Public Works and Government Services Canada

Requisition No. EZ899-152432/A

SPECIFICATIONS

For

Km 742.5 to Km 750.3 Highway Realignment Alaska Highway, BC

Project No. R.017173.801 March, 2015

APPROVED BY:

Alaska Hwy Program Manager, EASS — March-20-2015 Date

Construction Safety Coordinator — 2015-03-20 Date

TENDER:

Project Manager — March 19/2015 Date

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Specification / Drawings Index		Start Page
DIVISION 1 - GENERAL REQUIREMENTS		
01 11 10	Summary of Work	1
01 14 00	Work Restrictions, Access Development, Construction Staging, and Restoration	12
01 25 20	Mobilization and Demobilization	18
01 29 00	Payment Procedures	20
01 31 00	Project Management and Coordination	23
01 32 16	Construction Progress Schedules – Bar (Gantt) Chart	28
01 33 00	Submittal Procedures	31
01 35 00.06	Special Procedures – Traffic Control	36
01 35 33	Health and Safety	44
01 35 43	Environmental Protection	56
01 45 00	Quality Management	72
01 52 00	Construction Facilities	83
01 56 00	Temporary Barrier and Enclosures	86
01 59 10	Construction Camp	88
01 74 11	Cleaning	90
01 77 00	Closeout Procedures	91
01 78 00	Closeout Submittals	92
DIVISION 2 – EXISTING CONDITIONS		
02 41 13	Selective Site Demolition	94
02 61 33	Hazardous Materials	98
DIVISION 10 – SPECIALTIES		
10 14 53	Traffic Signage	102

DIVISION 31 – EARTHWORKS

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – SPECIALTY

DIVISION 34 – PRECAST CONCRETE

DIVISION 35 – MISCELLANEOUS

APPENDICES

Appendix	Description
A	Km 737 – 750.3 Highway Realignment, Alaska Highway, BC, Factual Geotechnical Data Report, Tetra Tech EBA – March 17, 2015
B	Environmental Protection Plan (EPP) – Checklist.
C	Responsibility Checklist For Authorizations/Approvals/Notifications/Permitting
D	Relevant Environmental Publications
E	PWGSC Preliminary Hazard Assessment Form *(Please Note: The Preliminary Hazard Assessment Form is provided for the Contractor's general information and reference only. PWGSC takes no responsibility for the completeness or any misrepresentation by the Contractor of the on-site hazards based on the information provided in the Preliminary Hazard Assessment Form. The Contractor shall remain responsible for the identifying and mitigating against all hazards on the project.*
F	KM 737 – 743.1 Highway Realignment Alaska Highway, BC – Issued for Tender Drawings
G	PWGSC Environmental Effects Evaluation (EEE) *Note: Document to be provided via amendment during the tendering period.*

REFERENCE DOCUMENTATION

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

Available online at:

http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf

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

Available online at:

http://www.dfo-mpo.gc.ca/Library/165353.pdf

LIST OF CONTRACT DRAWINGS

Sheet No.	Title	Drawing Number	Revision Number
1	Cover Page	C000	0
2	Project Location Plan, Project Key Plan, Drawing Index, Survey Monuments and Legend	C001	0
3	Plan / Profile	C110 – C123	0
4	Drainage and Associated Road Details	C201, C202, C203, C204, C205, C206,	0
5	Typical Sections	XS22 – XS74	0

PART 1 – GENERAL

1.1 Section Includes

.1 Specification Precedence.

.2 Work Covered by Contract Documents.

.3 Codes.

.4 Contractor's Use of Site.

.5 Owner Supplied Materials.

.6 Access to Owner Gravel Pits and Quarries.

.7 Work Completion.

.8 Site Inspection.

.9 Special Precautions.

.10 Survey.

.11 Electronic Contract Drawings.

.12 Contract Submittals.

.13 Supervisory Personnel.

.14 Special Requirements.

.15 Work by Others.

1.2 Specification Precedence

.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 these Specifications and an item found in one of the Reference Documents (Appendices), the Specifications shall govern.

1.3 Work Covered by Contract Documents

.1 The project includes.

.1 Improvements and realignments to the highway from Km 742+560 to Km 750+300

.2 The completion of previously completed improvements from Km 736+988 to 742+560 through the reshaping of crushed base gravel, placement of bituminous surface treatment (BST), and line painting.

For reference, Dawson Creek is at Km 0, Fort St. John is at approximately Km 75 and Fort Nelson is at approximately Km 455, Watson Lake is at approximately Km 986 on the Alaska Highway.

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

.1 Completion and submission of accepted submittals listed for review and acceptance by the Departmental Representative prior to the undertaking the work effected by the submittal.

.2 Clearing, removal, and burning or disposal of trees, brush and other vegetation within the designated construction footprint.

.3 Grubbing of stumps and organic materials within the designated construction footprint.

.4 Stripping of topsoil material, temporary stockpile, and reuse as topsoil.

.5 Pulverization of exiting and decommissioned portions of highway Bituminous Surface Treatment (BST).

.6 Development of construction access to facilitate construction. Restoration of the disturbed areas following the construction.

.7 Excavation, transport, place, and compact material for roadway embankment.

.8 Excavate, manufacture, transport, place, and compact crushed base gravel, sub-base course, and select subgrade fill material for roadway construction.

.9 Remove and dispose of existing drainage culverts and reinstate drainage channels where required.

.10 Supply and install drainage infrastructure including aluminized CSP culverts, culvert inlet and outlet riprap protection, ditch armouring, cut slope drainage swales, and ditch blocks.

.11 Design, supply, and install a large diameter SPCSP or Concrete Box Culvert.

.12 Design, supply, and install wire mesh faced mechanically stabilized earth (MSE) retaining wall.

.11 Remove and temporarily stockpile for later re-use, precast concrete barriers and lock blocks. Transport and dispose off-site, damaged precast concrete barriers and lock blocks.

.12 Supply and install precast concrete barriers and lock blocks.

.13 Remove and stockpile for re-use by others the existing traffic signage and posts.

.14 Supply and install BST and permanent line painting. Including BST and permanent line painting on a section of previously highway outside the limits of the work.

.15 Supply and install permanent traffic signage.

.16 Restoration to pre-construction conditions and Hydroseeding of disturbed areas and decommissioned highway.

.17 Construction layout surveys, quantity surveys, and as-built surveys.

.18 Environmental protection and monitoring.

.19 Traffic management including maintaining safe and efficient public traffic flow through the limits of the work via the implementation of the contractor's construction staging plans with the details of all required temporary lanes, traffic control, signage, and detours for the duration of the works.

.20 Dust control.

.21 Quality management and quality control.

.22 Work complete by Change Order (if required).

1.4 Codes

.1 Meet or exceed requirements of:

.1 Contract Documents;

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

.3 Other codes of Local, Provincial, or Federal application (in the case of conflict or discrepancy, the more stringent requirements shall apply).

.2 Perform all instream work and riparian work in accordance

with the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) Section 9 Approval for Instream Work, and the contract requirements.

1.5 Contractor's Use of Site

.1 Restrict work to within the limits shown on the drawings.

.2 Any additional areas required by the Contractor outside the lands owned by the Departmental Representative and designated for use on this project, shall be the Contractor's responsibility to organize. Any costs associated with the use of these additional lands shall be the Contractor's responsibility.

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

1.6 Owner Supplied Materials (Outside Limits of Work)

.1 PWGSC is providing access to the "as is" materials previously manufactured and stockpiled in the Km 750 Gravel Pit for use by the Contractor on this project. See Section 31 05 16 – Aggregates and Appendix A – Geotechnical Site Investigation Data Report – Km 737 – 750.3 Alaska Highway, BC for more details. A survey completed in October 2013 indicated that the following material quantities are available:

.1 6.35 mm Minus – 7,800 m^3

.2 12.7 mm Minus – 20,400 m^3

.3 19.05 mm Minus – 12,700 m^3

The Contractor will be responsible to ensure the selected material achieves the gradation requirements and other product requirements as detailed Section 31 05 16 – Aggregates for each material type the material is being used.

Note, base plan (contours) shown on contract drawings assume stockpiled materials have been removed.

.2 PWGSC is providing the Contractor access to the previously blasted and stockpiled rock at the Wood Creek Quarry (Km 650) for use by the Contractor as 50 Kg Class Riprap, and 250 Kg Class Riprap (see Section 31 37 00 – Riprap and Surface Drainage Material). The Contractor will be responsible for sorting through the stockpiled rock and selecting the appropriate rock which achieves the required gradation.

1.7 Access to Owner Gravel Pits and Quarries

.1 The Contractor's use of PWGSC's gravel pits and quarries as listed elsewhere within the specifications for the purposes of extraction / manufacture of granular materials and rock shall be subject to the following:

.1 Other Contractors may be working in the gravel pits and quarries completing similar or different types of work. Coordination with these other Contractors may be required.

.2 Laydown areas for equipment and stockpiles may be restricted due to other works ongoing or the existing size of the gravel pits and quarries.

.3 The security of equipment parked and material manufactured and stockpiled in the gravel pit and quarries along with the safety of the contractors personnel remains the Contractors responsibility.

PART 2 – EXECUTION

2.1 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.

.2 Refer to Invitation to Tender and Special Instructions to Bidders (SI) for details of the pre-tender meeting.

2.2 Work Completion

.1 Preparation of required submittals to commence any time after receipt of notice to proceed and be completed in sufficient time as to not delay the work.

.2 Commence onsite work on after June 1, 2016.

.3 Achieve Substantial Performance by October 15, 2016.

.4 Achieve Completion by October 30, 2016.

.5 Works may need to be temporally shut down during high flow, heavy rain events, or 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 river water level or adverse weather conditions adversely affect the Contractors 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 the high flows or adverse weather conditions.

.3 The Departmental Representative in conjunction with

MFLNRO 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 the high flows or adverse weather conditions.

.6 Regardless of who suspends the work, the Contractor will be responsible for maintaining the site and protecting the works throughout the suspension period.

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

2.3 Special Precautions

.1 The Contractor's attention is drawn to the possibility of impacting abandoned and live utilities 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, and await instructions from the Departmental Representative before proceeding with work in the vicinity of such encountered services and utilities. See Section 01 14 00 – Work Restrictions, Access Development, Construction Staging, and Restoration for more details.

.2 Existing structures, utilities, BST, culverts, bridges, and all others 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.

2.4 Survey

.1 Complete survey layout for all aspects of construction and payment (see Section 01 29 00 – Payment Procedures) using project survey control as shown on Contract Drawings. Survey methods and equipment shall be per industry standards approved by the Departmental Representative.

.2 Report any discrepancies between project survey control and Contract Drawings to the Departmental Representative as soon as they are discovered. Should a discrepancy be found, await written approval from the Departmental Representative prior to proceeding.

.3 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.

.4 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.

.5 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.

.6 The provision of the records of a survey of existing conditions by the Departmental Representative shall in no way limit or restrict the Contractors 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.

2.5 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 Representatives 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 hard copy contract drawings be discovered (at any time during the work), the hard copy 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

hard copy contract drawings. The Departmental Representative shall not be responsible for updating or correcting any discrepancies between the electronic contract drawings and the hard copy contract drawings identified by the Contractor.

2.6 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 Construction Staging Drawings (see Section 01 14 00).

.2 Project Schedule (see Section 01 32 16).

.3 Traffic Management Plan including (see 01 35 00.06)

.4 Health and Safety Plan (see Section 01 35 33).

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

.6 Quality Management Plan (see Section 01 45 00).

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

.8 Shop Drawings (including professional seal for design work required), Product Data / Samples, and Mix Designs (see Section 33 42 13.01 – Pipe Culverts – Design-Build, and Section 32 32 34 – Retaining Wall – Design-Build, and other sections as applicable).

.9 PWGSC Preliminary Hazard Assessment Form (Appendix E).

2.7 Supervisory Personnel

.1 Within five Days after 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.

.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 independent from the Contractor, experienced in Quality Management, and dedicated to quality matters from commencement of work until Substantial Performance and Completion of the Work (see Section 01 45 00 – Quality Management for further requirements).

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

2.8 Special Requirements

.1 The following special requirements for this project are emphasized for the Contractors attention:

.1 The Contractor shall choose and then design the desired culvert for Km 748+133 from the following options.

.1 2.935 m x 3.25 m vertical ellipse SPCSP.

.2 2.4 m x 3.65 m Concrete Box Culvert.

The Contractor will be responsible for selecting the

desired type of culvert, preparing a design based upon the design criteria and constraints provided, and providing detailed shop drawings for review and acceptance by the Departmental Representative. The shop drawings shall be sealed by a professional engineer qualitied to undertake the work. See Section 33 42 13.01 – Pipe Culverts – Design Build for further details.

.2 The Contractor will be responsible for selecting a wire mesh faced mechanically stabilized earth (MSE) retaining wall type and preparing a design based upon the design criteria and constraints provided. The details of the retaining wall shall be provided to the Departmental Representative for review and acceptance. The shop drawings shall be sealed by a professional engineer qualitied to undertake the work. See Section 33 32 34 – Retaining Wall – Design Build for further details.

.3 The Contractor will be responsible for the install of BST and Line Painting within the limits of the work (Km 742+560 – Km 750+300) and on a section of highway previously upgraded from Km 736+988 – Km 742+560.

Prior to the placement of BST in the section of highway previously upgraded from Km 736+988 – Km 742+560, the existing precast concrete barriers will need to be removed (then replaced following BST placement) and the existing crushed base gravel re-shaped and compacted to the design lines and grades.

The design drawings provide the design lines and grades from Km 736+988 – Km 742+560 are provided in Appendix F.

See Section 32 12 35 – Bituminous Surface Treatment for further details.

.4 Utility relocations by others will be undertaken prior to the commencement of the project work. The existing fiber optic conduit and cable shown on the drawings will be abandoned and a new fiber optic conduit and cable installed beyond the limits of clearing. See 2.9 – Work by others below and Section 01 14 00 – Work Restrictions, Access Development, Construction Staging, and Restoration for further details.

.6 Onsite work will not commence until Commence

onsite work on after June 1, 2016. See 2.2 – Work Completion above for addition project dates.

.7 The Contractor will be responsible for the supply and installation of geotechnical instrumentation in high fill locations to monitor ground conditions during embankment fill placement.

The Contactor will be responsible for the monitoring of settlement rates and movement in the installed toe pegs using survey instruments throughout the placement of materials in the high fill locations. Survey data collected will be provided to the Departmental Representative.

The Departmental Representative will be responsible for the monitoring of data collected by the piezometers and inclinometers throughout the placement of materials in the high fill locations.

The Contractor will be responsible for staging the lifts of embankment and granular material placement per the lift placement requirements in areas of high fills.

See Section 31 24 14 – Roadway Excavation, Embankment, and Compaction for further details.

2.9 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 Contractor 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. New fiber optic conduit will be placed on the native ground surface on average 2 – 3 m beyond limits of the proposed clearing on the east side of the project. In areas where the Trout River encroaches within 3 m of the proposed clearing, the fiber optic conduit may be within the clearing and embankment limits. In this instance the contractor will need to coordinate his operations with the owner of the fiber optic utility to ensure the fiber optic conduit is not damaged (see Section 01 14 00 for further details).

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Use of Work Site.

.2 Work Conducted in and Adjacent to Waterways.

.3 Utilities.

.4 Protection of Persons and Property.

.5 Use of Public Property.

.6 Construction Signage.

.7 Access Development.

.8 Construction Sequencing.

.9 Restoration.

1.2 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 The Contractor's office trailer may be set up in the locations identified in Section 01 52 00 – Construction Facilities. The Contractor's construction camp may be set up in the locations identified in Section 01 59 10.

.3 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.

.4 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.

.5 The Contractor shall provide sanitary facilities for work force 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.

.6 Any damage to the Work Site caused by the Contractor shall be repaired by the Contractor at its expense.

.7 The Contractor may work 24 hours per day, 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 No hauling of material during inclement weather.

1.3 Work Conducted in and Adjacent to Waterways

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

1.4 Utilities

.1 There are active utilities within the Highway Right of Way.

.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 Drawings.

.3 Prior to the commencement of onsite work, the existing fiber optic line shown on the drawing will be abandoned and a new fiber optic conduit and line will be placed on the native ground surface on average 2 m – 3 m beyond limits of the proposed clearing on the east side of the project.

.4 Where the Trout River encroaches within 3 m of the proposed clearing, the new fiber optic cable and conduit may be located within the proposed clearing and embankment limits. Should this occur and the conduit interfere with the work, the Contractor shall notify the Departmental Representative a minimum of seven (7) days in advance.

.5 If it is determined by the Departmental Representative that Utilities are affected by the permanent Work, the utilities will be relocated by Other Contractors. The Contractor shall cooperate and coordinate as required with Other Contractors engaged in Utility relocation operations on the Work Site.

.6 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.

.7 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.

.8 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.

.9 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 the Owner.

1.5 Protection of Persons and Property

.1 The Contractor shall comply with all applicable safety regulations of the Workers Compensation Board of British Columbia (WCB) including, but not limited to,. WCB's 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.

1.6 Use of Public Areas

.1 Off-road construction equipment will not be allowed on the Alaska Highway outside the limits of the work shown on the contract drawings except as designated in the Contractor's Construction Staging / Traffic Management Plans accepted by the Departmental Representative. Steel tracked equipment with cleats will not be allowed on BST outside the limits of the work or BST designated for future use.

.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 and dirt 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 the Owner. 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. Hauling units on Alaska Highway not to exceed legal highway load limits. 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 Highway meets all requirements for vehicles traveling on Public Highways in the Province.

1.7 Construction Signage

.1 No Signs or advertisements, other than regulatory or warning signs, PWGSC 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 35 00.06 – 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.

.5 The Contractor shall install two PWGSC supplied Government of Canada "Accelerated Infrastructure Program" signs at each end of the project in a location approved by the Departmental Representative.

1.8 Access Development

.1 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 shall be submitted to the Departmental Representative for approval on the Construction Staging / Traffic Management Drawings. All construction access shall be completed in conformance with the requirements of Section 01 35 43 – Environmental Protection and the Contractor's Environmental Protection Plan.

1.9 Construction Staging

.1 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 35 00.06 – Special

Procedures – Traffic Control are achieved.

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

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

.2 Prior to undertaking the work, construction staging drawings shall be prepared by the contractor and submitted to the Departmental Representative for review and acceptance a minimum of Ten (10) days prior to undertaking the work (see Section 01 33 00 – Submittal Procedures). The drawings shall be sealed by a professional engineer qualified to undertake the design work. The construction staging drawings shall cover each construction staging scenario and situations over the length of the project and shall:

.1 Describe / show graphically the proposed stages of construction to complete the work.

.2 Describe / show graphically how vehicle traffic will be accommodated throughout all stages of the work.

.3 Example representative construction staging drawing(s) are provided with the contract drawings to provide the Contractor with an example of the level of expected detail from the Contractors submitted construction staging drawings and to show the complexity of the staging issues on this project. The staging drawings provided are only example(s) of select construction staging scenarios on the project. The Contractor is responsible to provide construction staging drawings covering all construction staging scenarios and situations on the project.

.4 When preparing staging drawings for the areas of work covered by the example representative construction staging drawings provided with the contract drawings, the contractor may use the staging processes provided on these drawings or if desired, modify the staging processes shown to suite the Contractor's desired process.

1.10 Restoration

.1 Remove access points, roads, detours, 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 by:

.1 Restoring organic soils (if removed during access development).

.2 Eliminating uneven areas and low spots.

.3 Restoring existing and proposed drainage patterns as shown on the Contract Drawings.

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

.5 Hydroseeding all disturbed areas and areas designated for hydroseeding, per Section 32 93 21 – Hydroseeding.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Definitions.

.2 Measurement and Payment Procedures.

1.2 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, Construction Staging Plans, 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 cost incurred in the establishment and operation of offices, camps, and other facilities necessary to undertake the work.

.4 Removal and stockpiling of existing regulatory signage and posts designated for removal within the limits of the work.

.5 Installation and removal (if requested) of two PWGSC supplied Government of Canada "Accelerated Infrastructure Program" signs at each end of the project.

.6 Work and costs incurred in the completion of clean-up and project completion.

.7 All other work and costs incurred in the successful completion of mobilization and demobilization.

1.3 Measurement and Payment Procedures

.1 Payment for Mobilization and Demobilization will be made on the basis of the Price per Unit Bid for Mobilization in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs associated with the items of work listed in 1.2 Definition above.

.2 Payment for this item will be made at the Lump Sum price and will be scheduled as follows:

.1 50% at the beginning of construction (to a maximum of 5% of the total Tender Price) after the Contractor required submittals (including Construction Schedule,

Traffic Management Plan, Quality Management Plan, Environmental Protection Plan, Construction Staging, and any other submittals required prior to starting work) have been submitted for approval, accepted, and work onsite has commenced to the satisfaction of the Departmental Representative.

.2 The remainder once the project has achieved "Completion" and the site has been cleaned to the satisfaction of the Departmental Representative.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Basis of Payment.

.2 Survey.

1.2 Basis of Payment

.1 Basis of payment shall be per the Measurement and Payment Procedures in the applicable 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 (when required)), surveyed, and accepted by the Departmental Representative in the field. Provide to the Departmental Representative for each progress claim, survey data at each stage of construction to support progress claim quantities for each unit price item.

.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 1.3 of Section 01 25 20).

.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.

.6 Any work called for in the specifications or shown on the 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 pre-approved 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 Representatives 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 Representatives survey data indicates that materials were excavated or placed outside / beyond the specified tolerances of the design lines and grades on the contract drawings.

1.3 Survey

.1 Surveys shall be undertaken by the Contractor to verify quantities for payment purposes. Survey shall be considered incidental to the work and not measured for payment.

.2 Survey data collected shall be of sufficient density to fully characterize the work. Survey methods and location of surveyed cross sections is subject to prior approval of the Departmental Representative. At a minimum the Contractor shall survey the location of all treatment boundaries including changes in material type / placement, changes in surface treatment, and changes in the terrain.

.3 A survey of the existing ground surfaces, river banks, stream channels, and other topographic features shall be undertaken by the Contractor prior to initiation of construction. The survey shall be provided to the Departmental Representative for review and acceptance. Additionally, 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.

.4 Survey data shall be collected at an accuracy of +/-0.05 m horizontal and +/-0.05 m vertical or better and shall be referenced to the project elevation and coordinate grid system.

.5 Survey data shall be provided to the Departmental Representative in digital xyz format.

.6 The Contractor shall provide 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.

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

.8 All survey data provided to PWGSC shall utilize the coordinate system / tie into the survey control monuments as shown on the contract drawings.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Pre-construction Meeting.

.2 On-Site Documents.

.3 Schedules.

.4 Construction Progress Meetings.

.5 Submittals.

.6 Close-Out Procedures.

1.2 Pre-construction Meeting

.1 Following award of the contract and prior to the Contractor mobilizing to the site, 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, 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 days prior to the meeting. The Contractor shall notify all concerned parties of the meeting.

.4 The agenda is 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 Project schedule.

.3 Contractor submissions (requirements and submissions schedule).

.4 Requirements for temporary facilities, site sign, offices, construction camp, storage sheds, utilities, and fences.

.5 Permitting and Environmental requirements.

.6 Site security in accordance with Section 01 52 00 – Construction Facilities.

.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.

.8 Record drawings in accordance with Section 01 78 00 – Closeout Submittals.

.9 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 – Closeout Procedures.

.10 Monthly progress claims, administrative procedures, photographs, and holdbacks.

.11 Contractor's Quality Management and Quality Assurance undertaken by the Departmental Representative.

.12 Insurances and transcript of policies.

.13 Other business as required by the Departmental Representative or Contractor.

.5 Within 7 working 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 5 working days.

1.3 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 Manufacturer's installation and application instructions (if applicable).

.10 All permits (MFLNRO, DFO, NWPA, and/or others as required by the Contractor).

.11 Meeting minutes.

1.4 Schedules

.1 Submit preliminary construction progress schedule in accordance with Section 01 32 16 – 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, revise and resubmit as directed by Departmental Representative.

1.5 Construction Progress Meetings

.1 During the course of work the Departmental Representative may schedule construction progress meetings approximately every two weeks.

.2 Departmental Representatives and senior representatives of the Contractor, including but not necessarily limited to the Project Superintendent and major subcontractors shall be shall attend in person. Other contractor representatives including the Deputy Project Superintendent, Health and Safety Coordinator, Quality Control Manager, and Environmental Monitor 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 days prior to the meeting. The Contractor shall notify all concerned parties of the meeting.

.4 The meetings may be held on-site provided teleconference capabilities are available or at PWGSC's office in Fort Nelson. If held on site, the contractor shall provide physical space and make arrangements for the meetings.

.5 Agenda to include following:

.1 Review and approval of minutes of previous meeting.

.2 Review of work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules (if applicable).

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule and project submittals.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on construction schedule and on completion date.

.12 Other business.

.6 Within 7 working 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 5 working days.

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 PWGSC's cloud based system "CentralCollab". Support claims for payment with survey data and other evidence as required by the Departmental Representative.

.3 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative. If required by the Departmental Representative, provide supporting documents for proposed substitutions via PWGSC's cloud based system "CentralCollab".

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

.5 Process change orders through Departmental Representative via PWGSC's cloud based system "CentralCollab".

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

1.7 Closeout Procedures

.1 Notify Departmental Representative when work is considered ready for Substantial Performance.

.2 Accompany Departmental Representative on preliminary inspection to determine items listed for completion or correction.

.3 Comply with Departmental Representative's instructions for correction of items of work listed in executed certificate of Substantial Performance.

.4 Notify Departmental Representative of instructions for completion of items of work determined in Departmental Representative's final inspection.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Progress schedule.

.2 Schedule format.

.3 Submission of schedules.

.4 Critical path scheduling.

.5 Project Schedule Reporting.

1.2 Project Schedule

.1 Develop detailed Project Schedule derived from Master Plan in accordance with the project completion date found in Section 01 11 10 – Summary of Work.

.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 Environmental Protection Plan.

.2 Traffic Management Plan / Detour Plan.

.3 Construction Staging / Site Access.

.4 Quality Management Plan.

.5 Site Specific Health and Safety Plan, including MSDS sheets.

.6 Material Purchase Plan.

.7 Survey Plan.

.8 If applicable, Shop Drawings, product date, and samples.

.4 Mobilization.

.5 Work activities by segment / locations.

.6 Interim inspections.

.7 Site Clean-up / De-mobilization.

.8 Project Substantial Completion and Project Completion dates.

.3 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.

.4 Include dates when reviewed submittals will be required from the Departmental Representative.

1.3 Schedule Format

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

.2 Provide a separate bar for each major item of work or operation.

.3 Split horizontally for projected and actual performance.

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

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

.6 Identification of listings by systems description.

1.4 Submission of Schedules

.1 Submit initial format of schedules within 12 days after award of Contract.

.2 Submit schedules in electronic format via PWGSC's cloud-based system "CentralCollab" (login details to be provided by Departmental Representative at time of submission following contract award). Provide schedules in PDF format and native file format if requested by the Departmental Representative.

.3 If requested submit two hard copies to be retained by the Departmental Representative.

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

.5 Resubmit finalized schedule within five days after return of review copy.

.6 Submit revised progress schedule with each application for payment.

.7 Distribute copies of revised schedule to:

.1 Job site office.

.2 Subcontractors.

.3 Other concerned parties.

.8 Instruct recipients to report to Contractor within ten days any problems anticipated by timetable shown in the schedule.

1.5 Critical Path Scheduling

.1 Include complete sequence of construction activities.

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

.3 Show projected percentage of completion of each item as of the first day of the month.

.4 Indicate progress of each activity to date of submission schedule.

.5 Show changes occurring since previous submission of schedule:

.1 Major changes in scope.

.2 Activities modified since previous submission.

.3 Revised projections of progress and completion.

.4 Other identifiable changes.

.6 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 Contractor's.

1.6 Project Schedule Reporting

.1 Update project schedule on a monthly basis reflecting activity changes and completions, as well as activities in progress.

.2 Discuss project schedule at Construction Progress Meetings, identify activities that are behind schedule and provide measures to regain slippage.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 General requirements.

.2 Shop drawings and product data.

.3 Samples.

1.2 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 PWGSC's cloud-based system "CentralCollab" (login details to be provided by Departmental Representative at time of submission following contract award).

.3 Submittal reviews by the Departmental Representative will be completed within two weeks of the receipt of the submittal. 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 submittal back to the Departmental Representative for review within one week. The submittals will not be accepted until all comments from all reviews have been addressed to the satisfaction of the Departmental Representative.

.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.

1.3 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. If adjustments affect the value of work, state such in writing to the Departmental Representative prior to proceeding with 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 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by the 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 the Departmental Representative's review and acceptance, distribute copies.

.8 Submit an electronic copy of the Shop Drawing for each requested within the specification sections. Submit hard copies 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 and 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 that the Departmental Representative approves the detail design inherent in Shop Drawings, responsibility for which shall remain with the Contractor submitting same, and such review 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.

1.4 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.

.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.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and Payment Procedures.

.2 References.

.3 Definitions.

.4 Traffic Management Plan.

.5 Protection of Public Traffic.

.6 Informational and Warning Devices.

.7 Control of Public Traffic.

.8 Operational Requirements.

1.2 Measurement and Payment Procedures

.1 Payment for the cost of Traffic Control will be made on the basis of the Price per Unit Bid for Traffic Control in the Bid and Acceptance Form. The Price per Unit Bid shall include the completion of the Traffic Management Plan, signage, temporary concrete barriers and privacy fence, gravel shouldering (where required), traffic flaggers or automated traffic control devices and all other items necessary for the successful completion of the task.

.2 Measurement for Payment for completion of the Traffic Control will be made by Lump Sum based on the percentage of the work completed and accepted by the Departmental Representative.

1.3 References

.1 British Columbia Ministry of Transportation and Highways:

.1 Traffic Control Manual for Work on Roadways (latest edition)

.2 Traffic Management Guidelines for Work on Roadways (latest edition)

.3 Electrical and Traffic Engineering Manual (latest edition and all current technical bulletins)

.4 Supplement to TAC Geometric Design Guide (latest edition)

.2 Transportation Association Canada:

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

.3 Province of British Columbia:

.1 Workers Compensation Act Part 3 – Occupational Health and Safety

.2 Occupational Health and Safety Regulation

1.4 Definitions

.1 Delay – The total amount of time vehicles are stopped by all flaggers or automated traffic control devices due to the contractors 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 1.9.1.1 – Control of Public Traffic (20 min).

.2 Limits of Work – The limits of work for this project are defined as Km 742+560 and Km 753+300 as shown on the drawings.

During the reshaping of the Crushed Base Gravel, BST Placement, and Line Painting, the limits of work for the project are defined as Km 736+987 and Km 750+300.

1.5 Traffic Management Plan

.1 Provide for review and acceptance a Traffic Management Plan to the Departmental Representative. The Traffic Management Plan shall provide a complete and unambiguous plan of the traffic accommodation strategies proposed for use during the work. The Traffic Management Plan:

.1 Shall be fully integrated with the Contactor's plan, schedule, and the accepted construction staging drawings for carrying out the work.

.2 Shall be developed in accordance with the standards defined in the latest versions of all reference documents listed in 1.3 – References above.

.3 Shall conform with all the requirements of Section 01 35 00.06 – Traffic Control.

.2 The Traffic Management Plan shall be submitted to the Departmental Representative for review and acceptance at least 10 days prior to the start of any work affecting traffic flows. The Departmental Representative will review the Traffic Management Plan (first submission and if required subsequent re-submissions) within seven days of submission. Upon review of the plan the Departmental Representative will either:

.1 Reject the plan and provide comments outlining required changes or details of additional information needed. Following completion of edits, re-submit the plan for review.

.2 Accept the plan.

If the plan is rejected, the Contractor shall make edits and re-submit the plan for review and acceptance. Any review or comments requested by the Departmental Representative does not in any way relive the Contractor of any of their responsibilities for ensuring safe and appropriate traffic management. No work that affects the flow of traffic will be permitted until the Traffic Management Plan has been accepted by the Departmental Representative.

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

1.6 Protection of Public Traffic

.1 Comply with current requirements of Acts, Regulations, and By-Laws for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.

.2 When working on travelled highway:

.1 Position equipment to present a minimum of interference and hazard to the travelling public.

.2 Keep equipment units as close together as working conditions permit and preferably on the same side of the travelled highway.

.3 Do not leave equipment on the travelled way overnight.

.3 Do not close any lanes of road or highway without consulting the Departmental Representative. Before re-routing traffic, erect suitable signs and devices in accordance with instructions contained in the accepted Traffic Management Plan and Traffic Control Manual for Work on Roadways (latest edition).

.4 Provide and maintain reasonable access to property in the vicinity of work and in other areas as indicated.

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

.6 Keep travelled way and detours graded, free of pot holes, and of sufficient width for required number of lanes of traffic.

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

.8 Provide dust control.

.9 Complete new grade as soon as practical after disturbing existing roadway surface.

1.7 Informational and Warning Devices

.1 Provide, erect, and maintain signs, flashing warning lights, and other devices required to indicate construction activities and other temporary and unusual conditions resulting from project work that requires road user response as specified in the Traffic Control Manual for Work on Roadways (latest edition).

.2 Supply signs, delineators, barricades, traffic cones, and miscellaneous warning devices in accordance with the Traffic Control Manual for Work on Roadways (latest edition).

.3 Place signs and other devices in locations recommended in the Traffic Control Manual for Work on Roadways (latest edition).

.4 Meet with the Departmental Representative prior to commencement of work to prepare a list of signs and other devices required for the project. If the situation on-site changes, revise the list and review it with the Departmental Representative.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability, and location. Clean, repair, or replace to ensure clarity and reflectance.

.2 Removing or covering signs that do not apply to conditions existing from day to day.

.6 Provide Type D traffic cones as specified in the Traffic Control Manual for Work on Roadways (latest edition).

.7 Ensure that the necessary traffic cones and signs are in place prior to interference with traffic on existing roadways.

.8 Supply and maintain two (2) portable electrically illuminated message signs for the duration of the work. Position the

message signs approximately 1 km outside the limits of the work for the northbound and southbound traffic. Set the message signs to display messages notifying drivers of the construction, safety concerns related to the construction, and other relevant message as outlined in the Traffic Management Plan and agreed to by the Departmental Representative.

1.8 Control of Public Traffic

.1 Provide traffic control in accordance with the standards defined in the latest versions of all reference documents listed above in Section 1.3 – References and the requirements of these contract documents.

.2 Flag persons:

.1 Provide trained, competent flag persons with proof of certification from a recognized training program on traffic control procedures through construction zones.

.2 Provide flag persons with proper equipment and clothing in accordance with the standards defined in the latest versions of all reference documents listed above in Section 1.3 – References.

.3 Flag persons are required in the following situations:

.1 When public traffic is required to pass working vehicles or equipment that blocks all or part of travelled roadway.

.2 When it is necessary to institute a one-way traffic system through the construction area or other blockage where traffic volumes are heavy, approach speeds are high, and traffic signal system is not in use.

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.4 When temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are not readily available.

.6 In situations where complete protection for workers, working equipment, and public

traffic is not provided by other traffic control devices.

.7 When construction traffic is crossing roadway.

.8 At each end of restricted sections where pilot vehicles are required.

.3 Where the highway carrying two-way traffic is to be restricted to one lane alternating traffic for construction purposes, provide continuous (24 hrs. per day) traffic control using flag persons (1 flagger at each end of the work zone). Should the length of the one lane alternating traffic area be ≤ 100 m, the contractor may choose to control the single lane alternating traffic using portable traffic lights setup at each end of the one lane alternating traffic during non-working hours. The portable traffic lights shall meet the requirements of the standards defined in the latest versions of all reference documents listed above in Section 1.3 – References, be pre-approved by the Departmental Representative, and adjusted and regularly maintained during the period of restriction to ensure the timing of light changes are appropriate for the traffic volumes.

.4 Pilot Vehicles.

.1 Provide pilot vehicles equipped with orange flashing lights and signs clearly designating the vehicles as pilot vehicles in the following situations.

.1 Where equipment is working on a section of roadway longer than 300 m of shorter if visibility is limited.

.2 Where traffic is required to travel on partially completed roadway or on detours longer than 300 m of shorter if visibility is limited.

.3 Where it is necessary to institute one-way traffic > 300 in length.

.4 Where access through work would be otherwise dangerous.

.5 Remove travel lane restrictions as soon as completion of the work allows, outside of non-working hours (if possible), and during off-highway construction work.

.6 Changes to traffic control operation are to be reviewed and

accepted by Departmental Representative.

.7 Safely control traffic through unique or varied construction situations.

1.9 Operational Requirements

.1 Maintain traffic flow throughout the period of contract. Traffic flow restrictions shall be consistent with the plan outlined on the accepted Construction Staging drawings and Traffic Management Plan. Traffic may be restricted as follows.

.1 The maximum allowable delay to any individual motorist travelling through the project limits as a result of the Contractor's operations will be 20 minutes.

.2 Posted speed limit reduced to 30 km/h. All finished sections longer than two (2 km) shall be posted at 80 km/h.

.3 Horizontal and vertical geometrics for two Lane / two way traffic shall conform to the requirements as defined in table below.

Table: Roadway Requirements – Temporary Two-way / Two Lane Traffic	
Criteria	**Value**
Design Speed	30 km/hr
Design Vehicle	WB-20
Max Grade	8%
Maximum Superelevation	6%
Minimum Lane Width	3.3 m
Minimum Shoulder Width (Open)	0.5 m
Minimum Shoulder Width (Closed by Barrier)	1.0 m

Other geometric requirements (not listed) shall be in conformance with the BC MoT Supplement to TAC Geometric Design Guide (latest edition), and the Transportation Association Canada Geometric Design Guide for Canadian Roads (latest edition) for a 30 km/hr design speed.

.4 Horizontal and vertical geometrics for single lane alternating traffic shall conform with the requirements as defined in table below.

Table: Single Lane Alternating Traffic	
Criteria	**Value**
Design Speed	30 km/hr
Design Vehicle	WB-20
Max Grade	8%
Maximum Superelevation	6%
Minimum Lane Width	3.3 m
Minimum Shoulder Width (Open, width required both sides of lane)	0.5 m
Minimum Shoulder Width (Closed by Barrier, width required both sides of lane)	1.0 m

Other geometric requirements (not listed) shall be in conformance with the BC MoT Supplement to TAC Geometric Design Guide (latest edition), and the Transportation Association Canada Geometric Design Guide for Canadian Roads (latest edition) for a 30 km/hr design speed.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 References.

.2 Workers' compensation coverage.

.3 Compliance with regulations.

.4 Submittals.

.5 Responsibility.

.6 Health and safety coordinator.

.7 General

.8 Project / site conditions.

.9 Regulatory requirements.

.10 Work permits.

.11 Filing of notice.

.12 Health and safety plan.

.13 Emergency procedures.

.14 Hazardous products.

.15 Overloading.

.16 Fire safety requirements.

.17 Unforeseen hazards.

.18 Posted documents.

.19 Correction of non-compliance.

.20 Medical.

.21 Accidents and Accident Reports.

1.2 References

.1 Government of Canada:

.1 Canada Labour Code - Part II

.2 Canada Occupational Health and Safety Regulations.

.2 National Building Code of Canada (NBC):

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

.3 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 Fire Protection Engineering Services, HRSDC:

.1 FCC No. 301, Standard for Construction Operations.

.2 FCC No. 302, Standard for Welding and Cutting.

.5 American National Standards Institute (ANSI):

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

.6 Province of British Columbia:

.1 Workers Compensation Act Part 3-Occupational Health and Safety.

.2 Occupational Health and Safety Regulation.

.7 PWGSC Preliminary Hazard Assessment Form (Appendix E).

1.3 Workers' 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.

1.4 Compliance with Regulations

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

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

1.5 Submittals

.1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 33 00 – Submittal Procedures.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Submit the following:

.1 Health and Safety Plan.

.2 PWGSC Preliminary Hazard Assessment Form (Appendix E).

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

.4 Copies of incident and accident reports.

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

.6 Emergency Procedures.

.7 Resume of Health and Safety Coordinator detailing the Health and Safety Coordinator's past experience.

.4 The Departmental Representative will review the

Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 14 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

.5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.

.6 Submission of the 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.

1.6 Contractor's Responsibility

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

.2 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

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

1.7 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 site-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 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.

1.8 General

.1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

.2 Secure site during non-work 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.

1.9 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 PWGSC maintenance personnel travelling the highway.

.3 Local wildlife.

.4 Unpredictable and adverse weather conditions.

1.10 Regulatory Requirements

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of conflict between any 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.

1.11 Work Permits

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

1.12 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.

1.13 Health and Safety Plan

.1 Conduct a site-specific hazard assessment based on review of Contract Documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:

.1 Primary requirements:

.1 Contractor's safety policy.

.2 Identification of applicable compliance obligations.

.3 Definition of responsibilities for project

safety/organization chart for project.

.4 General safety rules for project.

.5 Job-specific safe work procedures.

.6 Inspection policy and procedures.

.7 Incident reporting and investigation policy and procedures.

.8 Occupational Health and Safety Committee/Representative procedures.

.9 Occupational Health and Safety meetings.

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

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.

.3 List hazardous materials to be brought on-site as required by work.

.4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.

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

.6 Identify personnel and alternates responsible for site safety and health.

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

.8 Identify wildlife management plans for bears and other large mammal safety.

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

.10 Identify fire safety and fire reporting procedures.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.

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

1.14 Emergency Procedures

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:

.1 Designated personnel from own company.

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

.3 Local emergency resources.

.4 Departmental Representative.

.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.

.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. Submit applicable MSDS and WHMIS documents as per Section 01 33 00 – Submittal Procedures.

.2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.

.3 Provide adequate means of ventilation acceptable

to the Departmental Representative and suitable for the hazard.

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 Fire Safety Requirements

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

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

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 Health and Safety Plan.

.2 Sequence of work.

.3 Emergency procedures.

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

.5 Notice of Project.

.6 Floor plans or site plans.

.7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

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

.9 Material Safety Data Sheets (MSDS).

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

.2 Post all Material Safety Data Sheets (MSDS) on-site, in a common area, visible to all 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 1 hand held emergency siren in all confined access locations.

.3 Provide a minimum of 1 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.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Definitions.

.2 References.

.3 Regulatory Overview.

.4 Submittals.

.5 Environmental Effects Evaluation.

.6 Site Access and Parking.

.7 Protection of Work Limits.

.8 Erosion Control.

.9 Pollution Control.

.10 Equipment Maintenance, Fuelling, and Operation.

.11 Operation of Equipment.

.12 Managing of Invasive Plan Vegetation.

.13 Fires and Fire Prevention and Control.

