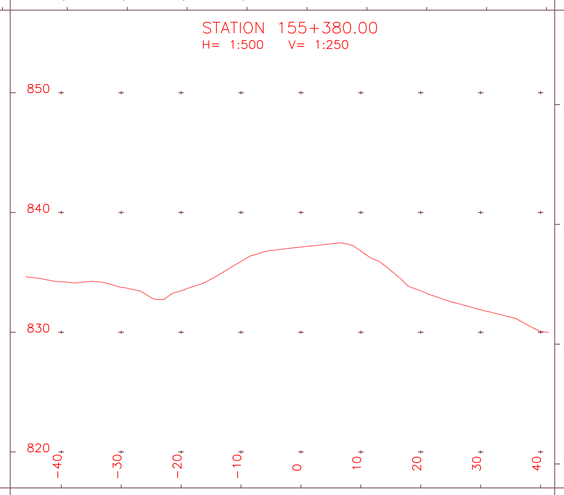
scale / echelle: **1: 1000**
sheet / feuille: **C06**
project no. / projet no.:
date / date: **08 JUNE 2007**
OF

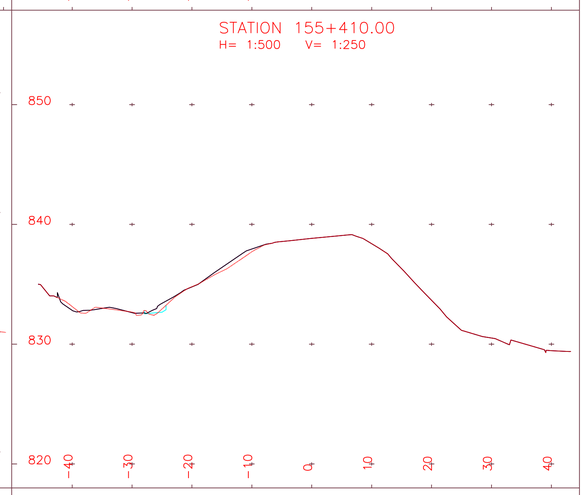


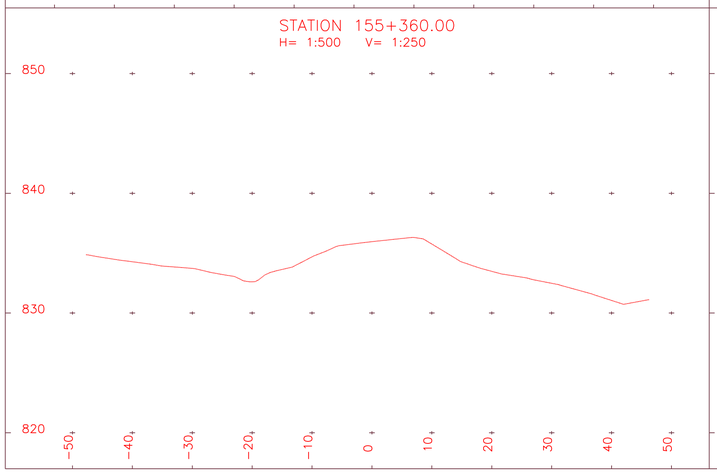


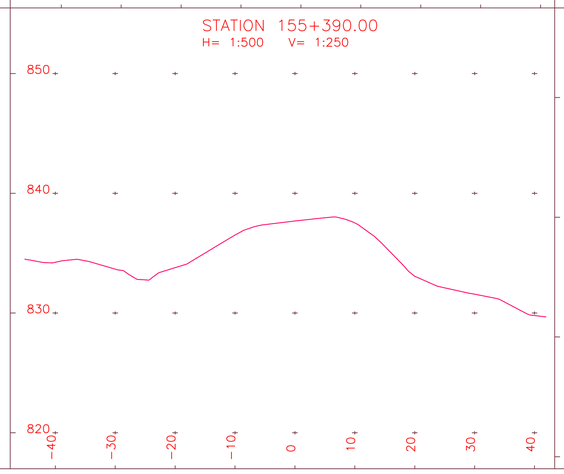


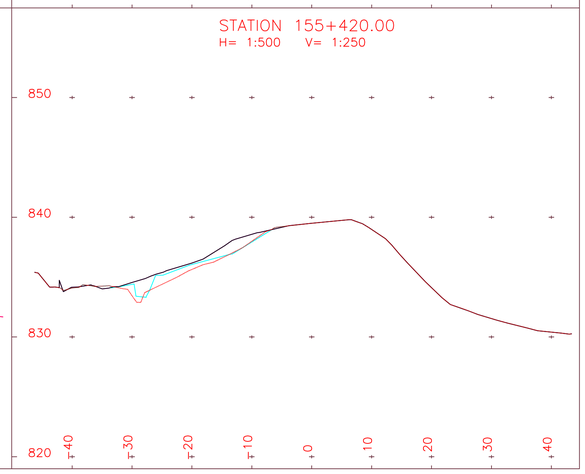












Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number
number du detail
B source drawing no.
de dessin no.
C detail on drawing no.
detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR

km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+340 TO STA 155+420
2004/10/28

designed by / concu par

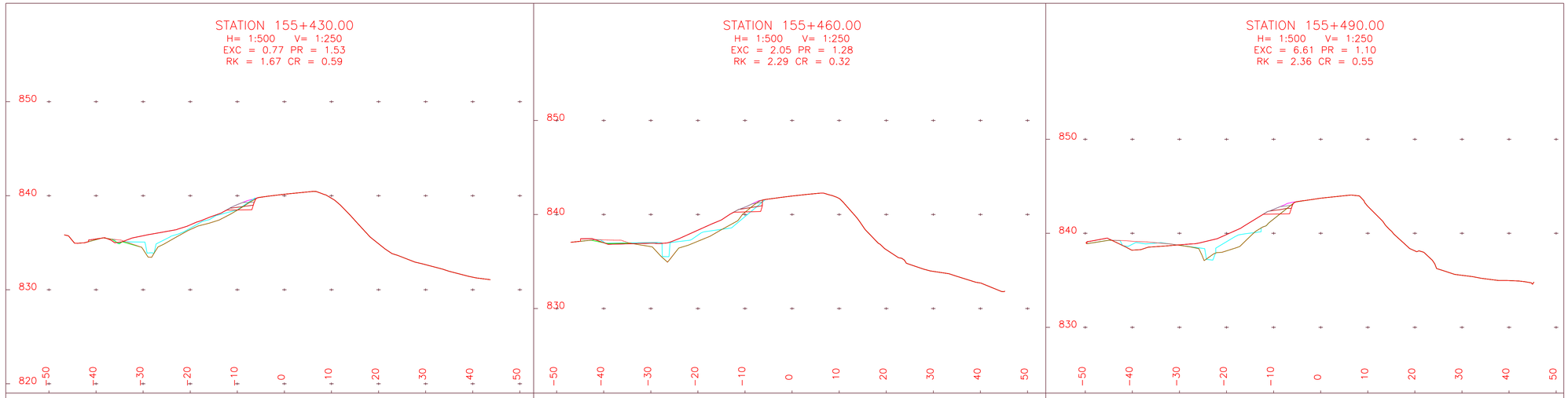
drawn by / dessine par
MCELHANNEY SURVEY / JG

approved by / approuve par

PWGSC Project Manager / Administrateur de Projets TPSGC

scale / echelle	sheet / feuille
1: 1000	**C07**
project no. / projet no.	OF
date / date	
08 JUNE 2007	

A1 841 x 594



A1 841 x 594

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR
km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+430 TO STA 155+510
2004/10/28

designed by / concu par

drawn by / dessine par
MCELHANNEY SURVEY / JG

approved by / approuve par

PWGSC Project Manager / Administrateur de Projets TPSGC

scale / echelle	sheet / feuille
1: 1000	**C08**
project no. / projet no.	OF
date / date	
08 JUNE 2007	

STATION 155+520.00
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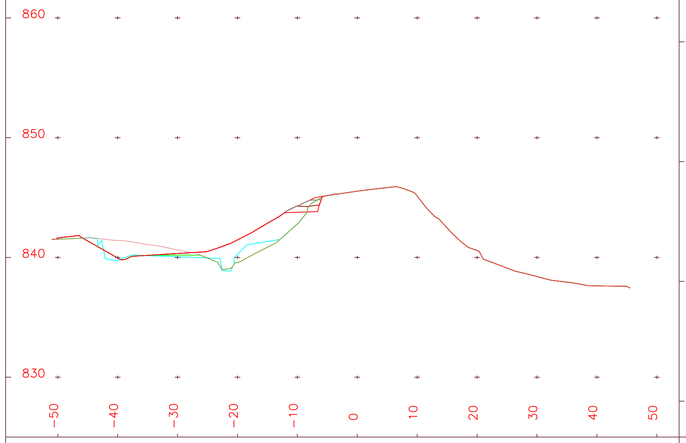
EXC = 15.23 PR = 1.37
RK = 2.36 CR = 0.36



STATION 155+530.00
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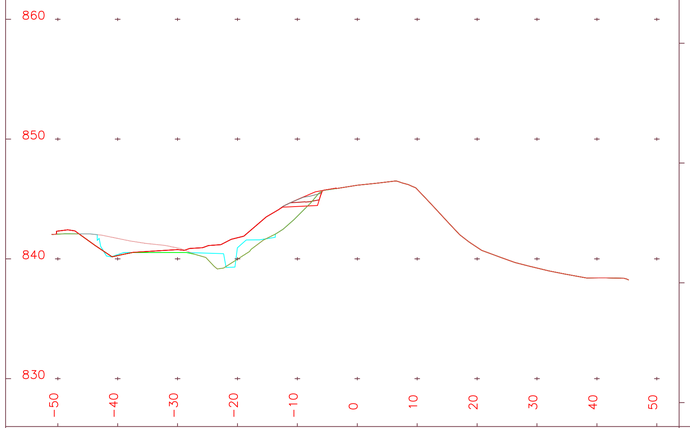
EXC = 14.84 PR = 1.77
RK = 1.96 CR = 0.59



STATION 155+540.00
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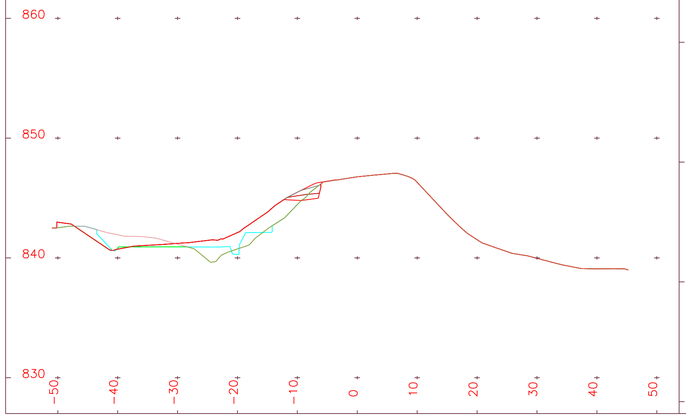
EXC = 13.75 PR = 2.18
RK = 2.10 CR = 0.62



STATION 155+550.00
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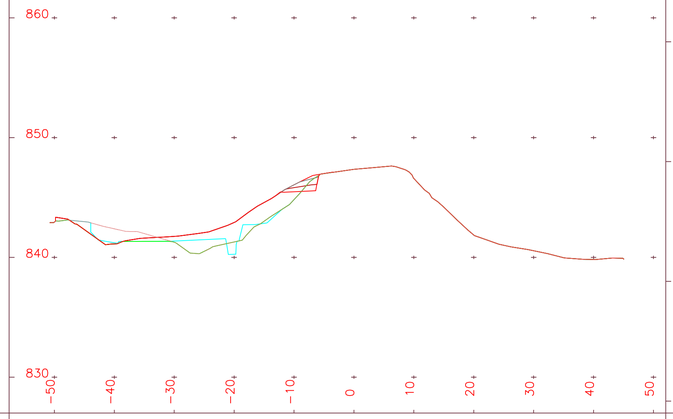
EXC = 12.56 PR = 1.91
RK = 2.16 CR = 0.52



STATION 155+560.00
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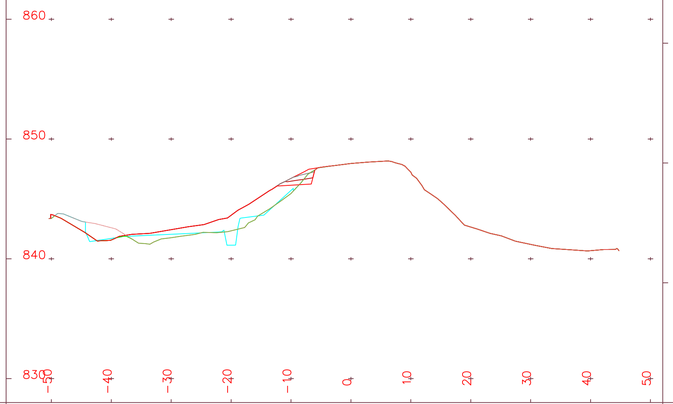
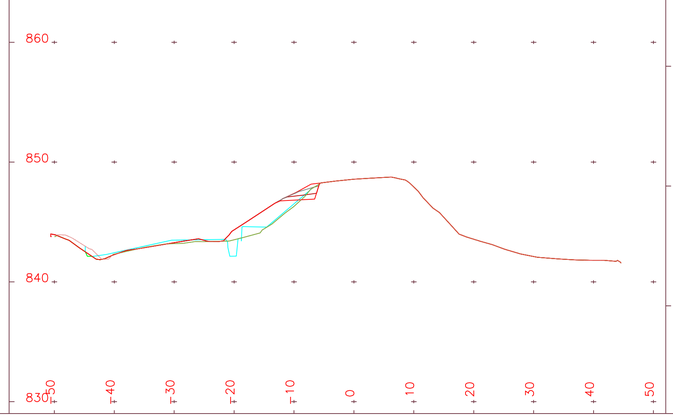
EXC = 9.48 PR = 1.58
RK = 2.11 CR = 0.72



STATION 155+570.00
H= 1:500 V= 1:250
EXC = 2.91 PR = 1.81
RK = 2.02 CR = 0.82



STATION 155+580.00
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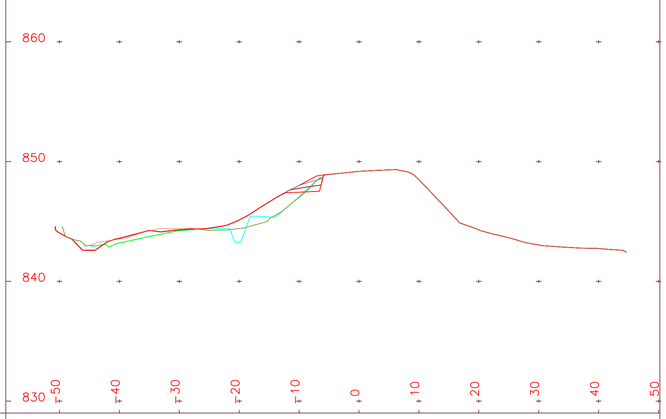
EXC = 5.58 PR = 1.63
RK = 2.03 CR = 0.87



STATION 155+590.00
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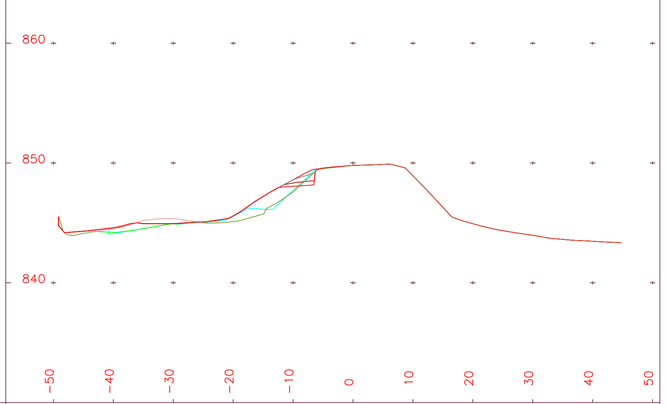
EXC = 6.61 PR = 1.85
RK = 1.59 CR = 0.76



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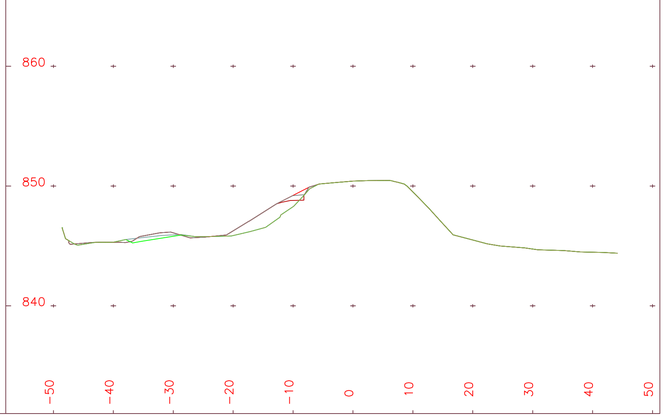
CR = 0.59



A1 841 x 594

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR

km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+520 TO STA 155+600
2004/10/28

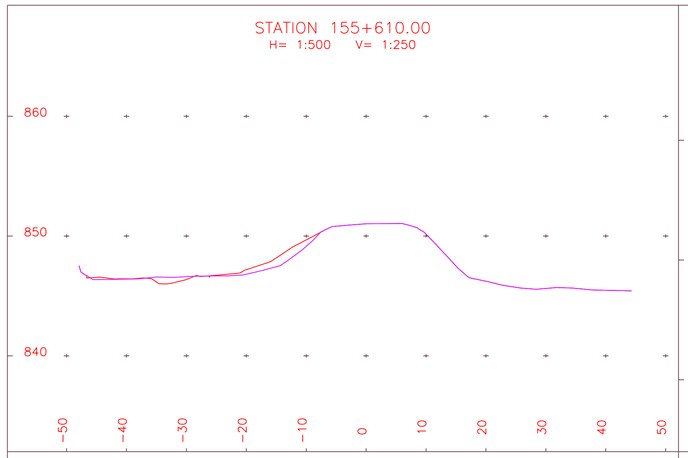
designed by / concu par

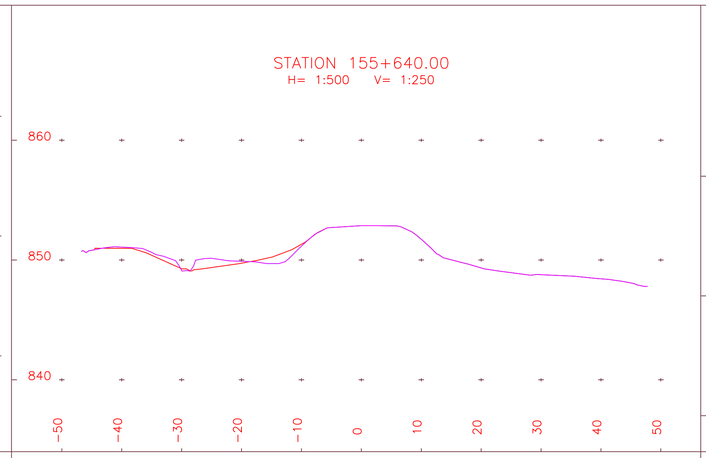
drawn by / dessine par
MCELHANNEY SURVEY / JG