.14 Wildlife.

.15 Relics and Antiquities.

.16 Waste Materials Storage and Removal.

.17 Wastewater Discharge Criteria.

.18 Camp Wastewater Discharge Criteria.

.19 Drainage.

.20 Site Clearing, Plant Protection, and Nesting Bird Protection.

.21 Environmental Protection Supplies.

.22 Notification.

.23 Environmental Monitoring.

1.2 Definitions

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely

affect human health and welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the 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.
www.agf.gov.bc.ca/cropprot/noxious.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 B).

.4 Responsibility Checklist For Authorizations /Approvals / Notifications / Permitting (Appendix C).

.5 Relevant Environmental Publications (Appendix D).

.6 PWGSC Environmental Effects Evaluation (EEE) Report (Appendix G).

.7 MFLNRO Section 9 Approval for Instream Work (to be provide to the contractor prior to the commencement of onsite work).

1.4 Regulatory Overview

.1 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.

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

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

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

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

.6 Pay specific attention to provincial BC MOE guidelines in Standards and Best Practices for Instream Works (2004).

1.5 Submittals

.1 The Contractor is required to prepare an Environmental Protection Plan (EPP). The EPP should include all relevant environmental impacts/issues at the site as indicated by the completion of the EPP Checklist (Appendix B). Review of the PWGSC Environmental Effects Evaluation (EEE), (Appendix G) will assist in completing this document. Prior to commencing construction activities or delivery of materials to site, submit the EPP (See Appendix B for Checklist) for review and approval by the Departmental Representative. The EPP will require the Contractor to carefully think through the entire project, including identifying what activities as works will be occurring, both generally and at specific sites, and by what methods. The Environmental Protection Plan 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 monitoring program (to be completed by the contractor). This includes

details and rational 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.

.2 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.

.3 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 the requirements of the applicable MOE Approval or Notification for instream work or under MOE guidelines, and all other applicable regulations including the requirements of these specifications.

.4 Drawings should show 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.

.5 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.

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

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

.8 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.

.9 Outline the avoidance and mitigate measures which the Contractor will undertake and implement to ensure compliance with the environmental regulations applicable to the project. The environmental regulations applicable to the project include the all requirements listed in these contract specifications and requirements outlined in the MOE Approval or Notifications for Instream Work (to be provided to the contractor after close of tender, prior to start of the onsite work). Should the MOE Approval or Notifications for Instream Work required additional environmental related tasks or level of effort not described in these specifications, the costs to complete these additional environmental related tasks and or level of effort will be covered by change order.

.10 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.

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

.2 All submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.5 Environmental Effects Evaluation

.1 Execution of the work is subject to the provisions within the Environmental Effects Evaluation (EEE) completed by a PWGSC Environmental Services Representative for the project (See Appendix G).

.2 Pursuant to the expectations of the EEE, EPPs are the next step to achieve the desired results of minimal adverse environmental effect, as the project is constructed.

.3 Failure to comply with or observe environmental protection measures as identified in these specifications may result in the work being suspended pending rectification of the problems.

1.6 Site Access and Parking

.1 The Contractor shall review both short and long 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 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.

1.7 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.

1.8 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 If necessary, 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).

1.9 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 metres 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 metres 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 re-fuelling, 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.

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

.3 Diesel and gasoline delivery vehicles, including bulk tankers shall be not be parked within 100 metres 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 1.9.4 of Pollution Control.

.5 Equipment use on the project shall be fuelled 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 sill-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.

.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.

1.11 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. Where construction activities require working close to surface water, the Contractor is required to describe measures to be employed to ensure fugitive materials (e.g. rocks, soil, branches) and especially deleterious substances (e.g. chemicals) does 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 PWGSC, 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.

1.12 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.

1.13 Fires and Fire Prevention and Control

.1 Comply with Forest Practices Code of British Columbia when burning timber and other organic material resulting from clearing operations. Onsite fires only permitted when approved by Departmental Representative. The burning of other waste products or materials generated as a result of the construction not permitted.

.2 Obtain all required burning permits from the province of British Columbia.

.3 Where fires or burning 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.

.4 A fire extinguisher shall be carried and available for use on each machine and at locations within the quarry in the event of fire. Should the contractor choose to burn timber and organic materials resulting from clearing operations, firefighting equipment (e.g. a water truck; minimum 500 imperial gallons with 500 feet of fire hose and a pump capable of producing 45 psi water pressure at the nozzle, three shovels, two Pulaski's, and two five gallon backpack pumps) shall be maintained at the construction site at a location known and easily accessible to all Contractors' staff. Contactor's staff shall receive basic training in early response to wildfire events during the "environmental briefing".

.5 Construction equipment shall be operated in a manner and with all original manufacturers' safety devices to prevent

ignition of flammable materials in the area.

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

.7 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 start-up meeting.

.8 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.

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

1.14 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, 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.

1.15 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 shall be reported to the Departmental Representative immediately. The Contractor and workers shall wait for instruction before proceeding with their work.

.2 All historical or archaeological objects found in the rock quarry 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.

.3 Human remains must be reported immediately to the local

RCMP.

1.16 Waste Materials 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.

1.17 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 metres from natural drainage courses and 100 metres from fish bearing waters, and will conform to the discharge requirements set out in the provincial Water Act Permit:

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

1.18 Camp Wastewater Discharge Criteria .1 Camp wastewater will be released onto the ground at a location that is a minimum of 30 metres from natural drainage courses and 100 metres from fish bearing waters and conform to the discharge requirements set out in the provincial Water Act Permit.

.2 If unable to meet the discharge criteria, provide additional storage and/or treatment necessary to meet criteria prior to discharge.

.3 Treat all camp wastewater to conform to the discharge

requirements set out in the Water Act Permit.

.4 No direct discharge is allowed to wetland or surface waters.

.5 Contractor must obtain approval from the Water Act Officer prior to discharging treated wastewater.

1.19 Drainage

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water. 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 silt fencing, 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 of 30 metres from natural drainage courses and 100 metres 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.

1.20 Site Clearing, Plant Protection, and Nesting Bird Protection

.1 Notify Departmental Representative of any nesting birds discovered during clearing operations or other works.

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

.3 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.

.4 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.

.5 Minimize stripping of topsoil and vegetation.

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

1.21 Environment Protection Supplies

.1 Comply with federal and provincial fisheries and environmental protection legislation, including preventing the loss or destruction of fish habitat, and minimizing the impact of sedimentation, siltation or otherwise causing a degradation in water quality.

.2 Provide a minimum of 30 m or more and as required of polypropylene silt fence (typical height of 0.9 m) and the necessary stakes for installation. This will be used as necessary to prevent sediment transport into water bodies.

.3 Provide a minimum of 50 lineal metres or more 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, dispose of used silt fence off-site as non-Hazardous Waste. Dispose of used absorbent boom in accordance with Section 02 61 33 - Hazardous Materials.

.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.

1.22 Notification

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

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

.3 Departmental Representative will issue stop order of Work until satisfactory corrective action has been taken.

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

1.23 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 The monitoring program shall satisfy all regulatory requirements and terms of these specifications. The onus is on the Contractor to monitor and ensure compliance, to

identify arising problems, and to subsequently take responsibility and all necessary measures in response. At a minimum, the environmental monitor shall be onsite during all instream works and all works within 10 m of a waterway.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes	.1	Measurement and Payment Procedures
	.2	References.
	.3	Definitions.
	.4	Responsibilities.
	.5	General.
	.6	Quality Management Plan.
	.7	Quality Control Personnel.
	.8	Testing by the Contractor.
	.9	Non-conformance Reports.
	.10	Frequency of QC Documentation and Submittal to Departmental Representative
	.11	Departmental Representative Inspection and Audits.
1.2 Measurement and Payment Procedures	.1	Payment for Quality Management will be made on the basis of the Price per Unit Bid for Quality Management in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for the completion and adherence to the Quality Management Plan including Quality Control and all other items necessary for successful completion of the work.
	.2	Measurement for Payment for Quality Management will be made by Lump Sum of the work completed and accepted by the Departmental Representative.
1.2 References	.1	British Columbia MoT – 2009 Standard Specifications for Highway Construction.
1.3 Definitions	.1	Quality Control (QC): The process of checking specific product or services to determine if they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory product or service performance.
	.2	Quality Assurance (QA): The process of ensuring that the Contractor's Quality Management Plan (QMP) (QC, non-conformances, etc.) are being followed. The results of the QA are provided as feedback to the Contractor. Where required the Contractor shall implement changes to the project based on the feedback received from the QA process.

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

1.4 Responsibilities

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

.1 Quality Control – The Contractors responsibility.

.2 Quality Assurance – The Departmental Representatives responsibility.

.3 Quality Management Plan – Prepared by the Contractor.

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 personnel independent from the Contractor's organization. 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.

.4 The Departmental Representative will review the Contractor's performance of the work and determine the acceptability of the work based on the Departmental Representatives Quality Assurance results and, where deemed appropriate by the Departmental Representative, supplemented by the Contractor's Quality Control results.

.5 Work failing to meet the conditions of the Contract shall be considered a non-conformance. A non-conformance report will then be issued by the Contractor. Non-conforming work shall be removed / replaced from the work.

.6 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.

.7 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 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 Contractor's Quality Management Plan shall be submitted to the Departmental Representative for review and acceptance. 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 either:

.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, re-submit the plan for review.

.3 Reject the plan and provide comments outlining required changes or additional information needed. Following completion of edits, re-submit the plan for review.

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

.4 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.

.5 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 to be completed by the Contractor (e.g. compaction, concrete, aggregate 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 environmental monitoring and reporting procedures to assure that the work is being completed in compliance with the requirements of the MFLNRO Section 9 Approval for Instream Work and all other applicable regulations including the requirements of these specifications.

.4 The Quality Control Plan shall include samples of all forms to be filled in by the Quality Control Personnel (ex. check sheets, test forms, daily reports, NCR's). All forms shall be signed by the Quality Control Manager and submitted promptly to the Departmental Representative.

.5 Procedures for the review of the submissions by the Contractor prior to submission to the Departmental Representative for review approval.

.6 Resumes of Quality Control Manager and designated replacements (if applicable) detailing the Quality Control Manager's past experience performing similar roles on similar projects.

.6 The Quality Management Plan will include the following information:

.1 The name of the Quality Control Manager and qualifications establishing a proven capability to provide the specific services required for the Project.

.2 The name of Quality Control testing agencies and their proven capability to provide the specific services required for the Project.

.3 A listing of Quality Control Staff (including names, qualifications and relevant experience) and their assigned roles and work scheduling in performing Quality Control duties.

.4 A list of testing equipment to be used for the work.

.7 The Quality Management Plan should describe how the Quality Control Personnel are allocated to Project requirements, the tasks assigned to each, and how their work will be coordinated.

.8 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.

1.7 Quality Control Personnel

.1 The Contractor shall appoint qualified, and experienced Quality Control Personnel (Quality Control Manager and Quality Control Staff), who are dedicated to quality matters, and independent from the Contractor's organization. The Quality Control Manager and Quality Control Staff will report regularly to the Contractor's management and report on the Contractor's conformance with the quality requirements on the project.

.2 The Contractor shall designate one person as the Quality Control Manager who shall be responsible for the implementation of the QC Plan. 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.

.3 The Quality Control Manager, or a designated replacement acceptable to the Departmental Representative empowered and able to perform all of the Quality Control Manager's duties, 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.

.4 At a minimum the Quality Control Manager shall:

.1 Be responsible to measure conformance of the work with the contract requirements and ensure that quality 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 Stop work when material, product, processes or submittals are deficient.

.6 Complete internal Non-conformance Reports (NCR's).

.7 Respond to NCR's issued by the Departmental Representative.

.8 Attend pre-construction and construction progress meetings.

1.8 Testing By the Contractor

.1 Testing required to provide Quality Control to assure that the work strictly complies with the Contract requirements shall be completed by the Contractor and at a minimum include:

.1 All testing required to confirm aggregate gradation and compaction where specified.

.2 All testing specified in the Contract Documents.

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

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

.1 The specific frequencies defined elsewhere in these specifications.

.2 The minimum QC testing frequencies as defined in the table below.

Table: Minimum QC Testing Frequencies

Activity	Test / Inspection	Frequency
Manufacture – Crushed Base Gravel	Gradation	The more stringent of: 1 Test per 3000 m^3 Manufactured or 1 test per hour of manufacturing
Manufacture – Sub-base Course	Gradation	The more stringent of: 1 Test per 3000 m^3 Manufactured or 1 test per hour of manufacturing
Manufacture – Select Subgrade Fill Material	Gradation	The more stringent of: 1 Test per 3000 m^3 Manufactured or 1 test per hour of manufacturing
Manufacture – BST Aggregate	Gradation	The more stringent of: 1 Test per 3000 m^3 Manufactured or 1 test per hour of manufacturing
Manufacture – Specialty Embankment	Gradation	The more stringent of: 1 Test per 2000 m^3 Manufactured or 1 test per hour of manufacturing
Manufacture – Cut Slope Stabilization Material	Gradation	The more stringent of: 1 Test per 2000 m^3 Manufactured or 1 test per hour of manufacturing
Screening / Sorting – Riprap	Gradation	1 Test per Every 1 Day of Production
Screening / Sorting – Natural Substrate	Gradation	1 Test per Every 1 Day of Production
Manufacture / Screening / Sorting – Cut Slope Drainage Swale Material	Gradation	1 Test per Every 1 Day of Production
Placement / Site Tolerance –	Survey	Final Lift, 5 points Along Each Cross Section at 10

Crushed Base Gravel		m Stations
Placement / Site Tolerance – Sub-base Course	Survey	Final Lift, 3 points Along Each Cross Section at 20 m Stations
Placement / Site Tolerance – Select Subgrade Fill Material	Survey	Final Lift, 3 points Along Each Cross Section at 20 m Stations
Placement / Site Tolerance – Embankment	Survey	Final Lift, 1 Point every 5 m Measured Along the Cross Section at 20 m Stations
Placement / Site Tolerance – Specialty Embankment	Survey	Final Lift, 1 Point every 5 m Measured Along the Cross Section at 20 m Stations
Placement / Site Tolerance – Cut Slope Stabilization Material	Survey	Final Lift, 1 Point every 5 m Measured Along the Cross Section at 20 m Stations
Placement / Site Tolerance – Riprap	Survey	1 Point every 5 m^2 of Riprap placed or less as approved by the Departmental Representative
Placement / Site Tolerance – Natural Substrate	Survey	1 Point every 5 m^2 of Natural Substrate placed or less as approved by the Departmental Representative
Placement / Site Tolerance – Cut Slope Drainage Swale Material	Survey	1 Point every 5 m^2 of Cut Slope Drainage Swale Material placed or less as approved by the Departmental Representative
Compaction – Crushed Base Gravel	In-Place Density	3 Randomly Located Tests Over the Full Width of Material Placed every 20 m Stations, Per each Lift of Placed Material
Compaction – Sub-base Course	In-Place Density	3 Randomly Located Tests Over the Full Width of Material Placed every 20 m Stations, Per each Lift of Placed Material
Compaction – Select Subgrade Fill Material	In-Place Density	3 Randomly Located Tests Over the Full Width of Material Placed every 20 m Stations, Per each Lift of Placed Material
Compaction – Embankment	In-Place Density	1 Test per 200 m^2 Per Lift of Placed Material or Proof Roll of Full Width of Each lift if 30% or More of the Embankment Material is Oversized (> 19 mm)
Compaction – Pulverized Existing BST for Reconstruction	In-Place Density	3 Randomly Located Tests Over the Full Width of Material Placed every 20 m Stations, Per each Lift of Placed Material
Manufacture – Pre-Cast Concrete Lock Blocks	Field Test of Plastic Properties (Air and Slump)	As per CSA Certified Manufacturing Plant QC Requirements
Manufacture – Pre-Cast Concrete Lock Blocks	Compressive Strength Tests	As per CSA Certified Manufacturing Plant QC Requirements
Manufacture – Precast Concrete Barrier	Field Test of Plastic Properties (Air and Slump)	As per CSA Certified Manufacturing Plant QC Requirements
Manufacture – Precast Concrete Barrier	Compressive Strength Tests	As per CSA Certified Manufacturing Plant QC Requirements
Cast-in-place Concrete – Concrete Culvert End Treatment	Field Test of Plastic Properties (Air and Slump)	1 Test per Every End Treatment Cast

Cast-in-place Concrete – Concrete Culvert End Treatment	Compressive Strength Tests	1 Set of 4 (one 7 Day and Three 28 Day) Cylinders for Every End Treatment Cast

.3 As defined in the BC Mot Standard Specification for Highway Construction (latest edition). 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). Wherever these standard specifications refer to standards (e.g. CSA, ASTM, and others) the minimum testing frequencies in these standards shall be utilized.

.4 One test per each individual area / location the material is utilized.

.3 Quality Control Testing agencies, their inspectors, and their representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the Contract Documents, nor to 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 Within 24 hrs. of the completion of a test, submit the test result to the Departmental Representative (hard copy if requested) and in electronic format via PWGSC cloud based system "CentralCollab".

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

1.9 Non-Conformance Reports

.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 is not in conformance, 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 correct and substandard remains or becomes part of the work, an internal Non-Conformance Report (NCR) shall be issued to the Contractor, with a copy to the Departmental Representative. Included as part of the NCR will be a required response time.

The Contractor shall then respond to the Quality Control Manager, with a copy to the Departmental Representative, with respect to the NCR, within the specified response time, with 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, the Quality Control Manager shall an issues an internal procedural Non-Conformance Report (NCR) to the Contractor, with a copy to the Departmental Representative. Included as part of the NCR will be a required response time.

The Contractor shall then respond to the Quality Control Manager, with a copy to the Departmental Representative, with respect to the NCR, within the specified response time, with 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 will issue to the Contractor a NCR with a required response time.

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.

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 If in the opinion of the Departmental Representative it is not expedient 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.

1.10 Frequency of QC Documentation and Submittal to Departmental Representative

.1 The frequency of QC Documentation (i.e. check sheets) completed by the Quality Control Personnel 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 QC Documentation shall achieve the following:

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

.2 Check sheets, Daily Reports, NCR's, test results, and other Documents and forms prepared as part of the Quality Management Plan and completed throughout the project to verify conformance with the contract requirements shall be distributed to the Departmental Representative in electronic format via PWGSC cloud based system "CentralCollab" within 24 hrs. of the completion. Submit to the Departmental Representative hard copies of the same documents, forms, and test results if requested.

1.11 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 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 Section Includes	.1	Installation and removal.
	.2	Scaffolding.
	.3	Hoisting.
	.4	Site storage/loading.
	.5	Security.
	.6	Equipment, tool, and materials storage.
	.7	Sanitary facilities.
	.8	Construction signage.
	.9	Construction laydown area, construction parking, and site office.
	.10	Power.
	.11	Communications.
	.12	Temporary heating, ventilation, and lighting.
	.13	Fire protection.
1.2 Installation and Removal	.1	Provide construction facilities in order to execute work expeditiously.
	.2	Remove from site all such work after use.
1.3 Scaffolding	.1	Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs as necessary to carry out work.
1.4 Hoisting	.1	Provide, operate, and maintain hoists and cranes as necessary for moving of workers, materials, and equipment.
	.2	Hoists and cranes shall be operated by qualified operators.
1.5 Site Storage/Loading	.1	Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
	.2	Do not load or permit to load any part of work with a weight or force that will endanger the work or existing infrastructure.

1.6 Security	.1	Provide and pay for responsible security personnel as required.
1.7 Equipment, Tool, and Materials Storage	.1	If required by the Contractor provide and maintain, in a clean and orderly condition, lockable weather proof sheds for storage of tools, equipment and materials.
	.2	Locate materials not required to be stored in weatherproof sheds on-site in a manner to cause least interference with public.
1.8 Sanitary Facilities	.1	Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
	.2	Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
1.9 Construction Signage	.1	No other signs or advertisements, other than those required by Section 01 35 00.06 – Traffic Control, are permitted on-site.
1.10 Construction Laydown Area, Construction Parking, and Site Office	.1	Confine construction laydown areas, site office locations, and construction parking to the locations identified below in compliance with Section 01 35 43 – Environmental Protection and as pre-approved by the Departmental Representative.
		.1 Within highway right of way, preferably on areas previously disturbed and off the traveled potion of the highway.
		.2 Km 750+000 Gravel Pit.
		.3 Other areas as pre-approved by the Departmental Representative.
1.11 Power	.1	Provide and pay for power as required for the completion of the works and operations of construction site offices.
1.12 Communications	.1	Provide and pay for on-site satellite phone communications or other reliable telephone systems allowing the Departmental Representative reliable communication to the Contractors onsite representative when onsite.
1.13 Temporary Heating, Ventilation, and Lighting	.1	Provide temporary heating, ventilation, and lighting as required during construction period to facilitate construction of the works.
1.14 Fire Protection	.1	Provide and maintain temporary fire protection equipment during performance of work.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes	.1	Installation and removal.
	.2	Hoarding.
	.3	Guiderail and barricades.
	.4	Access to site.
	.5	Public traffic flow.
	.6	Fire routes.
	.7	Protection for off-site and public property.
	.8	Protection of structure finishes.
1.2 Installation and Removal	.1	Provide temporary controls in order to execute Work expeditiously.
	.2	Remove from site all such work after use.
1.3 Hoarding	.1	Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.
1.4 Guiderails and Barricades	.1	Provide secure, rigid guiderails and barricades around deep excavations and open shafts.
	.2	Provide as required by governing authorities.
1.5 Access to Site	.1	Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.
1.6 Public Traffic Flow	.1	Provide and maintain competent signal flag persons, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the Public.
1.7 Fire Routes	.1	Maintain access to property for use by emergency response vehicles.
1.8 Protection for Off-site and Public Property	.1	Protect surrounding private and public property from damage during performance of Work.
	.2	Be responsible for damage incurred.
1.9 Protection of Structure Finishes	.1	Provide protection for finished and partially finished structure finishes and equipment during performance of Work.
	.2	Provide necessary screens, covers and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule three (3) day prior to installation.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes	.1	General Requirements.
	.2	Requirements of Regulatory Agencies.
	.3	Mobilization.
	.4	Maintenance.
	.5	Demobilization.
1.2 General Requirements	.1	The Contractor to provide its own construction camp and office as necessary. The construction camp and office may be set up in PWGSC's Km 750 Gravel Pit in a location and layout pre-approved by the Departmental Representative.
	.2	The Contractor shall be responsible for all utility services to the construction camp. The construction camp to be established and operated in accordance with local regulations.
1.3 Requirements of Regulatory Agencies	.1	Obtain necessary licenses and approvals required by Authority having Jurisdiction for authorized use of water and disposal of domestic sewage and other waste.
	.2	Comply with Environmental regulations.

PART 2 – PRODUCTS

	.1	Not Used.

PART 3 – EXECUTION

3.1 Mobilization	.1	Mobilize equipment, personnel, and materials as necessary to establish temporary construction camp and offices. Obtain necessary licenses and approvals from Authorities having Jurisdiction prior to mobilization. Camp and service area location and layout plan to be submitted to Departmental Representative for review and acceptance.
	.2	Temporary construction camps to be established and operated in accordance with local regulations.
3.2 Maintenance	.1	Maintain construction camp and offices in a neat and tidy condition.
3.3 Demobilization	.1	Upon vacating construction camp, offices and temporary services, clean-up and leave site in a condition satisfactory to the Departmental Representative and the Authorities having Jurisdiction.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Progressive cleanliness.

.2 Final cleaning.

1.2 Project Cleanliness

.1 Maintain work in a tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by the Departmental Representative.

.3 Make arrangements 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.

1.3 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 or BST finished areas.

.9 Clean drainage systems.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Inspection and declaration.

1.2 Inspection and Declaration

.1 Contractor's Inspection: Contractor and all subcontractors shall conduct an inspection of work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify the Departmental Representative in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made.

.2 Request the Departmental Representative's Inspection.

.2 Departmental Representative's Inspection: The Departmental Representative and Contractor will perform inspection of work to identify obvious defects or deficiencies. Contractor shall correct work accordingly.

.3 Completion: Submit written certification that the following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Work is complete and ready for final inspection.

.4 Final Inspection: When the items noted above are completed, request final inspection of work by the Departmental Representative and Contractor. If work is deemed incomplete by the Departmental Representative, complete the outstanding items and request re-inspection.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Submissions.

.2 As-built drawings and as-built survey.

.3 Recording actual side conditions.

1.2 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 weeks of substantial performance:

.1 As-built survey.

.2 As-built drawing and shop drawing mark-ups.

1.3 As-Built Drawings and As-Built Survey

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

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

.3 Provide as-built survey in digital xyz format. Survey file to include point number, coordinates, and point description.

.4 Submit one copy of Issued For Construction drawings which have been marked by the Contractor up to and including all "as-built" conditions.

1.4 Recording Actual Site Conditions

.1 The Departmental Representative will provide two sets of Issued for Construction (or Issued for Tender) drawings for use by the Contractor to record as-built conditions.

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

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

.4 At the completion of the work complete an as-built survey of the works including all areas disturbed and modified during construction. Survey to include sufficient point density to adequately characterize the work completed (refer to Section

01 29 00 – Payment Procedures, 1.3 Survey).

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 Signs.

.3 Precast concrete lock blocks.

.4 Precast concrete barrier.

.5 Culverts.

1.2 Measurement and Payment Procedures

.1 Measurement and Payment for removal of existing signage shall be incidental to the costs for Mobilization and Demobilization as defined in Section 01 25 20 - in Section Mobilization and Demobilization.

.2 Payment for removal and temporary stockpile of precast concrete lock blocks and precast concrete barrier will be made on the basis of the Price per Unit Bid for Remove and Temporarily Stockpile Existing Precast Concrete Lock Blocks and Remove and Temporarily Stockpile Existing Concrete Barrier in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for loading, transport, and temporary stockpiling and all other items necessary for successful completion of the work.

.3 Measurement for Payment for completion of the removal and temporary stockpile of precast concrete lock blocks and precast concrete barrier will be made by the count of Precast Concrete Lock Blocks and Precast Concrete Barrier moved from within the project limits (Km 742+560 and Km 750+300) and temporarily stockpiled as accepted by the Departmental Representative.

.4 Payment for offsite disposal of existing damaged precast concrete lock blocks will be made on the basis of the Price per Unit Bid for Offsite Disposal of Existing Damaged Precast Concrete Lock Blocks in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for loading, transport, and offsite disposal and all other items necessary for successful completion of the work.

.5 Measurement for Payment for completion of offsite disposal of existing damaged or existing end transition precast concrete lock blocks will be made by the count of Precast Concrete Lock Blocks (including End Transition Lock Blocks) removed from the within the project limits (Km 742+560 and Km 750+300) as accepted by the Departmental

Representative.

.6 Payment for removal and offsite disposal of existing CSP culverts and wood stave culverts will be made on the basis of the Price per Unit Bid for Existing CSP Culvert Removal and Offsite Disposal (≤ 800 mm Diameter), Existing CSP Culvert Removal and Offsite Disposal (> 800 mm Diameter), and Existing Wood Stave Culvert Removal and Offsite Disposal (≤ 800 mm Diameter) in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for.

.1 Native Material: excavation, backfill (when required), disposal (in a pre-approved location if unsuitable for re-use). If native material is re-used, native material volume shall be excluded from embankment volume for payment.

.2 Culverts and associated components (screens, debris catchments etc., if present): removal, loading, transport, and offsite disposal.

.3 All other items necessary for successful completion of the work.

.7 Measurement for Payment for completion of the removal and offsite disposal of existing CSP culverts and wood stave culverts will be made by the count of Existing CSP Culverts and Wood Stave Culverts removed and disposed of offsite as accepted by the Departmental Representative.

.8 Payment for removal and offsite disposal of the existing box culverts (Ed's Creek) will be made on the basis of the Price per Unit Bid for Existing Box Culvert Removal and Offsite Disposal (Ed's Creek, Km 748+133) in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for.

.1 Native Material: excavation, backfill (when required), disposal (in a location and condition acceptable to the Departmental Representative).

.2 Culverts: removal, loading, transport, and offsite disposal.

.3 All other items necessary for successful completion of the work.

.9 Measurement for Payment for the removal and offsite disposal of the existing box culverts (Ed's Creek) will be made by Lump Sum of the work completed and accepted by

the Departmental Representative. The single lump sum payment shall include all payment for the removal of both existing box culverts at Ed's Creek.

PART 2 – PRODUCTS

.1 Not Used

PART 3 – EXECUTION

3.1 Signs

.1 All existing regulatory signs and posts designated for removal on the contract drawings shall be removed by the contractor and stockpiled in a location pre-approved by the Departmental Representative. The Contractor shall take necessary precautions to prevent damage to the signs or posts during the removal, transport, and stockpiling process. The order and timing of sign removal shall be completed in conjunction with the Contractor's Traffic Management Plan to ensure necessary signage for the protection and control of public traffic is available throughout the construction.

3.2 Precast Concrete Lock Blocks

.1 Remove and temporarily stockpile in a location pre-approved by the Departmental Representative all existing precast concrete lock blocks designated for removal on the contract drawings. The Contractor shall take necessary precautions to prevent damage to the lock blocks during the removal, transport, and stockpiling process.

.2 Once stockpiled, the Departmental Representative will review the condition of each lock block and designate each block for reuse or offsite disposal. All existing end transitions lock block segments will be designated for offsite disposal.

.3 Lock blocks designated for offsite disposal shall be disposed of at an off-site disposal facility acceptable to the Departmental Representative.

3.3 Precast Concrete Barrier

.1 Remove and temporarily stockpile in a location pre-approved by the Departmental Representative all existing precast concrete barrier designated for removal on the contract drawings. The Contractor shall take necessary precautions to prevent damage to the lock blocks during the removal, transport, and stockpiling process.

3.4 Culverts

.1 Take all necessary precautions as outline in Section 01 35 43 – Environmental Protection and the Contractor's EPP to mitigate against sediment transport and other environmental pollution or damage during construction.

.2 Excavate and remove all existing culverts and associated

components (screens, debris catchments etc., if present) within the limits of the work. Dispose of the culverts in an offsite disposal facility permitted to accept the culvert materials (steel and creosote treated timber) and acceptable to the Departmental Representative. If requested by the Departmental Representative, salvage the associated culvert components (screens, debris catchments etc.) and stockpile in a location directed by the Departmental Representative.

.3 Unless noted otherwise in Section 31 23 33.01 – Excavation, Trenching, and Backfilling, re-use excavated material as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative. If material is re-used, volume of material to be excluded from embankment volume for payment.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Definitions.

.2 Submittals.

.3 Storage and handling.

.4 Transportation.

.5 Materials.

.6 Disposal.

1.2 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.

1.3 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 Submit Hazardous Materials Management Plan to the Departmental Representative that identifies all hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.4 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 naptha 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.

1.5 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 Section Includes

.1 Measurement and payment procedures.

.2 References.

.3 Wood posts and hardware.

.4 Signs.

.5 Wood posts and signs.

1.2 Measurement and Payment Procedures

.1 Payment for the supply and placement of permanent traffic signs will be made on the basis of the Price per Unit Bid for Traffic Signage in the Bid and Acceptance Form. The price per Unit Bid shall include all costs for supply and install of the sign and post, hardware, and all other items necessary for successful completion of the work.

.2 Measurement for Payment for Traffic Signage will be made by the count of each traffic sign (sign and post) installed and accepted by the Departmental Representative.

.3 The install of the two PWGSC supplied Government of Canada "Accelerated Infrastructure Program" signs at each end of the project will not be measured for payment. Refer to Section 01 25 20 – Mobilization and Demobilization.

1.3 References

.1 British Columbia MoT – Manual of Standard Traffic Signs & Pavement Markings (September 2000, or latest edition).

.2 British Columbia MoT – 2009 Standard Specifications for Highway Construction.

PART 2 – PRODUCTS

2.1 Wood Posts and Hardware

.1 The sign posts and hardware shall be in conformance with the BC MoT 2009 Standard Specification for Highway Construction, See Section 635, subsection 635.27 and the following requirements.

.1 The sign post shall be 6" x 4" pressure treated Douglas Fir/Larch, No. 1 Grade.

2.2 Signs

.1 Signs shall be per BC MoT Manual of Standard Traffic Signs & Pavement Markings and BC MoT 2009 Standard Specification for Highway Construction, See Section 635, subsection 635.32 and the following requirements.

.1 Signs shall be sheet aluminum.

PART 3 – EXECUTION

3.1 Wood Posts and Signs

.1 The wood posts and signs shall be installed per the BC MoT Manual of Standard Traffic Signs & Pavement Markings and BC MoT 2009 Standard Specification for Highway Construction, See Section 635, subsection 635.27 and subsection 635.32 and the following requirements.

.1 Post embedment depth shall be 1600 mm.

.2 Green and white paint not required.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 References.

.3 General.

.4 Crushed base gravel.

.5 Sub-base course.

.6 Select subgrade fill material.

.7 BST Aggregate.

.8 Specialty Embankment Material, Cut Slope Stabilization Material.

.9 Processing.

.10 QA sampling by the Departmental Representative.

.11 Handling and transportation.

.12 Stockpiling.

.13 Cleanup.

1.2 Measurement and Payment Procedures

.1 Measurement and Payment for Aggregate Materials shall be per the applicable work included in Section 31 23 33.01 – Excavating Trenching and Backfilling, Section 32 12 36.14 – BST, Section 32 11 18 – Select Subgrade Fill Material, Section 32 11 19 – Sub-base Course, Section 32 11 24 – Crushed Base Gravel, Section 33 42 13 – Pipe Culverts, and any other section as required by these specifications.

1.3 References

.1 British Columbia Ministry of Transportation and Infrastructure (BC MoT) – 2012 Standard Specifications for Highway Construction.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM C136 (latest edition), Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTMD2487 (latest edition), Standard Practice for Classification of Soils for Engineering Purposes (United Soil Classification System).

.3 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.4 ASTM C117-03, Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

.5 CGSB Spec.8-GP-2M, Sieves Testing, Woven Wire, Metric Series.

.6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.7 ASTM C131-01, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

PART 2 – PRODUCTS

2.1 General

.1 All materials are supplied to the Contractor "as is". The Contractor will be responsible for the manufacture, screening, blending, aeration or drying, or any other required processing to achieve all material requirements from the "as is" material.

.2 The Contractor may visit the site and take samples, complete drilling or complete test pits of the available materials to assist in defining the level of effort the Contractor will need to undertake to achieve gradation, compaction, and any other requirements or assist with any other concerns. The Contractor shall notify and obtain pre-approval from the Departmental Representative in advance of any drilling or test pit sampling undertaken by the Contractor.

.3 A collection of previously collected geotechnical data from the materials in this area is available for the Contractors reference in the Km 737 – 750.3 Highway Realignment, Alaska Highway, BC, Factual Geotechnical Data Report (Appendix A).

2.2 Crushed Base Gravel

.1 Crushed Base Gravel shall be manufactured by the Contractor from the "as is" material excavated or available from any combination of the following sources:

.1 Materials previously manufactured and stockpiled

in the Km 750 Gravel Pit.

.2 Materials designated to be excavated within the limits of the work.

.2 The PWGSC supplied material shall be screened / 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 (max 1% by volume, max 2% fine organic material when tested in accordance with ASTM 02974) and other deleterious materials.

.2 When tested in accordance to ASTM C136, or latest issue, the material shall have a gradation conforming to the following gradation limits:

Gradation Limits: Crushed Base Gravel	
Sieve Designation (mm)	Percent Passing by Weight
19	100
12.5	70 – 100
4.75	40 - 70
2.00	23 - 50
0.425	7 - 25
0.075	3 - 8

.3 Liquid limit when tested in accordance to ASTM D4318-00, maximum 25.

.4 Plasticity index when tested in accordance to ASTM D4318-00, maximum 6.

.5 Los Angles degradation when tested in accordance to ASTM C131-01, 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 freshly fractured face.

2.3 Sub-base Course

.1 Sub-base Course shall be manufactured by the Contractor from the "as is" material excavated or available from any combination of the following sources:

.1 Materials previously manufactured and stockpiled in the Km 750 Gravel Pit.

.2 Materials designated to be excavated within the limits of the work.

.2 The PWGSC supplied material shall be screened / 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 (max 1% by volume, max 2% fine organic material when tested in accordance with ASTM 02974) and other deleterious materials.

.2 When tested in accordance to ASTM C136, or latest issue, the material shall have a gradation conforming to the following gradation limits:

Gradation Limits: Sub-Base Course	
Sieve Designation (mm)	Percent Passing by Weight
100	100
4.75	20 - 65
0.075	0 - 8

.3 Grading of material shall not show marked fluctuations from opposite extremes of the limits given in Table 1, and the curve plotted from the sieve analysis shall flow in a similar manner from acute changes in direction.

.4 Even though particle sizes are within the limits of the grading sizes herein provided, materials will be considered unsuitable if particle shapes are thin or elongated or exhibit other characteristics precluding satisfactory compaction to create a roadbed acceptable to the Departmental Representative.

.5 Liquid limit when tested in accordance to ASTM D4318-00, maximum 25.

.6 Plasticity index when tested in accordance to ASTM D4318-00, maximum 6.

.7 Fracture, at least 20% of particles by mass retained on 4.75 mm sieve to have at least one freshly fractured face.

2.4 Select Subgrade Fill Material

.1 Select Subgrade Fill Material shall be manufactured by the Contractor from the "as is" material excavated or available from any combination of the following sources:

.1 Materials previously manufactured and stockpiled in the Km 750 Gravel Pit.

.2 Materials designated to be excavated within the limits of the work.

.2 The PWGSC supplied material shall be screened / 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 (max 1% by volume, max 2% fine organic material when tested in accordance with ASTM 02974) and other deleterious materials.

.2 When tested in accordance to ASTM C136, or latest issue, the material shall have a gradation conforming to the following gradation limits:

Gradation Limits: Select Subgrade Fill Material	
Sieve Designation (mm)	Percent Passing by Weight
150	100
0.075	0 - 10

.3 Regardless that the material meets the above gradation, it will be rejected if the compacted material ruts when a loaded tandem truck passes over it.

2.5 BST Aggregate

.1 BST Aggregate shall be 19.05 mm minus material shall be manufactured by the Contractor from the "as is" material excavated or available from any combination of the following sources:

.1 Materials previously manufactured and stockpiled in the Km 750 Gravel Pit.

.2 Materials designated to be excavated within the limits of the work.

.2 The BST Aggregate shall conform with the following requirements:

.1 When tested in accordance to ASTM C136, or latest issue, and ASTM C117, or latest issue, the material shall have a smooth gradation curve without sharp breaks conforming to the following gradation limits:

Gradation Limits: BST Aggregate	
Sieve Designation (mm)	Percent Passing by Weight
19	100
12.5	63 – 89
5	36 – 56
2.5	18 -38
1.25	12 -30
0.135	4 – 18
0.080	0 - 5

.2 Los Angeles Abrasion when tested in accordance to ASTM D423 (AASHTO T89) Gradation "B", Maximum % Loss by Mass: 25

.3 Moisture Content: 2% – 5%

.4 Crushed Fragments: 60% of fragments retained on the 5 mm sieve to have at least one freshly fractured face.

.5 Flat and elongated particles with length thickness ratio greater than 5:1. Maximum % By Mass: 8.

.6 Plasticity Index when tested in accordance to ASTM D4318-00, maximum 4.

2.6 Specialty Embankment Material, Cut Slope Stabilization Material

.1 Specialty Embankment Material and Cut Slope Stabilization Material shall be crushed angular rock manufactured by the Contractor from the "as is" material excavated or available from any combination of the following sources:

.1 Materials designated to be excavated within the limits of the work.

.2 The Specialty Embankment Material and Cut Slope Stabilization Material shall conform with the following requirements:

.1 The material shall have a gradation conforming to the following gradation limits:

Gradation Limits: Specialty Embankment Material and Cut Slope Stabilization Material	
Sieve Designation (mm)	Percent Passing by Weight
150	100
50	0 -10

.2 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.

PART 3 – EXECUTION

3.1 Processing

.1 Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.

.3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

3.2 QA Sampling by the Departmental Representative

.1 Provide Departmental Representative with access to source and processed material for sampling during production.

.2 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when directed by Departmental Representative to permit full cross section sampling.

.3 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

.4 Aggregates that do not meet specified tolerances for intended use are subject to rejection by the Departmental Representative as part of the QA process.

3.3 Handling and Transportation

.1 Avoid segregation, contamination, and degradation of aggregate during handling and transporting.

.2 Load limit restrictions will be in accordance with British Columbia Highway Traffic Act pertaining to registered

weight limits and vehicle size.

.3 Repair and maintain stockpile / laydown areas as necessary to a condition equal to or better than when work began.

3.4 Stockpiling

.1 Stockpile aggregates in locations approved by Departmental Representative and not closer than 1.5 m from the edge of the excavation slopes. 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 crushed gravel base not less than 100 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 Do not use conveying stackers.

.10 Prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.4 Cleanup

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles in locations directed by Departmental Representative.

.3 For temporary or permanent abandonment of aggregate source, restore source to conditions directed by Departmental Representative.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes	.1	Measurement and payment procedures.
	.2	Definitions.
	.3	Preparation.
	.4	Clearing.
	.5	Grubbing.
	.6	Removal and disposal.
	.7	Finished surface.
1.2 Measurement and Payment Procedures	.1	Payment for Clearing and Grubbing will be made on the basis of the Price per Unit Bid for Clearing and Grubbing in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for clearing of trees and brush, removal of all stumps and roots, disposal, and all other items necessary for successful completion of the work.
	.2	Measurement for Payment for completion of Clearing and Grubbing will be made on the total area within the limits of Clearing and Grubbing shown in the contract drawings, surveyed in square hectares, incorporated in the works, and accepted by the Departmental Representative. The total Clearing and Grubbing area measured for payment will include areas which may not require significant or any clearing and grubbing (ex. existing road).
1.3 Definitions	.1	Clearing: cutting off trees, brushing vegetative growth to ground level and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
	.2	Grubbing: excavating and disposing stumps and roots to 150mm below existing ground surface.
	.3	License to Cut: License required under Province of British Columbia's Forest Act that authorizes a Contractor to salvage and remove timber from Crown Land.
1.4 Protection	.1	Prevent damage to natural features and man-made structures which are to remain.
	.2	Repair any damaged caused by clearing and grubbing operations and if damaged, replace any tress designated to remain.

PART 2 – PRODUCTS

2.1 Not Used

PART 3 – EXECUTION

3.1 Preparation

.1 Inspect the site and verify with the Departmental Representative, the limits of the clearing and grubbing and items designated to remain.

.2 Unless advised otherwise, receive from the Departmental Representative the License to Cut prior to undertaking the work.