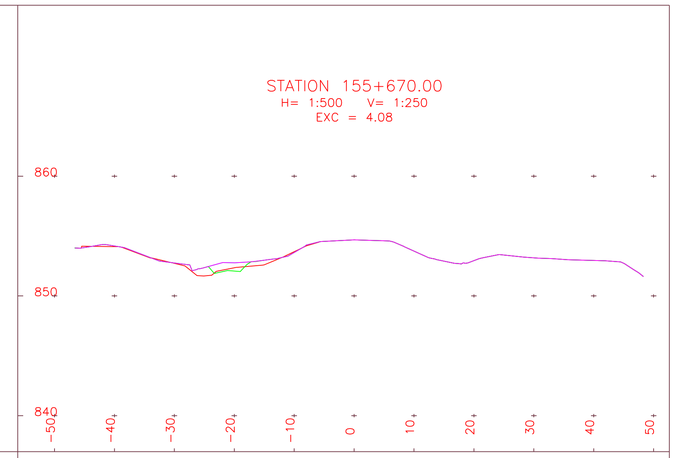
approved by / approuve par

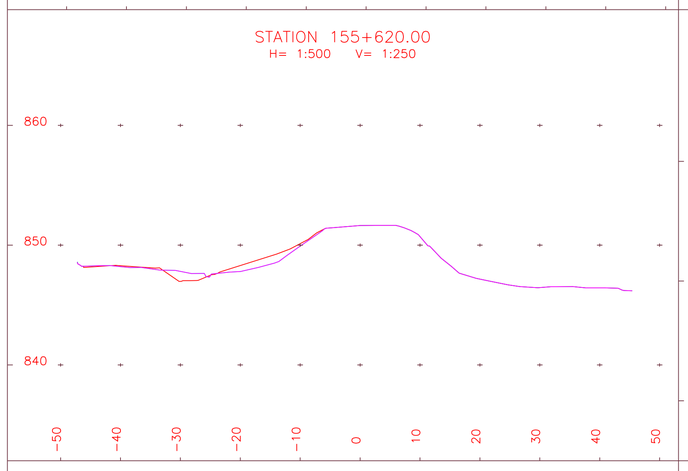
PWGSC Project Manager / Administrateur de Projets TPSGC

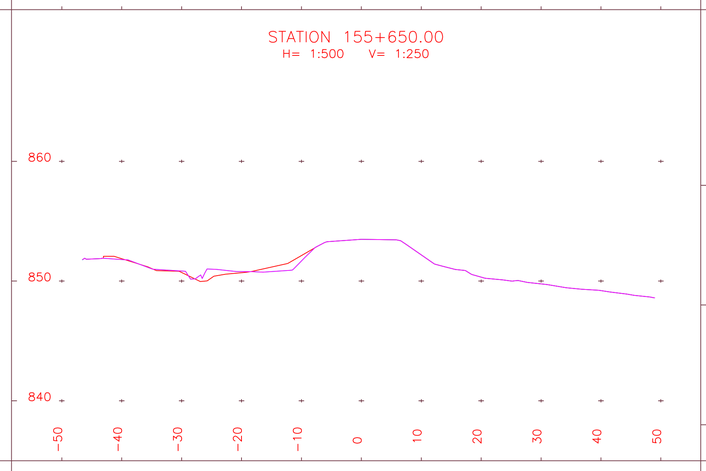
scale / echelle: **1: 1000**
sheet / feuille: **C09**
project no. / projet no.:
date / date: **08 JUNE 2007**
OF

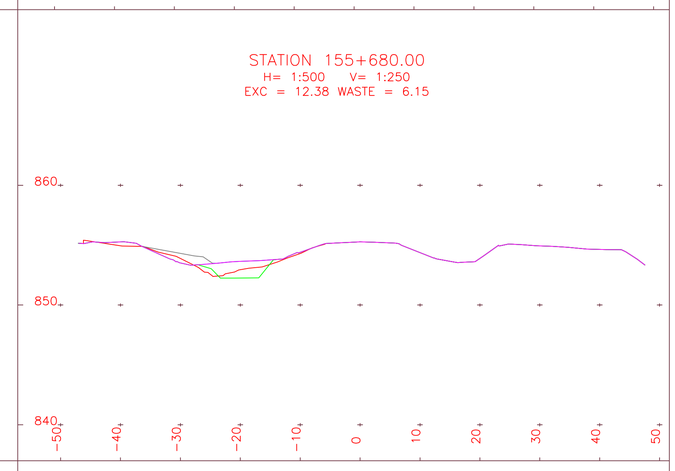


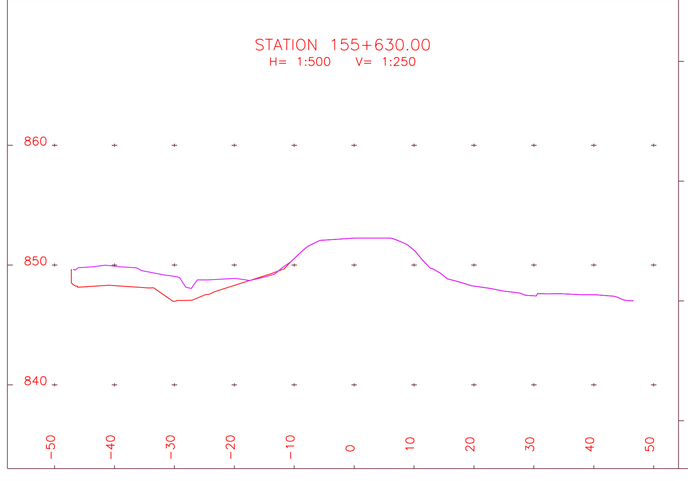


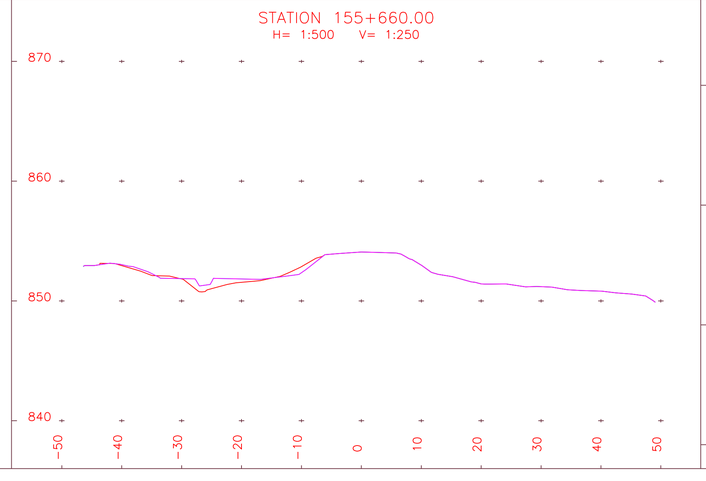


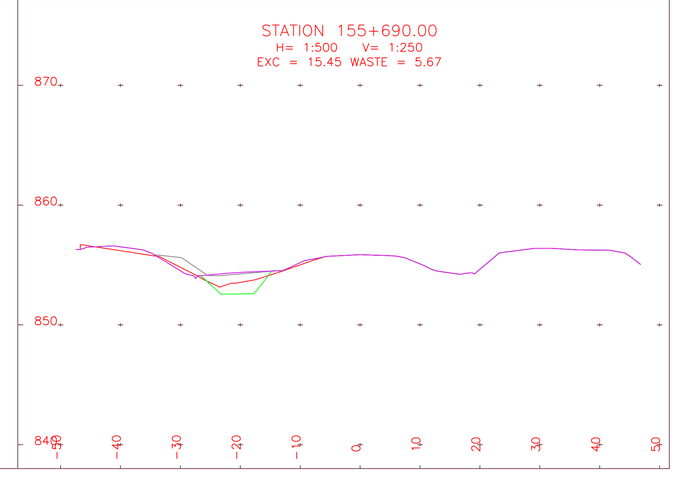












A1 841 x 594

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number
number du detail
B source drawing no.
de dessin no.
C detail on drawing no.
detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR

km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+610 TO STA 155+690
2004/10/28

designed by / concu por

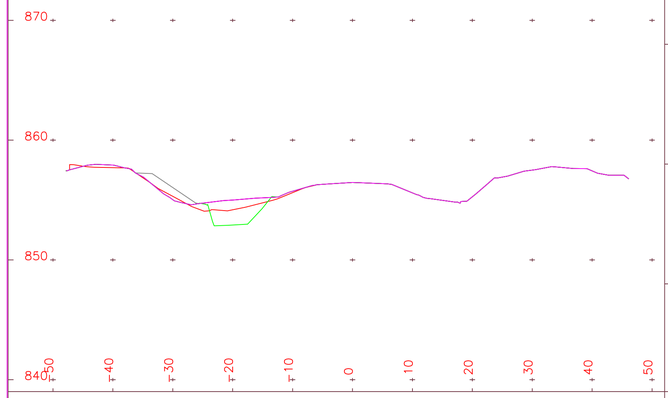
drawn by / dessine por
MCELHANNEY SURVEY / JG

approved by / approuve por

PWGSC Project Manager / Administrateur de Projets TPSGC

scale / echelle: **1: 1000**
project no. / projet no.:
date / date: **08 JUNE 2007**
sheet / feuille: **C10**
OF

STATION 155+700.00
H= 1:500 V= 1:250
EXC = 17.30 WASTE = 6.97



STATION 155+730.00
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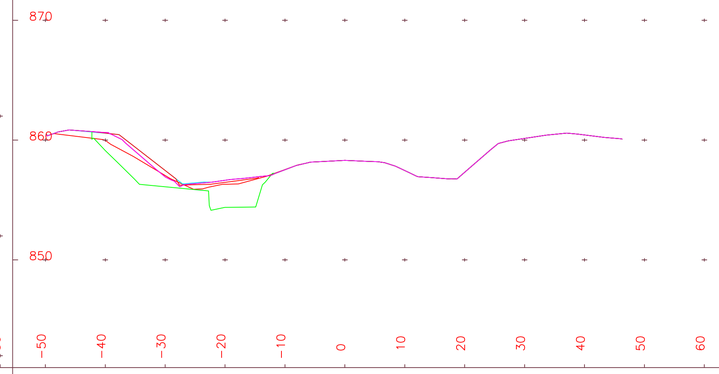
EXC = 45.70 WASTE2 = 8.03



STATION 155+760.00
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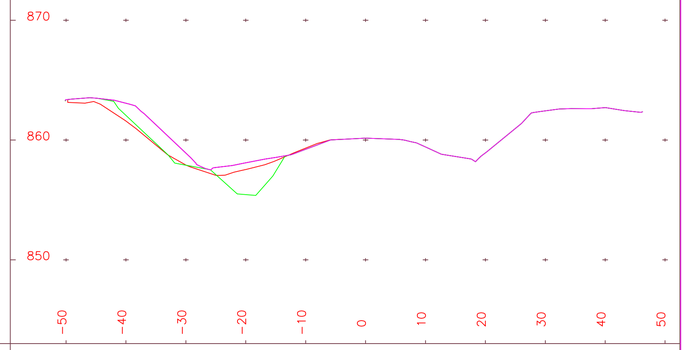
EXC = 39.50



STATION 155+710.00
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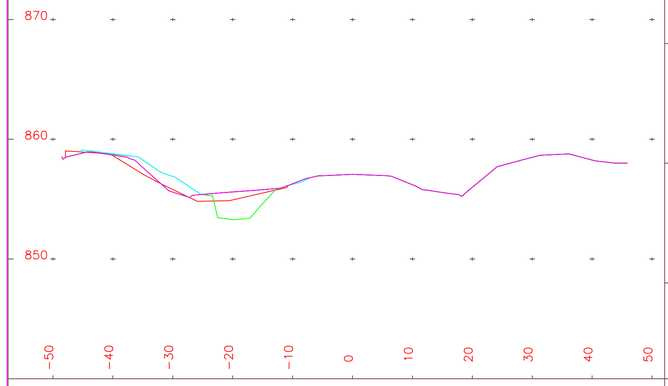
EXC = 18.35 WASTE = 9.95



STATION 155+740.00
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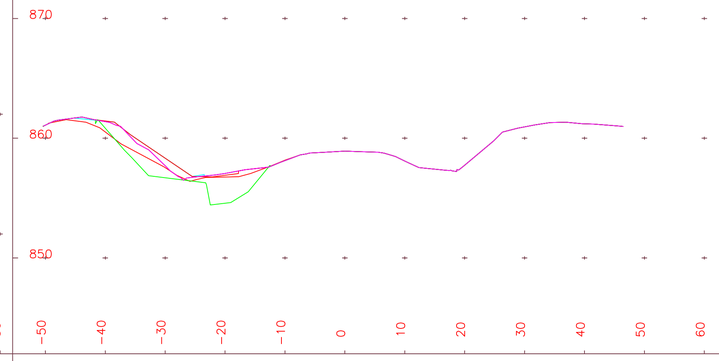
EXC = 37.53 WASTE2 = 2.02



STATION 155+770.00
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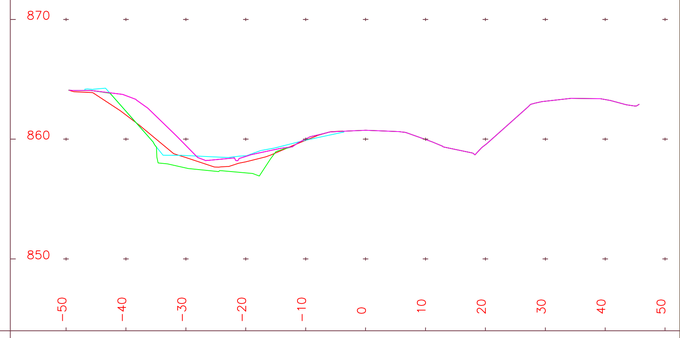
EXC = 43.80



STATION 155+720.00
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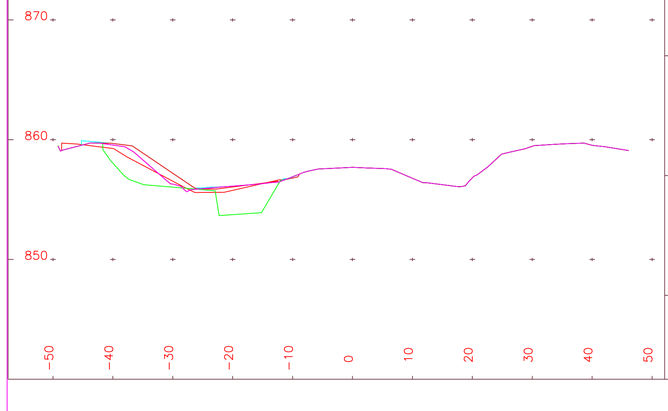
EXC = 40.45 WASTE2 = 47.70



STATION 155+750.00
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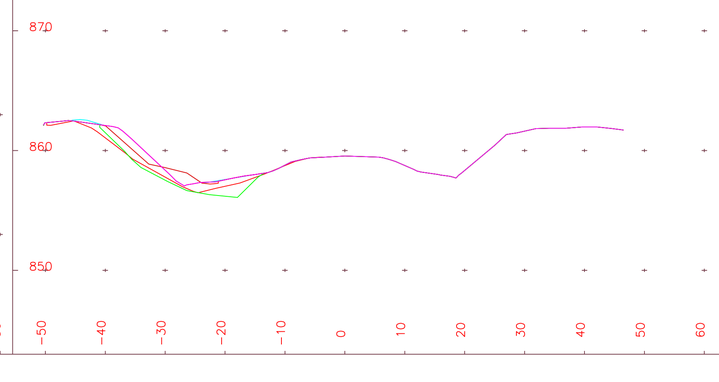
EXC = 28.27 WASTE2 = 6.12



STATION 155+780.00
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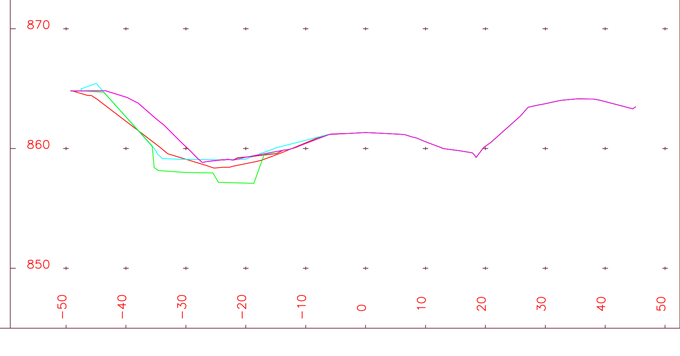
EXC = 53.00



A1 841 x 594

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY
SLIDE REPAIR
km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+700 TO STA 155+780
2004/10/28

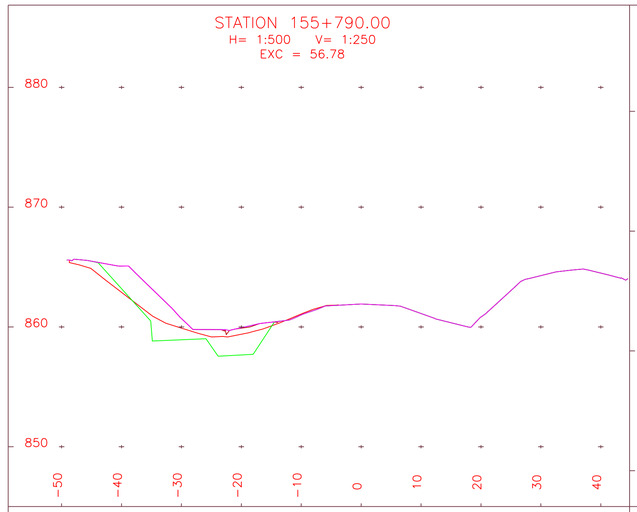
designed by / concu par

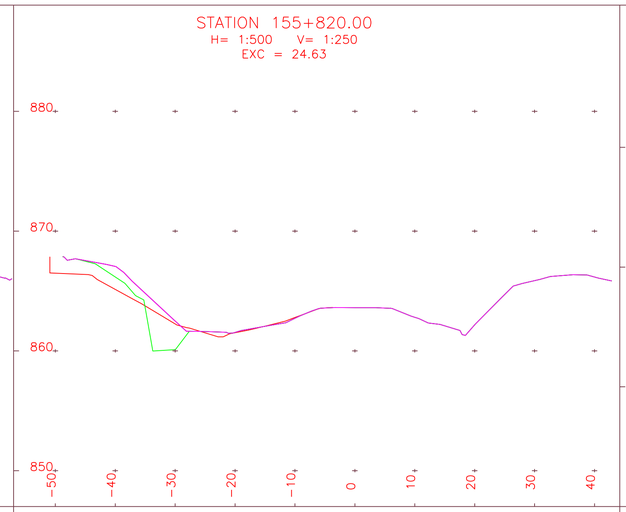
drawn by / dessine par
MCELHANNEY SURVEY / JG

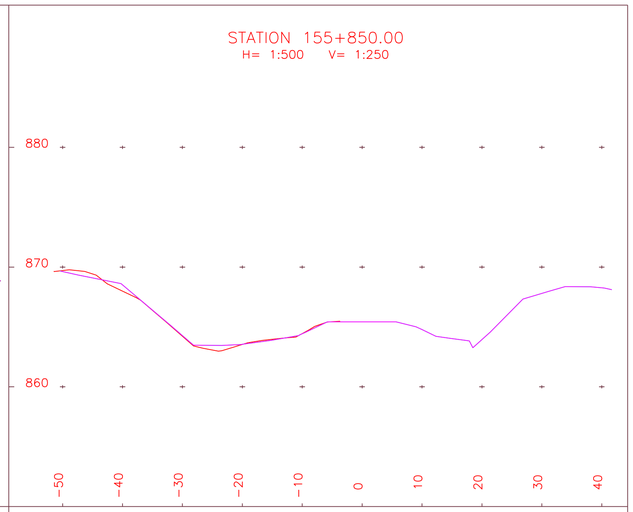
approved by / approuve par

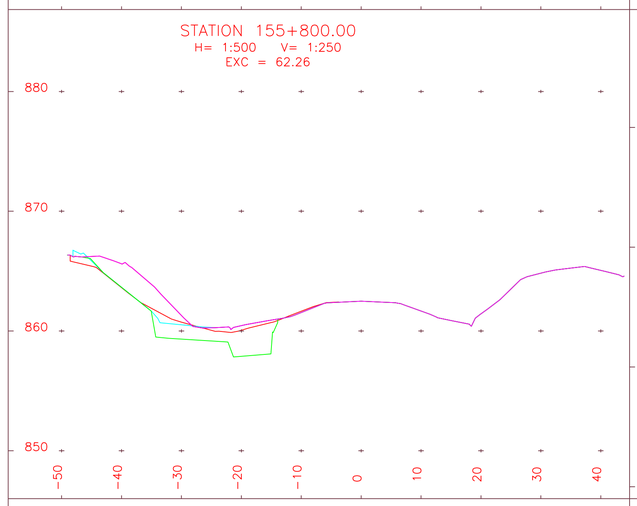
PWGSC Project Manager / Administrateur de Projets TPSGC