3.2 Clearing

.1 Clear trees, brush, and other vegetation designated for removal within the limits of Clearing and Grubbing shown on the contract drawings and as direct by the Departmental Representative.

.2 Cut off branches and cut down trees overhanding area cleared.

3.3 Grubbing

.1 Grub out stumps and wood debris including roots and embedded logs not less than 200 mm below ground surface.

.2 In areas with highway embankment fill, grubbing requirements on the downslope side of the embankment fill slope shall altered be as follows.

.1 No grubbing of stumps flush cut with ground elevation (< 0.1 m in height from surrounding ground).

.2 Clearing of all rocks > 0.3 m in diameter required.

3.4 Removal and Disposal

.1 Dispose of cleared and grubbed materials by chipping or burning.

.2 Chip or mulch and spread cleared and grubbed vegetative materials that is on site as directed by the Departmental Representative.

.3 Burning:

.1 Burning shall be completed inside clearing limits.

.2 Comply with Forest Practice Code of British Columbia Act when burning and all requirements of Section 01 35 43 – Environmental Protection.

3.5 Finished Surface

.1 Leave ground surface in a condition suitable for stripping of topsoil.

.2 In areas of flush cutting, leave stumps cut flush with ground elevation and root structure undisturbed.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 Riprap.

.3 Riprap underlayer.

.4 Woven geotextile.

.5 Crushed base gravel.

.6 Cut slope drainage swale material.

.7 Placement of riprap and riprap underlayer: general.

.8 Ditch construction (following culvert removal).

.9 Culvert inlet and outlet riprap protection.

.10 Steep slope riprap protection

.11 Ditch block.

.12 Cut slope drainage swale.

.13 Culvert inlet riprap protection (Ed's Creek, Km 748+133).

.14 Culvert outlet riprap protection and stream reestablishment (Ed's Creek, Km 748+133).

.15 Armoured ditching.

1.2 Measurement and Payment Procedures

.1 Payment for ditch construction following culvert removal will be made on the basis of the Price per Unit for Ditch Construction Following CSP Culvert & Wood Stave Culvert Removal (≤ 800 mm Diameter) and Ditch Construction Following CSP Culvert Removal (> 800 mm Diameter) in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavating and shaping of the ditch, disposal of the native materials on site, selecting, loading, transport, and placement of 50 Kg class riprap, the supply and install of woven geotextile, and all other items necessary for successful completion of the work.

.2 Measurement for Payment for completion of the Ditch Construction Following CSP Culvert & Wood Stave Culvert Removal (≤ 800 mm Diameter) and Ditch

Construction Following CSP Culvert Removal (> 800 mm Diameter) will be made by the count of ditch construction following culvert removal installations completed and accepted by the Departmental Representative.

.3 Payment for culvert inlet and outlet protection on culverts ≤ 1800 mm diameter will be made on the basis of the Price per Unit Bid for Culvert Inlet and Outlet Riprap Protection (Culverts ≤ 1800 mm Diameter) in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavating and disposal of the native materials in preparation for the riprap, selecting, loading, transport, and placement of 50 Kg class riprap, the supply and install of woven geotextile, and all other items necessary for successful completion of the work.

.4 Measurement for Payment for completion of the Culvert Inlet and Outlet Protection (Culverts ≤ 1800 mm Diameter) will be made by the count of culvert inlet and outlet protection installations installed and accepted by the Departmental Representative. Each culvert shall receive both inlet and outlet protection which will be counted as one installation.

.5 Payment for steep slope riprap protection will be made on the basis of the Price per Unit Bid for Steep Slope Riprap Protection in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavating and disposal of the native materials in preparation for the riprap, selecting, loading, transport, and placement of 50 Kg class riprap, the supply and install of woven geotextile, tree and brush removal (if necessary), and all other items necessary for successful completion of the work.

.6 Measurement for Payment for completion of Steep Slope Riprap Protection will be made on the length of steep slope riprap protection surveyed in lineal metres, measured parallel to the direction of the steep slope riprap protection, and accepted by the Departmental Representative.

.7 Payment for ditch block construction will be made on the basis of the Price per Unit for Ditch Block in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavating, transport, placement, and shaping of the material required to construct the ditch block and all other items necessary for successful completion of the work.

.8 Measurement for Payment for completion of the Ditch Block will be made by the count of ditch block installations

completed and accepted by the Departmental Representative.

.9 Payment - Culvert Inlet Riprap Protection (3300 mm Ed's Creek Culvert, km 748+133)

.10 Payment for culvert inlet riprap protection at Ed's Creek Culvert, km 748+133 will be made on the basis of the Price per Unit Bid for Culvert Inlet Riprap Protection (Ed's Creek, Km 748+133) in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavating and disposal of the native materials in preparation for the riprap, selecting, loading, transport, and placement of 50 Kg class riprap, the supply and install of woven geotextile, and all other items necessary for successful completion of the work.

.11 Measurement for Payment for completion of the Culvert Inlet Riprap Protection (Ed's Creek, Km 748+133) will be made by will be made by Lump Sum based on the percentage of the work completed and accepted by the Departmental Representative.

.12 Payment for culvert outlet riprap protection and stream reestablishment at Ed's Creek Culvert, km 748+133 will be made on the basis of the Price per Unit Bid for Culvert Outlet Riprap Protection and Stream Reestablishment (Ed's Creek, Km 748+133) in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavating and disposal of the native materials in preparation for the riprap and complete stream reestablishment slopes, selecting, loading, transport, and placement of 250 Kg Class riprap, 50 Kg class riprap and Riprap Underlay, the supply and install of woven geotextile, and all other items necessary for successful completion of the work.

.13 Measurement for Payment for completion of the Culvert Outlet Riprap Protection and Stream Reestablishment (Ed's Creek, Km 748+133) will be made by will be made by Lump Sum based on the percentage of the work completed and accepted by the Departmental Representative.

.14 Payment for cut slope drainage swales will be made on the basis of the Price per Unit Bid for Cut Slope Drainage Swale in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavating and disposal of the native materials, supply and placement of the woven geotextile, manufacture and placement of the cut slope drainage swale material, and all other items necessary for

successful completion of the work.

.15 Measurement for Payment for completion of Cut Slope Drainage Swale will be made on the length of cut slope drainage swale surveyed in lineal metres, measured parallel to the centerline of the swale, and accepted by the Departmental Representative.

.16 Payment for armored ditching will be made on the basis of the Price per Unit Bid for Armoured Ditching in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavating and disposal of the native materials in preparation for the riprap, selecting, loading, transport, and placement of 50 Kg class riprap, the supply and install of woven geotextile, and all other items necessary for successful completion of the work.

.17 Measurement for Payment for completion of the Armoured Ditching will be made by the count of the area of material surveyed in square meters, incorporated in the works and accepted by the Departmental Representative.

PART 2 – PRODUCTS

2.1 Riprap

.1 Riprap shall be 50 Kg Class Riprap and 250 Kg Class Riprap in accordance with Section 31 37 00 – Riprap and Surface Drainage Material.

2.2 Riprap Underlayer

.1 Riprap Underlayer shall be Specialty Embankment Materials or Cut Slope Stabilization Material in accordance with Section 31 05 16 – Aggregates: General.

2.2 Woven Geotextile

.1 The Woven Geotextile shall be Nilex 2002 or pre-approved equivalent.

2.3 Crushed Base Gravel

.1 Ditch Block material shall be Crushed Base Gravel in accordance with Section 31 05 16 – Aggregates: General.

2.4 Cut Slope Drainage Swale Material

.1 Cut Slope Drainage Swale Material shall be Cut Slope Drainage Swale Material in accordance with Section 31 37 00 – Riprap and Surface Drainage Material.

PART 3 – EXECUTION

3.1 Placement of Riprap and Riprap Underlayer: General

.1 Load, transport, and placed riprap material with care to ensure that material does not break or reduce in size smaller than the actual material size requirements when placed.

.2 Place Riprap and Riprap Underlayer materials on woven geotextile, on slopes and ground property shaped per the

lines and grades shown in the Contract Drawings and free from debris, snow and ice or other deleterious material.

.3 Riprap and Riprap Underlayer material shall be placed to the lines and thickness shown on the Contract Drawings. The finished surface of each riprap material shall be within the following limits but not uniformly high or low:

.1 50 Kg Class Riprap: +/- 100 mm

.2 250 Kg Class Riprap: + 250 mm, - 150 mm

.3 Riprap Underlayer: +/- 50 mm

.4 Place riprap and Riprap Underlayer materials using methods that do not lead to segregation or degradation of aggregate. Do not place by end dumping from haul units.

.5 Do not drop Riprap and Riprap Underlayer materials from a height greater than 0.5 m vertically from its final position.

.6 Place riprap and Riprap Underlayer materials commencing at the toe of the slope and proceeding up the slope. Riprap material shall be densely placed and individual stones shall be worked with placement equipment to form a well-keyed surface. Ensure placement of the riprap materials allows for positive drainage.

.7 Riprap and Riprap Underlayer materials 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.

.8 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.

.9 Dress all Riprap and Riprap Underlayer 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.

.10 Construction equipment is not permitted on Riprap or Riprap Underlayer surface.

.11 Maintain finished riprap material surfaces in a condition conforming to this section until acceptance.

3.2 Ditch Construction (Following Culvert Removal)	.1	Following excavation of the culvert designated for removal (see Section 02 41 13 – Selective Site Demolition), complete the ditch construction to the inverts of the existing culvert (now removed) and to the lines and grades shown on the contract drawings. Ensure excavation will allow for positive drainage upon placement of riprap.
	.2	Install 50 Kg Class Riprap and Woven Geotextile to the lines and grades shown on the contract drawings and to the requirements of Section 3.1 – Placement of Riprap and Riprap Underlayer: General, above. Ensure positive drainage following riprap placement.
	.3	Dispose of excavated waste material onsite in a condition acceptable to the Departmental Representative.
	.4	Hydroseed all disturbed areas including excavated waste material (excluding finished riprap surfaces).
3.3 Culvert Inlet and Outlet Riprap Protection	.1	Prior to or during installation of the culverts excavate ground to the lines and grades shown on the contract drawings to facilitate the installation of the Inlet and Outlet Riprap Protection. Ensure excavation will allow for positive drainage upon placement of riprap.
	.2	Re-use excavated material as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative.
	.3	Install 50 Kg Class Riprap and Woven Geotextile to the lines and grades shown on the contract drawings and to the requirements of Section 3.1 – Placement of Riprap and Riprap Underlayer: General, above. Ensure positive drainage following riprap placement.
3.4 Steep Slope Riprap Protection	.1	Prior to or during installation of the culverts commence installation of the Steep Slope Riprap Protection. Limits of the Steep Slope Riprap Protection shall be confirmed in the field by the Departmental Representative prior to undertaking the work. Excavate to the lines and grades shown on the contract drawings to facilitate the installation of the Steep Slope Riprap Protection. Ensure excavation will allow for positive drainage upon placement of riprap. Where Steep Slope Riprap Protection extends into uncleared / undisturbed areas minimize disturbance to adjacent trees and shrubs. If possible re-align Steep Slope Riprap Protection around trees larger than 200 mm in diameter rather than removing.

	.2	Re-use excavated material as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative.
	.3	Install 50 Kg Class Riprap and Woven Geotextile to the lines and grades shown on the contract drawings and to the requirements of Section 3.1 – Placement of Riprap and Riprap Underlayer: General, above. Ensure positive drainage following riprap placement.
3.5 Ditch Block	.1	Install ditch block in the location, lines, grades, shown on the contract drawings. Ensure complete ditch block will direct ditch water flows as intended and positive drainage (to culvert or other outlet) is maintained.
	.2	Compact ditch block material to minimum 95% maximum dry density (ASTM D698-12).
3.6 Cut Slope Drainage Swale	.1	During cut slope excavation, excavate ground to the lines and grades shown on the contract drawings to facilitate the installation of the Cut Slope Drainage Swale. Locations and extents of the Cut Slope Drainage Swales shall be confirmed in the field by the Departmental Representative prior to undertaking the work. Vary depth of excavation to ensure positive drainage across bench locations upon placement of Cut Slope Drainage Swale Material.
	.2	Re-use excavated material as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative.
	.3	Cut Slope Drainage Swale Material and Woven Geotextile to the lines and grades shown on the contract drawings. Ensure positive drainage following Cut Slope Drainage Swale Material placement.
3.7 Culvert Inlet Riprap Protection (Ed's Creek, Km 748+133)	.1	Prior to or during installation of the Culvert at Km 748+133, excavate ground to the lines and grades shown on the contract drawings to facilitate the installation of the Inlet Riprap Protection.
	.2	Complete excavation in compliance with the requirements of the EPP.
	.3	Re-use excavated material as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative.
	.4	Install 50 Kg Class Riprap and Woven Geotextile to the lines and grades shown on the contract drawings and to the

requirements of Section 3.1 – Placement of Riprap: General, above. Ensure positive drainage following riprap placement.

3.8 Culvert Outlet Riprap Protection and Stream Reestablishment (Ed's Creek, Km 748+133)

.1 Following completion of the Culvert at Km 748+133 and retaining walls, excavate ground to the lines and grades shown on the contract drawings to facilitate the Outlet Riprap Protection and Stream Reestablishment.

.2 Complete excavation in compliance with the requirements of the EPP.

.3 Remove existing culverts per the requirements of Section 02 41 13 – Selective Site Demolition.

.4 Dispose of the excavated material in an onsite location and condition acceptable to the Departmental Representative. Unless approved by the Departmental Representative, excavated material not be used as Embankment.

.5 Install 250 Kg Class Riprap, 50 Kg Class Riprap, and Woven Geotextile to the lines and grades shown on the contract drawings and to the requirements of Section 3.1 – Placement of Riprap: General, above. Ensure positive drainage following riprap placement.

3.9 Armoured Ditching

.1 During installation of embankment between Km 743+690 and Km 743+810 excavate ground and embankment to the lines and grades shown on the contract drawings to facilitate the installation of the Armoured Ditching. Ensure excavation will allow for positive drainage upon placement of riprap.

.2 Complete excavation in compliance with the requirements of the EPP.

.3 Re-use excavated material as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative.

.4 Install 50 Kg Class Riprap and Woven Geotextile to the lines and grades shown on the contract drawings and to the requirements of Section 3.1 – Placement of Riprap: General, above. Ensure positive drainage following riprap placement.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 Definitions

.3 References.

.4 Embankment material.

.5 Surplus excavation material.

.6 Specialty embankment.

.7 Woven geotextile.

.8 Cut slope stabilization material.

.9 Topsoil.

.10 Stripping of topsoil.

.11 Excavating.

.12 Embankment and specialty embankment material.

.13 Surplus excavation material.

.14 Cut slope stabilization material.

.15 Topsoil.

1.2 Measurement and Payment Procedures

.1 Payment for stripping of topsoil will be made on the basis of the Price per Unit Bid for Stripping in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs included with the excavating and temporarily stockpiling the stripped material and all other items necessary for successful completion of the work.

.2 Measurement for Payment for completion of Stripping will be made on the volume of material surveyed in cubic metres, excavated from the limits of the work, and accepted by the Departmental Representative.

.3 Payment for the excavation, transport, and placement of embankment will be made on the basis of the Price per Unit Bid for Embankment in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavation, transport, placement as embankment, compaction, and all

other items necessary for successful completion of the work.

.4 Measurement for Payment for completion of Embankment will be made on the volume of material surveyed in cubic metres incorporated into the finished highway embankment (at the completion of compaction) and accepted by the Departmental Representative. No separate measurement or payment for hauling or excavation of the material will be made. Excess embankment material resulting from excavation completed within the design lines and grades shown on the contract drawings will be placed as surplus excavation and counted as Embankment.

.5 Payment for the excavation, transport, manufacture, and placement of specialty embankment will be made on the basis of the Price per Unit Bid for Specialty Embankment in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for excavation, manufacture, transport, placement, compaction, woven geotextile, and all other items necessary for successful completion of the work. The install of the 1 m high gravel berm as shown on the contract drawings shall be incidental to the work and will not be measured for payment.

.6 Measurement for Payment for completion of Specialty Embankment will be made on the volume of material surveyed in cubic metres incorporated into the finished highway embankment (at the completion of compaction) as measured by neat lines, and accepted by the Departmental Representative. No separate measurement or payment for hauling of the material will be made.

.9 Payment for the excavation, transport, manufacture, and placement of cut slope stabilization material will be made on the basis of the Price per Unit Bid for Cut Slope Stabilization Material in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for sorting (as necessary), loading, transport, and placement and all other items necessary for successful completion of the work.

.10 Measurement for Payment for completion of Cut Slope Stabilization Material will be made on the volume of material surveyed in cubic metres incorporated into the finished cut slope as measured by neat lines, and accepted by the Departmental Representative.

.11 Payment for placement of topsoil will be made on the basis of the Price per Unit Bid for Topsoil Placement in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs included with the loading (if necessary), transport

(if necessary), spreading, racking, and grooming of the previously stripped material being reused as topsoil, and all other items necessary for successful completion of the work.

.12 Measurement for Payment for completion of Topsoil Placement will be made on the area of material surveyed in square metres, incorporated in the works and accepted by the Departmental Representative. Areas of spread wasted excess stripping will not be measured for payment.

.13 Payment for the installation and survey monitoring of geotechnical instrumentation will be made on the basis of the Price per Unit Bid for Geotechnical Instrumentation in the Bid and Acceptance Form. The Price per Unit Bid shall include all cost costs for the supply and install of the geotechnical instrumentation, survey monitoring of the Toe Pegs and finished Crushed Base Gravel within the high fill locations, and all other items necessary for the successful completion of the work.

.14 Measurement for Payment for completion of the Geotechnical Instrumentation will be made by Lump Sum based on the percentage of the work completed and accepted by the Departmental Representative.

1.3 Definitions

.1 Stripping: excavation of organic material covering the original ground.

.2 Common excavation: excavation of materials that are not rock excavation or stripping.

.3 Embankment: material derived from usable excavation and placed above stripped surface.

.4 Rock excavation:

.1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpillar D9L or equivalent and considered integral with parent mass.

.2 Boulder or rock fragments measuring in volume two cubic metres or more.

1.4 References

.1 ASTM D4318-10 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 ASTM D698-12, Standard Test Methods for Laboratory

Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).

.3 ASTM D1556-07 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

.4 ASTM D2167-08 Standard Test Methods for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

.5 ASTM D6938-10 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods.

PART 2 – PRODUCTS

2.1 Embankment Material

.1 Embankment material shall not contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or any other unsuitable material unless otherwise directed by Departmental Representative.

.2 Embankment material shall include the excavated and re-used as embankment, existing highway gravels and BST located within the zone of the proposed:

.1 Crushed Base Gravel and Sub-base Course materials.

.2 Select Subgrade Fill Material, except where the elevation of the existing highway driving surface (top of BST) is located within the zone of proposed Select Subgrade Fill Material and the material is pulverized and re-use in place as Select Subgrade Fill Material (refer to Section 31 26 13 – Pulverization of Existing BST and Section 32 11 18 – Select Subgrade Fill Material for further information).

2.2 Surplus Excavation Material

.1 Excavated material meeting the requirements of Embankment Material. Material shall not contain rock materials > 200 mm in diameter.

2.3 Specialty Embankment

.1 Specialty Embankment shall be Specialty Embankment material in accordance with Section 31 05 16 – Aggregates: General.

2.4 Woven Geotextile

.1 The Woven Geotextile shall be Nilex 2002 or pre-approved equivalent.

2.5 Cut Slope Stabilization

.1 Cut Slope Stabilization Material shall be Cut Slope

Material		Stabilization Material in accordance with Section 31 05 16 – Aggregates: General.
2.6 Topsoil	.1	Shall be organic material stripped from the native ground during stripping and temporarily stockpiled for later reuse. Topsoil shall be free of rocks > 150 mm in diameter and other debris hindering good vegetative growth.
2.7 Toe Pegs	.1	Shall be continuous lumber posts or pre-approved equivalent complete with a cap (set cap piece) to the size and dimensions shown on the typical detail in the contract drawings. Lumber shall be painted orange.
2.8 Piezometers	.1	Piezometers shall be RST Instruments Ltd. VW2100 Vibrating Wire Piezometers with a maximum pressure range of 0.7 MPa or pre-approved equivalent. Additional related components as shown in the typical detail in the contract drawings.
2.9 Slope Inclinometers	.1	Slope Inclinometers shall be 70 mm diameter RST Instruments Ltd. High-Endurance Inclinometer Casing or pre-approved equivalent. Additional related components shall be as shown in the typical detail in the contract drawings.

PART 3 – EXECUTION

3.1 Stripping of Topsoil	.1	Commence Stripping Excavation after Clearing and Grubbing.
	.2	Striping depths as indicated on the contract drawings and as directed by Departmental Representative
	.3	Stockpile stripped material within the limits of the work for re-use later as topsoil.
3.2 Excavating	.1	Complete excavation to the design lines and grades shown on the contract drawings. Notify Departmental Representative should excavated materials not achieve the requirements for Embankment Material.
	.2	During excavation maintain profiles, crowns and cross slopes to provide good surface drainage. Provide ditches as work progresses to provide drainage and construct interceptor ditches as shown on plans or as directed before excavating or placing embankment in adjacent area.
	.3	If, during excavation, material appearing to conform to classification for rock excavation is encountered, notify Departmental Representative and provide sufficient time to

enable measurements to be made to determine volume of rock. Payment for rock excavation (if required) will be completed via change order.

.4 Obtain embankment materials from suitable right-of-way excavations within the limits of work.

3.3 Embankment and Specialty Embankment Material

.1 Place excavated material as embankment and specialty embankment material following stripping to the design lines and grades, cross sections and dimensions as shown on the contract drawings. Wrap specialty embankment materials (underlay and overlay) with woven geotextile. Install geotechnical instrumentation in the required locations prior to the placement of embankment (see 3.4 – Geotechnical Instrumentation below). Install 1 m high gravel berm as shown on the contract drawings.

.2 In locations with high fills as identified in the table below, the Contractor shall be responsible for staging the placement of embankment and granular materials per the following time requirements.

.1 Embankment and granular material, 0 m – 4 m (as measured from bottom of stripped material): No material placement time restrictions.

.2 Embankment and granular material, 4 m – Top Finish Grade (as measured from bottom of stripped material): Rate of material placement not to exceed a thickness of one (1) m per every five (5) days. Lift thickness shall be measured in a compacted state.

The above time requirements for placement and compaction of embankment and granular material may be relaxed at the sole discretion of the Departmental Representative based on the review of the geotechnical monitoring data, survey data, and field observations during construction.

Table: High Fill Areas Requiring Staged Construction and Geotechnical Instrumentation
Location
Km 744+640 – Km 744+780
Km 745+530 – Km 745+780
Km 746+000 – Km 746+380
Km 749+560 – Km 749+800

.3 The Contractor shall observe precautions necessary for

protection of all geotechnical instrumentation devices installed for the duration of the work. After instrumentation devices have been installed, the Contractor shall replace at his own cost any equipment that is damaged or becomes unreliable for the monitoring and data collection requirements as a result of his negligence. Damaged monitoring equipment shall be repaired or replaced by the Contractor and the cost of this work shall be incidental to the project.

.4 When embankments are made on hillsides or existing embankments steeper than 1.5V:5H, the slopes of the embankment shall be terraced in a continuous series of steps a minimum of 1.5 m wide.

.5 If suitable, the material excavated to generate the terraced / steps on hillsides shall be spread and compacted into the adjoining embankment. No additional payment will be made for excavation of terraces / steps or for placing step material in the adjoining fill.

.6 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized.

.7 Maintain crowned surface during construction to ensure ready run-off of surface water.

.8 Drain low areas before placing materials.

.9 Place and compact to full width in layers not exceeding 200 mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.

.10 Where material consists of rock:

.1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.

.2 Carefully distribute rock material to fill voids with smaller fragments to form compact mass.

.3 Fill surface voids at subgrade level with rock spalls or selected material to form earth-tight surface.

.4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 300 mm of subgrade elevation.

.11 Break material down to sizes that enable required compaction and mix for uniform moisture to full depth of layer. Embankment materials which cannot be compacted to the required density due to high moisture content, or embankment materials with a natural moisture content greater than optimum, shall not be used without prior aeration and drying.

.12 Compact each layer to minimum 95% maximum dry density (ASTM D698-12). If more than 30% of the embankment material is oversized (retained on a 19 mm sieve), test compaction of the embankment using proof rolling.

Proof rolling shall require one complete coverage of the entire embankment area for each lift by the tires of a truck having a 9 tonne single axle dual tire or 17 tonne tandem axle group with dual tires with a tire pressure of 600 kPa.

When testing the compaction of the embankment material using proof rolling, the material shall be considered compacted when upon completing a pass over the embankment area, the embankment exhibits deformations less than 5 mm in depth.

.13 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

.14 Shape entire embankment to within 100 mm of design lines and grades. Finish slopes and ditch bottoms to neat condition, true to lines, grades and drawings where applicable.

.15 Remove rocks over 150 mm in any dimension from slopes and ditch bottoms.

.16 Hand finish slopes that cannot be finished satisfactorily by machine.

.17 Round top of cut slope per Cut Slope Treatment Detail found in the contract drawings.

.18 Run dozer tracks over slopes exceeding 3 m in height to leave growser tracks parallel to centerline of highway.

.19 Trim between constructed slopes and edge of Clearing to provide drainage free of humps, sags, ruts, and protruding stones.

.20 Maintain finished surfaces in condition conforming to this

Section until acceptance by Departmental Representative.

3.4 Geotechnical Instrumentation Installation and Monitoring

.1 Install Toe Pegs a minimum of 1 m into the native ground (measured following stripping) at the edge of the proposed embankment. Typical installation details are shown on the Drawings. Toe Pegs shall have a minimum stick out of 1.2 m above the final grade. Care shall be taken by the Contractor not to damage or disturb the toe pegs after installation. Toe pegs shall be installed in the locations shown on the contract drawings at a maximum spacing of 20 m.

.2 Install Piezometers under the supervision of the Departmental Representative. Typical installation details are shown on the Drawings. The Contractor shall install the piezometers down a cased borehole to a depth of 15 m from the bottom of the stripped surface prior to the start of fill placement. Extend drill depth if directed by the Departmental Representative (additional drilling costs to be covered by Change Order). The Contractor shall install the vibrating-wire transducer within a sand filter zone capped by a bentonite seal 2 m thick. The Contractor shall install a protective cover or casing overtop of the vibrating-wire cable, which shall be run laterally (horizontally) along the ground surface to a distance of least 3 m outward from the toe of the embankment fill. The exposed end of the piezometer cable shall be housed within a protective metal casing installed at or near the toe of the embankment fill. Care shall be taken by the Contractor not to damage the piezometer tip or cable after installation. The depth and elevation of the piezometer tip shall be recorded by the Contractor upon initial installation, and this information shall be clearly marked on a permanent label which shall be affixed to the end of the piezometer cable by the Contractor. Piezometers shall be installed in the locations shown on the contract drawings. At the completion of the installation, the Piezometers shall be fully functional as intended for the data collection requirements completed by the Departmental Representative.

.3 Slope inclinometers shall be installed under the supervision of the Departmental Representative. Typical installation details are shown on the Drawings. The Contractor shall install slope inclinometers to a depth of 10 m from the bottom of the stripped surface prior to the start of fill placement. Extend drill depth if directed by the Departmental Representative (additional drilling costs to be covered by Change Order). The installation shall be secured to base of the hole using RST Instruments Ltd. inclinometer casing anchors or pre-approved equivalent. The Contractor

shall ensure that probe grooves on the inside of the inclinometer casing are aligned in the anticipated direction of movement.

The annulus between the borehole wall and inclinometer casing shall be backfilled by the Contractor with a cement/bentonite grout compatible with the surrounding soil, which shall be placed in a manner not to damage or distort the casing (the use of grout ports to grout from the inside of the inclinometer casing is discouraged). Regardless of the method used, the Contractor shall not apply weight or force to the top of the inclinometer casing to hold it in place during grouting. The Contractor shall ensure that the upper portion of the inclinometer installation is protected by a 100 mm diameter outer steel casing to the dimensions shown on the Drawings. The inclinometer casing, and the 100 mm diameter outer steel casing, shall extend a minimum of 0.5 m above the final grade of the proposed embankment and granular materials.

At the completion of installation, the horizontal orientation (azimuth) of the probe grooves shall be measured by the Contractor using a compass and the primary ('A-A') groove clearly marked on the casing with permanent marking. The Contractor shall also carefully lower a sounding tape or "dummy" probe to the bottom of the completed installation, in a manner to prevent damage to the casing, in order to confirm there are no obstructions. The depth and elevation of the inclinometer tip shall be recorded by the Contractor following initial installation, and this information shall be clearly marked by the Contractor on the inclinometer casing with permanent marking. Slope inclinometers shall be installed in the locations shown on the contract drawings. At the completion of the installation, the slope inclinometer casings shall be fully functional as intended for the data collection requirements completed by the Departmental Representative.

.4 The Contractor shall monitor and survey the position and elevation of the toe pegs at the following intervals.

.1 Upon installation of the Toe Pegs.

.2 One day before placement of any lift;

.3 Immediately after placement and compaction of a maximum thickness of 1 m of embankment fill, once the total compacted thickness of the embankment reaches 4 m.

.4 Two days after placement and compaction of a maximum thickness of 1 m of embankment fill.

.5 Four days after placement and compaction of a maximum thickness of 1 m of embankment fill.

.6 Once a week after the first week of fill placement, if required.

The survey monitoring data shall include:

.1 Surveyed locations and elevations of the top of the toe pegs.

.2 Surveyed locations and elevations of the top of embankment fill adjacent to the toe pegs.

The survey monitoring data shall be provided by the Contractor to the Departmental Representative in a consistent format within twenty-four hours after completion of survey. The Contractor shall use consistent reference elevations and reference numbers for the toe pegs.

Survey data shall be collected at an accuracy of +/-0.05 m horizontal and +/-0.05 m vertical or better and shall be referenced to the project elevation and coordinate grid system.

.5 The Contractor shall perform survey monitoring along the centerline of the top elevation of the Crushed Base Course once placed and compacted. Survey monitoring shall be completed at consistent locations (maximum 20 m intervals) within the limits of the high fills. The survey monitoring shall be completed at the following intervals.

.1 Immediately following placement and compaction of the Crushed Base Course

.2 Weekly for a duration of one month, bi-weekly following the first month, or until the application of the BST.

The survey monitoring data shall be provided by the Contractor to the Departmental Representative in a consistent format within twenty-four hours after completion of survey. The Contractor shall use consistent reference elevations and reference stations.

Survey data shall be collected at an accuracy of +/-0.05 m horizontal and +/-0.05 m vertical or better and shall be

referenced to the project elevation and coordinate grid system.

3.5 Surplus Excavation Material

.1 Place surplus excavated material (if any) on the slopes of the finished embankment in locations directed by the Departmental Representative.

.2 Place surplus excavation to a maximum thickness of 200 mm. Shape surplus excavation to remove high a low spots within 50 mm of the average thickness. Neatly shape outside limits of placed material to eliminate sharp changes in lines and grades. Ensure ready run-off of surface water.

.3 Ensure placed Surplus Excavation is not placed in ditches or interfering with established or design drainage patterns.

.4 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized.

.5 Do not place surplus excavation material with boulders and rock fragments with dimensions exceeding 200 mm.

.6 Hand finish slopes that cannot be finished satisfactorily by machine.

.7 Run dozer tracks over placed surplus excavation and leave growser tracks parallel to centerline of highway.

.8 Trim between constructed slopes and edge of Clearing to provide drainage free of humps, sags, ruts, and protruding stones.

.9 Maintain finished surfaces in condition conforming to this Section until acceptance by Departmental Representative.

3.6 Cut Slope Stabilization Material

.1 Place Cut Slope Stabilization Material to within 100 mm of the design lines and grades, cross sections and dimensions as shown on the contract drawings.

.2 Place Cut Slope Stabilization Material in a manner to secure surface and create a stable mass.

.3 Finish surface even and neat in appearance.

3.7 Topsoil

.1 Spread topsoil on finished embankment slopes in locations approved by the Departmental Representative. Place topsoil to a thickness of 200 mm (+/- 25 mm, but not uniformly high or low). Neatly shape outside limits of topsoil material to eliminate sharp changes in lines and grades. Ensure ready run-off of surface water.

.2 Remove rocks > 150 mm in diameter and other debris hindering good vegetative growth from the placed topsoil.

.3 Finish surface even, free of large openings and neat in appearance.

.4 Maintain finished surfaces in condition conforming to this Section until acceptance by Departmental Representative.

.5 Waste excess stripping not required for re-use as topsoil between the toe of the embankment fill and the limits of clearing (only in locations approved by the Departmental Representative). Spread stripped material neatly without sharp edges or changes in grade to the thicknesses required but not as to interfere with drainage or ready run-off of surface water. Spreading of wasted excess stripping will not be measured for payment.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 References.

.3 Definitions.

.4 Equipment.

.5 Pulverization of existing BST for reconstruction.

.6 Pulverization of decommissioned highway BST.

1.2 Measurement and Payment Procedures

.1 Payment for pulverization of existing highway BST where the existing highway driving surface (top of BST) is located in the zone of proposed Select Subgrade Fill Material will be made on the basis of the Price per Unit Bid for Pulverization of Existing BST for Reconstruction in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for scarifying, mixing, re-grading (if required), compaction, and all other items necessary for successful completion of the work.

.2 Measurement for Payment for Pulverization of Existing BST for Reconstruction will be made by Lump Sum of the work completed and accepted by the Departmental Representative.

1.3 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

1.4 Definitions

.1 Base Preparation: in place reclamation procedure in which the existing BST and a predetermined portion of the underlying granular materials are scarified, mixed, and blended into a homogeneous material and incorporated into the road base. Re-grade as necessary.

PART 2 – PRODUCTS

2.1 Equipment

.1 The base preparation process shall be completed using a pulvi-mixer or other pre-approved equipment. In all cases the equipment selected by the Contractor shall be capable of scarifying the existing BST and granular materials into constituent particles and mixing the existing BST and granular materials into a single homogeneous material.

PART 3 – EXECUTION

3.3 Pulverization of Decommissioned Highway BST

.1 Pulverization existing highway BST designated on the contract drawings for decommissioning.

.2 Complete pulverization by.

.1 Scarify and mix existing BST and granular materials to a depth of 200 mm.

.2 Reduce existing BST and granular materials to a 50 mm maximum particle size.

.3 Scarify and mix existing BST and granular materials such that the material is mixed and blended into a homogeneous material.

.3 Reshaped the pulverized surface such that the finished surface is free of sharp changes in lines and grades and neat in appearance to the approval of the Departmental Representative.

.4 Maintain reshaped surface in condition conforming to this section until succeeding material (hydraulic seeding) is applied.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 References.

.3 General.

.4 Riprap.

.5 Riprap underlayer.

.6 Cut slope drainage swale material.

.7 Woven geotextile.

.8 General.

.9 Placement.

1.2 Measurement and Payment Procedures

.1 Measurement and Payment for riprap and surface drainage material shall be as per the applicable work included in Section 31 23 33.01.

1.3 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D4632-91(1996), Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

.2 ASTM D4533-91(1996), Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

.3 ASTM D4833-00, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

.4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kNm/m^3).

PART 2 – PRODUCTS

2.1 General

.1 All materials are supplied to the Contractor "as is". The Contractor will be responsible for the sorting, screening, manufacture, or any other required processing (excluding blasting) to achieve all material requirements from the "as is" material.

.2 The Contractor may visit the site and take samples to assist in defining the level of effort the Contractor will need to undertake to achieve gradation and any other requirements or assist with any other concerns.

.3 A collection of previously collected geotechnical data from the materials in this area (excluding Wood Creek Quarry riprap) is available for the Contractors reference in the Km 737 – 750.3 Highway Realignment, Alaska Highway, BC, Factual Geotechnical Data Report (Appendix A).

.4 Obtain Natural Substrate and Cut Slope Drainage Swale Material from designated borrow areas outside the limits of the work only after suitable right-of-way excavations within the limits of the work have been exhausted.

2.1 Riprap

.1 Riprap shall be 50 Kg Class Riprap and 250 Kg Class Riprap from the following sources:

.1 Previously blasted rock material at PWGSC's Wood Creek Quarry (Km 650), (see Section 01 11 10 – Summary of Work, 1.6 – Owner Supplied Materials). The rock material shall be sorted or screened by the Contractor into material achieving the Riprap requirements.

.2 From other offsite sources pre-approved by the Departmental Representative should the Contractor choose. Should the Contractor elect to supply all or part of the aggregate from other sources, any additional costs incurred will be incidental to the Unit Rate Bids for the different material types.

.2 The Riprap shall conform with the following requirements:

.1 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.

.2 Is a graded material conforming with the following gradation limits:

50 Kg Class Riprap		
Mass (kg) *	Nominal Diameter (mm) @ 2650 kg/m³	Percent Larger Than
300	600	0
150	500	15

50	350	50
5	160	85
1	95	100

250 Kg Class Riprap		
Mass (kg) *	Nominal Diameter (mm) @ 2650 kg/m³	Percent Larger Than
1000	950	0
750	850	15
250	600	50
25	275	85
5	150	100

.3 Neither the breath or the thickness of any individual piece of material is to be less than one-third of its length. A maximum of 2.0 percent by weight of such pieces will be permitted.

.4 Should the Contractor elect to supply all or part of the Riprap from other sources, the material shall conform with the requirements of:

.1 The requirements for the Riprap listed above in Section 2.4.3.

.2 Have a relative density: to ASTM C127, not less than 2.65.

2.2 Riprap Underlayer

.1 Riprap Underlayer shall be Specialty Embankment Materials or Cut Slope Stabilization Material in accordance with Section 31 05 16 – Aggregates: General.

2.3 Cut Slope Drainage Swale Material

.1 Cut Slope Drainage Swale Material shall be rounded aggregates or angular rock selected, sorted, screened, or manufactured by the Contractor into material achieving the Cut Slope Drainage Swale Material requirements from the following sources:

.1 Materials designated to be excavated within the limits of the work.

.2 Cut Slope Drainage Swale Material shall be a 300 mm minus material comprised of rounded aggregates or angular rock produced from screening and or blending of materials. The material shall have a generally uniform gradation conforming to following gradation limits:

Cut Slope Drainage Swale Material	
Sieve Designation (mm)	**Percent Passing by Weight**
300	100
150	20 – 50
50.0	0 – 10

.3 The Natural Substrate shall be substantially free of clay lumps, organic matter, and other extraneous material.

2.4 Woven Geotextile

.1 The Woven Geotextile shall be Nilex 2002 or pre-approved equivalent.

PART 3 – EXECUTION

3.1 General

.1 Aggregate extraction, processing, QA sampling, handling and transportation, stockpiling, and cleanup shall in accordance with the requirements of 3.1 – 3.4 of Section 31 05 16 – Aggregates: General.

3.2 Placement

.1 Placement of Riprap, Natural Substrate, Cut Slope Drainage Swale Material, and Woven Geotextile shall be in accordance with Section 31 23 33.01 – Excavating, Trenching, and Backfilling.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes	.1	Measurement and payment procedures.
	.2	References.
	.4	Materials.
	.5	Inspection and survey of underlying surface.
	.6	Placing.
	.7	Compaction.
	.8	Tolerances.
	.9	Protection
1.2 Measurement and Payment Procedures	.1	Payment for Select Subgrade Fill Material will be made on the basis of the Price per Unit Bid for Select Subgrade Fill Material in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs included with the excavation, manufacture, loading, transport, and placement of the Select Subgrade Fill Material, and all other items necessary for successful completion of the work.
	.2	Measurement for Payment for completion of Select Subgrade Fill Material will be made on the volume of material surveyed in cubic metres, incorporated in the works (at the completion of compaction and grading) and accepted by the Departmental Representative.
1.3 References	.1	ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

PART 2 – PRODUCTS

2.1 Materials	.1	Material shall be Select Subgrade Fill Material in accordance with Section 31 05 16 – Aggregates: General.

PART 3 – EXECUTION

3.1 Inspection and Survey of Underlying Surface.	.1	Place Select Subgrade Fill Material after underlying surface is surveyed by the Contractor and is inspected and approved by Departmental Representative.
3.2 Placing	.1	Place Select Granular Subgrade Fill Material to lines and grades shown on the contract drawings.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, properly shaped and compacted, and free from snow and ice.

.4 Begin spreading Select Subgrade Fill Material on crown line or on high side of one way slope.

.5 Place material in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.7 Remove and replace segregated material.

.8 Complete dust control using water as required throughout the work (see Section 32 15 60 – Roadway Dust Control).

3.3 Compaction

.1 Compact to density not less than 95% maximum dry density in accordance with ASTM D698.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted structure.

.3 Apply water as necessary during compacting to obtain specified density. If Select Granular Sub-grade Fill is excessively moist, take remedial action as directed by Departmental Representative.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.4 Tolerances

.1 Finished base surface to be within plus or minus 50 mm of the design lines and grades but not uniformly high or low.

3.5 Protection

.1 Maintain finished base in condition conforming to this section until acceptance by Departmental Representative and until succeeding material is applied. No separate payment will be made for maintenance.

.2 Complete dust control using water as required succeeding

material is applied (see Section 32 15 60 – Roadway Dust Control).

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes	.1	Measurement and payment procedures.
	.2	References.
	.4	Materials.
	.5	Inspection and survey of underlying surface.
	.6	Placing.
	.7	Compaction.
	.8	Tolerances.
	.9	Protection
1.2 Measurement and Payment Procedures	.1	Payment for sub-base course material will be made on the basis of the Price per Unit Bid for Sub-base Course in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs included with the excavation, manufacture, loading, transport, and placement of the sub-base course material, and all other items necessary for successful completion of the work.
	.2	Measurement for Payment for completion of Sub-base Course will be made on the volume of material surveyed in cubic metres, incorporated in the works (at the completion of compaction and grading) and accepted by the Departmental Representative.
1.3 References	.1	ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

PART 2 – PRODUCTS

2.1 Materials	.1	Material shall be Sub-base Course material in accordance with Section 31 05 16 – Aggregates: General.

PART 3 – EXECUTION

3.1 Inspection and Survey of Underlying Surface.	.1	Place Sub-base Course material after underlying surface is surveyed by the Contractor and is inspected and approved by Departmental Representative.
3.2 Placing	.1	Place Sub-base Course material to lines and grades shown on the contract drawings.