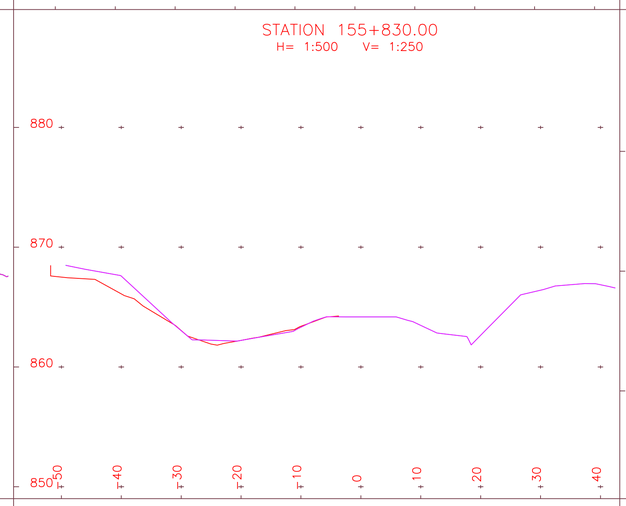
scale / echelle	sheet / feuille
1: 1000	**C11**
project no. / projet no.	OF
date / date	
08 JUNE 2007	

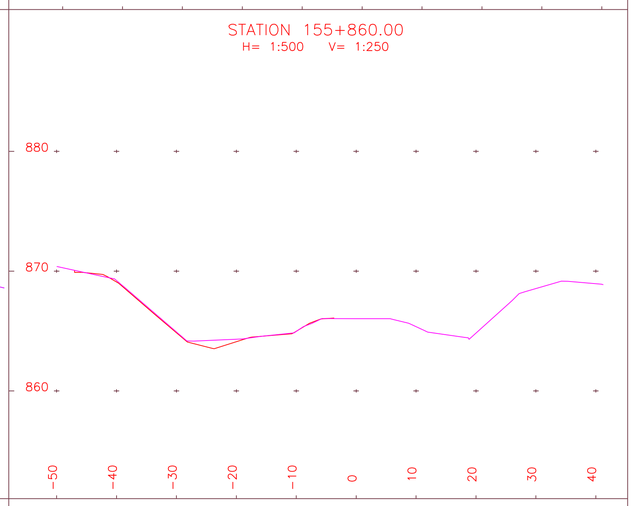


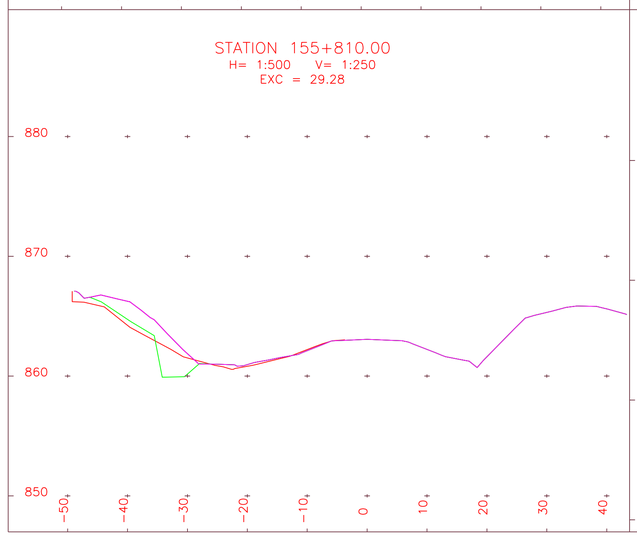


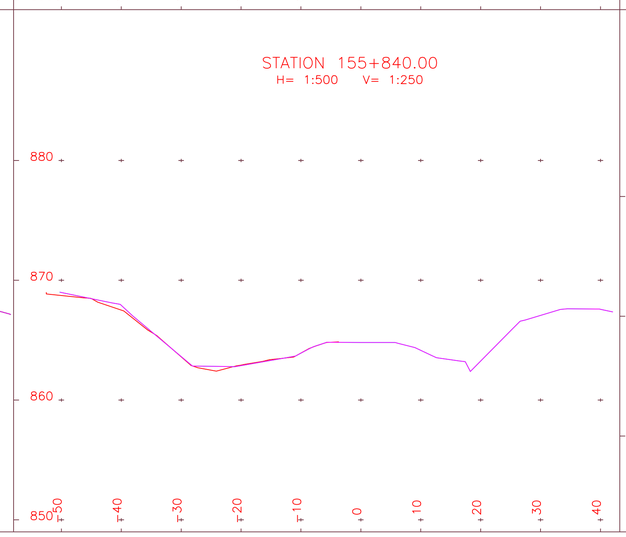


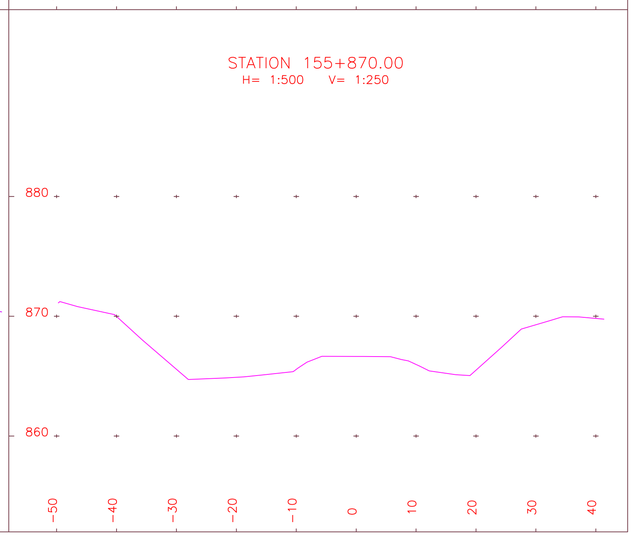












Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region

AS-BUILT

REVISIONS	DESCRIPTION	DATE
1	AS BUILT	2007/06/08

A detail number / number du detail
B source drawing no. / de dessin no.
C detail on drawing no. / detail sur dessin no.

project title / titre du projet

ALASKA HIGHWAY SLIDE REPAIR

km 155
BRITISH COLUMBIA

drawing title / titre du dessin

AS-BUILT
CROSS SECTIONS
STA 155+790 TO STA 155+870
2004/10/28

designed by / concu par

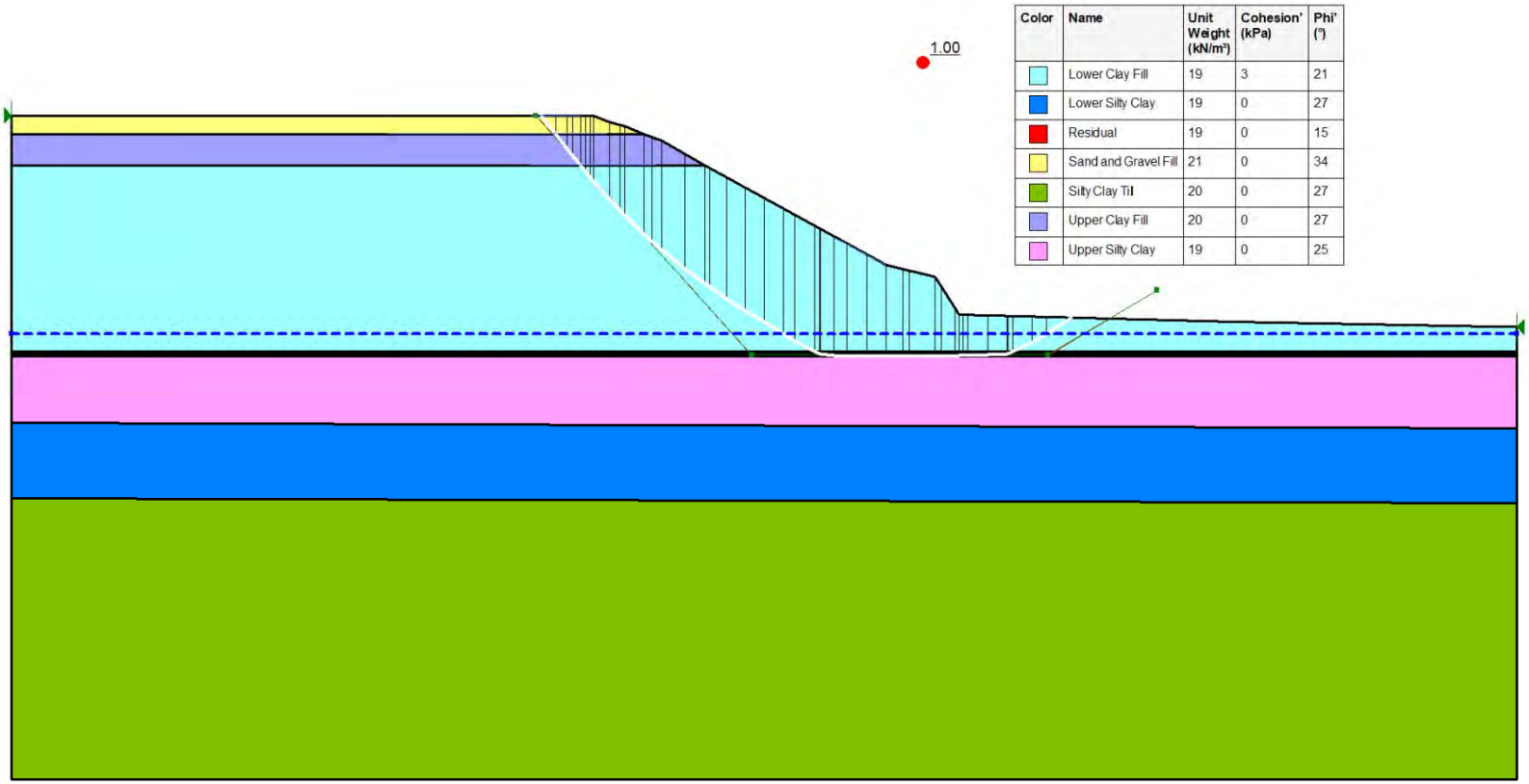
drawn by / dessine par
MCELHANNEY SURVEY / JG

approved by / approuve par

PWGSC Project Manager / Administrateur de Projets TPSGC

scale / echelle	sheet / feuille
1: 1000	**C12**
project no. / projet no.	OF
date / date	
08 JUNE 2007	