	.2	Ensure no frozen material is placed.
	.3	Place material only on clean unfrozen surface, properly shaped and compacted, and free from snow and ice.
	.4	Begin spreading Sub-base Course material on crown line or on high side of one way slope.
	.5	Place Sub-base Course material using methods which do not lead to segregation or degradation.
	.6	Place material in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
	.7	Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
	.8	Remove and replace segregated material.
	.9	Complete dust control using water as required throughout the work (see Section 32 15 60 – Roadway Dust Control).
3.3 Compaction	.1	Compact to density not less than 98% maximum dry density in accordance with ASTM D698.
	.2	Shape and roll alternately to obtain smooth, even and uniformly compacted structure.
	.3	Apply water as necessary during compacting to obtain specified density. If Sub-base Course material is excessively moist, take remedial action as directed by Departmental Representative.
	.4	In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
	.5	Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
3.4 Tolerances	.1	Finished base surface to be within plus or minus 50 mm of the design lines and grades but not uniformly high or low.
3.5 Protection	.1	Maintain finished base in condition conforming to this section until acceptance by Departmental Representative and succeeding material is applied. No separate payment will be made for maintenance.

.2 Complete dust control using water as required succeeding material is applied (see Section 32 15 60 – Roadway Dust Control).

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 References.

.4 Materials.

.5 Inspection and survey of underlying surface.

.6 Placing.

.7 Compaction.

.8 Tolerances.

.9 Protection.

.10 Reshaping existing Crushed Base Gravel for BST (Km 736+988 to Km 742+560).

1.2 Measurement and Payment Procedures

.1 Payment for crushed base gravel will be made on the basis of the Price per Unit Bid for Crushed Base Gravel in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs included with the excavation, manufacture, loading, transport, and placement of the crushed base gravel, and all other items necessary for successful completion of the work.

.2 Measurement for Payment for completion of Crushed Base Gravel will be made on the volume of material surveyed in cubic metres, incorporated in the works (at the completion of compaction and grading) and accepted by the Departmental Representative. The volume of Crushed Base Gravel measured for payment shall include Crushed Base Gravel used in the bedding and backfill of culverts as shown on the contract drawings.

.3 Payment for the cost of reshaping the existing Crushed Base Gravel for BST from station Km 736+988 to Km 742+560 will be made on the basis of the Price per Unit Bid for Reshaping Existing Crushed Base Gravel for BST (Km 736+988 to Km 742+560) in the Bid and Acceptance Form. The Price per Unit Bid shall include all cost for the reshaping of the crushed base gravel back to the design lines and grades, compaction, temporary removal of the precast concrete barrier and precast concrete lock blocks within the limits of the BST, replacement of the precast concrete barrier and precast concrete lock blocks following completion of the BST and all other items necessary for the successful completion of the task. Should additional

Crushed Base Gravel be required to achieve the design lines and grades, the volume of material added will be included in the volume of Crushed Base Gravel.

.4 Measurement for Payment for completion of the Reshaping Existing Crushed Base Gravel for BST (Km 736+988 to Km 742+560) will be made by Lump Sum based on the percentage of the work completed and accepted by the Departmental Representative.

1.3 References

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

PART 2 – PRODUCTS

2.1 Materials

.1 Material shall be Crushed Base Gravel in accordance with Section 31 05 16 – Aggregates: General.

PART 3 – EXECUTION

3.1 Inspection and Survey of Underlying Surface.

.1 Place Crushed Base Gravel after underlying surface is surveyed by the Contractor and is inspected and approved by Departmental Representative.

3.2 Placing

.1 Place Sub-base Course material to lines and grades shown on the contract drawings.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, properly shaped and compacted, and free from snow and ice.

.4 Begin spreading Sub-base Course material on crown line or on high side of one way slope.

.5 Place Crushed Base Gravel using methods which do not lead to segregation or degradation.

.6 Place material in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 Remove and replace segregated material.

.9 Complete dust control using water as required throughout

		the work (see Section 32 15 60 – Roadway Dust Control).
3.3 Compaction	.1	Compact to density not less than 100% maximum dry density in accordance with ASTM D698.
	.2	Shape and roll alternately to obtain smooth, even and uniformly compacted structure.
	.3	Apply water as necessary during compacting to obtain specified density. If Crushed Base Gravel material is excessively moist, take remedial action as directed by Departmental Representative.
	.4	In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
	.5	Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
3.4 Tolerances	.1	Finished base surface to be within plus or minus 20 mm of the design lines and grades but not uniformly high or low.
3.5 Protection	.1	Maintain finished base in condition conforming to this section until succeeding material (BST) is applied or until acceptance by Departmental Representative. No separate payment will be made for maintenance.
3.6 Reshaping Existing Crushed Base Gravel for BST (Km 736+988 to Km 742+560)	.1	Prior to the placement of BST, reshape the existing Crushed Base Gravel for from Km 736+988 to Km 742+560. Remove precast concrete lock blocks and precast concrete barrier within the limits of the proposed BST prior to reshaping the Crushed Base Gravel.
	.2	Reshape to the design lines and grades shown on the design drawings provided in Appendix F. Use equipment and methods required to achieve compaction and placement tolerances for Crushed Base Gravel as specified in this specification for Crushed Base Gravel.
	.3	If approved by the Departmental Representative, add new Crushed Base Gravel should the amount of existing Crushed Base Gravel be deficient to achieve the design lines and grades (including superelevation) shown on the contract drawings.
	.4	Replace precast concrete lock blocks and precast concrete barrier removed for the reshaping following the completion of the BST. The precast concrete lock blocks and precast

concrete barrier shall be placed to the design locations shown on the design drawings provided in Appendix F.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 Submittals.

.3 Samples.

.4 References.

.5 Product acceptance.

.6 BST materials.

.7 Storage.

.8 Equipment.

.9 Preparation and layout.

.10 Application.

.11 Workman ship.

.12 Traffic control

.13 Claims for vehicle damage.

1.2 Measurement and Payment Procedures

.1 Payment for asphalt material will be made on the basis of the Price per Unit Bid for Asphalt Material in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for purchase, delivery, storage, handling, and use of the Asphalt Material, and all other items necessary for successful completion of the work.

No separate payment will be made for repairing, replacing or disposing of failed BST surface treatment. Aggregate and/or asphaltic patching material (cold mix) required for repairing or replacing surface treatment to be provided by the Contractor at his cost. If required, PWGSC aggregate and/or asphaltic patching material will be made available to the Contractor at the following rates – Aggregate $18.00/m^3$ - Cold Mix $200.00/m^3$.

.2 Measurement for Payment for the supply of the Asphalt Material will be made by the mass of material measured in tonnes incorporated into the BST, scaled, and accepted by the Departmental Representative.

All asphalt material to be weighed on scales approved by

Weights and measures Inspection Services, Department of Consumer and Corporate Affairs, Canada. Proof of such approvals to be provided to Departmental Representative upon request. Weigh slips to show printed tare weight to be provided and loaded weight for each delivery.

.3 Payment for bituminous surface treatment (BST) will be made on the basis of the Price per Unit Bid for Bituminous Surface Treatment in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs included with the manufacture, loading, transport, and placement of the BST aggregate, the supply and placement of asphalt materials and emulsion products, and all other items necessary for successful completion of the work.

.4 Measurement for Payment for completion of Bituminous Surface Treatment will be made on the area of material surveyed in square metres, incorporated in the works and accepted by the Departmental Representative.

1.3 Submittals

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

.2 Submit to the Departmental Representative for review and approval a professionally prepared graded seal coat design, from which asphalt emulsion application rate, the asphalt emulsion compatibility with the aggregate, spraying temperature, and the aggregate spread rate shall be determined. The Contractor shall inform the Departmental Representative of the intended emulsion application rate and aggregate spread rate three days prior to start of work and at any time subsequent changes are made to these rates.

1.4 Samples

.1 The Contractor shall sample the Aspahlt Materials. These samples shall be obtained, handled and stored in accordance with ASTM procedure D140 "Standard Practice for Sampling Bituminous Surface Material" and per manufacturers' recommendations.

.2 Provide test results, certified by a professional Engineer, from an independent laboratory, on each load of asphalt material sampled from middle 1/3 of load. Sampling shall be done on site by the Contractor, and shall consist of two samples, one to be tested and one to be retained as a witness sample.

.3 Provide Departmental Representative with these test results within two (2) weeks of the completion of the BST.

1.5 References

.1 British Columbia MoT – 2009 Standard Specifications for

Highway Construction.

1.6 Product Acceptance

.1 The completed BST shall be free of surface defects as described in the following tables and may be rated by the Departmental Representative for satisfactory performance at any time within one year of completion.

.2 Performance rating will be in accordance with the criteria described in the following tables:

Table: Surface Defect Parameters

Surface Defects	Severity	Rating Parameters
Loss of Cover Aggregate (Ravelling)	Very good	No noticeable aggregate loss
	Good	A few pock marks, less than 5 per 0.09 m^2
	Fair	Frequent pock marks closely spaced, more than 6 per 0.09 m^2
	Poor	Extensive pock marks or few surface disintegrations surface defects
	Very poor	Disintegrations with potholes
Potholes	Very good	Few minor potholes, only involves BST
	Good	Few deep potholes, involves granular base
	Fair	Intermittent potholes
	Poor	Frequent potholes
	Very poor	Extensive or potholes throughout
Flushing/Bleeding	Very good	No/very faint noticeable colour change in wheel path
	Good	Few sections with asphalt on surface
	Fair	Intermittent sections with asphalt on surface
	Poor	Frequent sections with asphalt on surface, has wet look or asphalt on surface throughout
	Very poor	Wet look with tire noise like a wet pavement
Total Failure	Any	Any condition where the asphalt material fails or disintegrates under traffic and aggregate is picked up or "kicked off" by traffic

Table: Density of Surface Defects

Units	Ravelling (% Length)	Potholes (Numbers)	Flushing/Bleeding (% Length)
Few	<5%	<5	<5%
Intermittent	>5%<20%	>5<15	>5%<20%
Frequent	>20%<50%	>15<30	>20%<50%

Extensive	>50%<80%	>30<50	>50%<80%
Throughout	>80%	>50	>80%

Note: ** Based on percent of surface area affected per 0.5 lane km length of BST application.

.3 The departmental Representative will notify the Contractor in writing of the requirement for repairs/replacement of failed BST.

.4 Repair/replacement of failed surface treatments shall be completed within 30 days of notification by the Departmental Representative in accordance with the requirements of Table below. When surface condition is a safety concern, repair/replacement of failed surface treatments shall be completed within 7 days of notification by the Departmental Representative. Any materials used in repair/replacement surface treatments shall be consistent with those originally specified in the contract or otherwise approved by the Departmental Representative. Failure to complete repair/replacement within specified time frame will result in work being affected by the Departmental Representative with cost assessed to the Contractor.

Table: Surface Treatment Repair/Replacement Criteria		
Surface Defect	**Severity**	**Repair/Replace Method**
Loss of Cover Aggregate (Ravelling)	Very Good/Good	None
	Fair/Poor/Very Poor	Reseal of affected area ***
Potholes	Very Good/Good	All potholes to be filled with asphaltic patching material and reseal
	Fair/Poor/Very Poor	Patch potholes and reseal affected area ***
Flushing/Bleeding	Very Good/Good	None
	Fair	Application of Sand Blotter
	Poor/Very Poor	Reseal of affected area. Removal of initial surface treatment at Contractor's option
Flushing/Bleeding	Any	Remove and dispose of failed surface treatment in its entirety and apply new surface treatment.

Note: *** Reseal shall consist of a new BST single application. Area of the reseal repair/replacement shall not be less than one application width x 10 metres in length. If there is less than 10 metres between two sections in the application pass designated for repair/replacement, the repair/replacement shall be continuous. If density of surface defects is extensive throughout, reseal entire section.

PART 2 – PRODUCTS

2.1 BST Materials

.1 Asphalt material to be supplied by Contractor – BC-MOT-Section 952 Grade HF250S emulsified asphalt, with anti-

stripping agent added at manufacturers' suggested rate.

.2 If the supplier elects to incorporated nontraditional material components such as, but not limited to, crude oil, waste products and industrial or manufacturing by-products in the High Float emulsified asphalt, the Departmental Representative must be advised in writing before any material is supplied.

.3 BST aggregate shall be BST Aggregate in accordance with Section 31 05 16 – Aggregates: General.

PART 3 – EXECUTION

3.1 Storage

.1 Emulsion products received and stored that show signs of separation or that are not homogenous shall be removed and disposed of at the Contractor's expense and no payment will be made for those materials.

3.2 Equipment

.1 Pressure Distributor.

.1 Distributor to be designed, equipped, maintained and operated so that asphalt material at even temperature may be applied uniformly on variable widths of surface up to 4.88 m at readily determined and controlled rates from 0.3 to 5.5 litre/m2. The litres of emulsified asphalt loaded on to pressure distributor are to be metered for purposes of checking application rates.

.2 Capable of distributing asphalt material in uniform spray without atomization at rate and temperature required.

.3 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir with minimum weight of 10,000 kg.

.4 Equipped with 4.88 metre minimum length spray bar capable of vertical adjustment and of instant full opening and positive cut-off complete with rotary adjustable spray nozzles, designed to ensure uniform fan shaped delivery overlapping to produce uniformly spread surface.

.2 Mechanical Aggregate Spreader.

.1 A self-propelled unit of approved design supported by at least four wheels equipped with pneumatic tires on two axles. Aggregate spreader to be

equipped with positive controls in order that required amount of material will be deposited uniformly over full width of asphalt material.

.3 Rollers.

.1 Minimum of two self-propelled pneumatic tired rollers with minimum weight of 10,000 kg.

.4 Power Broom.

.1 Power broom unit supported by at least four wheels equipped with pneumatic tires on two axels.

.2 Capable of vertical and horizontal angular adjustment.

.3 Minimum 2000 mm brush length.

3.3 Preparation and Layout

.1 Obtain approval of existing surface of Granular Base, re-claimed material or previously applied BST before applying asphalt surface treatment material.

.2 Grade surface of Granular Base to specified grade and cross section. Immediately before asphalt emulsion is applied, broom or otherwise clean as necessary to remove foreign material.

.3 Apply BST in the areas, locations, and limits indicated on the contract documents.

3.4 Application

.1 Schedule work to approval of Departmental Representative.

.2 Apply asphaltic material approved pressure distributor at rate required but at minimum rate of 1.4 litre/m^2 on overlay and minimum 2.3 litre/m^2 on granular base.

.3 Apply aggregate as per design rate required to ensure coverage and minimize wastage. All asphalt material to be covered with aggregate. Roll surface, a minimum of three passes after applying aggregate.

.4 Where required, apply second application of asphalt material and aggregate minimum 72 hours after initial application. Broom surface prior to commencing second application.

.5 Emulsion and aggregate shall be applied only when shade air temperature is at least 10°C. No application shall take place when weather is misty or raining.

3.5 Workmanship

.1 Layout and construct edges parallel to centerline and true to designated design.

.2 Construct longitudinal and transverse joints so as to prevent surface irregularities which would impede moisture runoff or affect vehicle ride or steering.

.3 Construct BST to prevent surface corrugations or rutting greater than 12 mm or which affect vehicle ride.

.4 Construct required repair/replacement patches to prevent surface irregularities which would impede moisture runoff or affect vehicle ride or steering.

.5 Begin sweeping no sooner than 72 hours after application of BST and as often as necessary after 72 hours to remove all loose material from entire road surface and over the fore slope.

.6 On patching areas sweep no sooner than 48 hours after application of BST and sweep until all loose material is removed from entire road surface including the fore slope.

3.6 Traffic Control

.1 Direct traffic through project in accordance with the requirements of Section 01 35 00.06 - Special Procedures: Traffic Control and the following additional requirements.

.1 Pilot traffic continually, until first sweeping, through applied BST sections greater than 1 km in length.

.2 Keep traffic off freshly sprayed asphalt.

.3 If necessary to route traffic over new treatment, restrict speed to 10 km/h or less, until rolling is completed and asphalt has taken initial set.

.4 Install "no road line" signs until centerline paint markings are completed.

.5 Complete dust control using water as required.

3.7 Claims for Vehicle Damage

.1 Without any way limiting his obligations of liabilities herein, during construction and up until final acceptance by the Departmental Representative Contractor shall be fully responsible for all claim damages caused by flying aggregate and shall address, respond to and deal with each claim submitted.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 Water.

.3 Dust control using water.

1.2 Measurement and Payment Procedures

.1 Measurement for Payment for the completion of dust control using water shall not be made and shall be considered incidental to the work.

PART 2 – PRODUCTS

2.1 Water

.1 If necessary, apply for necessary environmental permits for the extraction of water from local sources.

PART 3 – EXECUTION

3.1 Dust Control Using Water

.1 Complete dust control using water over the full width of all utilized driving lanes whenever:

.1 Dust from travelling vehicles impairs driver's vision such that objects greater than 150 m are obscured.

.2 As deemed necessary by the Departmental Representative.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 Materials.

.3 Equipment.

.4 Layout and location of work.

.5 Dimensions of lines.

.6 Condition of surfaces.

.7 Application.

.8 Tolerances.

.9 Protection of completed work.

1.2 Measurement and Payment Procedures

.1 Payment for line painting will be made on the basis of the Price per Unit Bid for Line Painting in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs included with the layout, eradication of previous paint marks (where required), supply and installation of the line painting, and all other items necessary for successful completion of the work.

.2 Measurement for Payment for completion of Line Painting will be made on the length of line painting surveyed in kilometers (measured per line km), measured parallel to the direction of the centerline of the proposed highway, and accepted by the Departmental Representative. Double lines (or simultaneous and broken lines) shall be counted as one single line for quantity calculation. Gaps between broken lines will be considered as a line, and with the gap distance counted in the line quantity.

PART 2 – PRODUCTS

2.1 Paint

.1 Paint.

.1 To CGSB 1 206 M89, alkyd traffic paint.

.2 Color: to CGSB 1-GP-12C, yellow 505 – 308 and 1-GP-12C, white 513 – 301.

.2 Thinner.

.1 To CGSB 1-GP-5M.

.3 Glass Beads.

.1 Overlay Type: to CGSB 1-GP-74M.

PART 3 – EXECUTION

3.1 Equipment

.1 Provide all equipment including but not limited to painting truck, pilot truck and ancillary equipment to load and transport materials.

.2 Painting truck to apply paint and beads as specified.

.3 Eradicator to remove lines if required as directed by Departmental Representative.

3.2 Layout and Location of Work

.1 Layout work as follows.

.1 Contractor shall be responsible for all pre-marking required to properly apply markings.

.2 Paint line types in the locations as provided on the contract drawings.

.2 Paint pavement markings as follows:

.1 Solid (White edge lines), Double Solid (yellow directional dividing lines), Simultaneous Solid and Broken (yellow directional dividing lines prohibiting passing from lane bounded by solid line), Broken (yellow directional dividing lines permitting passing).

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 General.

.2 Measurement and payment procedures.

.3 Submittals.

.4 References.

.5 Quality management.

.6 Retaining wall.

.7 Soil materials.

.8 Install of retaining wall.

1.2 General

.1 The retaining wall shall be provided by the Contractor as a design-build component of the project. The Contractor shall be responsible for all aspects of the wall design and construction to the requirements of this specification. The design of the retaining wall shall consider global stability and incorporate and be integrated with all features and properties of design-build culvert at Ed's Creek (Km 748+133, see Section 33 42 13.01 – Pipe Culverts – Design Build) and the culvert inlet and outlet riprap protection shown on the contract drawings (refer to Section 31 23 33.01 – Excavating Trenching and Backfilling).

1.3 Measurement and Payment Procedures

.1 Payment for the Retaining Wall will be made on the basis of the Price per Unit Bid for Design-Build Retaining Wall in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for:

.1 Design of the retaining wall.

.2 Supply, transport, and install of the wire-mesh faced mechanically stabilized earth Retaining Wall units, all Retaining Wall Geotextiles and Geogrid, and all other components required for the construction of the wall per the manufactures recommendations and design drawings.

.3 Excavation of native materials required for the installation of the retaining walls. Re-use excavated material as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative.

.4 Excavation, manufacture, loading, transport, placement, and compaction of all required granular materials (including any facing stone materials and subbase / foundation materials (as required)) as required for the construction of the retaining wall (includes all backfill and granular materials placed between the outside faces of the two retaining walls and all materials specific to the retaining walls outside this area).

.5 Inspection during construction by a technical representative of the supplier and designer of the wire-mesh faced mechanically stabilized earth Retaining Wall.

.6 All other items necessary for successful completion of the work.

The Price per Unit Bid shall not include the costs for Crushed Base Gravel (See Section 32 11 24), Sub-base Course (see Section 32 11 19), and Select Subgrade Fill Material (see Section 32 11 18) placed within 1 m of the finished grade of the highway behind the retaining walls. The costs for these materials will be paid per the applicable unit rate bid in the Bid and Acceptance Form.

.2 Measurement for Payment for the Design-Build Retaining Wall will be made on the area of Retaining Wall surveyed / measured in square metres, incorporated in the works and accepted by the Departmental Representative. Measurement of the area of the Retaining Wall will be taken of the total front face of the new wall. Areas of overlap (nesting) of the wire-mesh faced mechanically stabilized earth retaining wall units forming the Retaining Wall will only be included in the measurement for the total front face area once (i.e. overlap areas will not be double counted). The area of each retaining wall face (east and west side of highway) will be measured for payment.

1.3 Submittals

.1 Submit to the Departmental Representative for review and approval professionally prepared shop drawings of the complete retaining wall design (east and west side of highway) at least forty five (45) days prior to construction. Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures. At a minimum the shop drawing submission shall include.

.1 Details, dimensions, sizes, lengths, spacings, locations, quantities, and layout of the MSE wall system including the primary reinforcement,

secondary reinforcement, welded wire mesh facing units with support struts, subsurface drain (if required), geotextile fabrics, reinforced soil fill(s) and all backfill materials, levelling pads, and subbase / foundation materials. Additionally the shop drawings shall include material compaction requirements, material standards, strengths and design life, other pertinent information required to adequately review the proposed design.

.2 Details of the integration of the MSE wall system with the proposed Ed's Creek culvert.

.3 Design notes and calculations including at a minimum the design of the soil reinforcing materials, internal stability of the MSE system including bearing pressures and frictional resistances, global stability of the MSE system.

.4 MSE wall system product characteristics, performance criteria, physical size, finish and limitations.

.5 Details of the construction procedures, installation instructions, and quality control to be undertaken by the Contractor during construction.

.6 Documentation showing the selected MSE wall system in use in at least 5 projects of similar magnitude, size, and application as required on this project.

.2 All retaining wall shop drawings are to be in metric units.

.3 The shop drawings shall be sealed by a professional engineer qualified to undertake the work and registered in British Columbia.

.4 Within two (2) weeks of submission and upon review of the shop drawings and supplemental information, the Departmental Representative will either:

.1 Reject the shop drawings and provide comments outlining required changes or details of additional information needed. Following completion of edits, re-submit the shop drawing for review.

.2 Accept the shop drawings.

If the shop drawings are rejected, the Contractor shall make

edits and re-submit the shop drawings for review and acceptance. Any review or comments requested by the Departmental Representative does not in any way relive the Contractor of any of their responsibilities for the design of the complete MSE wall system. No work that affects the MSE wall system will be permitted until the Traffic Management Plan has been accepted by the Departmental Representative.

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

.6 At the completion of the work, the designer shall seal the shop drawing mark-ups certifying that the work was completed per the design or mark-ups provided based the information provided by the Quality Control Manager or additional field inspections (if completed). Refer to Section 01 78 00 – Closeout Submittals for additional details.

1.4 References

.1 American Society of Testing and Materials (ASTM)

.1 D374-94 – Test Methods for Thickness and Solid Electrical Insulation

.2 D1388-96 – Standard Test Method for Stiffness of Fabrics, Option A.

.3 D2455-96 – Standard Test Method for Identification of Carboxylic Acid in Alkyd Resins.

.4 D4595-94 – Standard Test Method of Tensile Properties of Geotextiles by the Wide Width strip method.

.5 D4355-92 – Standard Test Method for Deterioration of Geotextiles from Exposure to ultraviolet Light and Water (Xenon-Arc Type Apparatus).

.6 D4603-96- Test Method for Determining Inherent Viscosity of Poly (Ethylene Terephthalate).

.7 D4716-95 – Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.

.8 D4759-92 – Practice for Determining the Specification Conformance of Geosynthetics.

.9 D5262-97 - Standard Test Method for Evaluating Unconfined Tensile Creep Behaviour of

Geosynthetics.

.10 D5818-95 – Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage.

.11 D6637-01 – Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-rib Tensile Method.

.2 Geosynthetics Research Institute (GRI)

.1 GG2-87 - Standard Test Method for Geogrid Junction Strength.

.2 GG4-91 – Determination of the Long-Term Design Strength of Geogrids.

.3 GG5-91 – Standard Test Method for "Geogrid Pullout".

.4 GG7 - Standard Test Method for Carboxyl End Group Content of Poly (Ethylene Terephthalate) (PET) Yarns Based on a Relative Viscosity Value.

.5 GG8 - Determination of the Number Average Molecular Weight of Poly (Ethylene Terephthalate) (PET) Yarns.

.3 U.S. Federal Highways Administration (U.S. FHWA).

.1 FHWA NHI-00-043 – Mechanically Stabilized Earth Walls and Reinforced Soil Slope Design and Construction Guidelines (Demonstration Project 82).

.2 FHWA NHI-00-044 – Corrosion/Degradation of Soil Reinforcements.

.4 Canadian Highway Bridge Design Code (CAN/CSA-S6-06, latest edition).

1.5 Quality Management

.1 Quality Control and Quality Assurance in accordance with Section 01 45 00 – Quality Management and the following requirements.

.1 The Quality Control Manager shall be responsible for all inspections, testing, survey, procedures for verifying and documenting conformance of the work to the shop drawings and contract

requirements. The Quality Control procedures shall be included in the Quality Management Plan.

.2 The quality control undertaken shall at a minimum conform to the manufactures minimum requirements and shall include all requirements outlined by the retaining wall designers to confirm conformance with the retaining wall design.

.3 During the first two days of the wired-mesh faced mechanically stabilized earth (MSE) retaining wall system installation, facilitate the inspection of the work by a technical representative of the supplier and designer to ensure compliance of the manufactures written recommended installation procedures and design. The technical representative and designer shall be onsite for a minimum of two full working days with a minimum of five rows of mechanically stabilized earth (MSE) retaining wall system installation during this time.

.4 Completion of site reviews and inspections by the supplier and designer as deemed necessary throughout the work.

.5 A representative of the supplier of the culvert shall be available via phone and email to the Departmental Representative, Quality Control Manager, and Contractor on an "as-needed" basis during construction.

.2 In addition to the Quality Control undertaken by the Contractor, the Departmental Representative may undertake, random sampling, inspection, and testing for the purpose of Quality Assurance.

PART 2 – PRODUCTS

2.1 Retaining Wall

.1 The Retaining Wall shall be a wired-mesh faced mechanically stabilized earth (MSE) retaining wall system such as SierraScape® Retaining Wall System (manufactured by Tensar International) or equivalent.

.2 All mechanical components for the retaining wall system (including reinforcement) shall come from single manufacturer or system designed to be jointly integrated.

.3 The design of the retaining walls shall conform to the overall dimensions, angles, and locations shown in the contract drawings, the geometry of the proposed highway,

and be integrated with all features and properties of the design-build culvert at Ed's Creek (Km 748+133, see Section 33 42 13.01 – Pipe Culverts – Design-Build), and the culvert inlet and outlet riprap protection shown on the contract drawings (refer to Section 31 23 33.01 – Excavating Trenching and Backfilling).

.4 The design of the retaining walls shall be designed for internal stability of the retaining walls and global stability of the retaining walls with a minimum factor of safety of 1.5. The global stability design shall consider all opportunities for failure considering the Ed's Creek Culvert, required culvert inlet and out riprap protection, existing native materials.

.5 The design life of the retaining walls and all associated components shall be 100 years.

.6 The design the retaining walls, shall account for stability, long-term settlements and wall deformations. Stability analyses shall be carried out and the retaining wall designed for acceptable short term and long term stability in order to prevent failure or excessive deformation. Additional requirement related to stability and settlements include.

.1 Deformations of the embankment and wall (including settlement and lateral movements) shall be determined using appropriate deformation analyses, with representative soil parameters derived from site specific geotechnical investigations and local experience.

.2 The expected range of embankment and wall displacements including settlement and lateral movements shall be taken into account in the design and performance of the retaining walls over the expected design life. Any differential settlement between the retaining walls and design-build culvert at Ed's Creek shall be within industry standards and less than what would reasonably be expected to cause any failure of the retaining wall or design-build culvert at Ed's Creek.

.7 All steel reinforcement (primary reinforcement, and secondary reinforcement (if used)) shall be protected from exposure to roadway deicing salt by an impervious geomembrane placed above the soil reinforcement layers. The geomembrane shall be sloped to drain all runoff away from the MSE wall components.

.8 The reinforcement (primary reinforcement, and secondary reinforcement (if used)) shall have a mechanical connection to the wired-mesh facing units.

.9 The retaining wall backfill materials within 1 m of the proposed highway grade shall consist of materials of equal or greater properties to the following.

.1 Depth 0 m – 0.3 m (from finished grade): Crushed Base Gravel (See Section 32 11 24)

.2 Depth 0.3 m – 0.6 m (from finished grade): Sub-base Course (see Section 32 11 19)

.3 Depth 0.6 m – 0.1 m (from finished grade): Select Subgrade Fill Material (see Section 32 11 18)

2.2 Soil Materials

.1 The soil materials used to complete the retaining walls including reinforced soil fill(s), backfill materials, levelling pad materials, and subbase / foundation materials shall be Material manufactured by the Contractor from the "as is" material excavated from within the designated excavation within the limits of the work.

.2 All materials are supplied to the Contractor "as is". The Contractor will be responsible for the manufacture, screening, blending, aeration or drying, or any other required processing to achieve all material requirements as designated by the retaining wall designer from the "as is" material.

.3 The Contractor may visit the site and take samples, complete drilling or complete test pits of the available materials to assist in defining the level of effort the Contractor will need to undertake to achieve gradation, compaction, and any other requirements or assist with any other concerns. The Contractor shall notify and obtain pre-approval from the Departmental Representative in advance of any drilling or test pit sampling undertaken by the Contractor.

.4 A collection of previously collected geotechnical data from the materials in this area is available for the Contractors reference in the Km 737 – 750.3 Highway Realignment, Alaska Highway, BC, Factual Geotechnical Data Report (Appendix A).

PART 3 – EXECUTION

3.1 Install of Retaining Wall

.1 Install of the Retaining Wall and associated components

shall be per the manufactures written recommended installation procedures, the designer's requirements, and this section of the specifications. Should an inconsistency between these requirements occur, the consult the Departmental Representative for further direction prior to proceeding.

.2 Install the retaining wall system per the lines and grades shown on the design shop drawings and the contract drawings. Ensure the retaining walls are integrated with all features and properties of the design-build culvert at Ed's Creek (Km 748+133, see Section 33 42 13.01 – Pipe Culverts – Design-Build), and the culvert inlet and outlet riprap protection shown on the contract drawings (refer to Section 31 23 33.01 – Excavating Trenching and Backfilling).

.3 Excavate native materials (as required, reuse as embankment if suitable). Place backfill materials on a properly shaped surface and properly placed Geogrid material per the lines and grades shown in the Contract Drawings and free from debris, snow and ice, organic material, or other deleterious material. Place materials to the maximum lift thickness specified by the designer and compacted to the maximum density requirements.

.4 Use care during placement of backfill fill materials and use appropriately sized compaction equipment to ensure that the Retaining Wall does not deviate from design lines and grades during the backfill and compaction work. Prior to starting compaction, discuss with and gain approval from the retaining wall designer for the use of compaction equipment proposed by the contractor to complete the compaction work.

.5 Adjust depth of nesting on top row of retaining wall system units to ensure:

.1 The nesting depth does not exceed the maximum limits as defined on the contract drawings.

.2 The full retaining wall height as shown on the contract drawings (dimension on each individual cross section) is achieved.

.3 The maximum lift thickness of Crushed Base Gravel situated above the top of the retaining wall system units is not exceeded.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Product data.

.2 Scheduling.

.3 Product handling and storage.

.4 Materials.

.5 Equipment.

.6 Workmanship.

.7 Protection of surfaces.

.8 Preparation of slurry.

.9 Slurry application.

.10 Warranty and maintenance.

1.2 Measurement and Payment Procedures

.1 Payment for hydraulic seeding will be made on the basis of the Price per Unit Bid for Hydroseeding in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for supply, placement, warranty, and maintenance of the Hydroseeding in all areas of decommissioned highway, topsoil, cut slopes and other disturbed areas as detailed in these specifications or as directed by the Departmental Representative.

.2 Measurement for Payment for completion of Hydroseeding will be made on the area of material surveyed in hectors, incorporated in the works and accepted by the Departmental Representative.

1.3 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 Mulch.

.1 Shipping Bill: issued by supplier of material, identifying manufacturer and supplier, material, and net dry-air mass in

each container.

.3 Tackifier.

.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.

.2 Guarantees.

.3 Chemical Analysis.

.2 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.

1.4 Scheduling

.1 Schedule hydraulic seeding to coincide with the completion of other related works on which the hydraulic seeding shall be applied.

1.5 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 mulch, tackifier, and fertilizer in moisture-proof containers displaying product date.

.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:

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 Wood Fiber Mulch shall be specifically manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with the following properties:

.1 Made from wood cellulose fibre.

.2 Organic matter content: 95% +/- 0.5%

.3 Value of pH: 6.0

.4 Potential water absorption: 900%

.3 Tackifier shall be powder produced from natural plant gum or acceptable equivalent and with the following properties:

.1 Free flowing.

.2 Non-corrosive.

.3 Biodegradable.

.4 Water dilutable.

.5 Liquid dispersion.

.4 Water: free of impurities that would inhibit germination and growth.

.5 Fertilizer:

.1 To Canada Fertilizers Act and Regulations.

.2 Complete synthetic, 50% slow release sulfur coated urea. Ratio: 18:18:18.

2.2 Equipment

.1 Capable of mixing and evenly distributing seed, fertilizer, and mulch 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 and appropriate nozzles.

PART 3 – EXECUTION

3.1 Workmanship

.1 Apply hydroseeding in all areas of decommissioned highway, topsoil, cut slopes and other disturbed areas as detailed in these specifications or as directed by the Departmental Representative.

.2 Do not spray onto structures, signs, guiderails, plant material, 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 over 10 km/h, frozen ground or ground covered with snow, ice or standing water, or other adverse conditions.

.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 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 mulch and charge slowly into seeder. Use optimum carrying capacity of water relative to mulch as follows:

.1 Spray mulch 55kg/1000 L.

.2 Silva-Fiber 43kg/1000 L.

.3 Verdyol Standard 38kg/1000 L.

.4 Fibramulch 47kg/1000 L.

.4 After all other material is in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

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 and appropriate nozzles.

.2 Slurry mixture applied per hectare:

.1 Seed mixture: 125kg.

.2 Fall rye: 110kg.

.3 Mulch: According to 3.3.4 above.

.4 Tackifier: 45kg on slopes 1.5:1 or steeper.

.5 Water: Minimum 30,000 L.

.6 Fertilizer: 360kg.

.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 Section Includes

.1 Measurement and payment procedures.

.2 References.

.3 Delivery, storage, and handling

.4 Material certification.

.5 Aluminized CSP culverts.

.6 Culvert end treatment.

.7 Zinc-rich paint.

.8 Culvert bedding and backfill.

.9 General.

.10 Culvert bedding.

.11 Culvert placement.

.12 Culvert joints.

.13 Culvert backfilling.

.14 Culvert end treatment.

.15 Culvert inlet and outlet protection.

.16 Steep slope riprap protection.

1.2 Measurement and Payment Procedures

.1 Payment for the supply and install of aluminized CSP culverts will be made on the basis of the Price per Unit Bid for Aluminized CSP Culverts in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs included with the supply, transport, dewatering (as required), excavation, install, mitred end treatment (when required), bedding and backfill materials (Crushed Base Gravel Bedding Material), couplings, fittings, and hardware for the Aluminized CSP Culverts, and all other items necessary for successful completion of the work.

.2 Measurement for Payment for completion of Aluminized CSP Culverts will be made on the length of culvert surveyed in lineal metres, measured parallel to the direction of the culvert along the invert of the culvert, and accepted by the Departmental Representative.

1.3 References

.1 Canadian Standards Association (CSA International).

.1 CSA-G401-01, Corrugated Steel Pipe Products.

.2 CSA-B182.8-02, Profile Polyethylene Storm Sewer and Drainage Pipe and Fittings.

1.4 Delivery, Storage, and Handling

.1 Handle and store pipe products in a manner to avoid damage, alteration, deterioration and soiling.

.2 Where the material supplied is damaged, the Contractor shall immediately separate nested sections of the plate or pipe to facilitate more detailed inspection by the Departmental Representative. Culvert material designated by the Departmental Representative as unacceptable, due to damage or failure to meet specified requirements, shall be immediately repaired or replaced by the Contractor to the acceptance of the Departmental Representative.

1.5 Material Certification

.1 Prior to ordering materials, submit manufacturer's test data and certification in accordance with Section 01 33 00 – Submittal Procedures.

.2 Certification to be marked on pipe culverts.

PART 2 – PRODUCTS

2.1 Aluminized CSP Culverts

.1 Aluminized CSP Culverts shall be CSP with an aluminum coating such as Armtec Hel-Cor Aluminized Steel Type 2 CSP culverts, Atlantic Industries Limited Aluminized Type 2 CSP culverts, or a pre-approved equivalent. All culverts used on the project shall conform to the following.

.1 Corrugated steel pipe: to CSA-G401.

.2 Culverts to be annular or spiral with annular ends. Coupling bands to be two piece annular bolted with minimum width of nine corrugations.

.3 Minimum wall thickness to be.

.1 Culverts ≤ 1800 mm Diameter: 2.0 mm.

.4 Corrugations to be.

.1 Culverts ≤ 1800 mm Diameter: 68 mm x 13 mm.

.5 Aluminized type 2 coating – provide 75 year

service life in a low-abrasion environment with pH between 5 and 9 and resistivity above 1,500 ohm-cm.

.2 Alternate aluminized CSP culverts may be considered but must be pre-approved by the Departmental Representative. Should the contractor propose an alternative aluminized CSP culvert product, it will be the Contractor's responsibility to prove that the product is equivalent or better than the product listed above.

.3 Ensure that all components for each particular Aluminized CSP Culvert comes from a single supplier.

2.2 Culvert End Treatment

.1 Culvert end treatment shall be as follows.

.1 Culverts ≤ 1800 mm Diameter: 3:1 mitred end sections.

2.3 Zinc-rich paint

.1 Zinc-rich paint shall be Galvacon™ or preapproved equivalent.

2.4 Culvert Bedding and Backfill

.1 Bedding and backfill material shall be Crushed Base Gravel in accordance with Section 32 11 24 – Crushed Base Gravel.

PART 3 – EXECUTION

3.1 General

.1 Complete culvert installation and related works in conformance with the requirements of Section 01 35 43 – Environmental Protection and the Contractor EPP.

3.2 Culvert Bedding

.1 Complete excavation and dewater excavation, as necessary, to allow placement of culvert bedding in dry condition. Excavate to the lines and grades shown on the contract drawings.

.2 Place required bedding thickness (as shown on contract drawings) of Crushed Base Gravel on bottom of excavation and compact to minimum 95% maximum density to ASTM D698.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to the camber as indicated on the contract drawings, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.3 Culvert Placement

.1 Place culvert such that when complete the alignment, grade, camber, location, and inverts are incompliance with the

alignment, grade, location, and inverts shown on the contract drawings.

.2 Begin pipe placing at downstream end.

.3 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.4 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

3.4 Culvert Joints

.1 Match corrugations of coupler with pipe sections before tightening.

.2 Insert and tighten bolts.

.3 Tap couplers firmly with a rubber mallet or similar non-marring tool as they are being tightened, to take up slack and ensure snug fit.

.4 Repair spots where damage has occurred to coating in the field by applying two coats of zinc rich paint approved by the CSP supplier. Allow each coat to dry before placing second coat, bedding or backfill.

3.5 Culvert Backfilling

.1 Backfill around and over culverts as indicated on the contract drawings.

.2 Place Crushed Base Gravel in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.3 Compact each layer to 98% maximum density to ASTM D698 taking special care to obtain required density under haunches. Hand tamp where necessary to obtain compaction.

.4 Protect installed culvert with minimum 900 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 2H:1V.

.5 Place backfill in unfrozen condition.

3.6 Culvert End Treatment

.1 End treatment shall be completed as follows.

.1 Culverts ≤ 1800 mm Diameter: 3:1 mitred end sections. All cut edges shall be made smooth by grinding so that all the

burrs are removed. Any damaged galvanizing shall be restored by zinc metallizing in accordance with CSA G401.

3.7 Culvert Inlet and Outlet Protection	.1	Complete Culvert Inlet and Outlet Protection per Section 31 23 33.01 – Excavating, Trenching, and Backfilling.
3.8 Steep Slope Riprap Protection	.1	Complete Culvert Inlet and Outlet Protection per Section 31 23 33.01 – Excavating, Trenching, and Backfilling.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 General.

.2 Measurement and payment procedures.

.3 Submittals.

.4 References.

.5 Quality management.

.6 Culvert.

.7 Backfill and bedding materials.

.8 Install of culvert.

1.2 General

.1 The culvert at Ed's Creek (Km 748+133) shall be provided by the Contractor as a design-build component of the project. The Contractor shall be responsible for aspects of the culvert design and construction to the requirements of this specification. The design of the culvert shall consider and be integrated with all features and properties of the design-build retaining wall (see Section 32 32 34 – Retaining Wall – Design-Build) and the culvert inlet and outlet riprap protection shown on the contract drawings (refer to Section 31 23 33.01 – Excavating Trenching and Backfilling).

1.3 Measurement and Payment Procedures

.1 Payment for the culvert at Ed's Creek will be made on the basis of the Price per Unit Bid for Design-Build Culvert (Ed's Creek, KM 748+133) in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for:

.1 Selection of the type and design of the culvert.

.2 Supply, transport, and install of the culvert materials and all other components required for the construction of the culvert per the manufactures recommendations and design drawings.

.3 Excavation of native materials required for the installation of the culvert. Re-use excavated material as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative.

.4 Excavation, manufacture, loading, transport, placement, and compaction of all required granular

materials (including bedding materials and foundation materials) as required for the construction of the culvert.

.5 All other items necessary for successful completion of the work.

.2 Measurement for Payment for the completion of the Design-Build Culvert (Ed's Creek, Km 748+133) will be made by Lump Sum based on the percentage of the work completed and accepted by the Departmental Representative.

1.3 Submittals

.1 Submit to the Departmental Representative for review and approval professionally prepared shop drawings of the complete culvert at least forty five (45) days prior to construction. Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures. At a minimum the shop drawing submission shall include.