A1 841 x 594



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Lower Clay Fill	19	3	21
	Lower Silty Clay	19	0	27
	Residual	19	0	15
	Sand and Gravel Fill	21	0	34
	Silty Clay Til	20	0	27
	Upper Clay Fill	20	0	27
	Upper Silty Clay	19	0	25

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

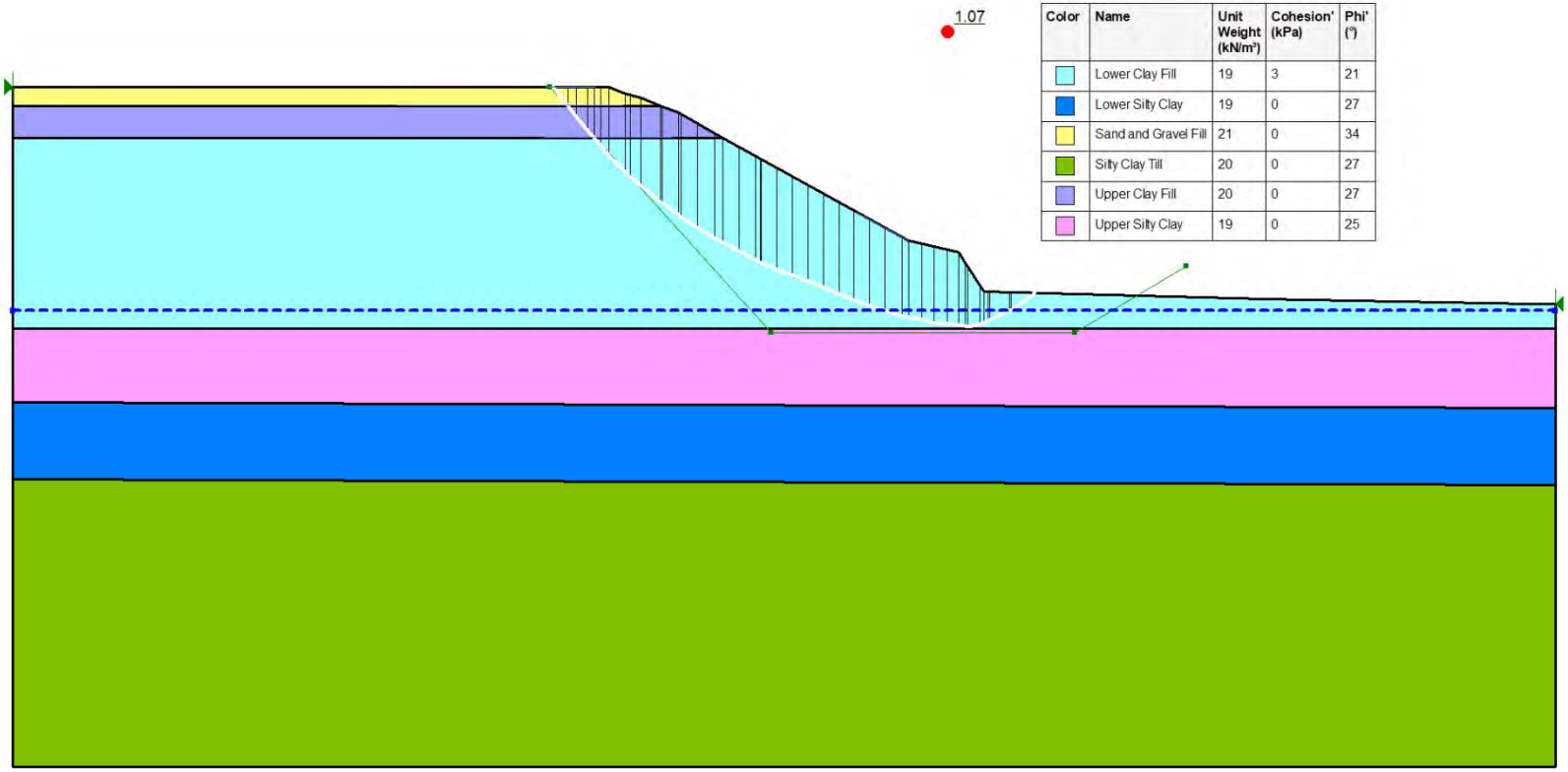
PROJECT
PSPC ALASKA HIGHWAY SLIDE MITIGATION KM 155.5

CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-23
PREPARED	J.BRUNSWICK
DESIGN	J.BRUNSWICK
REVIEW	R.JASSAL
APPROVED	R.WILLIAMS

TITLE
SLOPE STABILITY ASSESSMENT
EXISTING SLOPE CONDITION WITH WEAK (RESIDUAL) LAYER

PROJECT No.	Phase	Rev	FIGURE
19129643	****	0	H1



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Lower Clay Fill	19	3	21
	Lower Silty Clay	19	0	27
	Sand and Gravel Fill	21	0	34
	Silty Clay Till	20	0	27
	Upper Clay Fill	20	0	27
	Upper Silty Clay	19	0	25

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

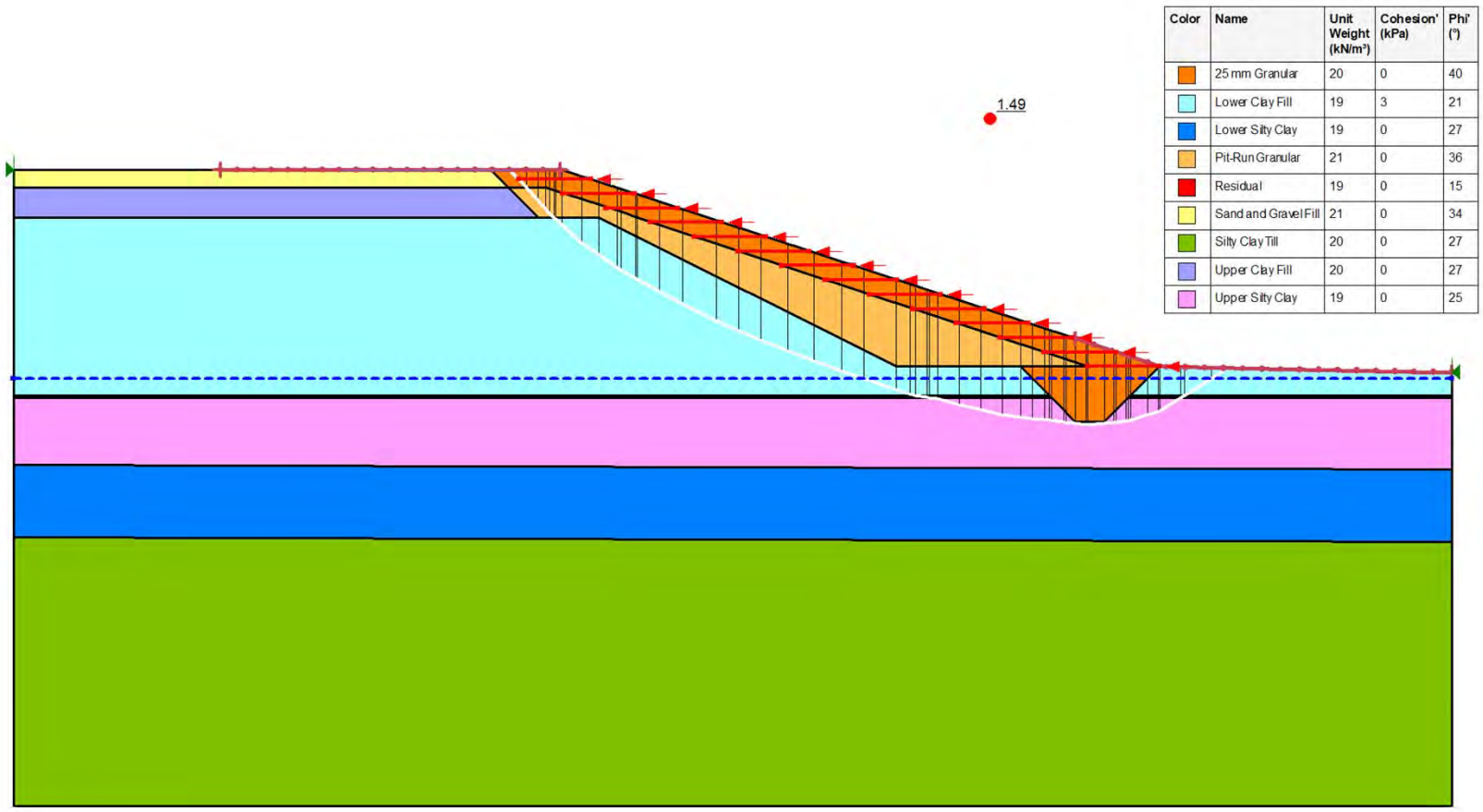
PROJECT
PSPC ALASKA HIGHWAY SLIDE MITIGATION KM 155.5

CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-23
PREPARED	J.BRUNSWICK
DESIGN	J.BRUNSWICK
REVIEW	R.JASSAL
APPROVED	R.WILLIAMS

TITLE
SLOPE STABILITY ASSESSMENT
EXISTING SLOPE CONDITION WITHOUT WEAK (RESIDUAL) LAYER

PROJECT No.	Phase	Rev	FIGURE
19129643	****	0	H2



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	25 mm Granular	20	0	40
	Lower Clay Fill	19	3	21
	Lower Silty Clay	19	0	27
	Pit-Run Granular	21	0	36
	Residual	19	0	15
	Sand and Gravel Fill	21	0	34
	Silty Clay Till	20	0	27
	Upper Clay Fill	20	0	27
	Upper Silty Clay	19	0	25

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
PSPC ALASKA HIGHWAY SLIDE MITIGATION KM 155.5

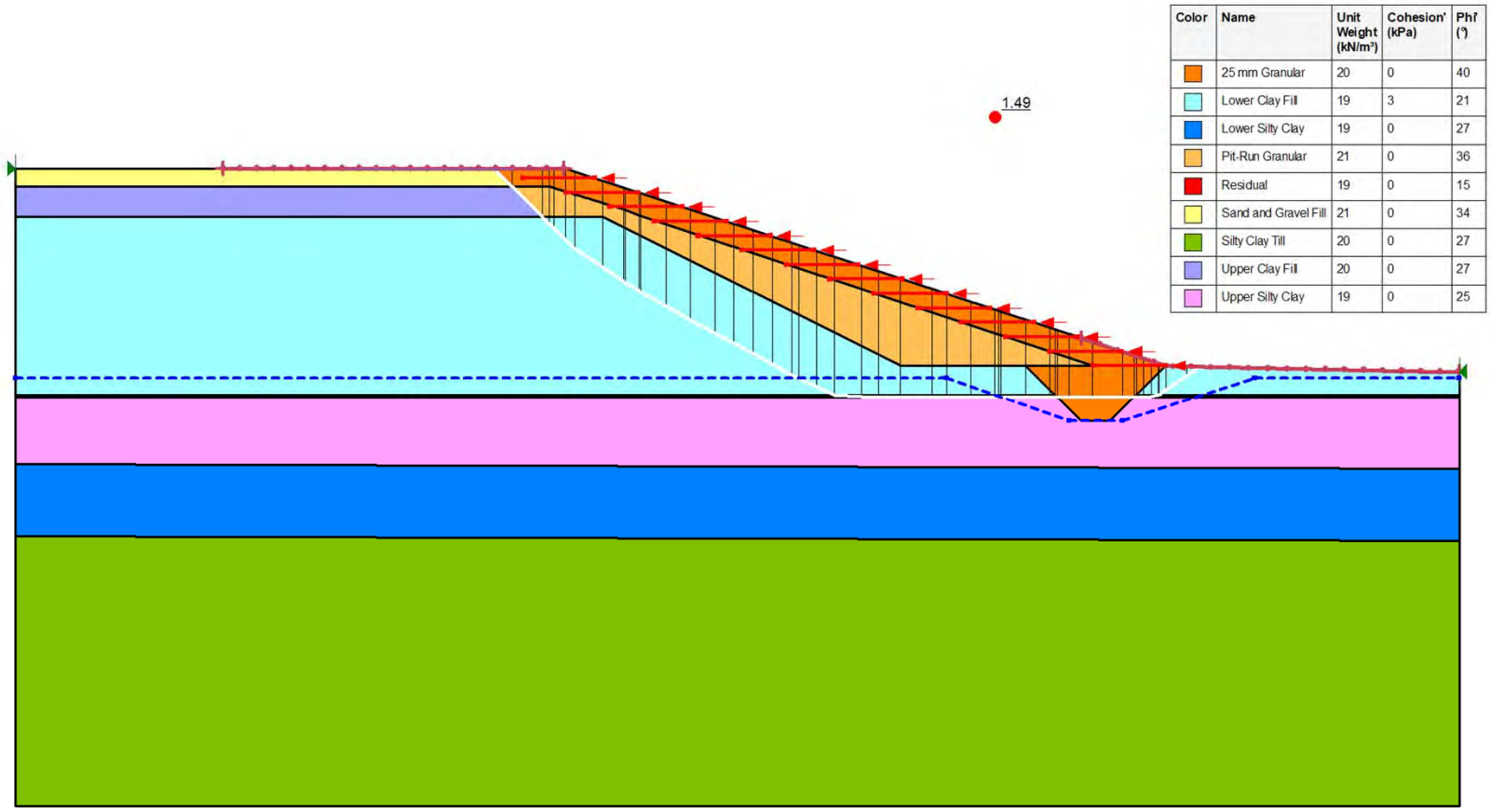
CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-23
PREPARED	J.BRUNSWICK
DESIGN	J.BRUNSWICK
REVIEW	R.JASSAL
APPROVED	R.WILLIAMS

TITLE
SLOPE STABILITY ASSESSMENT
EXISTING SLOPE CONDITION WITH WEAK (RESIDUAL) LAYER ABOVE BASE OF SHEAR KEY AND NO GROUNDWATER DRAWDOWN

PROJECT No.	Phase	Rev	FIGURE
19129643	****	0	H3

https://golderassociates.sharepoint.com/sites/114909/Project%20Files/6%20Deliverables/Issued%20to%20Client_For%20WP/19129643-011-R-Rev0/APP%20H/03_Slope%20Stability%20Output/Figures%20-%20APP%20H.pptx



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	25 mm Granular	20	0	40
	Lower Clay Fill	19	3	21
	Lower Silty Clay	19	0	27
	Pit-Run Granular	21	0	36
	Residual	19	0	15
	Sand and Gravel Fill	21	0	34
	Silty Clay Till	20	0	27
	Upper Clay Fill	20	0	27
	Upper Silty Clay	19	0	25

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
PSPC ALASKA HIGHWAY SLIDE MITIGATION KM 155.5

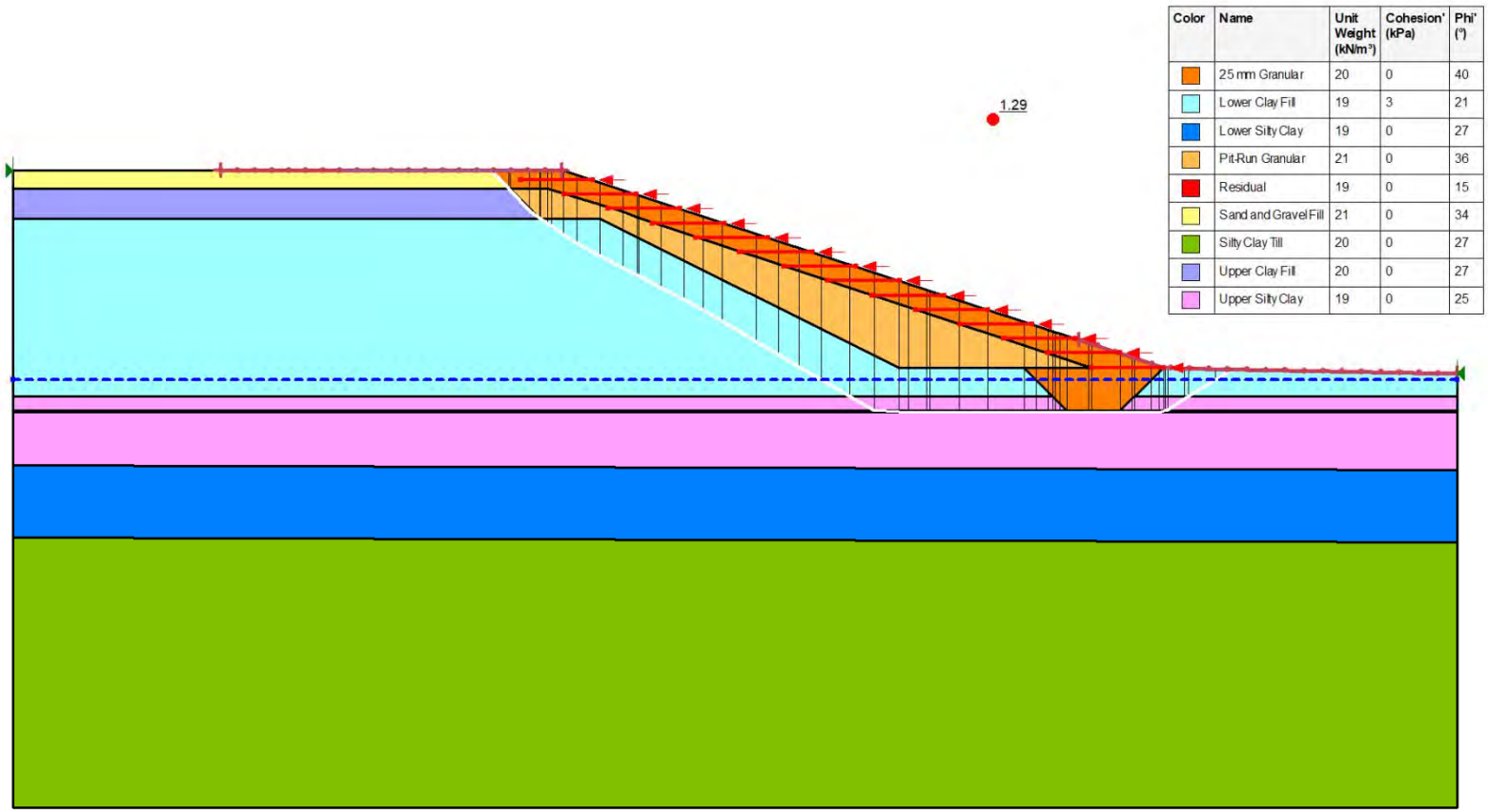
CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-23
PREPARED	J.BRUNSWICK
DESIGN	J.BRUNSWICK
REVIEW	R.JASSAL
APPROVED	R.WILLIAMS

TITLE
SLOPE STABILITY ASSESSMENT
EXISTING SLOPE CONDITION WITH WEAK (RESIDUAL) LAYER ABOVE BASE OF SHEAR KEY AND GROUNDWATER DRAWDOWN

PROJECT No.	Phase	Rev	FIGURE
19129643	****	0	H4

https://golderassociates.sharepoint.com/sites/114909/Project%20Files/6%20Deliverables/Issued%20to%20Client_For%20WP/19129643-011-R-Rev0/APP%20H/03_Slope%20Stability%20Output/Figures%20-%20APP%20H.pptx



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	25 mm Granular	20	0	40
	Lower Clay Fill	19	3	21
	Lower Silty Clay	19	0	27
	Pit-Run Granular	21	0	36
	Residual	19	0	15
	Sand and Gravel Fill	21	0	34
	Silty Clay Till	20	0	27
	Upper Clay Fill	20	0	27
	Upper Silty Clay	19	0	25

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
PSPC ALASKA HIGHWAY SLIDE MITIGATION KM 155.5