.1 Details, dimensions, sizes, lengths, quantities, and layout of the culvert including the details of the geotextile fabrics (if required), backfill materials, levelling pads, end treatment, and subbase / foundation materials. Additionally the shop drawings shall include material compaction requirements, product literature and data sheets, performance criteria, physical size, finish, and other pertinent information required to adequately review the proposed design.

.2 Details of the integration of the culvert with MSE wall system.

.3 Design notes and calculations including at a minimum the bearing pressures and performance criteria of the culvert.

.4 Details of the construction procedures, installation instructions, and quality control to be undertaken by the Contractor during construction.

.2 All culvert shop drawings are to be in metric units.

.3 The shop drawings shall be sealed by a professional engineer qualified to undertake the work and registered in British Columbia.

.4 Within two (2) weeks of submission and upon review of the shop drawings and supplemental information, the Departmental Representative will either:

.1 Reject the shop drawings and provide comments outlining required changes or details of additional information needed. Following completion of edits, re-submit the shop drawing for review.

.2 Accept the shop drawings.

If the shop drawings are rejected, the Contractor shall make edits and re-submit the shop drawings for review and acceptance. Any review or comments requested by the Departmental Representative does not in any way relive the Contractor of any of their responsibilities for the design of the complete MSE wall system. No work that affects the MSE wall system will be permitted until the Traffic Management Plan has been accepted by the Departmental Representative.

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

.6 At the completion of the work, the designer shall seal the shop drawing mark-ups certifying that the work was completed per the design or mark-ups provided based the information provided by the Quality Control Manager or additional field inspections (if completed). Refer to Section 01 78 00 – Closeout Submittals for additional details.

1.4 References

.1 Canadian Highway Bridge Design Code (CAN/CSA-S6-06, latest edition).

.2 Alberta Transportation.

.1 Bridge Standard Drawings – Culverts (Available online at http://www.transportation.alberta.ca/4860.htm)

.1 S-1444-93 – Concrete End Treatment for Large Steel Culverts – Sheet 1 (Rev 2).

.2 S-1445-93 – Concrete End Treatment for Large Steel Culverts – Sheet 2 (Rev 3).

1.5 Quality Management

.1 Quality Control and Quality Assurance in accordance with Section 01 45 00 – Quality Management and the following requirements.

.1 The Quality Control Manager shall be responsible for all inspections, testing, survey, procedures for verifying and documenting conformance of the

work to the shop drawings and contract requirements. The Quality Control procedures shall be included in the Quality Management Plan.

.2 The quality control undertaken shall at a minimum conform to the manufactures minimum requirements and shall include all requirements outlined by the culvert designers to confirm conformance with the retaining wall design.

.3 Completion of site reviews and inspections by the supplier and designer as deemed necessary throughout the work.

.4 A representative of the supplier of the culvert shall be available via phone and email to the Departmental Representative, Quality Control Manager, and Contractor on an "as-needed" basis during construction.

.2 In addition to the Quality Control undertaken by the Contractor, the Departmental Representative may undertake, random sampling, inspection, and testing for the purpose of Quality Assurance.

PART 2 – PRODUCTS

2.1 Culvert

.1 The Contractor shall choose and then design the desired culvert for Ed's Creek (Km 748+133) from the following options.

.1 2.935 m (span) x 3.25 m (rise) vertical ellipse SPCSP culvert, min. wall thickness 5.0 mm (galvanized crown, polymer coated invert). Inlet end treatment per Alberta Transportation Drawings.

.1 S-1444-93 – Concrete End Treatment for Large Steel Culverts – Sheet 1 (Rev 2).

.2 S-1445-93 – Concrete End Treatment for Large Steel Culverts – Sheet 2 (Rev 3).

.2 2.4 m (inside span) x 3.65 m (inside rise) Concrete Box Culvert (wall thickness to be determined). Inlet end treatment designed with a mitre and chamfer to maximize flows through the culvert.

.2 All components for the culvert shall come from single manufacturer or system designed to be jointly integrated.

.3 The design of the retaining walls shall conform to the overall dimensions, angles, and locations shown in the contract drawings, the geometry of the proposed inlet and outlet riprap treatment (refer to Section 31 23 33.01 – Excavating Trenching and Backfilling), and be integrated with all features and properties of the design-build retaining wall (see Section 32 32 34 – Retaining Wall – Design-Build).

.4 The design of the culvert shall consider the cover requirements above the culvert and any additional loading, stability, or settlement requirements from the design-build retaining wall. This at a minimum will include:

.1 Culvert bedding, design of connections, and the following specific requirements.

.1 SPCSP – wall thickness, bolting pattern and spacing, bolt capacity.

.2 Concrete box culvert – wall thickness, rebar requirements, concrete strength.

.5 The design life of the culvert shall be 75 years.

.6 The design of the culvert and culvert backfill, shall account for stability, long-term settlements and deformations. A stability and settlement analyses shall be carried to determine the expected range of deformations and displacements including settlement and lateral movements over the design life of the culvert.

The design of the culvert (including camber) shall account for short term and long term settlements, differential settlements between the culvert and the retaining wall in order to prevent failure or excessive deformation.

Deformations of the culvert (including settlement and lateral movements) shall be determined using appropriate engineering analyses with representative soil parameters derived from site specific geotechnical investigations and local experience.

2.2 Backfill and Bedding Materials

.1 The backfill and bedding materials used shall be material manufactured by the Contractor from the "as is" material excavated from within the designated excavation within the limits of the work.

.2 All materials are supplied to the Contractor "as is". The Contractor will be responsible for the manufacture,

screening, blending, aeration or drying, or any other required processing to achieve all material requirements as designated by the culvert designer from the "as is" material.

.3 The Contractor may visit the site and take samples, complete drilling or complete test pits of the available materials to assist in defining the level of effort the Contractor will need to undertake to achieve gradation, compaction, and any other requirements or assist with any other concerns. The Contractor shall notify and obtain pre-approval from the Departmental Representative in advance of any drilling or test pit sampling undertaken by the Contractor.

.4 A collection of previously collected geotechnical data from the materials in this area is available for the Contractors reference in the Km 737 – 750.3 Highway Realignment, Alaska Highway, BC, Factual Geotechnical Data Report (Appendix A).

PART 3 – EXECUTION

3.1 Install of Culvert

.1 Install of the culvert and associated components shall be per the manufactures written recommended installation procedures, the designer's requirements, and this section of the specifications. Should an inconsistency between these requirements occur, the consult the Departmental Representative for further direction prior to proceeding.

.2 Install the culvert shall be per the lines and grades shown on the design shop drawings and the contract drawings. Ensure the culvert is integrated with all features and properties of the culvert inlet and outlet riprap protection shown on the contract drawings (refer to Section 31 23 33.01 – Excavating Trenching and Backfilling) and the design-build retaining wall (see Section 33 32 34 – Retaining Wall – Design-Build).

.3 Complete excavation in compliance with the requirements of the EPP. Divert creek flows, pump, and dewater excavation as necessary to complete the excavation, placement of bedding materials, placement of the culvert, and culvert backfill.

.4 Excavate native materials (as required). Reuse excavated materials as embankment (if suitable) or dispose of the material in an onsite location and condition acceptable to the Departmental Representative.

.5 Place backfill and bedding materials on a properly shaped

surface and properly placed per the lines and grades shown in the Contract Drawings and free from debris, snow and ice, organic material, or other deleterious material.

.6 Place backfill and bedding materials to the maximum lift thickness specified by the designer and compacted to the maximum density requirements.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Measurement and payment procedures.

.2 References.

.3 Submittals.

.4 Quality management.

.5 Existing precast concrete barrier.

.6 New precast concrete barrier.

.7 Existing precast concrete lock blocks.

.8 New precast concrete lock blocks.

.9 Lock block leveling pad material.

.10 Install precast concrete lock blocks (existing and new)

.11 Install precast concrete barriers (existing and new)

1.2 Measurement and Payment Procedures

.1 Payment for the placement of existing precast concrete barrier will be made on the basis of the Price per Unit Bid for Placement of Existing Precast Concrete Barrier in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for transport and placement of the precast concrete barrier, and all other items necessary for successful completion of the work.

.2 Measurement for Payment for the Placement of Existing Precast Concrete Barrier will be made by the count of each type of existing precast concrete barrier installed and accepted by the Departmental Representative. The count of the existing precast concrete barrier installed will not include precast concrete barrier which are temporarily removed for reshaping and BST placement from Km 736+988 to Km 742+560.

.3 Payment for the supply and install of new precast concrete barrier will be made on the basis of the Price per Unit Bid for Precast Concrete Barrier in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for supply, transport, and placement of the precast concrete barrier, and all other items necessary for successful completion of the work.

.4 Measurement for Payment for completion of the Precast

Concrete Barrier will be made by the count of each type of new precast concrete barrier installed and accepted by the Departmental Representative.

.5 Payment for the placement of existing precast concrete locks blocks will be made on the basis of the Price per Unit Bid for Placement of Existing Precast Concrete Lock Blocks in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for transport and placement of the precast concrete lock blocks, and all other items necessary for successful completion of the work.

.6 Measurement for Payment for the Placement of Existing Precast Concrete Lock Blocks will be made by the count of each existing precast concrete lock block installed and accepted by the Departmental Representative. The count of the existing lock blocks placed will not include lock blocks which are temporarily removed for reshaping and BST placement from Km 736+988 to Km 742+560.

.7 Payment for the supply and install of new precast concrete lock blocks will be made on the basis of the Price per Unit Bid for Precast Concrete Lock Blocks in the Bid and Acceptance Form. The Price per Unit Bid shall include all costs for supply, transport, and placement of the precast concrete lock blocks, and all other items necessary for successful completion of the work.

.8 Measurement for Payment for completion of the Precast Concrete Lock Blocks will be made by the count of each type of new precast concrete lock blocks installed and accepted by the Departmental Representative.

1.3 References

.1 British Columbia MoT – 2009 Standard Specifications for Highway Construction.

1.4 Submittals

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

1.5 Quality Management

.1 Quality Control and Quality Assurance in accordance with Section 01 45 00 – Quality Management.

.2 In addition to the Quality Control undertaken by the Contractor, the Departmental Representative may undertake, through an independent CSA-certified testing firm, random sampling, inspection, and testing for the purpose of Quality Assurance.

.3 Provide access to all portions of the work and cooperate with the Departmental Representatives.

.4 Make space available for storage and curing of test samples.

.5 Allow ample time for notification and inspection before scheduling concrete placement.

.6 In the case of the ambiguity whether the product or work conforms to the applicable standard, the Departmental Representative reserves the right to have such product of system tested or re-inspected to ascertain the conformance.

.7 Upon request, the Contractor will furnish the Departmental Representative with the concrete production records used in the work.

PART 2 – PRODUCTS

.1 Existing Precast Concrete Barrier

.1 The existing precast concrete barrier shall be the existing precast concrete barrier stockpiled in accordance with Section 02 41 13 – Selective Site Demolition.

.2 New Precast Concrete Barrier

.1 New precast concrete barrier shall be in accordance with Section 941 – Precast Reinforced Concrete Barriers of the British Columbia MoT – 2009 Standard Specifications for Highway Construction. The precast concrete barrier units used shall be as follows.

.1 Precast Concrete Bull-nose 460 mm – CBN-H.

.2 Precast Concrete Transition Barrier 690 mm to 460 mm – CTB-1E.

.3 Precast Concrete Transition Barrier 810 mm to 690 mm – CTB-2H.

.4 Precast Concrete Median Barrier 810 mm – CMB-E & CMB-H.

.5 Precast Concrete Pier Barrier 810 mm – CPB-H & CPB – E.

.3 Existing Precast Concrete Lock Blocks

.1 The existing precast concrete lock blocks shall be the existing precast concrete lock blocks stockpiled in accordance with Section 02 41 13 – Selective Site Demolition.

.4 New Precast Concrete Lock Blocks

.1 Retaining wall blocks shall conform to the following requirements.

.1 Minimum compressive strength at 28 days: 20 MPa

(verified by standard test cylinders with results conforming to CSA A23.1.17.6.7.1). Units shall be tagged to correlate with representative test results.

.2 Be free of all cracks and other defects that would interfere with the placement, durability, and locking of the units. All shear keys shall be free of damage.

.3 Block dimensions shall be as shown on the contract drawings. Allowable deviation from dimension is +/- 15 mm for the width and depth, and +/- 7 mm for height.

.4 The chamfered corners of the blocks shall provide approximately 50 cm^2 of drainage area per block. Clearance of roughly 10 mm around the locking grooves / shear keys shall provide additional drainage.

.5 Concrete CSA exposure: Class N.

.6 Minimum lifting strength of lifting loop: 15,900 kg.

Lock Block Leveling Pad Material

.1 Lock block leveling pad shall be Crushed Base Gravel in accordance with Section 31 05 16 – Aggregates: General.

PART 3 – EXECUTION

3.1 Install Precast Concrete Lock Blocks (Existing and New)

.1 Complete excavation of native materials (if required) to facilitate the installation of the Crushed Base Gravel leveling pad to the lines and grades shown on the contract drawings.

.2 Install Crushed Base Gravel in accordance to the placing and compaction requirements outlined in Section 32 11 24 – Crushed Base Gravel.

.3 Commence installation of the precast concrete lock blocks following Departmental Representative review and approval of the Crushed Base Gravel leveling pad.

.4 Install existing precast concrete lock blocks in Rock Catchment Type 1 areas.

.5 Install lock blocks per the lines and grades shown on the contract drawings. Allowable vertical tolerance from the line and grades shown is +/- 25 mm / 1.5 m of horizontal wall length and vertical wall height.

3.2 Install Precast Concrete

.1 Install precast concrete barrier following the completion and

Barriers (Existing and New)

acceptance of the Bituminous Surface Treatment.

.2 Install precast concrete barrier units in the locations and alignment shown on the contract drawings.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes	.1	Environmental Requirements.
	.2	Site Clearing and Plant Protection.
	.3	Drainage.
1.2 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 B).
	.4	Responsibility Checklist For Authorizations /Approvals / Notifications / Permitting (Appendix C).
	.5	Relevant Environmental Publications (Appendix D).
	.6	PWGSC Environmental Effects Evaluation (EEE) Report (Appendix G).
	.7	MFLNRO Section 9 Approval for Instream Work (to be provided to the contractor prior to the commencement of onsite work).

PART 2 – PRODUCTS

	.1	Not used.

PART 3 – EXECUTION

3.1 Environmental Requirements	.1	Use borrow material from watercourse beds when approved by the Departmental Representative.
	.2	Design and construct temporary crossings to minimize environmental impact to watercourse.
	.3	Dumping excavated fill, waste material, or debris not shown on the Contract Drawings into the watercourse is prohibited.
	.4	Underwater blasting is not permitted.
3.2 Site Clearing and Plant Protection	.1	Conduct work to provide minimal disturbance to vegetated buffer zones. Protect trees and plants on-site and adjacent properties where indicated.

.2 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 zone.

.3 Leave root mass and stumps in place.

.4 Maintain temporary erosion and pollution control features installed under this contract for the duration of the work. If requested by the Departmental Representative leave erosion and pollution control features in place at the conclusion of the work.

3.3 Drainage

.1 Pumping water containing suspended materials into watercourses is prohibited.

END OF SECTION

R.017173.801
Appendix A

TETRA TECH EBA

OQM | Organizational Quality Management Program

March 17, 2015

ISSUED FOR USE
FILE: 704-V33103085-01

Public Works and Government Services Canada
219, 800 Burrard St.
Vancouver, BC V6Z 0B9

Attention: Alex Taheri, P.Eng., PMP

Subject: Km 737 - 750.3 Highway Realignment, Alaska Highway, BC
Factual Geotechnical Data Report

1.0 INTRODUCTION

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by Public Works and Government Services Canada (PWGSC) to provide geotechnical, hydrotechnical, environmental and civil engineering services for the realignment of Km 737 to 750.3 of the Alaska Highway in northern British Columbia.

This letter report outlines the methodology and findings of geotechnical site explorations undertaken to date by Tetra Tech EBA and others, presents the factual data obtained during the course of these studies, and briefly discusses the surficial geology of the project site.

The purpose of this report is to provide a summary of all available factual geotechnical data for the benefit of all parties involved with the tendering and construction of this project.

2.0 PROJECT LOCATION AND DESCRIPTION

The project site is located approximately 12 km south of the Liard River Bridge and 25 km north of Muncho Lake. The location of the site is shown on Drawing No. C001. The nearest major community is Fort Nelson, BC at Km 455 of the Alaska Highway.

The existing highway and the realigned section from Km 737 to 750 are situated within the Trout River Valley on the west side of the Trout River. Along the valley bottom, the highway is situated on alluvial deposits from the Trout River, comprising variable mixtures of sands, gravels, cobbles and boulders with occasional areas of silt and sandy silt. In most locations these materials are blanketed by a surficial layer of organics. Along the sidewalls of the valley, the alluvial deposits give way to steep terraces up to 100 m in height, generally comprised of glaciofluvial and glaciolacustrine deposits which were laid down at the end of the last ice age. These terraces are erosional features which have been formed by fluvial downcutting of the valley by the Trout River and other tributary creeks in post-glacial time. The material exposed in the terraces is primarily comprised of sand and gravel with some oversize material (cobbles and boulders), although thick sequences of silt and fine sand are also present at lower elevations along the base of some of the terraces. Large cuts are required where the realigned highway section encroaches into these terraces.

3.0 GEOTECHNICAL SITE EXPLORATIONS

3.1 Previous Studies by Others

The following geotechnical site explorations have been previously commissioned by PWGSC along this section of the Alaska Highway:

Tetra Tech EBA Inc.
Suite 1000 – 10th Floor, 885 Dunsmuir Street
Vancouver, BC V6C 1N5 CANADA
Tel 604.685.0275 Fax 604.684.6241

- Terra Engineering Ltd. 1999. Geotechnical Exploration / Drilling Boreholes, Km 737-750, Alaska Highway, BC. Report to PWGSC dated December 3, 1999. 330 pp.
- Thurber Engineering Ltd. 2001. Proposed Culvert, Ed's Creek, Km 748.1, Alaska Highway, British Columbia, Geotechnical Investigation. Report to PWGSC dated January 31, 2001. 31 pp.
- UMA Engineering Ltd. 2002. Design Services - Km 733 to Km 737, Alaska Highway, BC, Final Geotechnical Report. Report to PWGSC dated September 2002. 32 pp.

A brief description of the information contained in these reports is provided below.

3.1.1 Terra Engineering (1999)

Terra Engineering Ltd. completed an extensive drilling program along the Km 737 to 750 corridor in 1999. A total of 166 boreholes (BH5-1 to BH5-166) were drilled and logged through this area using a track-mounted drill rig. The boreholes were spaced at approximate 100 m intervals in fill sections and 50 m intervals in cut sections based on an existing realignment design completed by PWGSC. Geotechnical laboratory index testing was conducted on select soil samples recovered from the boreholes. A copy of the Terra (1999) report is attached in Appendix A. The borehole locations are also shown on the Drawings.

3.1.2 Thurber Engineering (2001)

Thurber Engineering Ltd. completed a drilling program at Ed's Creek (~ Km 748.1) in 2000 to support the design of a new steel multiplate arch culvert structure at this location. Two boreholes (TH00-1 and TH00-2) were drilled using a track-mounted drill rig on either side of the creek, upstream of the existing highway, near the centreline of the realignment design completed by PWGSC. Geotechnical laboratory index testing was conducted on select soil samples recovered from the boreholes. A copy of the Thurber (2001) report is attached in Appendix B. The borehole locations are also shown on the Drawings.

3.1.3 UMA Engineering (2002)

UMA Engineering Ltd. completed a drilling program in 2002 to investigate a proposed cut and borrow pit at Km 746.6 where a large terrace of sand and gravel is located. Three boreholes (TH-02-36 to TH-02-38) were drilled from the top of the terrace to terminus depths of 38 to 41 m. Geotechnical laboratory index testing was conducted on select soil samples recovered from the boreholes. A copy of the UMA (2002) report is attached in Appendix C. The borehole locations are also shown on the Drawings.

3.2 Tetra Tech EBA (2013 - 2014)

Tetra Tech EBA completed two site visits to the Km 737 - 750.3 corridor in October 2013 and September 2014. As part of the October 2013 site visit, a total of eight grab samples of the soil were obtained from the terrace deposits above the existing highway route at the locations shown in Table 1, below. An additional three grab samples were obtained in September 2014 from the material stockpiles at the existing PWGSC gravel pit at Km 750. No drilling or other subsurface exploratory work was undertaken as part of Tetra Tech EBA's site visits.

Table 1: Grab Sample Locations (2013)

Sample Number	Approximate Sample Location	
	Station[1] (Km)	Offset[2] (m)
SA-1	737+150	20 L
SA-2	744+780	65 L
SA-3	744+820	50 L
SA-4	743+660	30 R
SA-5	746+280	60 L
SA-6	746+360	65 L
SA-7	746+620	25 L
SA-8	746+550	25 R

1. Highway chainage as per the realignment design shown on the Drawings.
2. Offsets to the Left (L) or Right (R) of the highway centreline are based on heading northbound in the direction of increasing chainage.

3.2.1 Laboratory Testing

The following laboratory testing was conducted on the grab samples obtained from the October 2013 and September 2014 site visits:

- **Geotechnical Index Testing**: The grab samples were submitted for geotechnical index testing including natural moisture content, Atterberg limits and grain size analyses. The majority of this testing was conducted at Tetra Tech EBA's laboratory in Nanaimo, BC. The test results are presented in Appendix D.
- **Direct Shear Testing**: Samples SA-3 and SA-8 were submitted to the laboratory of Thurber Engineering Ltd. of Victoria, BC for Direct Shear testing (ASTM D3080). The test results are presented in Appendix D.
- **Petrographic Examination**: Sample SA-6 was also submitted to the laboratory of Vancouver Petrographics Ltd. of Langley, BC for petrographic examination (ASTM C295). The test results are presented in Appendix D.

4.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Public Works and Government Services Canada (PWGSC) and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Public Works and Government Services Canada (PWGSC), or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Tetra Tech EBA's General Conditions are provided in Appendix E of this report.

5.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.

Prepared by:
Jason Pellett, P.Eng. P.Geo.
Senior Geotechnical Engineer
Direct Line: 778.945.5841
Jason.Pellett@tetratech.com

Reviewed by:
Kim Johnston, P.Eng.
Principal Specialist - Geotechnical
Direct Line: 778.945.5885
Kim.Johnston@tetratech.com

JP/KJ/ml

APPENDIX A
TERRA ENGINEERING (1999) REPORT

Terra Engineering Ltd.

1245 East 7th Avenue
Vancouver, British Columbia
Canada V5T 1R1
Phone: (604) 874-1245
Fax: (604) 874-2358

Report Submitted to:

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
1000 - 9700 Jasper Avenue
Edmonton, Alberta
T5J 4E2

GEOTECHNICAL EXPLORATION / DRILLING BOREHOLES
Km 737-750
ALASKA HIGHWAY, BC

By
Terra Engineering Ltd.
954C Laval Crescent
Kamloops, BC
V2C 5P5

December 3, 1999
FileNo.: 992-1474

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 General

Terra Engineering Ltd. (TEL) was retained by Mr. Patrick Whidden and Gerald Dwyer of Public Works and Government Services Canada (PWGSC) to carry out a geotechnical exploration/borehole drilling program for Km 737 to 750 of the Alaska Highway in May of 1999.

The scope of work was to provide drilling equipment and staff to advance boreholes to the required depths at designated locations. This included taking soil samples, logging the soils encountered and where requested, conducting SPT tests at regular depth intervals. In addition, laboratory testing for moisture content determination, gradation analyses, and Atterberg limits was required. A factual report presenting the results of drilling and laboratory testing was to be provided at the completion of the geotechnical program. The drilling was conducted under the direction of a PWGSC representative, who selected the borehole locations, depths and drilling methods.

This report presents our findings on soil conditions encountered during the drilling and exploration program. It does not, in anyway, include efforts to explore or assess the site characteristics that may be directed at environmental-type concerns.

Use of this report is subject to the Statement of General Conditions which is included at the end of the text of this report. The reader's attention is drawn specifically to these conditions as it is considered essential that they be followed for proper use and interpretation of the report.

1.2 Proposed Site

The drilling program was conducted along the right of way of the proposed Alaska Highway alignment at approximately Km 737 to Km 750, which was close to existing right of way.

2.0 GEOTECHNICAL EXPLORATION PROGRAM

2.1 Field Exploration Program

A field drilling program was conducted during the period of June 1 to July 22, 1999. A total of 166 boreholes were drilled using a Mobile Augers M5T rubber track mounted rotary drill rig owned and operated by Geotech Drilling Ltd. of Prince George. The drill rig was equipped with solid stem and hollow stem augers for soil drilling, and with an air rotary "down hole" percussion hammer, and a triple tube diamond coring water flush system for bedrock. The locations of boreholes were surveyed by PWGSC upon the completion of field drilling.

Ms. Cathy Brown, GIT and Mr. Richard Wells, EIT, of Terra Engineering Ltd., monitored the drilling operation and performed the required field testing. The soils encountered were logged based on preliminary visual classification and representative samples were taken for laboratory classification and testing.

2.2 Laboratory Testing

Laboratory tests included visual soil classification and natural moisture content determination for all samples. Grain size analysis and Atterberg limits were performed on selected samples taken during the field drilling program.

3.0 SOIL PROFILES AND COMMENTS

3.1 Site Description

The drilling locations were located along the proposed right of way, which was roughly parallel to the existing right of way. The southern portion of the job site crosses Prochniak Creek, then continues north along the Trout River Valley. The southern portion follows the valley floor and the northern portion continues along the western valley sidewall.

A series of photos were taken at periodic intervals along the proposed right of way. These photos are presented in Appendix A.

3.2 General Soil Profiles and Comments

Detailed soil descriptions, including moisture contents of the samples taken during field exploration, are presented on the borehole logs in Appendix B. The borehole locations were determined by PWGSC representative Laurent McCall according to preliminary Highway design information. The locations were later surveyed by PWGSC and were stored in PWGSC's database.

In general the soils encountered were predominantly granular. There were occasional areas of silt and sandy silt soils. A very dense dry granular soil was encountered periodically throughout the job site and appeared to be more common in the northern end of the job site. Drilling was very difficult in these soils and conventional dry auger drilling was not capable of advancing through the very dense gravels. A pneumatic air hammer and casing advancing system was utilized to advance boreholes where these very dense soils were encountered.

During the course of the field exploration a weak acid was applied to selected samples of the very dense gravel and a strong reaction or fizz was noted. The high relativity density and the reaction to a weak acid may indicate the presence of a cemented gravel. The excavation of test pits prior to construction may be prudent to ensure that conventional excavation techniques will be sufficient and to ensure that the possibly cemented soils are not collapsible (metastable).

Bedrock was not encountered over large areas of the proposed right of way. The isolated outcrops of bedrock that were encountered had a low rippability potential and blasting may be required for excavation and removal of the bedrock material.

3.3 Groundwater

Groundwater seepage, where encountered, was noted on the borehole logs. In general seepage was only encountered in localized areas. No efforts were undertaken to assess whether the seepage was related to a regional groundwater or a perched water table. Seasonal variations of the groundwater table should be expected and it should be noted that groundwater conditions typically fluctuate with changes in precipitation and can be influenced by other factors.

4.0 CLOSURE

This report is based on the information obtained from the boreholes advanced at the proposed site. The intent of this report is to provide factual data regarding the soil conditions at locations selected by PWGSC. Terra Engineering Ltd. is not responsible for any third party extrapolation of data between borehole locations or below the depths drilled.

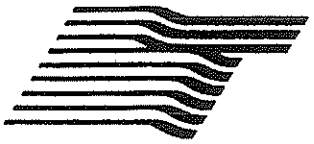
Thank you for selecting the services of Terra Engineering Ltd. If you have any questions or comments please contact do not hesitate to contact Ben Weiss or Richard Wells at (604) 874-1245.

Respectfully Submitted by

TERRA ENGINEERING LTD.

Ben Weiss, P. Eng.
Senior Geotechnical Engineer

Richard Wells, E.I.T.
Junior Geotechnical Engineer



Statement of General Conditions

1. STANDARD OF CARE

This study and Report have been prepared in accordance with gegnerally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made. Geotechnical studies and reports do not include environmental consulting unless specifically stated in the geotechnical report.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF THE REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report 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 the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

a. Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and engineering estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilising the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarising such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b. Reliance on Provided information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons provided information.

c. To avoid misunderstandings, Terra should be retained to work with the other design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to engineering issues. So to, Terra should be retained to provide field reviews during the construction, consistent with building codes guidelines and generally accepted practices.

APPENDIX A

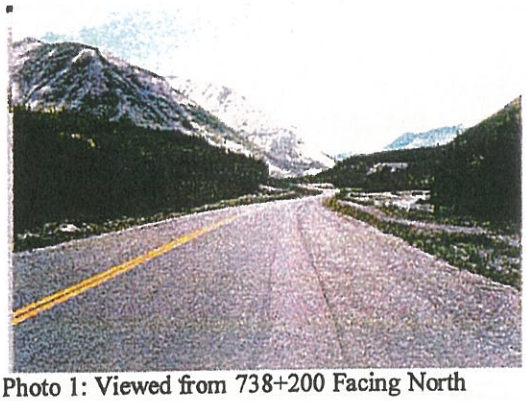


Photo 1: Viewed from 738+200 Facing North

Photo 2: Viewed from 739+400 Facing North

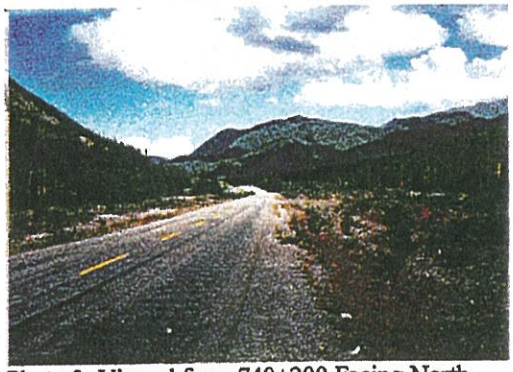


Photo 3: Viewed from 740+200 Facing North

Photo 4: Viewed from 741+200 Facing North

Photo 5: Viewed from 742+225 Facing North

Photo 6: Viewed from 743+200 Facing North

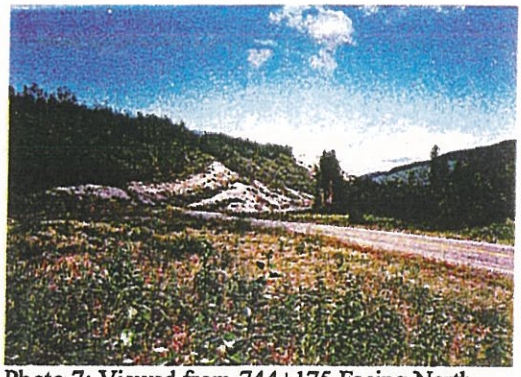


Photo 7: Viewed from 744+175 Facing North

Photo 8: Viewed from 745+150 Facing North

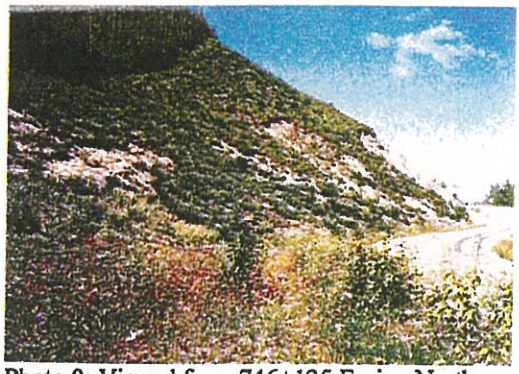


Photo 9: Viewed from 746+125 Facing North

Photo 10: Viewed from 747+025 Facing North

Photo 11: Viewed from 748+250 Facing North

Photo 12: Viewed from 749+200 Facing North

APPENDIX B

LOG OF BOREHOLE NO. BH5-1

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+185

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			OVERBURDEN – SAND, brown, loose–compact, gravelly		21	
1.0		0.9	GRAVEL – grey–brown, compact–dense, sandy, bouldery, some silt, dry			
2.0		2.1	SAND – brown, compact–dense, dry		14	
		2.4				
		2.6	BOULDER – brown, compact–dense, sandy, gravelly, dry			
3.0			SAND – brown, dense–very dense, silty, trace gravel, dry		15	
4.0						
5.0					16	
		5.8	SAND – grey/brown, very dense, silty, moist Interlayered with SILT – grey/brown, very stiff, sandy, some clay, moist		17	
7.0						
8.0					18	
9.0		9.0	SAND – brown, dense, some silt, moist		19	
10.0						
11.0					20	
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: / /99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 2

LOG OF BOREHOLE NO. BH5-1

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+185

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
12.0									40.0
13.0									41.0
14.0		14.0	CLAY – grey, hard, silty, some sand, moist–wet		22				42.0
15.0		15.2	SAND– grey, dense, some sand, trace clay and gravel, moist		24				43.0
16.0									44.0
17.0					25				45.0
18.0					26				46.0
19.0					27				47.0
20.0									48.0
21.0					28				49.0
22.0									50.0
23.0					29				51.0
24.0		23.5	BOTTOM OF BOREHOLE						52.0
									53.0
									54.0
									55.0
									56.0
									57.0
									58.0
									59.0
									60.0
									61.0
									62.0
									63.0
									64.0
									65.0
									66.0
									67.0
									68.0
									69.0
									70.0
									71.0
									72.0
									73.0
									74.0
									75.0
									76.0
									77.0
									78.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: / /99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-2

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+300 L of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			OVERBURDEN						
		0.6	SAND – grey/brown, compact, gravelly, dry						
1.0									1.0
		1.7	SAND – grey, compact, silty, dry–moist		30				
2.0		2.0	GRAVEL – grey, compact, sandy, clasts approximately 1–2" subangular, dry						2.0
3.0					31				3.0
		3.5	BOTTOM OF BOREHOLE						
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/08/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-3

JOB NUMBER: 992-1474
CLIENT: Public Works and Govt Services Canada
SITE LOCATION: 737+425

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			ELEVATION:			
0.0		0.6	COBBLES – grey, loose–compact, dry			
1.0			GRAVEL – grey, compact, sandy, dry	X	32	
		1.5	BOTTOM OF BOREHOLE			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/08/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-4

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+500

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO.	INSTRUMENTATION DATA
0.0		0.3	SAND – brown, compact, dry			
		0.6	GRAVEL – grey, compact, cobbly, dry		33	
1.0			GRAVEL – grey, compact, bouldery, sandy, dry		34	
		1.4	BOTTOM OF BOREHOLE			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/08/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-5

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+550

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			SAND – brown, compact, gravelly, some pebbles, dry		35	
1.0		0.9	GRAVEL and SAND – brown, compact, trace silt, dry.		36	
		1.5	BOTTOM OF BOREHOLE			

Recovery (%) 20 40 60 80
ROD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/08/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-6

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+625

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			SILT – grey–brown, firm, sandy, some clay, moist		38	
		0.6	GRAVEL – brown, compact, sandy, some cobbles, trace silt, moist			
1.0					37	
		1.5	BOTTOM OF BOREHOLE			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
ROD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-7

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+675

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
		0.6	SILT TOPSOIL – dark brown, firm, some clay, moist.		39				1.0
1.0			SAND – beige, loose–compact, silty, some clay, moist		40				2.0
		1.5	BOTTOM OF BOREHOLE						3.0
2.0									4.0
3.0									5.0
4.0									6.0
5.0									7.0
6.0									8.0
7.0									9.0
8.0									10.0
9.0									11.0
10.0									12.0
11.0									13.0
12.0									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

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Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-8

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+725 7m L of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			OVERBURDEN TOPSOIL – silty			
		0.6	SAND – beige, loose–compact, silty, moist			
1.0		1.5				
		1.7	SILT – grey/brown, stiff, sandy, trace–some clay, moist, frozen		40	
2.0			SAND – brown, compact, gravelly, some silt, dry–moist			
3.0		2.9	BOULDERS – grey/pink, white chips, compact, some sand, gravel, dry – sieve conducted on rock chips		41	
4.0					42	
5.0					43	
		5.6				
6.0		5.9	GRAVEL – brown, dense, sandy, some cobbles, trace silt, moist		44	
		6.2	SILT – grey, stiff–very stiff, gravelly, some sand, clay, moist		45	
		6.7	SILT – grey, stiff–very stiff, clayey, some sand, moist		46	
7.0		7.2	SILT – brown–grey, stiff–very stiff, sandy, some gravel, trace clay, moist			
8.0			BOTTOM OF BOREHOLE			
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-9

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+725 2m R of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SAND – brown, soft–firm, silty, moist		47				0.0
		0.6	GRAVEL – brown–grey, loose–compact, silty, some sand to sandy, trace clay, moist						
1.0		1.2	SAND and GRAVEL – brown, compact, trace cobbles and silt, dry–moist		48				4.0
		1.5	BOTTOM OF BOREHOLE						
2.0									7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/10/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-10

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+825 on Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
		0.2	OVERBURDEN – cobbles						
			SAND – brown, loose, some silt, moist–dry		48				
		0.6	SAND – brown, loose–compact, silty, moist						
1.0		1.1	SILT – grey, firm–stiff, rust mottling, some sand		49				
		1.5	BOTTOM OF BOREHOLE						
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-11

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – brown, loose-compact, some cobbles, sandy, some silt, dry		1				1.0
1.0		0.9	BOTTOM OF BOREHOLE – AUGER REFUSAL						2.0
2.0									3.0
3.0									4.0
4.0									5.0
5.0									6.0
6.0									7.0
7.0									8.0
8.0									9.0
9.0									10.0
10.0									11.0
11.0									12.0
12.0									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-12

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL - brown, loose-compact, sandy, some cobbles, trace clay, dry		51				
1.0					52				
		1.5	BOTTOM OF BOREHOLE						
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/08/99	EQUIPMENT: Mobile Auger - M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-13

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+225

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SAND and GRAVEL – brown, loose–compact, trace silt, some cobbles, moist		52				0.0
1.0		1.2			53				1.0
			BOTTOM OF BOREHOLE – AUGER REFUSAL						2.0
2.0									3.0
3.0									4.0
4.0									5.0
5.0									6.0
6.0									7.0
7.0									8.0
8.0									9.0
9.0									10.0
10.0									11.0
11.0									12.0
12.0									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-14

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0			SAND – brown, loose, trace silt, dry		54	
1.0		0.9	SAND and GRAVEL – brown–grey, loose to compact, trace cobbles, trace silt, dry to moist		55	
2.0		1.5	BOTTOM OF AUGERHOLE			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-15

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+435

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			SAND and GRAVEL – brown, loose–compact, trace silt, some cobbles, moist		57				1.0
1.0					58				4.0
		1.4	BOTTOM OF BOREHOLE – AUGER REFUSAL						5.0
2.0									7.0
3.0									10.0
4.0									15.0
5.0									16.0
6.0									20.0
7.0									24.0
8.0									27.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-16

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+525

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0		0.2	GRAVEL – brown, compact, sandy, some silt, moist		59	
		0.6	SAND – grey-brown, compact, silty, some gravel, moist			
1.0			SAND & SILT INTERLAYERED			
			SAND – grey, compact, silty, moist-wet		60	
		1.5	SILT – grey, firm-stiff, sandy, moist-wet			
2.0			BOTTOM OF BOREHOLE			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-17

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION: CANCELLED						0.0
1.0									1.0
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: / /99 | EQUIPMENT: Mobile Auger – M5T

LOG OF BOREHOLE NO. BH5-18

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+625

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0			SAND – brown, loose, silty, some gravel, moist		61	
1.0		0.9	SILT – beige, firm, sandy, some gravel, moist		62	
		1.2	BOTTOM OF BOREHOLE – AUGER REFUSAL			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-19

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+725

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.2	OVERBURDEN TOPSOIL						0.0
		0.5	SAND - brown, loose, dry-moist		63				1.0
1.0			SAND - brown, compact, gravelly, some silt, cobbles, dry-moist						2.0
					64				3.0
		1.4	BOTTOM OF BOREHOLE - AUGER REFUSAL						4.0
2.0									5.0
									6.0
3.0									7.0
									8.0
4.0									9.0
									10.0
5.0									11.0
									12.0
6.0									13.0
									14.0
7.0									15.0
									16.0
8.0									17.0
									18.0
9.0									19.0
									20.0
10.0									21.0
									22.0
11.0									23.0
									24.0
12.0									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/10/99 | EQUIPMENT: Mobile Auger - M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-20

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			GRAVEL - brown, loose-compact, sandy, some silt, loose-compact		67				0.0
1.0					68				1.0
		1.5	BOTTOM OF BOREHOLE						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/10/99 | EQUIPMENT: Mobile Auger - M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-21

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			SAND and GRAVEL – brown, loose–compact, trace silt, dry–moist		67				1.0
1.0					68				4.0
		1.2	BOTTOM OF BOREHOLE – AUGER REFUSAL						
2.0									7.0
3.0									10.0
4.0									13.0
5.0									17.0
6.0									20.0
7.0									23.0
8.0									27.0
9.0									30.0
10.0									33.0
11.0									37.0
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/10/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-22

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+225

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL - brown, loose-compact, sandy, trace silt, dry-moist		69				1.0
1.0					70				2.0
		1.2	BOTTOM OF BOREHOLE - AUGER REFUSAL						3.0
2.0									4.0
3.0									5.0
4.0									6.0
5.0									7.0
6.0									8.0
7.0									9.0
8.0									10.0
9.0									11.0
10.0									12.0
11.0									13.0
12.0									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/10/99 | EQUIPMENT: Mobile Auger - M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-23

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			SAND – brown, compact, silty, moist		71	
		0.5	SAND – brown, compact, silty, some gravel, moist			
1.0		1.1	GRAVEL – brown, compact, sandy, trace silt, moist		72	
		1.5	BOTTOM OF BOREHOLE			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-24

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+425

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – grey/brown, compact, sandy, some silt, moist		73				1.0
1.0									2.0
					74				3.0
		1.5	BOTTOM OF BOREHOLE						4.0
2.0									5.0
3.0									6.0
4.0									7.0
5.0									8.0
6.0									9.0
7.0									10.0
8.0									11.0
9.0									12.0
10.0									13.0
11.0									14.0
12.0									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-25

JOB NUMBER: 892-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+425

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			SAND – grey/brown, compact, gravely, trace silt, moist		75				
1.0									1.0
					76				
		1.5	BOTTOM OF BOREHOLE						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/10/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-26

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+525

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0		0.5	SILT – brown, firm, sandy, some clay, moist		77	
			SAND – brown, compact, silty, moist			
1.0		1.1				
		1.5	SILT – brown, firm, sandy, trace clay, burnt woody debris, moist		78	
			BOTTOM OF BOREHOLE			

Recovery (%) 20 40 60 80
ROD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(m): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0
DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/10/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-27

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+625

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	OVERBURDEN TOPSOIL						0.0
			SILT - beige/brown, firm, some sand, trace clay, moist		79				1.0
1.0									4.0
		1.4			80				5.0
		1.5	SILT - beige/brown, firm, some gravel, moist						
2.0			BOTTOM OF BOREHOLE						7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									19.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/10/99 | EQUIPMENT: Mobile Auger - M5T

LOG OF BOREHOLE NO. BH5-28

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+725 5m R of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			GRAVEL – brown, loose–compact, sandy, trace cobbles, moist		B1				0.0
		0.6	GRAVEL and SAND – brown, loose–compact, trace silt, moist		B2				
1.0		1.5	BOTTOM OF BOREHOLE						1.0
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-29

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC – M.C. – LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0		0.1	ELEVATION: OVERBURDEN ORGANICS						0.0
			SAND – brown, loose–compact, gravelly, some–trace silt, dry–moist		84				
1.0		0.9	GRAVEL – brown, loose–compact, sandy, some silt, dry–moist						1.0
		1.4			85				
		1.5	GRAVEL and SAND – brown, compact, trace silt, dry–moist						
2.0			BOTTOM OF BOREHOLE						2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-30

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
			GRAVEL – brown, loose–compact, sandy, dry		B5			
1.0		0.9	GRAVEL – brown, loose–compact, cobbly, sandy, trace silt, boulders, dry		B6			
		1.5	BOTTOM OF BOREHOLE					
2.0								
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0° 0' 0" W 0° 0' 0"

LOG OF BOREHOLE NO. BH5-31

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			GRAVEL - brown, loose-compact, sandy, some silt, cobbles, trace boulders, dry		87				0.0
		0.6	(Boulders on surface)						
1.0		0.9	GRAVEL - brown, compact, sandy, some silt, trace cobbles, dry		88				4.0
		1.4	GRAVEL and SAND - brown, compact, trace silt, dry						
2.0			BOTTOM OF BOREHOLE - AUGER REFUSAL						7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									19.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/10/99 | EQUIPMENT: Mobile Auger - M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-32

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			BOULDER (>1.5ft) – brown, compact, surrounded by sandy Gravel, trace silt, dry		89				1.0
1.0		0.8	BOTTOM OF BOREHOLE – AUGER REFUSAL						2.0
2.0									3.0
3.0									4.0
4.0									5.0
5.0									6.0
6.0									7.0
7.0									8.0
8.0									9.0
9.0									10.0
10.0									11.0
11.0									12.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-33

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+225

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			GRAVEL – brown, loose–compact, sandy, some silt, trace cobbles, dry–moist		90				0.0
		0.6	GRAVEL – brown, loose–compact, sandy, trace silt, cobble, and boulders, dry–moist		91				
1.0		1.2	BOTTOM OF BOREHOLE – AUGER REFUSAL						1.0
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0° 0' 0" W 0° 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-34

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0		0.1	OVERBURDEN SAND – brown, loose, gravelly, rootlets, dry		92				0.0
			GRAVEL – brown, loose–compact, sandy, some cobbles, dry						
1.0		1.1	GRAVEL and SAND – brown, compact, cobbly, trace silt, dry		93				1.0
		1.5	BOTTOM OF BOREHOLE						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

ELEVATION:

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-35

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+425

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0		0.2	OVERBURDEN SILT			
			SILT – beige, firm, sandy, moist		94	
		0.8	SAND – beige, compact, some silt, dry to moist		95	
1.5			BOTTOM OF BOREHOLE			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-36

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+725

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
		0.5	GRAVEL - brown, loose-compact, sandy, some silt, cobbles, moist-dry		96			
1.0			GRAVEL - brown, loose-compact, cobbly, sandy, trace silt, dry		97			
		1.5	BOTTOM OF BOREHOLE					
2.0								
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								39.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger - M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-37

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL FILL – grey, loose to compact, sandy, trace silt, dry.		98				1.0
1.0					99				2.0
		1.5	BOTTOM OF BOREHOLE						3.0
2.0									4.0
									5.0
3.0									6.0
									7.0
4.0									8.0
									9.0
5.0									10.0
									11.0
6.0									12.0
									13.0
7.0									14.0
									15.0
8.0									16.0
									17.0
9.0									18.0
									19.0
10.0									20.0
									21.0
11.0									22.0
									23.0
12.0									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-38

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	ELEVATION: OVERBURDEN						0.0
		0.6	GRAVEL – brown–grey, loose–compact, sandy, some silt, dry–moist		100				1.0
1.0		1.2	GRAVEL – grey, loose–compact, sandy, some silt, dry–moist						4.0
		1.5	GRAVEL and SAND – brown, compact, trace silt, wet		101				5.0
2.0			BOTTOM OF BOREHOLE Note: Water seepage observed at 5ft.						6.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									19.0
7.0									24.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-39

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
			ELEVATION:						
0.0		0.2	OVERBURDEN – brown–beige, loose, rootlets, sand, some silt, moist						0.0
		0.5	SAND – brown, loose–compact, some silt, some rusting, moist		102				1.0
1.0		1.1	SAND – brown–beige, compact, some gravel, trace silt		103				2.0
		1.5	SAND – grey–brown, compact, trace silt, trace gravel, moist–wet						3.0
2.0			BOTTOM OF BOREHOLE						4.0
3.0									5.0
4.0									6.0
5.0									7.0
6.0									8.0
7.0									9.0
8.0									10.0
9.0									11.0
10.0									12.0
11.0									13.0
12.0									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-40

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0	XXX	0.2	SAND – brown, loose, dry			
			SAND – brown, loose–compact, some silt, gravelly, dry–moist		104	
1.0		1.1				
			GRAVEL – grey, loose–compact, sandy, trace silt, dry		105	
		1.5	BOTTOM OF BOREHOLE			

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

DEPTH(m): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0
DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-41

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+225

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0		0.2	SAND – brown, loose, some silt, gravel, dry–moist		106	
			GRAVEL – grey, loose–compact, sandy, some silt, dry			
1.0		1.2	GRAVEL and SAND – brown, loose–compact, trace silt, dry–moist		107	
		1.5	BOTTOM OF BOREHOLE			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-42

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SAND and GRAVEL – brown–grey, loose to compact, trace silt, dry–moist		109				0.0
1.0		1.1	BOTTOM OF BOREHOLE – AUGER REFUSAL		110				1.0
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0
									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-43

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+425

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			GRAVEL and SAND - grey, compact, trace						0.0
		0.6	silt, moist.		111				
1.0					112				1.0
		1.5	BOTTOM OF BOREHOLE Note: Water seepage observed at 2ft.						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger - M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-44

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+525

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL - brown-grey, loose-compact, sandy, trace silt, moist-dry		113				1.0
1.0					114				4.0
		1.5	BOTTOM OF BOREHOLE						
2.0									7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									19.0
7.0									22.0
8.0									25.0
9.0									28.0
10.0									31.0
11.0									34.0
12.0									37.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger - M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-45

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+625

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0		0.1	ELEVATION: OVERBURDEN – GRAVEL FILL (ditch)					0.0
			GRAVEL – brown, loose–compact, sandy, trace silt, moist		115			1.0
1.0					116			4.0
		1.5	BOTTOM OF BOREHOLE					5.0
2.0								6.0
3.0								10.0
4.0								13.0
5.0								16.0
6.0								20.0
7.0								23.0
8.0								26.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-46

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / ROD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 / N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:					
		0.3	OVERBURDEN – TOPSOIL, SILT brown, firm, sandy, some gravel, moist		117			
1.0		1.1	GRAVEL – brown, loose–compact, silty, some sand, moist					
		1.5	SAND and GRAVEL – brown, trace silt, wet		118			
2.0			BOTTOM OF BOREHOLE Note: Water seepage observed at 4ft.					

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-47

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 741+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	OVERBURDEN – organics, topsoil						0.0
		0.3 0.5	GRAVEL – brown, compact, silty, some sand, trace cobble, moist		1				1.0
1.0			SILT – beige, firm, moist						2.0
		1.2	GRAVEL – brown, compact, silty, some sand, trace cobble, moist		2				3.0
		1.5	SAND – brown, compact, gravely, trace silt, wet–moist						4.0
2.0			BOTTOM OF BOREHOLE						5.0
3.0									6.0
4.0									7.0
5.0									8.0
6.0									9.0
7.0									10.0
8.0									11.0
9.0									12.0
10.0									13.0
11.0									14.0
12.0									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-48

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0		0.1	OVERBURDEN – gravel, dry			
			SAND and GRAVEL – grey-brown, compact, trace silt, dry-moist		121	
1.0					122	
		1.4	BOTTOM OF BOREHOLE – AUGER REFUSAL			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-49

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+150 2m R of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	ELEVATION: OVERBURDEN – organics, moss						0.0
			GRAVEL – grey, compact, sandy, trace silt, wet		123				1.0
1.0									2.0
					124				3.0
		1.5	BOTTOM OF BOREHOLE						4.0
2.0									5.0
									6.0
3.0									7.0
									8.0
4.0									9.0
									10.0
5.0									11.0
									12.0
6.0									13.0
									14.0
7.0									15.0
									16.0
8.0									17.0
									18.0
9.0									19.0
									20.0
10.0									21.0
									22.0
11.0									23.0
									24.0
12.0									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-50

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+250

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	DEPTH(ft)
			ELEVATION:				
0.0		0.1	OVERBURDEN – organics, topsoil				0.0
			GRAVEL and SAND – brown-grey, loose to compact, trace silt, moist		125		1.0
1.0					126		2.0
		1.5	BOTTOM OF BOREHOLE				3.0
			Note: Water seepage observed at 2ft.				4.0
2.0							5.0
							6.0
							7.0
3.0							8.0
							9.0
							10.0
4.0							11.0
							12.0
							13.0
5.0							14.0
							15.0
							16.0
6.0							17.0
							18.0
							19.0
7.0							20.0
							21.0
							22.0
8.0							23.0
							24.0
							25.0
9.0							26.0
							27.0
							28.0
10.0							29.0
							30.0
							31.0
11.0							32.0
							33.0
							34.0
12.0							35.0
							36.0
							37.0
							38.0
							39.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-51

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
		0.6	OVERBURDEN – ORGANICS to SAND dark brown, loose, cobbly, some boulders, moist		127				1.0
1.0			BOTTOM OF BOREHOLE – AUGER REFUSAL						2.0
2.0									3.0
3.0									4.0
4.0									5.0
5.0									6.0
6.0									7.0
7.0									8.0
8.0									9.0
9.0									10.0
10.0									11.0
11.0									12.0
12.0									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-52

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+425

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / ROD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	ELEVATION: OVERBURDEN						0.0
			GRAVEL – brown, compact, sandy, some silt, cobble, dry–moist		128				
1.0		1.2	SAND – grey, compact, some gravel, silt, wet.		129				4.0
		1.5	BOTTOM OF BOREHOLE						
			Note: Water seepage observed at 4ft.						
2.0									7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-53

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+525

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	ELEVATION: OVERBURDEN – TOPSOIL						0.0
			SAND – brown, loose–compact, gravelly, some silt, cobble, dry–moist		130				1.0
					131				2.0
1.0		0.9	BOTTOM OF BOREHOLE – AUGER REFUSAL						3.0
2.0									4.0–7.0
3.0									8.0–11.0
4.0									12.0–15.0
5.0									16.0–19.0
6.0									20.0–23.0
7.0									24.0–27.0
8.0									28.0–31.0
9.0									32.0–35.0
10.0									36.0–39.0
11.0									
12.0									

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-54

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+625

MPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
CKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
			ELEVATION:						
0.0		0.1	OVERBURDEN						0.0
			SAND – brown, loose–compact, gravelly, trace silt, dry		132				
1.0					133				4.0
		1.4							
		1.5	SAND – brown, compact, gravely, trace silt, dry–moist						
2.0			BOTTOM OF BOREHOLE						

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/11/99 | EQUIPMENT: Mobile Auger – M5T

LOG OF BOREHOLE NO. BH5-55

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+725

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
			ELEVATION:						
0.0		0.1	OVERBURDEN – ORGANICS, grey, moist–wet						0.0
		0.5	SAND – grey, moist–wet, silty, loose		134				1.0
		0.6	ORGANIC – black, loose, peat, wet						2.0
1.0			SAND – grey, loose, some silt, trace gravel, wet.						3.0
		1.4			135				4.0
		1.5	SILT – grey–beige, soft, sandy, wet						5.0
			BOTTOM OF BOREHOLE						6.0
2.0									7.0
									8.0
3.0									9.0
									10.0
4.0									11.0
									12.0
5.0									13.0
									14.0
6.0									15.0
									16.0
7.0									17.0
									18.0
8.0									19.0
									20.0
9.0									21.0
									22.0
10.0									23.0
									24.0
11.0									25.0
									26.0
12.0									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5–56

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
			SAND – grey–black, soft, some silt, trace gravel, organics, wet		137				
			changes from some silt ot silty		138				
1.0		0.9	BOTTOM OF BOREHOLE – AUGER REFUSAL						
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-57

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 742+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0		0.1	OVERBURDEN – SAND, gravelly			
		0.3	SILT – beige, stiff, some sand, moist		139	
			SAND and GRAVEL – dark brown, loose to compact, trace silt, moist			
1.0		0.9			140	
		1.2	SAND – brown, compact, gravelly, some silt, moist			
			BOTTOM OF BOREHOLE			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/12/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-58

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0		0.1	OVERBURDEN			
			GRAVEL – grey, loose–compact, sandy, some silt, dry–moist		141	
1.0		1.2				
		1.5	SAND and GRAVEL – grey, compact, sandy, trace silt, wet		142	
2.0			SAND – brown, compact, wet–moist			
			BOTTOM OF BOREHOLE			
			Note: Water seepage observed at 4ft.			
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) ■ 20 40 60 80
◆RQD (%)◆ 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
◆N (blows/300 mm)◆ 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/12/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-59

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0		0.6	ORGANICS – black, loose, silty, peaty, wood organic odour, moist		144	
1.0		1.2	SILT – grey, laminated (grey–beige), soft, sandy, moist			
		1.5	SAND – grey, loose–compact, some gravel, trace silt, wet		145	
			BOTTOM OF BOREHOLE			
			Note: Water seepage observed at 4ft.			

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/12/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-60

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+225

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH (ft)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			ELEVATION:			
		0.3	SILT – brown–black, soft, sandy, peaty, some gravel, woody debris, moist		146	
			SILT – grey, firm, sandy, gravelly, moist–wet			
		1.2	SAND and GRAVEL – grey, compact, trace silt, wet		147	
		1.5	BOTTOM OF BOREHOLE Note: Water seepage observed at 4ft.			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-61

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0			ORGANICS – black, loose, peaty, silt, organic odour, moist		148	
		0.6	SAND – grey, loose, some silt, laminated sandy silt/silty sand, moist–wet			
1.0		1.1	SAND and GRAVEL – grey–brown, loose to compact, trace silt, wet		149	
		1.5	BOTTOM OF BOREHOLE			
2.0			Note: Water seepage observed at 2ft.			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/11/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-62

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0		0.3	OVERBURDEN – SILT, brown, firm, some gravel, moist		150	
			GRAVEL and SAND – brown, compact, trace silt, moist		152	
1.0		1.1	SILT – laminated grey/beige, stiff, sandy, wet		151	
		1.5	BOTTOM OF BOREHOLE			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/12/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-63

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+525

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			SAND and GRAVEL – brown, loose–compact, some cobbles, trace silt, dry		152				1.0
					153				2.0
		0.8	BOTTOM OF BOREHOLE						3.0
1.0									4.0
2.0									5.0
									6.0
3.0									7.0
									8.0
4.0									9.0
									10.0
5.0									11.0
									12.0
6.0									13.0
									14.0
7.0									15.0
									16.0
8.0									17.0
									18.0
9.0									19.0
									20.0
10.0									21.0
									22.0
11.0									23.0
									24.0
12.0									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-64

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+625

AMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
ACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			SAND – grey/brown, loose–compact, gravelly, some cobbles, trace silt, dry–moist		154	
1.0		0.5	SAND and GRAVEL – grey, compact, trace silt, wet–moist		155	
2.0		1.5	BOTTOM OF BOREHOLE Note: Water seepage observed at 3ft.			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

OGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

erra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-65

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+725

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SAND – brown, loose, woody debris, trace gravel, trace silt, dry–moist		156				0.0
		0.5	SILT – black–brown, soft, some gravel, sand, peat, woody debris, moist						
1.0		1.1	SAND – black–brown, firm–stiff, some gravel, trace silt, peat, organic odour moist		157				4.0
		1.5	BOTTOM OF BOREHOLE						
2.0									7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-66

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH (m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH (ft)
0.0			ELEVATION:						0.0
		0.5	OVERBURDEN – ORGANICS, brown–black, loose, some gravel, woody debris, organic odour, moist		158				1.0
1.0			SAND – brown, loose, some silt, dry–moist						2.0
									3.0
									4.0
		1.5	BOTTOM OF BOREHOLE		159				5.0
									6.0
									7.0
									8.0
									9.0
									10.0
									11.0
									12.0
									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-67

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 743+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:				20 40 60 80	20 40 60 80	0.0
			GRAVEL and SAND – grey/brown, loose to compact, some cobbles, trace silt, dry–moist		160				1.0
- 1.0					161				2.0
		1.5	BOTTOM OF BOREHOLE						3.0
- 2.0									4.0
									5.0
- 3.0									6.0
									7.0
- 4.0									8.0
									9.0
- 5.0									10.0
									11.0
- 6.0									12.0
									13.0
- 7.0									14.0
									15.0
- 8.0									16.0
									17.0
- 9.0									18.0
									19.0
- 10.0									20.0
									21.0
- 11.0									22.0
									23.0
- 12.0									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-68

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 744+025 L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH (m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH (ft)
0.0			ELEVATION:						0.0
1.0			SAND and GRAVEL – dark brown, loose to compact, trace silt, moist		162				1.0 – 4.0
					163				4.0 – 5.0
		1.5	BOTTOM OF BOREHOLE						5.0
2.0									6.0 – 7.0
3.0									8.0 – 9.0
4.0									10.0
									11.0 – 12.0
5.0									13.0 – 14.0
6.0									15.0 – 16.0
7.0									17.0 – 19.0
8.0									20.0 – 21.0
9.0									22.0 – 23.0
10.0									24.0 – 25.0
11.0									26.0 – 27.0
12.0									28.0 – 29.0
									30.0 – 31.0
									32.0 – 33.0
									34.0 – 35.0
									36.0 – 37.0
									38.0 – 39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-69

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 744+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – dark brown, loose–compact, sandy, trace cobbles, trace silt, moist		164				1.0
- 1.0									2.0
					165				3.0
- 2.0									4.0
					166				5.0
		2.4	GRAVEL and SAND – dark brown, compact, trace silt, moist–wet						6.0
- 3.0		3.0	BOTTOM OF BOREHOLE		167				7.0
									8.0
									9.0
- 4.0									10.0
									11.0
									12.0
- 5.0									13.0
									14.0
									15.0
- 6.0									16.0
									17.0
									18.0
- 7.0									19.0
									20.0
									21.0
- 8.0									22.0
									23.0
									24.0
- 9.0									25.0
									26.0
									27.0
- 10.0									28.0
									29.0
									30.0
- 11.0									31.0
									32.0
									33.0
- 12.0									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-70

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH (m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 ROD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SILT – dark brown, firm, sandy, some gravel, trace peat, organic odour, rootlets–woody debris, moist		168				0.0
1.0		1.4	GRAVEL and SAND – dark brown, loose to compact, trace silt, woody debris, moist		169				1.0
					170				
					171				
		3.0	BOTTOM OF BOREHOLE						

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: / /99 | EQUIPMENT: Mobile Auger – M5T

EBA Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0° 0' 0" W 0° 0' 0"

LOG OF BOREHOLE NO. BH5-71

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 744+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
			ELEVATION:						
0.0			SAND – brown–beige, soft, plastic, silty, trace gravel, moist–wet		172				0.0
1.0		0.9	SAND – brown, soft, plastic, some silt, trace gravel, wet		173				1.0
		1.5	BOTTOM OF BOREHOLE						
2.0									7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-72

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 744+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
		0.5	SILT – dark brown, soft, some sand, woody debris, moist	I	174				1.0
		0.6	SAND – brown, loose, silty, moist						2.0
1.0		1.2	SILT – dark brown, soft, some sand, woody debris, moist						3.0
		1.4	SILT – brown, moist, firm	I	175				4.0
		1.5	SAND – brown, moist, some silt, trace gravel, compact						5.0
2.0			BOTTOM OF BOREHOLE						6.0
3.0									7.0
									8.0
4.0									9.0
									10.0
5.0									11.0
									12.0
6.0									13.0
									14.0
7.0									15.0
									16.0
8.0									17.0
									18.0
9.0									19.0
									20.0
10.0									21.0
									22.0
11.0									23.0
									24.0
12.0									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/12/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0° 0' 0" W 0° 0' 0"

LOG OF BOREHOLE NO. BH5-73

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / ROD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:				20 40 60 80	20 40 60 80	0.0
0.0			SAND – dark brown, soft, some silt, trace gravel, woody debris, moist		176				1.0
1.0					177				2.0
		1.5	BOTTOM OF BOREHOLE						3.0
2.0									4.0
3.0									5.0
									6.0
4.0									7.0
									8.0
5.0									9.0
									10.0
6.0									11.0
									12.0
7.0									13.0
									14.0
8.0									15.0
									16.0
9.0									17.0
									18.0
10.0									19.0
									20.0
11.0									21.0
									22.0
12.0									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: / /99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-74

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			ELEVATION:			
		0.5	TOPSOIL – dark brown, very soft, woody debris, silty sand, moist		178	
		0.8	SILT – brown, soft firm, sandy, trace clay, gravel, woody debris, plastic, moist			
1.0			SAND – compact, some gravel, trace silt moist		179	
		1.5	BOTTOM OF BOREHOLE			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: / /99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-75

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			SAND and GRAVEL – dark brown, loose to compact, trace silt, moist–wet		180	
1.0		1.2			181	
			BOTTOM OF BOREHOLE – AUGER REFUSAL			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0
DEPTH(ft): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 26.0, 27.0, 28.0, 29.0, 30.0, 31.0, 32.0, 33.0, 34.0, 35.0, 36.0, 37.0, 38.0, 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: / /99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-76

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 744+625

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SILT – grey–beige, firm, sandy, some gravel, medium plasticity, moist–wet		182				0.0
1.0		0.8	GRAVEL and SAND – grey–beige, loose to compact, trace silt, moist		183				1.0
		1.5	BOTTOM OF BOREHOLE						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/12/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-77

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0		0.1	OVERBURDEN			
			SILT – mottled brown/beige, firm, some gravel, sandy, moist		184	
1.0		1.1	SAND – beige, loose–compact, gravelly, some silt, moist		185	
		1.5	BOTTOM OF BOREHOLE			
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: / /99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-78

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 744+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
0.0			GRAVEL – brown, loose–compact, sandy, trace silt, trace cobbles, moist		186				0.0
1.0									1.0
		1.4	BOTTOM OF BOREHOLE – AUGER REFUSAL		187				
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/13/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-79

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / ROD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
			GRAVEL and SAND - grey/brown, loose to compact, some silt, moist		188			
1.0		1.1						3.0
			SAND - brown, loose-compact, gravelly, some silt, moist		189			
		1.5	BOTTOM OF BOREHOLE					
2.0								6.0
3.0								10.0
4.0								13.0
5.0								16.0
6.0								20.0
7.0								23.0
8.0								26.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/13/99	EQUIPMENT: Mobile Auger - M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-80

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	DEPTH(ft)
			ELEVATION:				
0.0			GRAVEL and SAND – light brown, compact, some silt, moist.		190		0.0
1.0					191		1.0
		1.2	BOTTOM OF BOREHOLE – AUGER REFUSAL				
2.0							2.0
3.0							3.0
4.0							4.0
5.0							5.0
6.0							6.0
7.0							7.0
8.0							8.0
9.0							9.0
10.0							10.0
11.0							11.0
12.0							12.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/13/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-81

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+225

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
			GRAVEL and SAND – dark brown, firm, some silt, cobbles, moist		192			
		0.6	BOTTOM OF BOREHOLE – AUGER REFUSAL					
1.0								3.0
2.0								7.0
3.0								10.0
4.0								13.0
5.0								16.0
6.0								20.0
7.0								23.0
8.0								27.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/13/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-82

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	ELEVATION: OVERBURDEN – ORGANIC						0.0
			GRAVEL – grey, loose–compact, sandy, some silt, wet		193				
1.0		1.1	SAND – grey, compact, plastic, silty, gravely, wet		194				1.0
		1.5	BOTTOM OF BOREHOLE						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/13/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-83

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+425

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	OVERBURDEN						0.0
		0.6	SAND and GRAVEL – brown, loose, some silt, cobbles, moist		195				1.0
			BOTTOM OF BOREHOLE – AUGER REFUSAL						
1.0									2.0
2.0									3.0
3.0									4.0
4.0									5.0
5.0									6.0
6.0									7.0
7.0									8.0
8.0									9.0
9.0									10.0
10.0									11.0
11.0									12.0
12.0									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/13/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5–84

JOB NUMBER: 992–1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+525

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
0.0			SAND – brown, loose–compact, silty, some gravel, moist		200			0.0
1.0								1.0
		1.2						
		1.5	SAND and GRAVEL – brown, compact, some silt, dry		201			
			BOTTOM OF BOREHOLE					
2.0								6.0
3.0								10.0
4.0								13.0
5.0								16.0
6.0								19.0
7.0								23.0
8.0								26.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-85

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+725

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
			SAND – brown–beige, loose–compact, some gravel, some silt, dry		202			
1.0					203			
		1.2	BOTTOM OF BOREHOLE					
2.0								
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-86

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – brown to dark brown, loose–compact, sandy, some silt and cobble, dry		204				1.0
1.0					205				4.0
		1.5	BOTTOM OF BOREHOLE						5.0
2.0									6.0
									7.0
3.0									10.0
									11.0
4.0									12.0
									13.0
									14.0
5.0									15.0
									16.0
									17.0
6.0									18.0
									19.0
									20.0
7.0									21.0
									22.0
									23.0
8.0									24.0
									25.0
									26.0
									27.0
									28.0
9.0									29.0
									30.0
									31.0
									32.0
10.0									33.0
									34.0
									35.0
									36.0
11.0									37.0
									38.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/14/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-87

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 745+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
			ELEVATION:				20 40 60 80	20 40 60 80	
0.0			OVERBURDEN TOPSOIL – black, loose, organic odour, silt, some sand, trace peat, moist		206				0.0
		0.5	SAND – brown, compact, silty, moist						
1.0					207				1.0
		1.5	BOTTOM OF BOREHOLE						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/14/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-88

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 746+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
			OVERBURDEN – TOPSOIL with gravel, black–brown, loose, moist		208				
		0.6	GRAVEL – brown, loose to compact, sandy, some silt, moist to dry						
1.0					209				
		1.4 / 1.5	SILT – brown–beige, firm–stiff, gravelly, some sand, moist						
			BOTTOM OF BOREHOLE						
2.0									1.0
3.0									2.0
									3.0
4.0									4.0
									5.0
5.0									6.0
									7.0
6.0									8.0
									9.0
7.0									10.0
									11.0
8.0									12.0
									13.0
9.0									14.0
									15.0
10.0									16.0
									17.0
11.0									18.0
									19.0
12.0									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-89

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 746+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	ELEVATION: OVERBURDEN – TOPSOIL						0.0
			GRAVEL – brown, loose, sandy, some silt, cobble, moist		210				1.0
		0.8	BOTTOM OF BOREHOLE – AUGER REFUSAL						2.0
1.0									3.0
									4.0
									5.0
2.0									6.0
									7.0
									8.0
3.0									9.0
									10.0
									11.0
4.0									12.0
									13.0
									14.0
5.0									15.0
									16.0
									17.0
6.0									18.0
									19.0
									20.0
7.0									21.0
									22.0
									23.0
8.0									24.0
									25.0
									26.0
9.0									27.0
									28.0
									29.0
10.0									30.0
									31.0
									32.0
11.0									33.0
									34.0
									35.0
12.0									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-90

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 746+225

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH (feet)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID (20 40 60 80)	N (blows/300 mm) (20 40 60 80)	DEPTH (ft)
0			ELEVATION:						0.0
			SAND – brown, loose–compact, gravelly, trace silt, moist		211				1.0
									2.0
									3.0
					212				4.0
		1.5	BOTTOM OF BOREHOLE						5.0
									6.0
									7.0
									8.0
									9.0
									10.0
									11.0
									12.0
									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-91

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 746+300

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL - brown, loose-compact, sandy, some silt, moist		213				1.0
1.0					214				2.0
		1.5	BOTTOM OF BOREHOLE						3.0
2.0									4.0
3.0									5.0
4.0									6.0
5.0									7.0
6.0									8.0
7.0									9.0
8.0									10.0
9.0									11.0
10.0									12.0
11.0									13.0
12.0									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger - M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-92

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 746+625

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			BOULDERS – grey, loose–compact, trace sand, some gravel, dry		215				0.0
1.0		1.1	BOTTOM OF BOREHOLE – Auger refusal						3.0
2.0									6.0
3.0									9.0
4.0									13.0
5.0									16.0
6.0									19.0
7.0									23.0
8.0									26.0
9.0									29.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-93

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 746+725

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – brown, compact, sandy, some silt, boulders, moist		216				1.0
		0.5	BOTTOM OF BOREHOLE – AUGER REFUSAL						2.0
1.0									3.0
									4.0
2.0									5.0
									6.0
3.0									7.0
									8.0
4.0									9.0
									10.0
5.0									11.0
									12.0
6.0									13.0
									14.0
7.0									15.0
									16.0
8.0									17.0
									18.0
9.0									19.0
									20.0
10.0									21.0
									22.0
11.0									23.0
									24.0
12.0									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-94

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 746+850

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH (m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH (ft)
0.0			ELEVATION:						0.0
			TOPSOIL, SILTY SAND – black, loose, woody debris, gravel, peaty, moist		216				1.0
1.0		1.1							2.0
			SAND – brown–black, loose, gravely, trace silt, some to trace peat, moist		217				3.0
		1.5	BOTTOM OF BOREHOLE						4.0
2.0									5.0
									6.0
3.0									7.0
									8.0
4.0									9.0
									10.0
5.0									11.0
									12.0
6.0									13.0
									14.0
7.0									15.0
									16.0
8.0									17.0
									18.0
9.0									19.0
									20.0
10.0									21.0
									22.0
11.0									23.0
									24.0
12.0									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0° 0' 0" W 0° 0' 0"

LOG OF BOREHOLE NO. BH5-95

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 746+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
0.0			OVERBURDEN TOPSOIL black, loose, silt, some gravel, peat, moist		218				1.0
1.0					219				4.0
1.5		1.5	BOTTOM OF BOREHOLE						5.0
2.0									7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									19.0
7.0									22.0
8.0									25.0
9.0									28.0
10.0									31.0
11.0									34.0
12.0									37.0
									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-96

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+025

MPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
CKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH (m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH (ft)
			ELEVATION:				20 40 60 80	20 40 60 80	
0.0			OVERBURDEN.		220				0.0
1.0		0.9	SAND – grey, compact, gravely, some silt, moist.		221				1.0
		1.5	BOTTOM OF BOREHOLE.						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

GGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0° 0' 0" W 0° 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-97

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+125

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			OVERBURDEN – TOPSOIL with SILT, black, moist–wet, some gravel, sand, peat, moist to wet		222				1.0
1.0		0.8	BOTTOM OF BOREHOLE – AUGER REFUSAL						2.0
2.0									3.0
									4.0
3.0									5.0
									6.0
4.0									7.0
									8.0
5.0									9.0
									10.0
6.0									11.0
									12.0
7.0									13.0
									14.0
8.0									15.0
									16.0
9.0									17.0
									18.0
10.0									19.0
									20.0
11.0									21.0
									22.0
12.0									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/14/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5–98

JOB NUMBER: 992–1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+425

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
			ELEVATION:						
0.0			GRAVEL – grey, loose–compact, silty, some sand, trace clay, wet		223				0.0
1.0					224				1.0
		1.5	BOTTOM OF BOREHOLE						
2.0									2.0
3.0									3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

Recovery (%): 20 40 60 80
ROD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-99

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+325

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			FILL – brown, loose, sandy gravel, moist			
		0.6	SILT – grey, firm, gravelly, trace clay, moist to wet		225	
1.0					226	
					227	
2.0		2.1	SAND – grey, compact, some silt, wet			
3.0		3.0	BOTTOM OF BOREHOLE Note: – Water seepage observed at 6.5ft.		228	
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/14/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-100

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+525

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
			SAND – brown, loose to compact, gravelly, some silt, moist		229			
		0.6	BOTTOM OF BOREHOLE – AUGER REFUSAL					
1.0								3.0
2.0								6.0
3.0								10.0
4.0								13.0
5.0								16.0
6.0								20.0
7.0								23.0
8.0								26.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/14/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-101

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+625

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL - brown, loose to compact, sandy, some silt, dry to moist		230				1.0
1.0					231				4.0
		1.5	BOTTOM OF BOREHOLE						5.0
2.0									7.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									19.0
7.0									22.0
8.0									25.0
9.0									28.0
10.0									31.0
11.0									34.0
12.0									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/14/99	EQUIPMENT: Mobile Auger - M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-102

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+725

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:				20 40 60 80	20 40 60 80	0.0
			TOPSOIL, black-brown, gravel, silt, peaty, woody debris, trace organic odour, moist		232				
1.0					233				
		1.5	BOTTOM OF BOREHOLE						
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-103

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			TOPSOIL – black/brown, loose, silt, organic, wood debris, some gravel, peaty, rootlets, moist		234				0.0
		0.6	TOPSOIL – black–beige, loose, some silt, sand, woody debris, moist						
1.0		1.1			235				4.0
		1.5	GRAVEL – beige, compact, sandy, some silt, dry to moist						5.0
2.0			BOTTOM OF BOREHOLE						6.0
3.0									10.0
4.0									15.0
5.0									16.0
6.0									20.0
7.0									24.0
8.0									27.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/14/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-104

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
		0.3	TOPSOIL – some gravel and sand		237			
		0.5	GRAVEL – brown, loose to compact, sandy, some silt, dry to moist		236			
1.0			BOTTOM OF BOREHOLE – AUGER REFUSAL					
			Note:					
			– Sample 237 (@0–1') taken from redrill					
2.0								
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/14/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-105

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION: BOULDERS – grey, compact, some sand, dry						0.0
1.0					238				1.0
					239				2.0
2.0					240				3.0
		2.3	BOTTOM OF BOREHOLE						4.0
3.0									5.0
4.0									6.0
5.0									7.0
6.0									8.0
7.0									9.0
8.0									10.0
9.0									11.0
10.0									12.0
11.0									13.0
12.0									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/16/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-106

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	DEPTH(ft)
			ELEVATION:				
0.0		0.3	OVERBURDEN – GRAVEL SAND FILL				0.0
			BOULDERS – grey, loose, some sand, cobble, dry		241		1.0
1.0			– compact below 1.1m		242		2.0
		1.5	LARGE BOULDERS		243		3.0
2.0		2.3	BOTTOM OF BOREHOLE				4.0
3.0							5.0
4.0							6.0
5.0							7.0
6.0							8.0
7.0							9.0
8.0							10.0
9.0							11.0
10.0							12.0
11.0							13.0
12.0							14.0
							15.0
							16.0
							17.0
							18.0
							19.0
							20.0
							21.0
							22.0
							23.0
							24.0
							25.0
							26.0
							27.0
							28.0
							29.0
							30.0
							31.0
							32.0
							33.0
							34.0
							35.0
							36.0
							37.0
							38.0
							39.0

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/16/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-107

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 737+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			OVERBURDEN TOPSOIL – rootlets			
1.0		0.9	SAND – brown, loose, some gravel, dry to trace silt, moist		244 245	
2.0		1.8	SILT – stiff, sandy, some gravel, wet to moist		246	
		2.7				
3.0		2.9	GRAVEL – brown, compact, sandy, trace silt silt, moist			
		3.4	SILT – brown, stiff, sandy, some gravel, moist		247	
4.0			SILT – grey, stiff, some sand, trace clay, wet			
		4.3	SAND – brown, compact, some silt, moist		248	
5.0		4.6	CLAY – grey, stiff, silty, stiff			
		4.9	BOTTOM OF BOREHOLE			
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/16/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-108

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
		0.5	COBBLES – grey/brown, compact, gravelly, some sand, dry					
1.0			COBBLES – grey white pink, compact, gravelly, some sand, dry		250			
					251			
		1.5	GRAVEL – cobbly					
2.0					252			
		2.4	SAND – compact, gravely, trace silt, moist – Boulder at 2.7m		253			
3.0		3.0	BOTTOM OF BOREHOLE					
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/16/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-109

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
		0.5	BOULDER & COBBLES – grey white pink, compact, dry		249			
			BOTTOM OF BOREHOLE – AUGER REFUSAL					
12.0								39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/16/99 | EQUIPMENT: Mobile Auger – MST

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-110

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 938+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0			SAND – brown, loose to compact, gravelly, some silt, cobbles, dry to moist		253	
1.0					254	
2.0					255	
		2.4	GRAVEL and SAND – brown, compact, some silt and cobbles, dry to moist		256	
3.0					257	
		3.7	SAND – brown, compact to dense, gravelly, some silt, cobbles, dry to moist		258	
4.0		4.3	BOTTOM OF BOREHOLE			
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/17/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-111

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
0.0			COBBLES – brown, compact, gravelly, some sand, trace silt, dry		259			1.0
1.0		1.2	GRAVELLY – brown, compact to dense, sandy, some cobbles, dry to moist		260			4.0
		1.8			261			6.0
2.0		2.1	SAND – brown, compact, gravelly, trace silt, moist		262			7.0
		2.7	GRAVEL – grey, compact to dense, sandy, trace silt, some cobbles, moist					8.0
3.0			BOTTOM OF BOREHOLE					10.0
			Note:					
			– Switch to Pneumatic Air Hammer below 1.5m					
4.0								14.0
5.0								16.0
6.0								20.0
7.0								24.0
8.0								27.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/17/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-112

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 738+925

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			SAND – brown, compact, some gravel, trace silt, dry		263				1.0
		0.6	GRAVEL – grey, compact, some sand, cobbles and boulders						2.0
1.0					264				3.0
		1.5	Boulder at 1.4m						4.0
			BOTTOM OF BOREHOLE						5.0
2.0									6.0
									7.0
3.0									8.0
									9.0
4.0									10.0
									11.0
5.0									12.0
									13.0
6.0									14.0
									15.0
7.0									16.0
									17.0
8.0									18.0
									19.0
9.0									20.0
									21.0
10.0									22.0
									23.0
11.0									24.0
									25.0
12.0									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/17/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-113

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
0.0			GRAVEL – brown, compact, sandy, trace silt, some cobbles, dry to moist		267				0.0
1.0					268				3.0
		1.5	BOTTOM OF BOREHOLE						5.0
2.0									6.0
3.0									10.0
4.0									13.0
5.0									16.0
6.0									19.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/17/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-114

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+025

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – brown, loose to compact, sandy, trace silt, moist		265				1.0
1.0					266				2.0
		1.5	BOTTOM OF BOREHOLE						3.0
2.0									4.0
3.0									5.0
									6.0
4.0									7.0
									8.0
5.0									9.0
									10.0
6.0									11.0
									12.0
7.0									13.0
									14.0
8.0									15.0
									16.0
9.0									17.0
									18.0
10.0									19.0
									20.0
11.0									21.0
									22.0
12.0									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/17/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-115

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 739+025 R of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0			COBBLES – grey/brown, compact, gravelly, some sand, boulders, trace silt, dry to moist		269	
1.0		0.9	SAND – grey, compact, gravely, cobbly, some silt, dry		270	
					271	
2.0		2.0	BOTTOM OF BOREHOLE – AUGER REFUSAL			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/17/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-116

JOB NUMBER: 982-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+500

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A--CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 / N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	ELEVATION: GRASS					0.0
			GRAVEL – grey, loose to compact, sandy and silty, wet		272			
1.0					273			
		1.5	BOTTOM OF BOREHOLE					
2.0								
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/17/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-117

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+725 L of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION: MINIMUM RECOVERY						0.0
1.0		0.9	COBBLES – grey/brown, compact to dense, gravelly, sandy, trace silt, dry		274				5.0
2.0		1.7	GRAVEL – grey/brown, compact, sandy, some silt, moist		275				7.0
3.0		3.0	BOTTOM OF BOREHOLE		276				10.0
4.0									13.0
5.0									17.0
6.0									20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/17/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-118

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+775

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			SAND – brown, compact, gravelly, some silt, dry to moist		277	
1.0		1.1	GRAVEL – grey, compact, sandy, some silt, moist		278	
		1.4	SAND – grey, dense, gravelly, moist			
2.0		1.8	GRAVEL – grey/brown, dense, sandy, some silt, moist		279	
		2.4	GRAVEL – grey/brown, dense, trace silt, moist		280	
3.0		3.4	GRAVEL – grey/brown, dense, sandy, some silt, moist		281	
4.0		4.0	GRAVEL – grey, dense, some sand, moist		282	
		4.6	BOTTOM OF BOREHOLE			
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/17/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-119

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 740+825

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0		0.2	ELEVATION: COBBLES – grey, loose to compact, dry					0.0
			GRAVEL – brown, compact, sandy, some silt, cobbles		283			
1.0					284			5.0
		1.5	BOTTOM OF BOREHOLE					
2.0								6.0
3.0								10.0
4.0								13.0
5.0								17.0
6.0								20.0
7.0								23.0
8.0								26.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

LOGGED BY: CB | TRANSCRIBED BY: CB | COMPLETION DATE: 06/14/99 | EQUIPMENT: Mobile Auger – M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-120

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+250

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.1	OVERBURDEN TOPSOIL – rootlets, some cobbles, wet						0.0
		0.5	SAND – brown, loose, gravelly, some silt, dry to moist		290				1.0
1.0			SAND – grey/brown, dense to very dense, gravely, trace silt, moist						2.0
									3.0
									4.0
					291			84/10	5.0
2.0		2.0	SAND – brown, very dense, sandy, trace silt and gravel, moist		292				6.0
									7.0
									8.0
					293				9.0
3.0					294			50/5	10.0
									11.0
									12.0
4.0					296				13.0
									14.0
					295			50/6	15.0
		4.9	BOTTOM OF BOREHOLE						16.0
5.0									17.0
									18.0
									19.0
6.0									20.0
									21.0
									22.0
7.0									23.0
									24.0
									25.0
8.0									26.0
									27.0
									28.0
9.0									29.0
									30.0
									31.0
10.0									32.0
									33.0
									34.0
									35.0
11.0									36.0
									37.0
									38.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/18/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-121