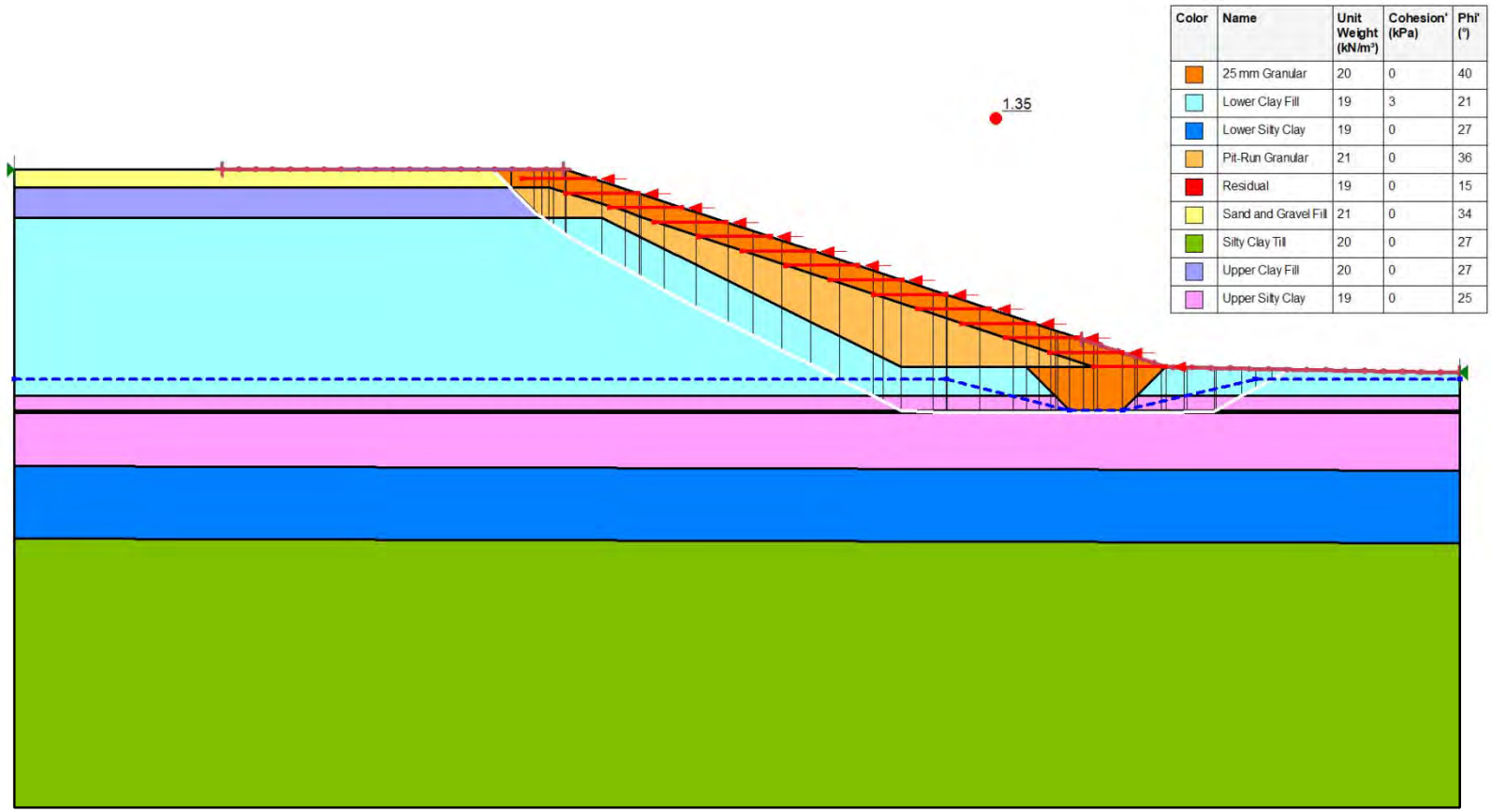
CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-23
PREPARED	J.BRUNSWICK
DESIGN	J.BRUNSWICK
REVIEW	R.JASSAL
APPROVED	R.WILLIAMS

TITLE
SLOPE STABILITY ASSESSMENT
3H:1V REINFORCED SLOPE WITH WEAK (RESIDUAL) LAYER BELOW BASE OF SHEAR KEY AND NO GROUNDWATER DRAWDOWN

PROJECT No.	Phase	Rev	FIGURE
19129643	****	0	H5

https://golderassociates.sharepoint.com/sites/114909/Project%20Files/6%20Deliverables/Issued%20to%20Client_For%20WP/19129643-011-R-Rev0/APP%20H/03_Slope%20Stability%20Output/Figures%20-%20APP%20H.pptx



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	25 mm Granular	20	0	40
	Lower Clay Fill	19	3	21
	Lower Silty Clay	19	0	27
	Pit-Run Granular	21	0	36
	Residual	19	0	15
	Sand and Gravel Fill	21	0	34
	Silty Clay Till	20	0	27
	Upper Clay Fill	20	0	27
	Upper Silty Clay	19	0	25

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
PSPC ALASKA HIGHWAY SLIDE MITIGATION KM 155.5

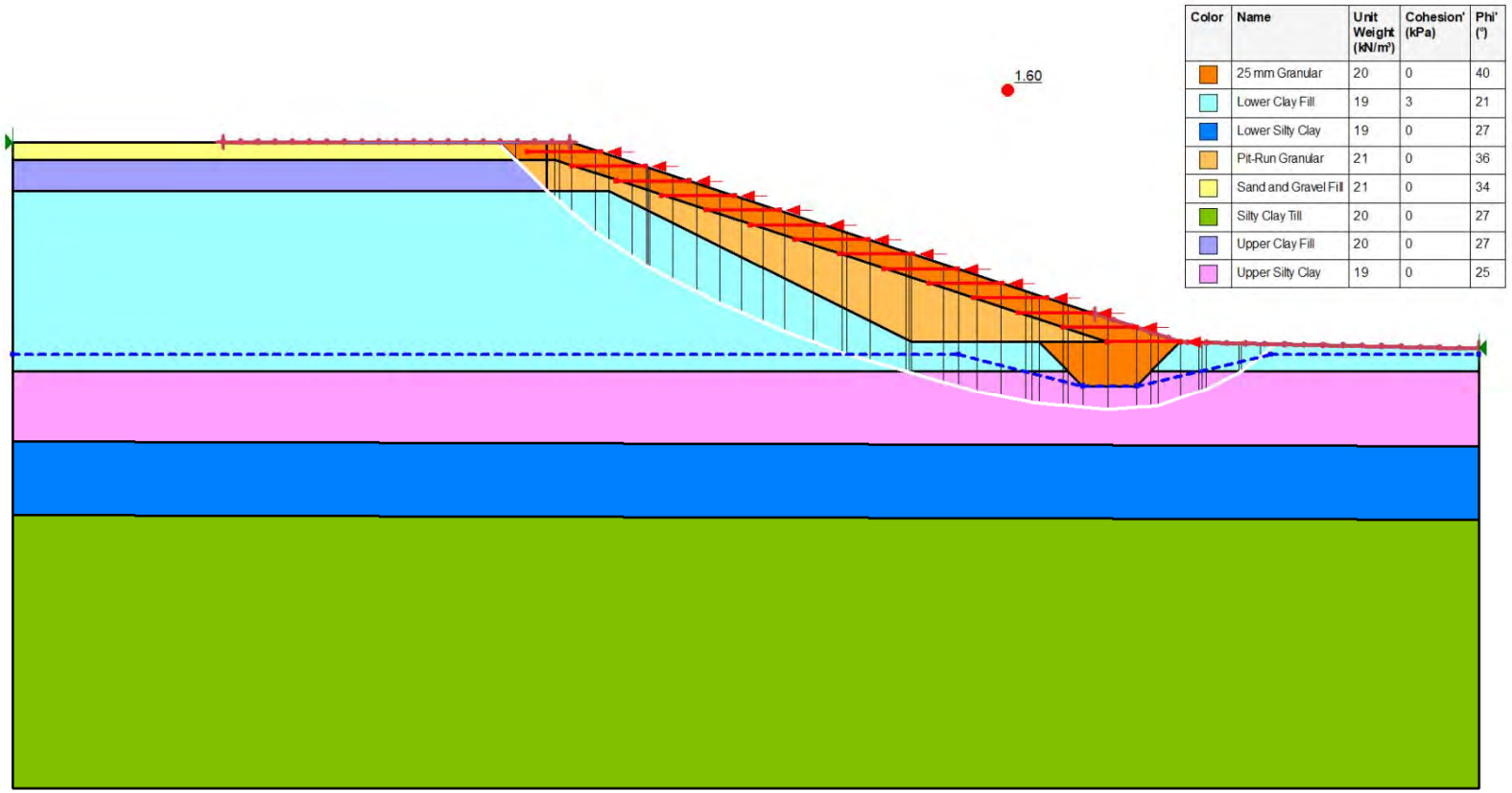
CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-23
PREPARED	J.BRUNSWICK
DESIGN	J.BRUNSWICK
REVIEW	R.JASSAL
APPROVED	R.WILLIAMS

TITLE
SLOPE STABILITY ASSESSMENT
3H:1V REINFORCED SLOPE WITH WEAK (RESIDUAL) LAYER BELOW BASE OF SHEAR KEY AND GROUNDWATER DRAWDOWN

PROJECT No.	Phase	Rev	FIGURE
19129643	****	0	H6

https://golderassociates.sharepoint.com/sites/114909/Project%20Files/6%20Deliverables/Issued%20to%20Client_For%20WP/19129643-011-R-Rev0/APP%20H/03_Slope%20Stability%20Output/Figures%20-%20APP%20H.pptx



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	25 mm Granular	20	0	40
	Lower Clay Fill	19	3	21
	Lower Silty Clay	19	0	27
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	Silty Clay Till	20	0	27
	Upper Clay Fill	20	0	27
	Upper Silty Clay	19	0	25

CLIENT
PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT
PSPC ALASKA HIGHWAY SLIDE MITIGATION KM 155.5

CONSULTANT
GOLDER

YYYY-MM-DD	2020-09-23
PREPARED	J.BRUNSWICK
DESIGN	J.BRUNSWICK
REVIEW	R.JASSAL
APPROVED	R.WILLIAMS

TITLE
SLOPE STABILITY ASSESSMENT
3H:1V REINFORCED SLOPE WITHOUT WEAK (RESIDUAL) LAYER AND GROUNDWATER DRAWDOWN

PROJECT No.	Phase	Rev	FIGURE
19129643	****	0	H7

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