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			TOPSOIL – brown, loose to compact, silt, some gravel, moist		303				0.0
		0.5	GRAVEL – brown, compact, sandy, some silt, cobbles, moist						
1.0									1.0
		1.4			304				
		1.5	SAND – brown, dense, gravelly, some silt, moist		305			50/4	5.0
2.0			GRAVEL – sandy, some silt, cobbles						
		2.4			306				8.0
			SAND – brown, dense, gravelly, trace silt, dry to moist						
3.0					307			50/4	10.0
		4.0							
4.0		4.1	GRAVEL – some silt, sandy						13.0
			GRAVEL – brown, very dense, silty, some sand, moist		308				
		4.6							15.0
5.0			SILT – brown, stiff, some sand and gravel, dry		309				16.0
		5.2							
		5.5	SILT – brown, very dense, gravelly, some sand, dry						
6.0			BOTTOM OF BOREHOLE						20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/18/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-122

JOB NUMBER: 992-1474
CLIENT: Public Works and Gov't Services Canada
SITE LOCATION: 747+250 R of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80 N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			GRAVEL – brown, compact, sandy, some silt, moist		297			0.0
1.0								1.0
		1.5			298			
			GRAVEL – brown, dense, some silt, trace sand, moist					
2.0		2.1			299			7.0
			GRAVEL – brown, very dense, silty, some sand, moist					8.0
3.0					300			9.0
					301			10.0
4.0			– wet below 4m					14.0
		4.6			302			
			BOTTOM OF BOREHOLE					15.0
5.0								16.0
6.0								19.0
7.0								23.0
8.0								26.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

LOGGED BY: CB	TRANSCRIBED BY: CB	COMPLETION DATE: 06/18/99	EQUIPMENT: Mobile Auger – M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-123

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
0.0			GRAVEL – grey, compact, sandy, trace silt, dry to moist.						
1.0					1				
2.0									
2.7		2.7	SILT – brown, hard, trace sand, moist to wet.		2				
3.0									
4.0					3				
5.0									
6.0					4				
6.9		6.9	moisture chnages from moist to wet.						
7.0					5			60/10	
8.0									
9.0					6			60/6	
9.3		9.3	BOTTOM OF BOREHOLE. SEEPAGE AT 6.9m.						
10.0									
11.0									
12.0									39.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/06/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-124

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 744+900 L of Center line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION: SAND and GRAVEL – grey, very dense, trace silt, dry.						0.0
1.0									1.0
2.0					1				2.0
3.0					2				3.0
4.0									4.0
5.0									5.0
6.0					3			60/6	6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0		10.7	SAND – grey, very dense, some gravel, trace silt, dry to moist.						11.0
12.0									12.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/06/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 4

LOG OF BOREHOLE NO. BH5-124

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 744+900 L of Center line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
12.0			ELEVATION:						40.0
13.0									41.0
		13.7	GRAVEL and SAND – grey, very dense, trace silt, moist.						
14.0									46.0
15.0									51.0
16.0									56.0
		16.8	SAND – grey, very dense, trace silt, trace gravel, moist.						
17.0					4			60/6	57.0
18.0									61.0
19.0					5			60/6	62.0
20.0									66.0
21.0									71.0
22.0									72.0
23.0									76.0
24.0									78.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/06/99 | EQUIPMENT: MST

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-124

JOB NUMBER: 902-1474
CLIENT: PWGSC
SITE LOCATION: 744+900 L of Center line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
24.0			ELEVATION:						70.0
25.0									80.0
26.0									90.0
27.0									100.0
28.0									110.0
29.0									120.0
30.0									130.0
31.0		31.1	SAND – grey, very dense, some silt, moist.						140.0
32.0									150.0
33.0									160.0
34.0									170.0
35.0									180.0
36.0									190.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/06/99	EQUIPMENT: MST
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 3 of 4

LOG OF BOREHOLE NO. BH5-124

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 744+900 L of Center line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
36.0			ELEVATION:						119.0
37.0									120.0
38.0		38.1							125.0
		38.4	SAND and GRAVEL - grey, very dense, trace silt, moist to wet. changes from moist to wet.						126.0
39.0									128.0
					9			60/6	130.0
40.0		40.2	BOTTOM OF BOREHOLE. Seepage at 38.4m						131.0
41.0									135.0
42.0									138.0
43.0									141.0
44.0									144.0
45.0									149.0
46.0									151.0
47.0									155.0
48.0									157.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/06/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 4 of 4

LOG OF BOREHOLE NO. BH5-125

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / ROD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION: GRAVEL – grey, very dense, occasional boulders, sandy, trace silt, dry.						0.0
1.0									1.0
2.0					1			60/8	2.0
3.0					2				3.0
4.0									4.0
5.0					3			60/3	5.0
6.0					4				6.0
7.0									7.0
8.0					5			60/3	8.0
9.0									9.0
10.0		10.4	SAND – grey, very dense, some silt, trace gravel, dry.						10.0
11.0					6			60/11	11.0
12.0									12.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/10/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-125

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
12.0			ELEVATION:						40.0
13.0									41.0
									42.0
									43.0
									44.0
									45.0
14.0				SPT	7			60/10	46.0
									47.0
									48.0
15.0									49.0
									50.0
									51.0
									52.0
16.0									53.0
									54.0
									55.0
									56.0
17.0									57.0
									58.0
									59.0
18.0				SPT	8			60/10	60.0
									61.0
									62.0
19.0									63.0
									64.0
									65.0
									66.0
20.0									67.0
									68.0
									69.0
21.0									70.0
									71.0
									72.0
22.0									73.0
									74.0
									75.0
23.0				SPT	9			60/8	76.0
									77.0
24.0									78.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/10/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-125

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
24.0			ELEVATION:				20 40 60 80	20 40 60 80	79.0
25.0									80.0
26.0									81.0
27.0									82.0
28.0									83.0
29.0									84.0
30.0									85.0
31.0									86.0
32.0									87.0
		32.3	BOTTOM OF BOREHOLE.						88.0
33.0									89.0
34.0									90.0
35.0									91.0
36.0									92.0
									93.0
									94.0
									95.0
									96.0
									97.0
									98.0
									99.0
									100.0
									101.0
									102.0
									103.0
									104.0
									105.0
									106.0
									107.0
									108.0
									109.0
									110.0
									111.0
									112.0
									113.0
									114.0
									115.0
									116.0
									117.0
									118.0

SPT: 10 — 60/5
SPT: 11 — 60/4

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/10/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-126

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION: SILT – brown, hard, sandy, trace clay, moist.						0.0
1.0									1.0
2.0				X	1				2.0
3.0				X	2			69/11	3.0
4.0									4.0
5.0				X	3			60/8	5.0
6.0									6.0
7.0									7.0
8.0				X	4			60/8	8.0
9.0		9.1	SAND – brown, very dense, silty, moist.						9.0
10.0									10.0
11.0				X	5			60/8	11.0
12.0									12.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/13/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-126

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE	DISTURBED	ENVIRONMENTAL	SPT	A-CASING	DIAMOND CORE	SOLID STEM
BACKFILL TYPE	BENTONITE	PEA GRAVEL	SLOUGH	GROUT	DRILL CUTTINGS	SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
			ELEVATION:				20 40 60 80	20 40 60 80	
12.0									40.0
13.0									41.0 42.0 43.0 44.0 45.0
14.0									46.0 47.0 48.0 49.0
15.0									50.0 51.0 52.0 53.0
16.0									54.0 55.0 56.0 57.0
17.0									58.0 59.0
18.0				⊠	6			60/3	60.0 61.0 62.0 63.0 64.0
19.0									65.0 66.0 67.0 68.0
20.0									69.0
21.0		21.0	POSSIBLE BEDROCK	⊠	7			60/1	70.0 71.0 72.0 73.0 74.0
22.0		21.3	BOTTOM OF BOREHOLE.						75.0 76.0 77.0
23.0									78.0
24.0									

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/13/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 2 of 2

LOG OF BOREHOLE NO. BH5-127

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0			SAND – grey, very dense, gravely, trace silt, moist.		1	
1.0		0.9	BEDROCK. moderate rippability potential.		2	
2.0		2.1	low rippability potential.		3	
3.0		3.7	BOTTOM OF BOREHOLE.			
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/14/99	EQUIPMENT: MST
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-128

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL and SAND – grey, very dense, trace silt, moist.		1				
1.0		0.9	SILT – grey, hard, some sand, moist.						3.0
2.0									7.0
		2.4	GRAVEL – grey, very dense, silty, some sand, dry.						8.0
3.0									10.0
		3.4	BEDROCK. low rippability potential.						11.0
4.0									13.0
		4.3	BOTTOM OF BOREHOLE.						14.0
5.0									16.0
6.0									20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/14/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-129

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
		0.6	GRAVEL – brown, dense, silty, some sand, dry to moist.						1.0
1.0			GRAVEL – brown, dense, sandy, trace silt, moist.						2.0
2.0		2.4	BOTTOM OF BOREHOLE.						3.0
3.0									4.0
4.0									5.0
5.0									6.0
6.0									7.0
7.0									8.0
8.0									9.0
9.0									10.0
10.0									11.0
11.0									12.0
12.0									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

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LOG OF BOREHOLE NO. BH5-130

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SAND – grey, very dense, gravely, trace silt, moist.		1				0.0
1.0									1.0
2.0		2.1	SAND and GRAVEL – grey, very dense, trace silt, moist.						2.0
3.0		3.2	BOTTOM OF BOREHOLE.		2				3.0
4.0									4.0
5.0									5.0
6.0									6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-131

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 746+450 L of Center line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – grey, loose, sandy, trace silt, occasional boulders and cobbles, moist.		1				
2.4		2.4	SAND – grey, very dense, gravely, trace silt, dry.		2			60/4	
4.0		4.0	GRAVEL – grey, very dense, sandy, occasional cobbles, dry.		3			60/5	
					4			60/4	
10.7		10.7	SAND – grey, very dense, gravely, dry.						
12.0									39.0

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 2

LOG OF BOREHOLE NO. BH5-131

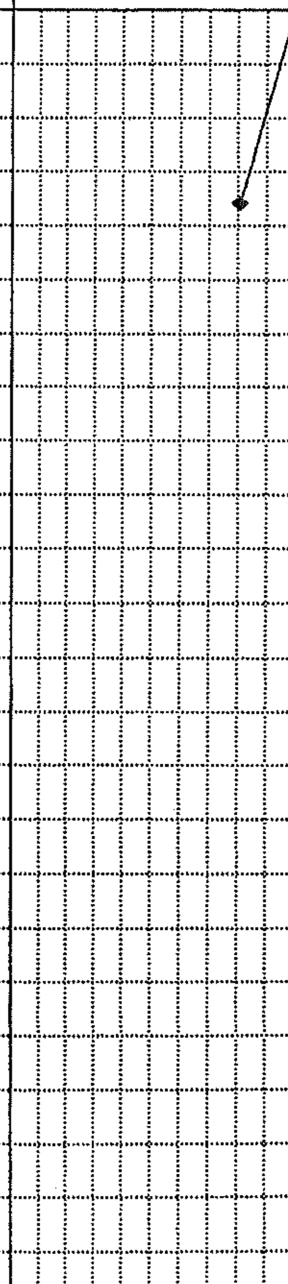
JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 746+450 L of Center line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH (m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	DEPTH (ft)
12.0							40.0
13.8				SPT	5		45.3
15.0				DISTURBED	6		49.0
15.2		15.2	BOTTOM OF BOREHOLE.				50.0
24.0							78.0

Chart headings: ■ Recovery (%) ■ 20 40 60 80; ◆ RQD (%) ◆ 20 40 60 80; PLASTIC M.C. LIQUID 20 40 60 80; ◆ N (blows/300 mm) ◆ 20 40 60 80



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LOG OF BOREHOLE NO. BH5-132

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0	XXX	0.2	TOPSOIL.						0.0
			SAND – grey, very dense, gravely, trace silt, moist.		1				1.0
1.0					2				2.0
2.0									3.0
					3				4.0
3.0									5.0
4.0					4				6.0
									7.0
5.0					5				8.0
									9.0
6.0									10.0
					6				11.0
7.0		7.6	BOTTOM OF BOREHOLE.						12.0
8.0									13.0
									14.0
9.0									15.0
									16.0
10.0									17.0
									18.0
11.0									19.0
									20.0
12.0									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

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Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-133

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			GRAVEL – brown, very dense, sandy, some to trace silt, dry.		1				0.0
1.0					2				1.0
2.0		2.7	GRAVEL and SAND – brown, very dense, trace silt, dry.		3				2.0
3.0									3.0
4.0					4				4.0
5.0									5.0
6.0					5				6.0
7.0									7.0
8.0					6				8.0
9.0		9.1	BOTTOM OF BOREHOLE.		7				9.0
10.0									10.0
11.0									11.0
12.0									12.0

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Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-134

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION: TOPSOIL.		1				0.0
1.0		0.6	GRAVEL – grey, very dense, sandy, some silt, dry.		2				1.0 – 4.0
2.0		2.1	changes from some silt to trace silt.		3				5.0 – 10.0
4.0		4.3	changes from trace silt to some silt.		4				11.0 – 14.0
5.0					5				15.0 – 20.0
6.0					6				21.0 – 23.0
7.0		7.0	BOTTOM OF BOREHOLE.						24.0 – 39.0
8.0									
9.0									
10.0									
11.0									
12.0									

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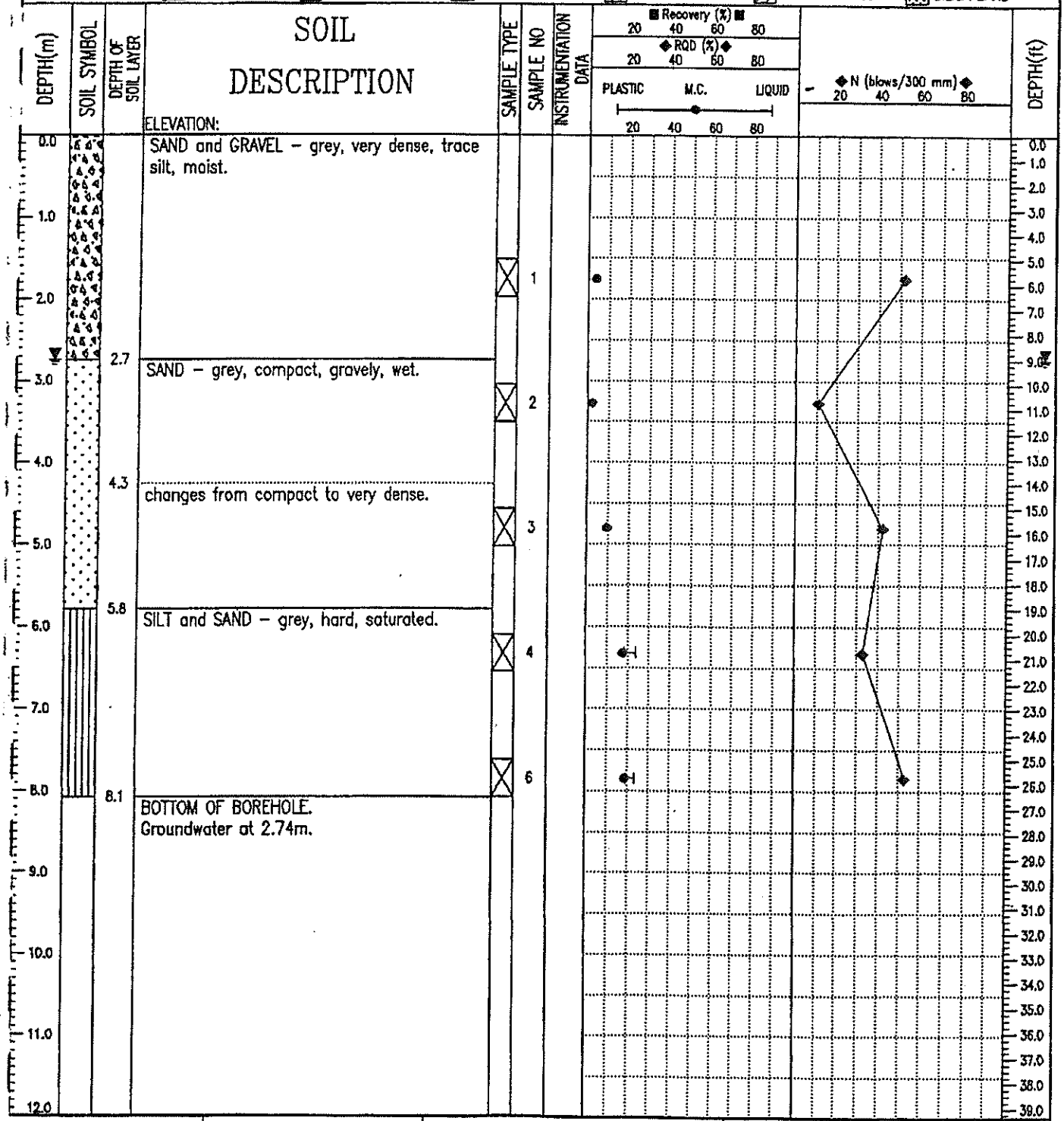
LOG OF BOREHOLE NO. BH5-135

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 748+100

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND



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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-136

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+175 11m R of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SAND – brown, dense, some silt, trace gravel, moist.		1		H		0.0
1.0					2				1.0
2.0									2.0
3.0		2.7	SAND – brown, dense, some gravel, trace silt, moist.		3				3.0
4.0		4.0	changes from moist to wet.		4		H		4.0
5.0									5.0
6.0					5		H		6.0
7.0		7.0	SAND and GRAVEL – brown, dense, trace silt, moist.		7				7.0
8.0		7.6	BOTTOM OF BOREHOLE. soils were saturated at 3.96m.						8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

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Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-137

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 748+175 11m L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			SILT – mottled grey/brown, sandy, stiff, moist.		1				1.0
1.0									2.0
					2				3.0
2.0									4.0
		2.4	GRAVEL and SAND – brown, dense, some silt, moist.						5.0
3.0					3				6.0
									7.0
4.0					4				8.0
									9.0
5.0									10.0
					5				11.0
6.0									12.0
									13.0
7.0					6				14.0
		7.6	BOTTOM OF BOREHOLE.						15.0
8.0									16.0
									17.0
9.0									18.0
									19.0
10.0									20.0
									21.0
11.0									22.0
									23.0
12.0									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-138

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+300 L of Center Line.

SAMPLE TYPE: DISTURBED; ENVIRONMENTAL; SPT; A-CASING; DIAMOND CORE; SOLID STEM
BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SILT – dark brown, stiff, sandy, trace organics, moist.		1				0.0
1.0		0.9	SILT – mottled gray/brown, stiff, some sand, moist to wet.		2				1.0
2.0		2.4	GRAVEL and SAND – grey, dense, trace silt, moist.		3				2.0
3.0									3.0
4.0					4				4.0
5.0									5.0
6.0		6.1	BOTTOM OF BOREHOLE.		5				6.0
7.0									7.0
8.0									8.0
9.0									9.0
10.0									10.0
11.0									11.0
12.0									12.0

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Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-139

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 748+300 11m R of Center line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
			ELEVATION:						
0.0			SILT – dark brown, stiff, sandy, trace organics, moist.		1				0.0
1.0		0.9	SILT – mottled gray/brown, stiff, some sand, moist to wet.		2		H		1.0
2.0		2.1	GRAVEL and SAND – grey, dense, trace silt, moist.		3				2.0
3.0									3.0
4.0					4				4.0
5.0									5.0
6.0					5				6.0
7.0									7.0
		7.6	BOTTOM OF BOREHOLE.		6				8.0
8.0									9.0
9.0									10.0
10.0									11.0
11.0									12.0
12.0									13.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5–140

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+400 11m R of Center line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			SILT – dark brown, stiff, sandy, trace organics, moist.		1				0.0
1.0		0.9	SILT – mottled gray/brown, stiff, some sand, moist to wet.		2				1.0 – 4.0
2.0		2.1	SAND – grey, dense, gravely, trace silt, moist.		3				5.0 – 10.0
3.0									11.0 – 14.0
4.0					4				15.0 – 18.0
5.0									19.0 – 20.0
6.0		6.1	BOTTOM OF BOREHOLE.		5				21.0 – 39.0
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-141

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 748+400 11m L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
		0.9	SILT – dark brown, stiff, sandy, trace organics, moist.		1				
1.0			SILT – mottled gray/brown, stiff, some sand, moist to wet.		2				
		1.8	GRAVEL and SAND – grey, dense, trace silt, moist.		3				
4.0					4				
		4.6	BOTTOM OF BOREHOLE.						
12.0									39.0

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

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Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-142

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 748+500 11m L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			SILT – brown, stiff, sandy, trace gravel, dry.		1				1.0
		0.6	GRAVEL – grey, very dense, sandy, trace silt, dry.						2.0
1.0					2				3.0
									4.0
2.0									5.0
									6.0
					3				7.0
3.0									8.0
									9.0
									10.0
4.0									11.0
					4				12.0
									13.0
5.0									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
6.0		6.1	BOTTOM OF BOREHOLE.		5				20.0
									21.0
									22.0
7.0									23.0
									24.0
									25.0
									26.0
8.0									27.0
									28.0
									29.0
									30.0
9.0									31.0
									32.0
									33.0
									34.0
10.0									35.0
									36.0
									37.0
									38.0
11.0									39.0
12.0									

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/20/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-143

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+500 11m R of Center Line

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
0.0			TOPSOIL.		1			0.0
		0.6	SILT – grey, stiff, sandy, moist.					
1.0					2			4.0
2.0								7.0
		2.4	SAND – grey, dense, gravely, trace silt, moist.		3			
3.0		3.0	BOTTOM OF BOREHOLE.					10.0
4.0								13.0
5.0								16.0
6.0								19.0
7.0								23.0
8.0								26.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/21/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-144

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+600 11m L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			SILT – brown, stiff, sandy, occasional boulders, moist.		1	
1.0		0.9	GRAVEL – grey, very dense, sandy, some silt, dry.		2	
2.0		1.8	SAND – brown, dense, some to trace silt, moist.			
		2.4	GRAVEL – grey, very dense, sandy, some silt, dry.		3	
4.0					4	
		4.6	BOTTOM OF BOREHOLE.			
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
ROD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/21/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-145

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+500 R of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – grey, dense, sandy, some silt, dry to moist.		1				
		0.6	BOULDER						
1.0					2				
		1.5	GRAVEL – grey, very dense, sandy, some silt, moist.						
2.0					3				
3.0									
4.0					4				
		4.6	BOTTOM OF BOREHOLE.						
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									39.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/21/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-146

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+600 11m R of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:						0.0
			SAND – grey, dense, gravely, trace silt, occasional bits of organic material, dry. (possibly fill).		1				
1.0					2				
2.0									
3.0		3.0	BOTTOM OF BOREHOLE.		3				
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									39.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/22/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-147

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+700 11m L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:					0.0
			SAND – brown, compact, silty, some gravel, trace organics, dry.		1			
1.0					2			
2.0		2.1	SAND and GRAVEL – brown, compact, trace silt, moist.		3			
3.0		3.0	BOTTOM OF BOREHOLE.					

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/22/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-148

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+800 L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	DEPTH(ft)
			ELEVATION:				
0.0		0.3	TOPSOIL.		1		0.0
			SILT – mottled grey/brown, stiff, some sand, moist to wet.				
1.0					2		4.0
2.0		2.1	SAND – grey, dense, gravely, trace silt, dry.				7.0
3.0		3.0	BOTTOM OF BOREHOLE.		3		10.0
4.0							15.0
5.0							16.0
6.0							20.0
7.0							23.0
8.0							26.0
9.0							30.0
10.0							33.0
11.0							36.0
12.0							39.0

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/19/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-149

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 748+800 on Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0			ELEVATION:			
0.0			SAND and GRAVEL – dark brown, dense, some silt, dry.		1	
1.0					2	
2.0						
3.0					3	
		3.4	SAND – brown, dense, gravely, trace silt, moist.			
4.0					4	
5.0						
6.0					5	
		6.1	BOTTOM OF BOREHOLE.			
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%): 20 40 60 80
RQD (%): 20 40 60 80
PLASTIC M.C. LIQUID: 20 40 60 80
N (blows/300 mm): 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-150

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 748+900 6m R of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			SAND – dark brown, compact, gravely, some silt, moist.		1				0.0
1.0					2				1.0
2.0									2.0
3.0		3.0			3				3.0
			BOTTOM OF BOREHOLE.						4.0
4.0									5.0
5.0									6.0
6.0									7.0
7.0									8.0
8.0									9.0
9.0									10.0
10.0									11.0
11.0									12.0
12.0									13.0
									14.0
									15.0
									16.0
									17.0
									18.0
									19.0
									20.0
									21.0
									22.0
									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/22/98 | EQUIPMENT: MST

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" |

LOG OF BOREHOLE NO. BH5-151

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+900 11m L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0			TOPSOIL.		1	
		0.6	SAND – grey, loose to compact, silty, some gravel, moist to wet.		2	
3.0		3.0	BOTTOM OF BOREHOLE.		3	

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-152

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+800 L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0		0.6	SAND – brown, compact, trace gravel, trace silt, dry.		1	
			changes from dry to moist.		2	
3.0		3.0	BOTTOM OF BOREHOLE.		3	

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-153

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 749+000 11m L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0		0.3	TOPSOIL.		1	
			SAND – grey, brown, compact, some silt, trace gravel, moist to wet.		2	
1.0		1.7	SILT – dark brown, stiff, sandy, trace gravel, moist.		3	
2.0		3.0	BOTTOM OF BOREHOLE.			
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-154

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 749+100

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
		0.3	TOPSOIL.		1				1.0
			SILT - grey/brown, soft to stiff, some sand, wet.						2.0
1.0					2				3.0
									4.0
									5.0
2.0		2.0	SAND - grey, compact, gravely, some silt, moist.						6.0
									7.0
									8.0
					3				9.0
3.0		3.0	BOTTOM OF BOREHOLE.						10.0
4.0									11.0
									12.0
5.0									13.0
									14.0
									15.0
6.0									16.0
									17.0
									18.0
7.0									19.0
									20.0
									21.0
8.0									22.0
									23.0
									24.0
9.0									25.0
									26.0
									27.0
10.0									28.0
									29.0
									30.0
11.0									31.0
									32.0
									33.0
12.0									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/22/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

LOG OF BOREHOLE NO. BH5-155

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
			ELEVATION:			
0.0			TOPSOIL.		1	
		0.6	SILT – grey/brown, soft to stiff, sandy, moist to wet.		2	
		1.7	SAND – dark brown, compact, silty, some gravel, moist.		3	
3.0		3.0	BOTTOM OF BOREHOLE.			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0
DEPTH(ft): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 26.0, 27.0, 28.0, 29.0, 30.0, 31.0, 32.0, 33.0, 34.0, 35.0, 36.0, 37.0, 38.0, 39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-156

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 749+200 11m L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:				20 40 60 80	20 40 60 80	0.0
		0.3	TOPSOIL.		1				
			SILT - grey, stiff, some sand, moist.						
1.0					2				
2.0		2.3	SAND - brown, compact, some silt, trace gravel, moist.						
					3				
3.0		3.0	BOTTOM OF BOREHOLE.						
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									39.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/22/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-157

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 749+300

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION (ELEVATION:)	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA
0.0		0.3	TOPSOIL.		1	
			SILT - grey, stiff, some sand, wet.			
1.0					2	
		1.5	BOTTOM OF BOREHOLE.			

Recovery (%) 20 40 60 80
RQD (%) 20 40 60 80
PLASTIC M.C. LIQUID 20 40 60 80
N (blows/300 mm) 20 40 60 80

DEPTH(ft): 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-158

JOB NUMBER: 982-1474
CLIENT: PWGSC
SITE LOCATION: 749+400 R of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
			ELEVATION:						
0.0		0.3	TOPSOIL.		1				0.0
			SILT – brown, stiff, some sand, trace gravel, wet.						
1.0					2				4.0
2.0		2.1	SILT – brown, stiff, some to trace sand, saturated.						7.0
3.0		3.0	BOTTOM OF BOREHOLE.		3				10.0
4.0									13.0
5.0									16.0
6.0									20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-159

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 749+400 L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION ELEVATION:	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 RQD (%) 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0		0.3	TOPSOIL.		1				0.0
			SAND – grey, compact, silty, trace gravel, moist.						
1.0		1.5	changes from moist to wet.		2				4.0
3.0		3.0	BOTTOM OF BOREHOLE.		3				9.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/22/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-160

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+500

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
		0.3	TOPSOIL.		1				
			SILT – grey, stiff, some sand, wet.						
1.0					2		H		3.0
2.0									
3.0		3.0			3		H		10.0
			BOTTOM OF BOREHOLE.						
4.0									13.0
5.0									16.0
6.0									20.0
7.0									23.0
8.0									26.0
9.0									30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-161

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION:

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
0.0			ELEVATION:				20 40 60 80	20 40 60 80	0.0
		0.3	TOPSOIL.		1				1.0
1.0			SILT – grey, stiff, some sand, wet.						2.0
					2				3.0
2.0									4.0
									5.0
3.0		3.0	BOTTOM OF BOREHOLE.		3				6.0
4.0									7.0
									8.0
5.0									9.0
									10.0
6.0									11.0
									12.0
7.0									13.0
									14.0
8.0									15.0
									16.0
9.0									17.0
									18.0
10.0									19.0
									20.0
11.0									21.0
									22.0
12.0									23.0
									24.0
									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-162

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 749+600 on Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID	N (blows/300 mm)	DEPTH(ft)
			ELEVATION:						
0.0		0.2	TOPSOIL.		1				0.0
			SILT – gray, stiff, sandy, trace gravel, moist.						
1.0					2				4.0
		1.5	BOTTOM OF BOREHOLE.						5.0
2.0									7.0
3.0									10.0
4.0									15.0
5.0									17.0
6.0									20.0
7.0									22.0
8.0									25.0
9.0									27.0
10.0									30.0
11.0									32.0
12.0									35.0
									36.0
									37.0
									38.0
									39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-163

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 749+700 on Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) / RQD (%) / PLASTIC M.C. LIQUID / N (blows/300 mm)	DEPTH(ft)
0.0		0.2	ELEVATION: TOPSOIL. SILT – gray, stiff, sandy, trace gravel, moist.		1			0.0
1.0					2		H	4.0
		1.5	BOTTOM OF BOREHOLE.					
2.0								6.0
3.0								10.0
4.0								13.0
5.0								16.0
6.0								19.0
7.0								23.0
8.0								26.0
9.0								30.0
10.0								33.0
11.0								36.0
12.0								39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-164

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 749+800 on Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | DIAMOND CORE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			SAND - grey, loose, trace gravel, moist.		1				1.0
1.0									2.0
					2				3.0
		1.5	BOTTOM OF BOREHOLE.						4.0
2.0									5.0
									6.0
3.0									7.0
									8.0
4.0									9.0
									10.0
5.0									11.0
									12.0
6.0									13.0
									14.0
7.0									15.0
									16.0
8.0									17.0
									18.0
9.0									19.0
									20.0
10.0									21.0
									22.0
11.0									23.0
									24.0
12.0									25.0
									26.0
									27.0
									28.0
									29.0
									30.0
									31.0
									32.0
									33.0
									34.0
									35.0
									36.0
									37.0
									38.0
									39.0

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Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0" | Page 1 of 1

LOG OF BOREHOLE NO. BH5-165

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 748+800 L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION: GRAVEL – grey, very dense, sandy, trace silt, dry.						0.0
1.0					1			60/11	5.0
2.0									10.0
3.0					2				11.0
4.0									15.0
5.0									16.0
6.0					3			95/11	20.0
7.0									21.0
8.0									26.0
9.0		9.1	BOTTOM OF BOREHOLE		4				30.0
10.0									31.0
11.0									36.0
12.0									39.0

LOGGED BY: RW	TRANSCRIBED BY: RW	COMPLETION DATE: 07/22/99	EQUIPMENT: M5T
Terra Engineering Ltd. (Vancouver, B.C.)		COORDINATES: N 0 0' 0" W 0 0' 0"	Page 1 of 1

LOG OF BOREHOLE NO. BH5-166

JOB NUMBER: 992-1474
CLIENT: PWGSC
SITE LOCATION: 749+875 L of Center Line.

SAMPLE TYPE: DISTURBED | ENVIRONMENTAL | SPT | A-CASING | SHELBY TUBE | SOLID STEM
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SILICA SAND

DEPTH(m)	SOIL SYMBOL	DEPTH OF SOIL LAYER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	INSTRUMENTATION DATA	Recovery (%) 20 40 60 80 / RQD (%) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	N (blows/300 mm) 20 40 60 80	DEPTH(ft)
0.0			ELEVATION:						0.0
			GRAVEL – grey, very dense, sandy, trace silt, occasional boulders and cobbles, dry to moist.		1				1.0
1.0					2				4.0
2.0									7.0
3.0					3				10.0
4.0					4				13.0
5.0									16.0
6.0					5				19.0
7.0									22.0
		7.3	SAND – grey, dense, trace gravel, trace silt, moist.		6				24.0
8.0									26.0
9.0					7				29.0
		9.1	BOTTOM OF BOREHOLE.						30.0
10.0									33.0
11.0									36.0
12.0									39.0

LOGGED BY: RW | TRANSCRIBED BY: RW | COMPLETION DATE: 07/22/99 | EQUIPMENT: M5T

Terra Engineering Ltd. (Vancouver, B.C.) | COORDINATES: N 0 0' 0" W 0 0' 0"

APPENDIX C

Terra Engineering Ltd.
*Vancouver (604) 874-1245
Port Coquitlam (604) 945-9939
*Kamloops (250) 372-5321
Williams Lake (250) 398-8788
Abbotsford (604) 859-6403
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

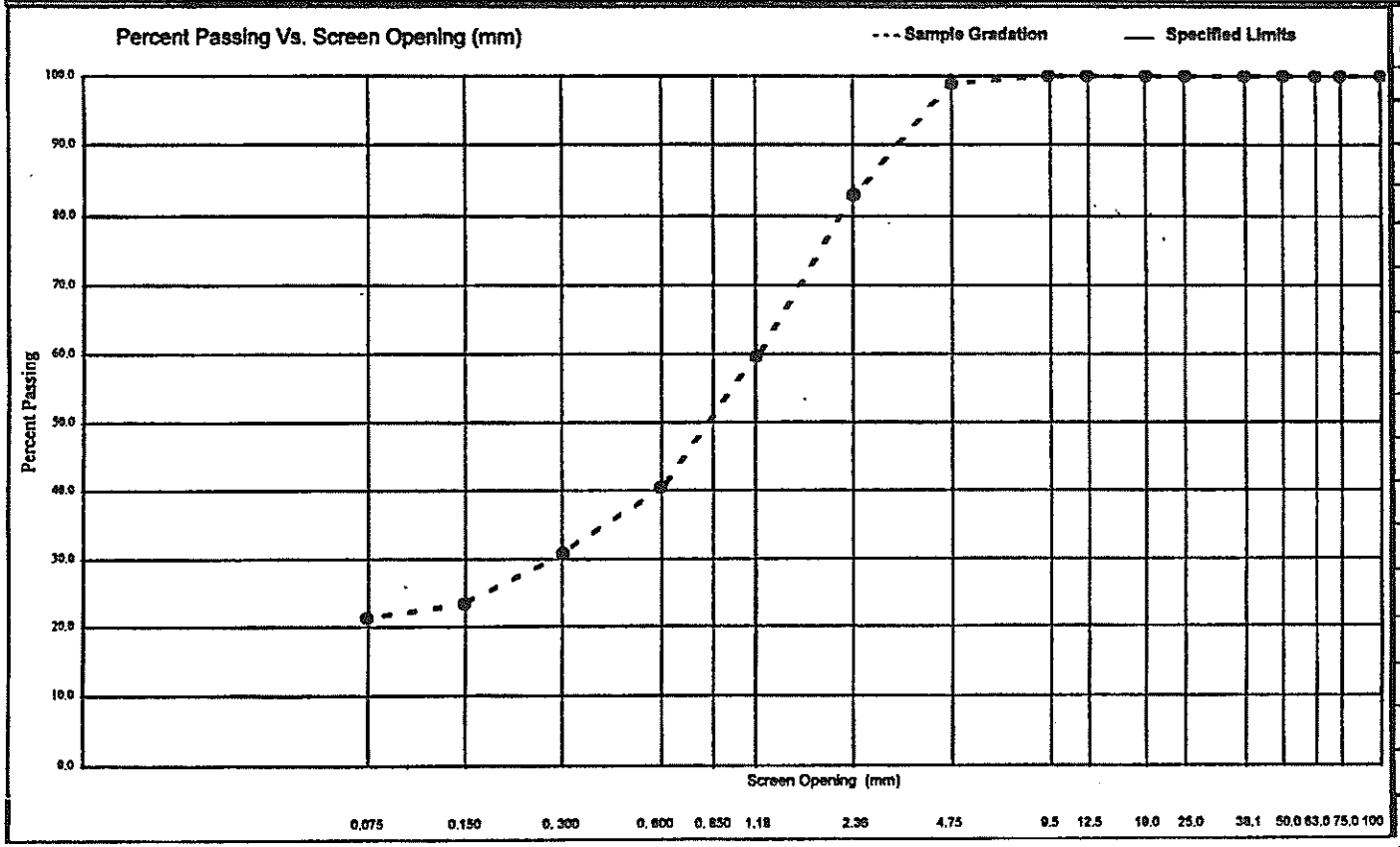
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Sand - Silty, trace Gravel
Sample No:
Source: BH5-1 @ 10'-12'
Specified Limits:

Sampled by: CB **Date:** 10-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	98.9		
2.36	83.0		
1.180[1]	59.6		
0.600	40.4		
0.300	30.9		
0.150	23.4		
0.075	21.3		

Remarks:

Gravel: 1.1 **Sand:** 77.7 **Fines:** 21.3 Moisture % 26.6

Reviewed by:

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Abbotsford (604) 859-6403
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

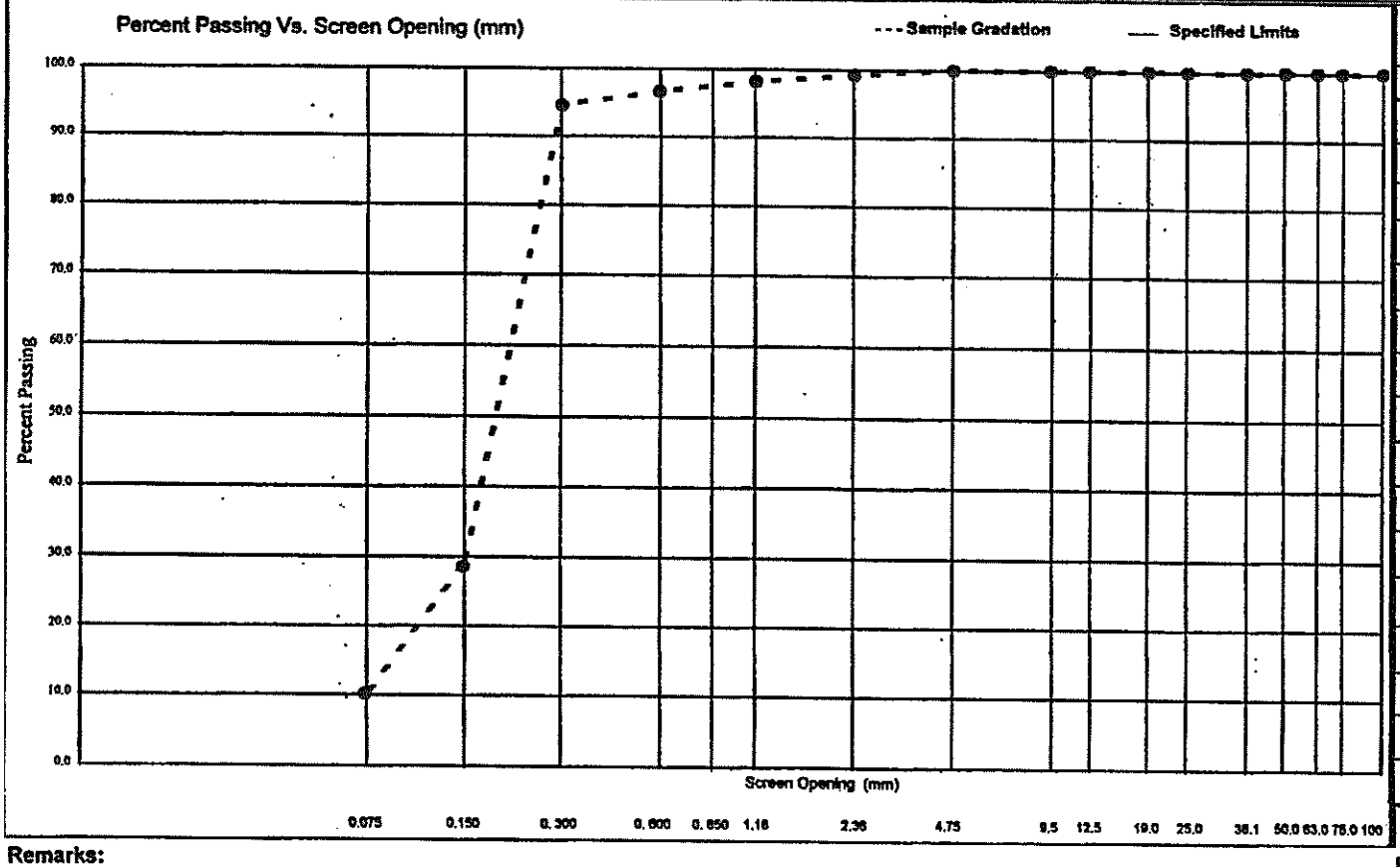
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 21-Jul-99

Type of Sample: Sand - some Silt
Sample No:
Source: BH5-1 @ 34'-36'
Specified Limits:

Sampled by: CB **Date:** 04-Jun-99
Tested by: EA **Date:** 21-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	99.2		
1.180	98.2		
0.600	96.6		
0.300	94.5		
0.150	28.6		
0.075	10.1		

Remarks:

Gravel: 0.0 **Sand:** 89.9 **Fines:** 10.1 Moisture % 3.5

Reviewed by:

BH5-1 @ 34'-36'

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Report of: Aggregate Sieve Analysis

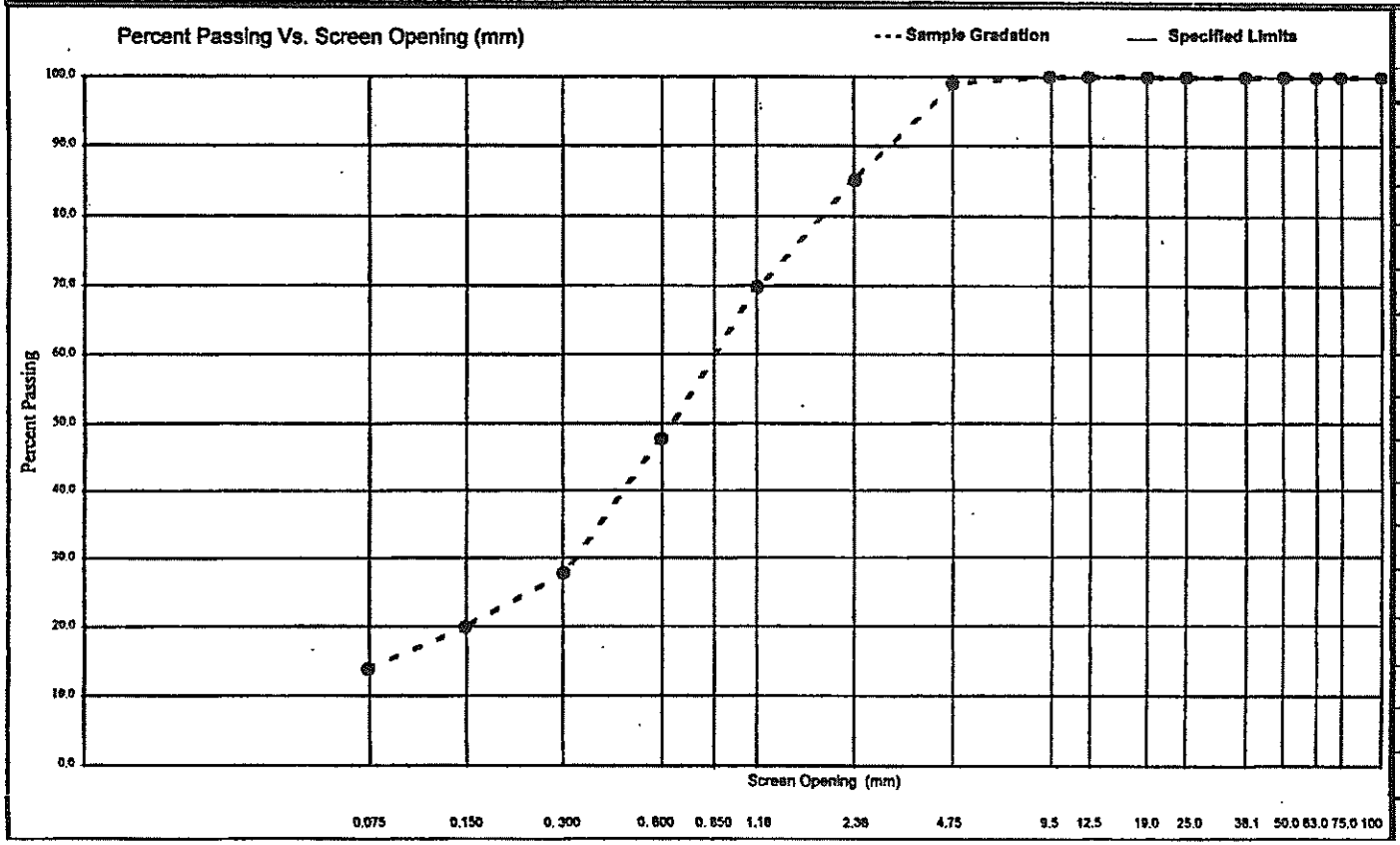
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
c
Project No: 992-1474
Location:
Date of Report: 21-Jul-99

Type of Sample: Sand - some Silt, trace Gravel
Sample No:
Source: BH5-1 @ 60'-65'
Specified Limits:

Sampled by: CB **Date:** 6-Jun-99
Tested by: EA **Date:** 21-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	99.0		
2.36	85.0		
1.180	69.8		
0.600	47.7		
0.300	27.8		
0.150	19.9		
0.075	13.8		

Remarks:

Gravel: 1.0 **Sand:** 85.3 **Fines:** 13.8 Moisture % 11.7

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Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

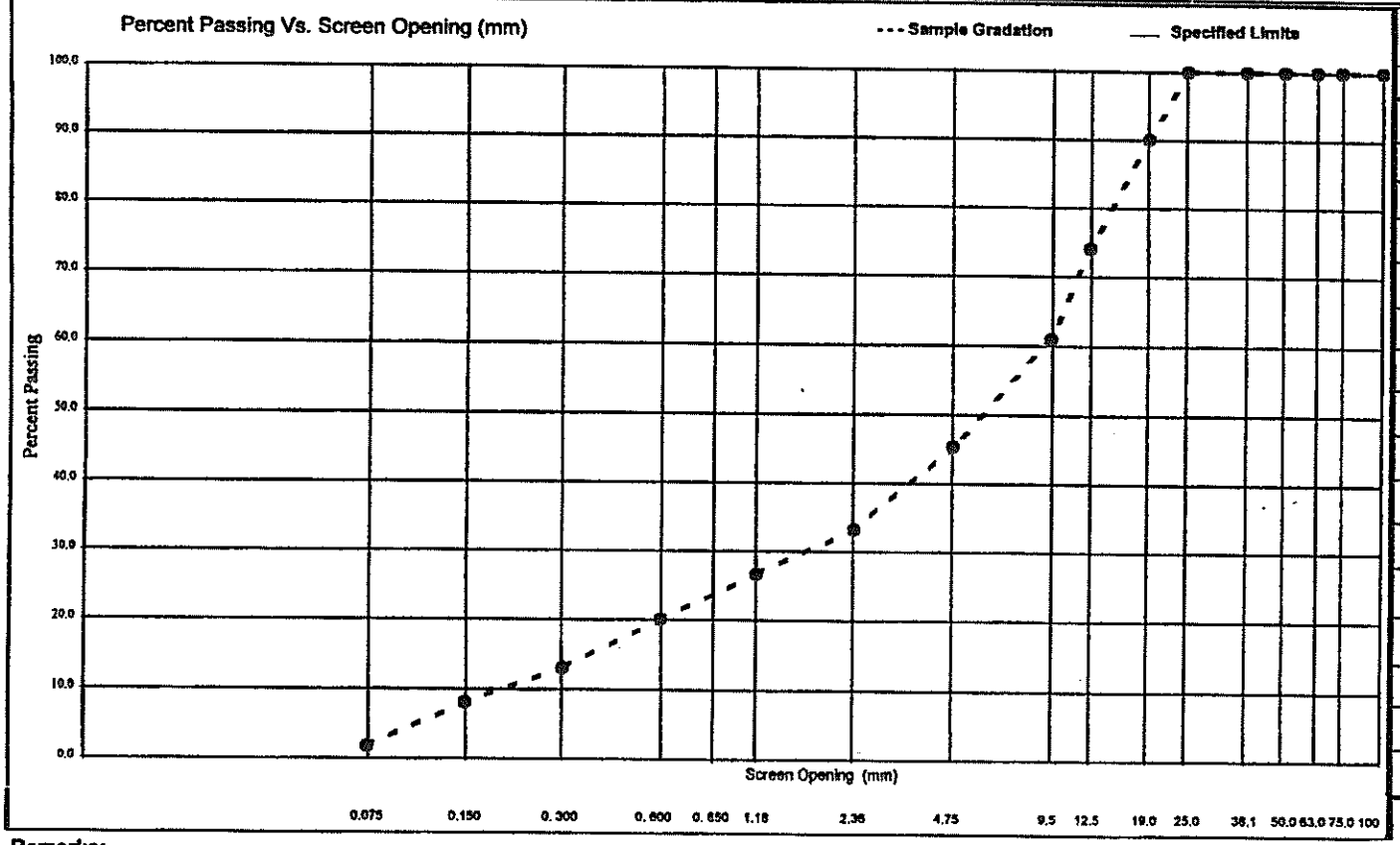
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-5 @ 4'-5'
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 10-Jun-99
Date: 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	90.0		
12.5	74.1		
9.50	60.9		
4.75	45.4		
2.36	33.2		
1.180	26.6		
0.600	20.1		
0.300	13.0		
0.150	8.1		
0.075	1.8		

Remarks:

Gravel: 54.6 **Sand:** 43.6 **Fines:** 1.8 Moisture % 4.2

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Report of: Aggregate Sieve Analysis

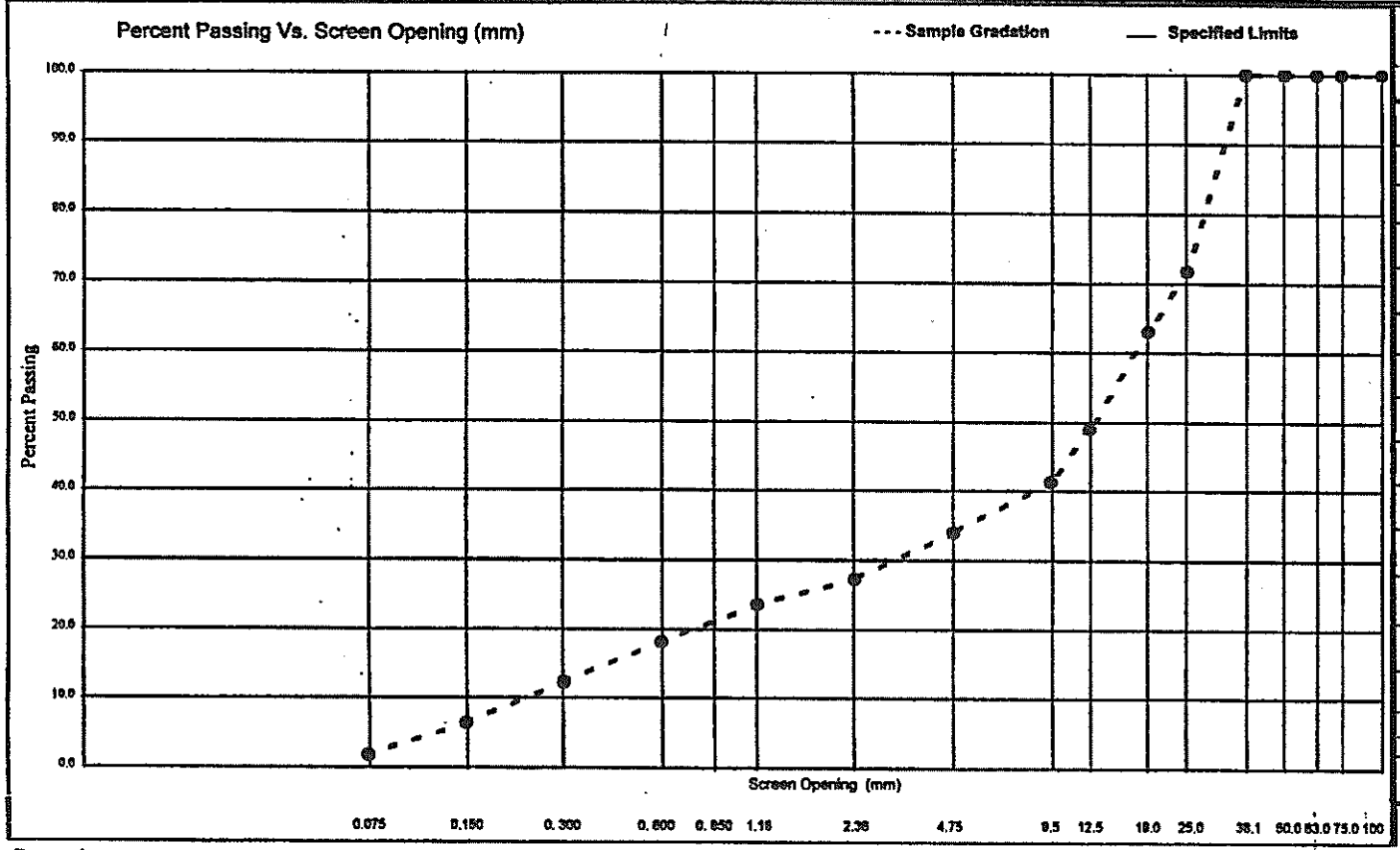
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 21-Jul-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-6 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 08-Jun-99
Tested by: EA **Date:** 21-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	71.8		
19.0	63.1		
12.5	49.0		
9.50	41.2		
4.75	34.0		
2.36	27.3		
1.180	23.6		
0.600	18.1		
0.300	12.2		
0.150	6.4		
0.075	1.7		

Remarks:

Gravel: 66.0 **Sand:** 32.2 **Fines:** 1.7 Moisture % 4.3

Reviewed by:

BH5-6 @ 4'-5'

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Report of: Aggregate Sieve Analysis

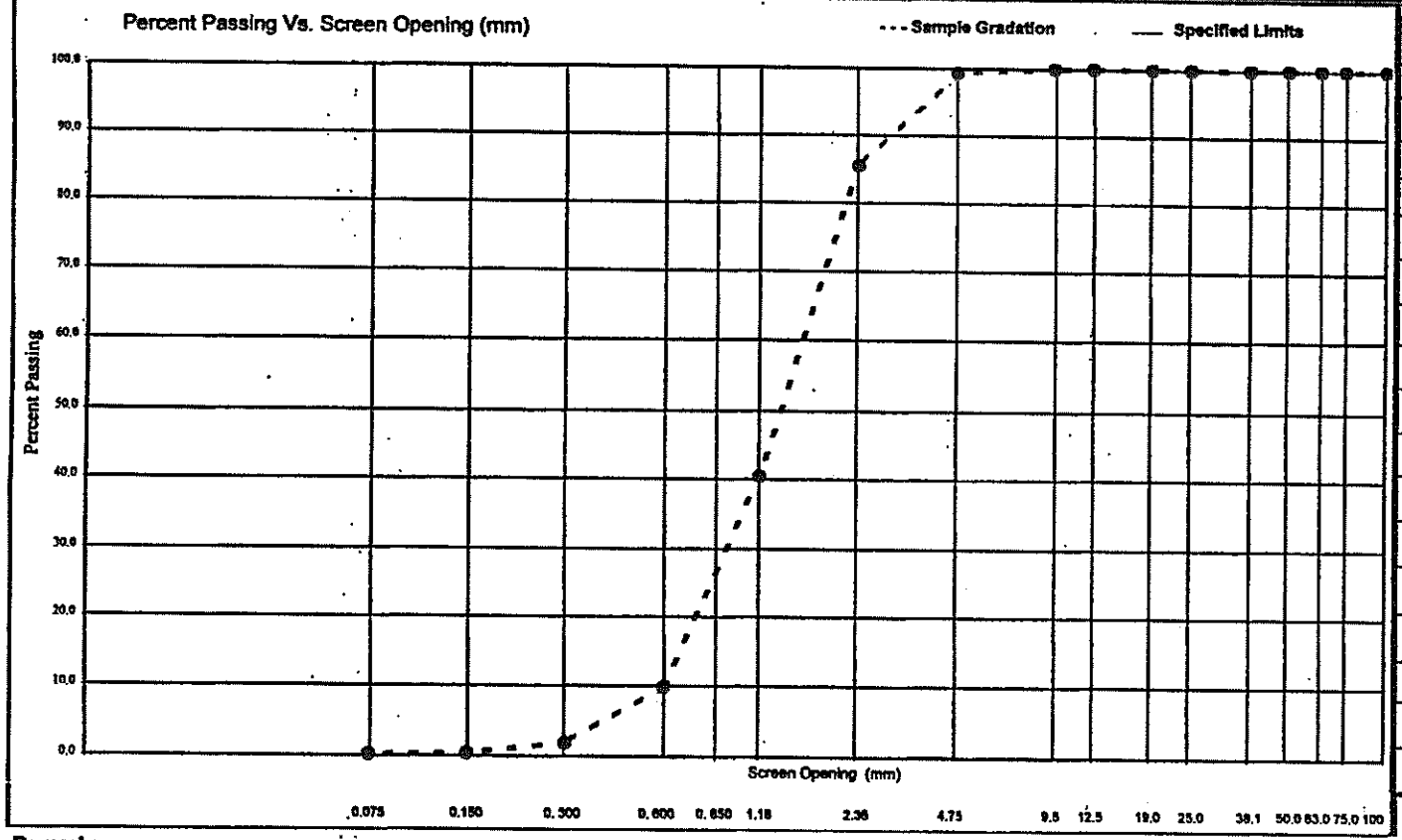
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 21-Jul-99

Type of Sample: Sand
Sample No:
Source: BH5-8 @ 14'-15'
Specified Limits:

Sampled by: CB **Date:** 08-Jun-99
Tested by: EA **Date:** 21-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	99.3		
2.36	85.4		
1.180	40.4		
0.600	9.8		
0.300	1.8		
0.150	0.3		
0.075	0.2		

Remarks:

Gravel: 0.7 **Sand:** 99.2 **Fines:** 0.2 Moisture % 0.7

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*Kamloops (250) 372-5321 Williams Lake (250) 398-8788
Abbotsford (604) 859-6403 Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

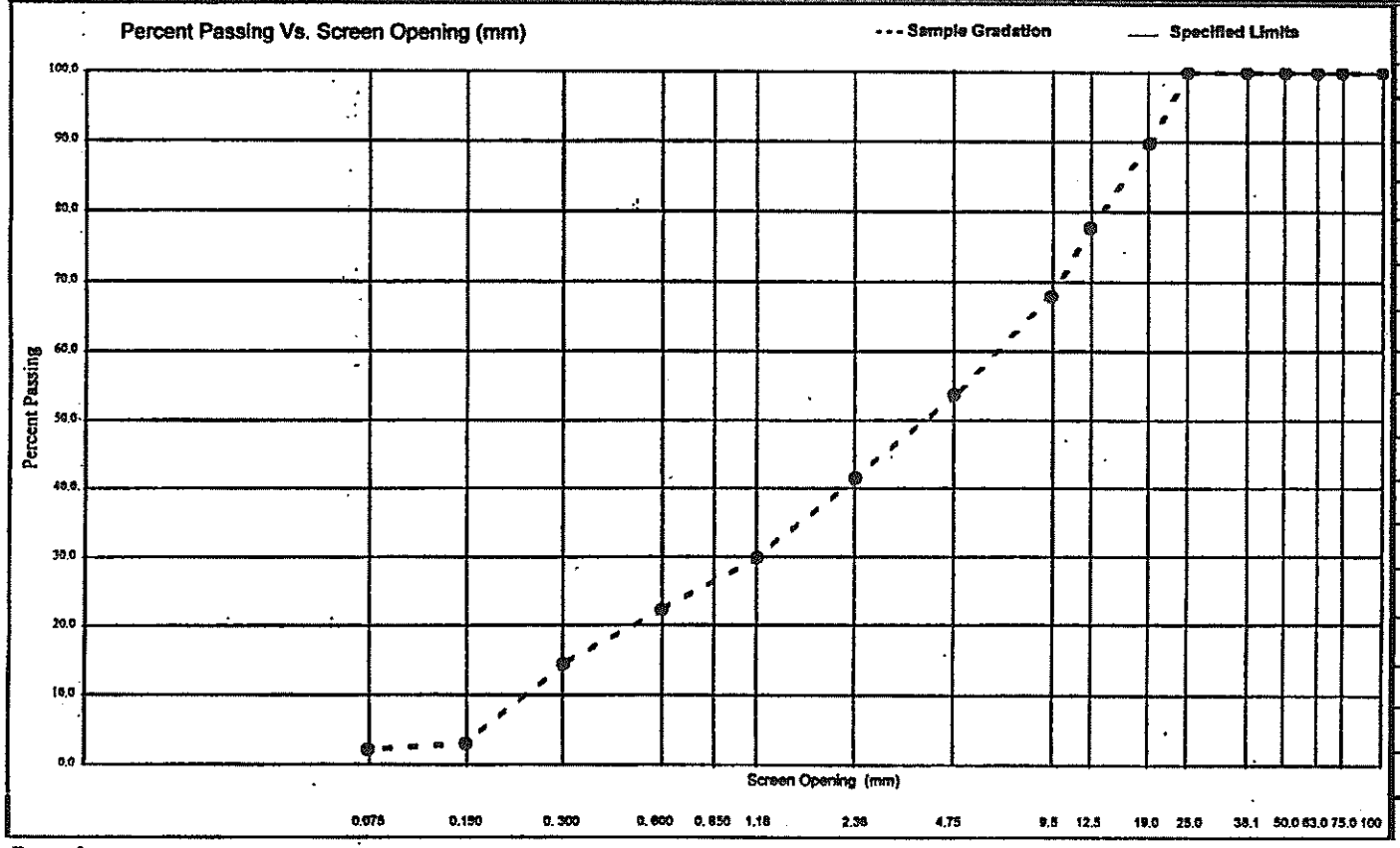
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-9 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 10-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	89.7		
12.5	77.6		
9.50	67.9		
4.75	53.7		
2.36	41.5		
1.180[1]	29.8		
0.600	22.2		
0.300	14.5		
0.150	3.0		
0.075	2.2		

Remarks:

Gravel: 46.3 **Sand:** 51.5 **Fines:** 2.2 Moisture % 4.2

Reviewed by:

Terra Engineering Ltd.
*Vancouver (604) 874-1245
Port Coquitlam (604) 945-9939
*Kamloops (250) 372-5321
Williams Lake (250) 398-8788
Abbotsford (604) 859-6403
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
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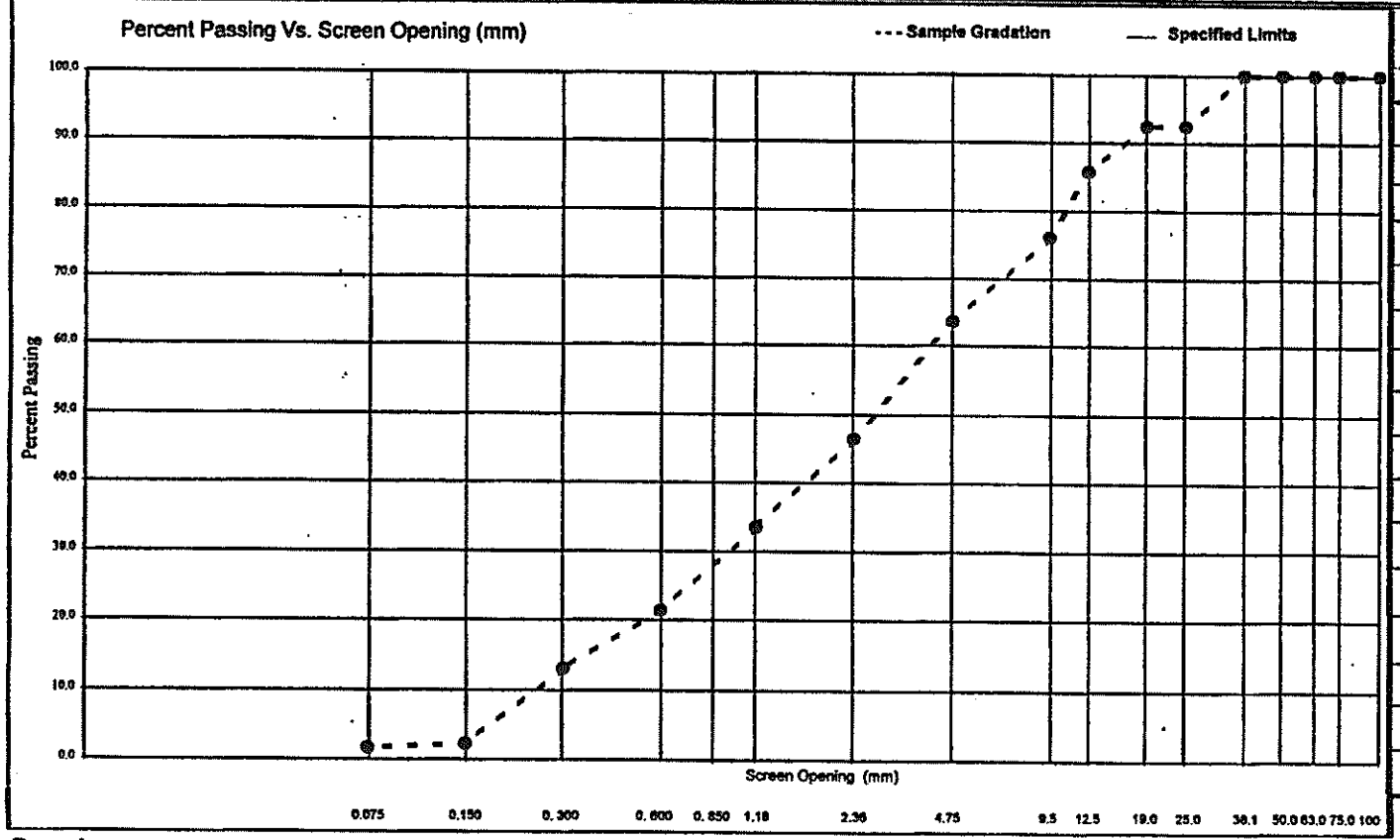
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-13 @ 3'-4'
Specified Limits:

Sampled by: CB **Date:** 10-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	92.5		
19.0	92.5		
12.5	85.7		
9.50	76.1		
4.75	63.6		
2.36	46.4		
1.180	33.5		
0.600	21.4		
0.300	13.0		
0.150	2.2		
0.075	1.6		

Remarks:

Gravel: 36.4 **Sand:** 62.0 **Fines:** 1.6 Moisture % 6.0

Reviewed by:

BH5-13 @ 3'-4'

Terra Engineering Ltd.
Vancouver (604) 874-1245
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Kamloops (250) 372-5321
Williams Lake (250) 398-8788
Abbotsford (604) 859-8403
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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
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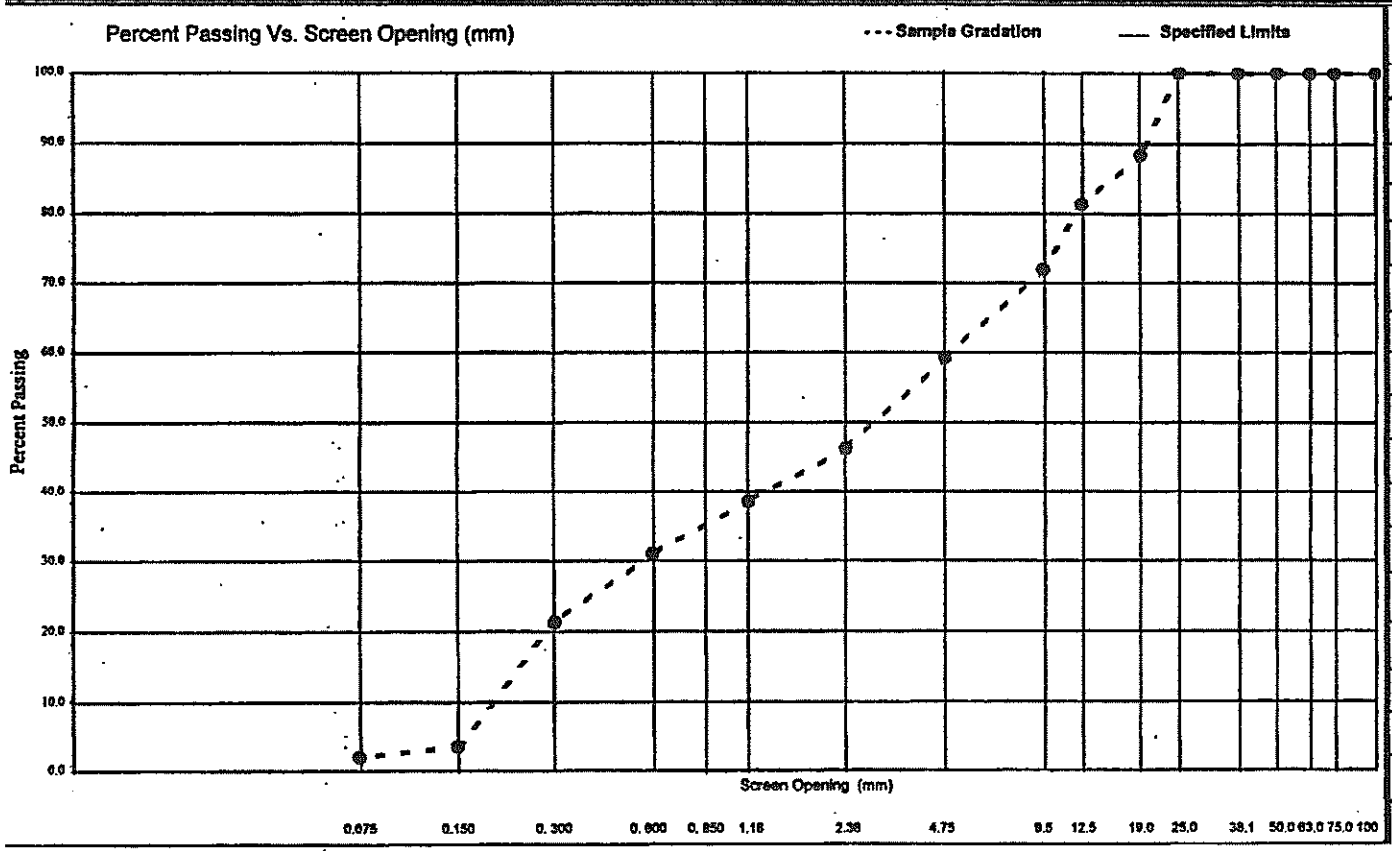
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-14 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 10-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	88.4		
12.5	81.3		
9.50	71.9		
4.75	59.2		
2.36	46.2		
1.180	38.6		
0.600	31.0		
0.300	21.3		
0.150	3.5		
0.075	1.9		

Remarks:

Gravel: 40.8 **Sand:** 57.3 **Fines:** 1.9 Moisture % 6.4

Reviewed by:

BH5-14 @ 4'-5'

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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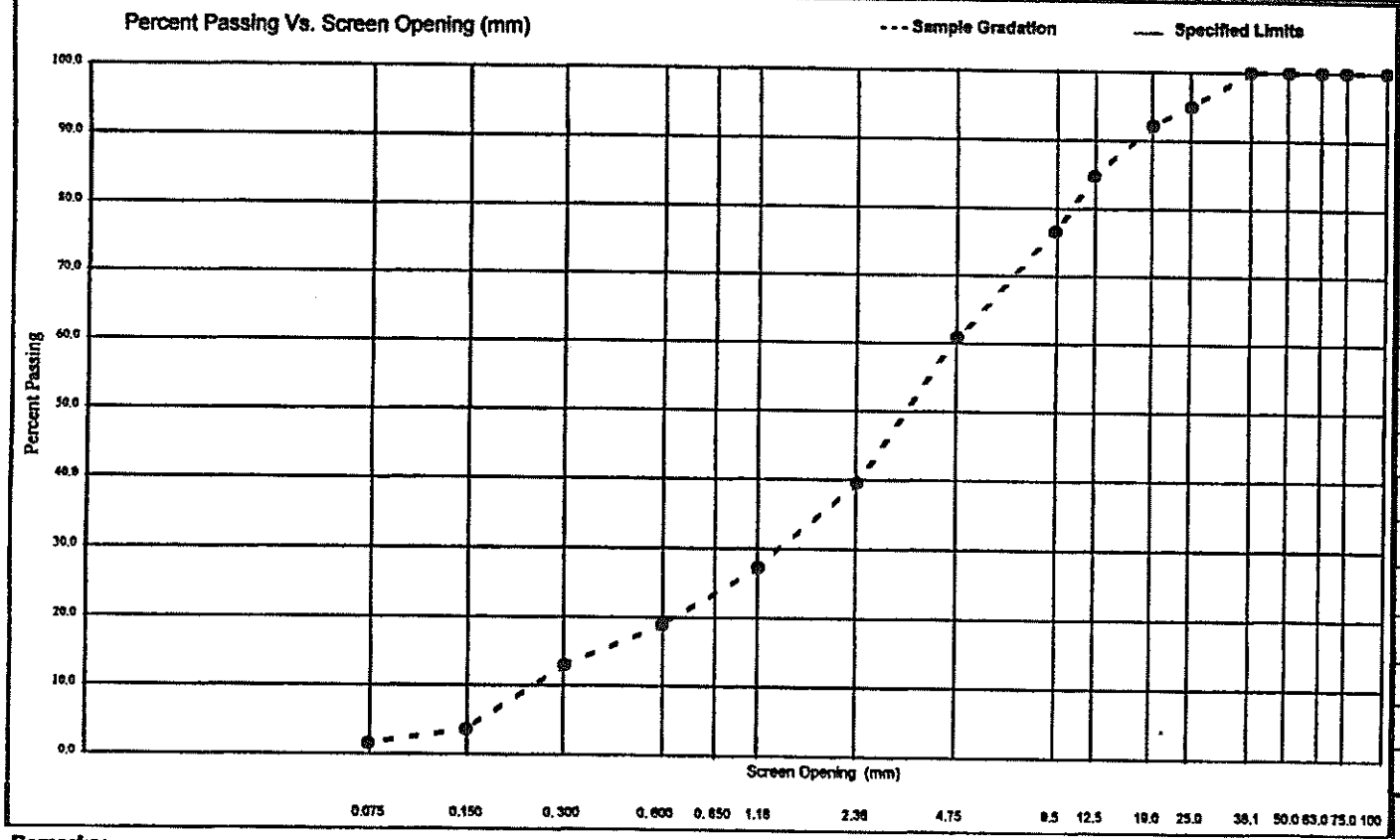
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-15 @ 3.5'-4.5'
Specified Limits:

Sampled by: CB **Date:** 10-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	94.9		
19.0	92.1		
12.5	84.8		
9.50	76.6		
4.75	60.8		
2.36	39.5		
1.180	27.3		
0.600	18.9		
0.300	12.9		
0.150	3.7		
0.075	1.6		

Remarks:

Gravel: 39.2 **Sand:** 59.3 **Fines:** 1.6 Moisture % 2.9

Reviewed by:

Terra Engineering Ltd.
Vancouver (604) 874-1245
Port Coquitlam (604) 945-9939
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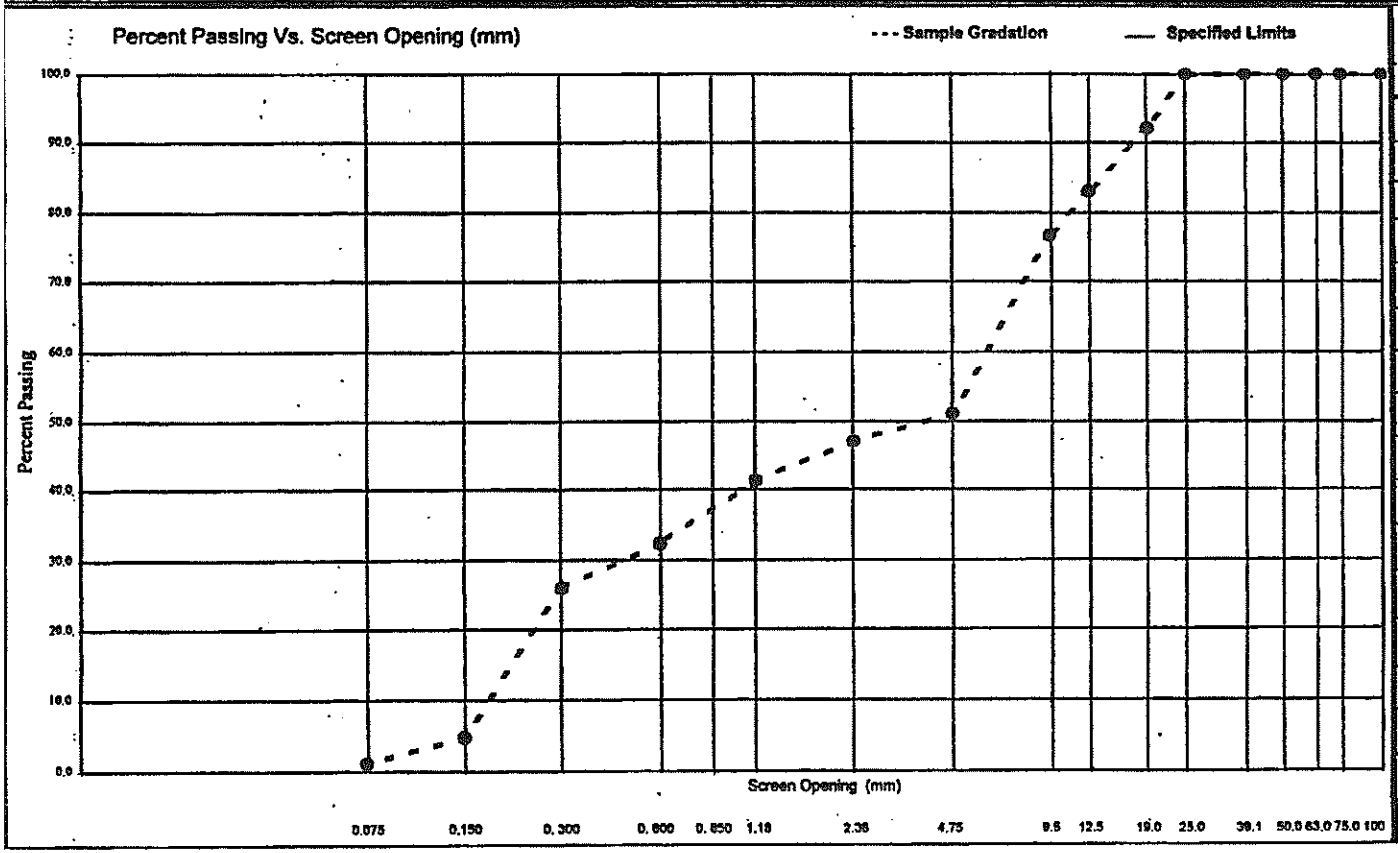
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-21 @ 3'-4'
Specified Limits:

Sampled by: CB **Date:** 10-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	92.0		
12.5	83.0		
9.50	76.7		
4.75	51.1		
2.36	47.0		
1.180	41.2		
0.600	32.3		
0.300	26.0		
0.150	4.7		
0.075	1.1		

Remarks:

Reviewed by:

Gravel: 48.9 **Sand:** 50.0 **Fines:** 1.1 Moisture % 6.0

BH5-21 @ 3'-4'

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Port Coquitlam (604) 945-9939
*Kamloops (250) 372-5321
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Report of: Aggregate Sieve Analysis

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Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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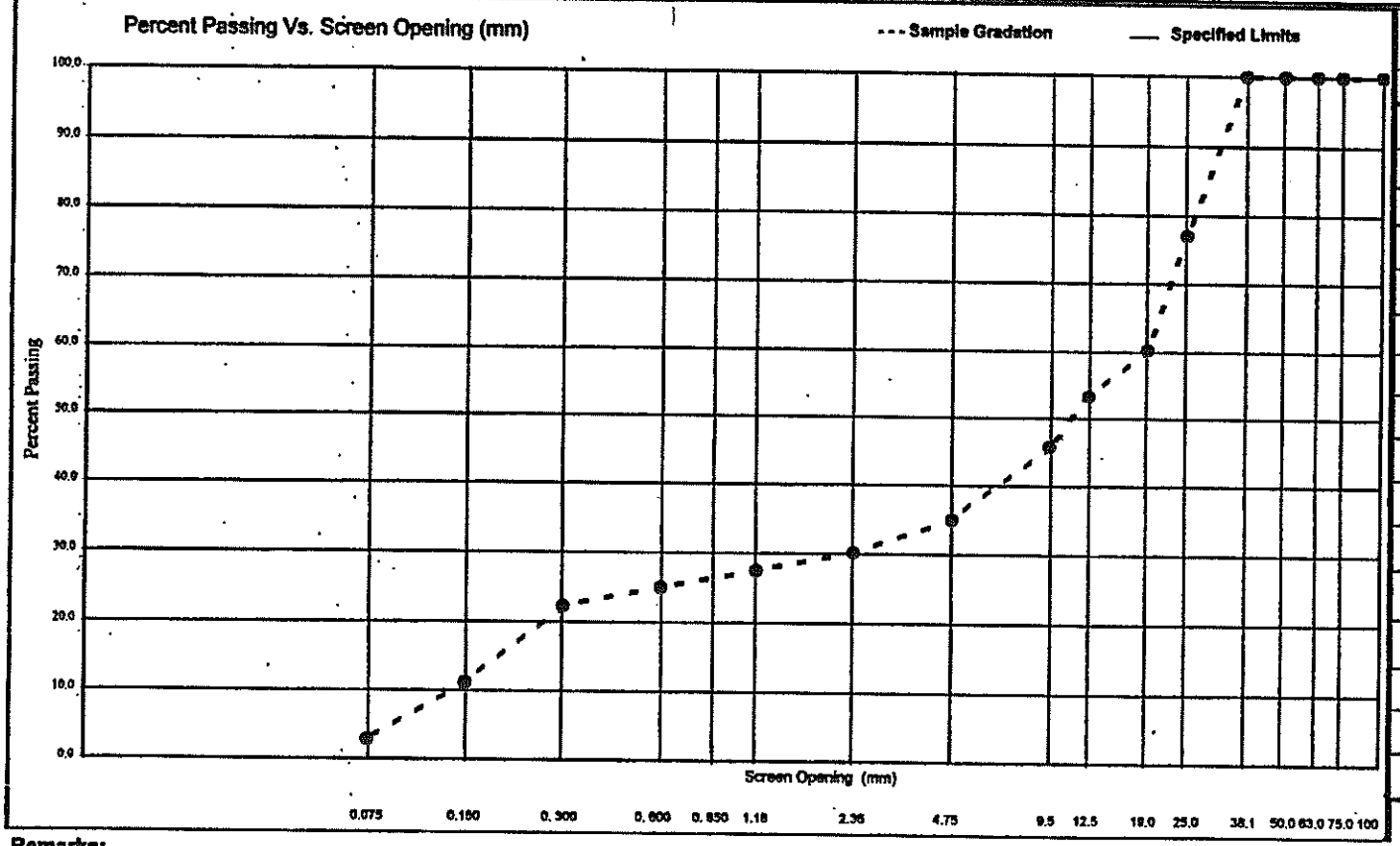
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-23 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	77.0		
19.0	60.2		
12.5	53.2		
9.50	45.8		
4.75	34.9		
2.36	30.1		
1.180	27.5		
0.600	25.0		
0.300	22.3		
0.150	11.1		
0.075	2.8		

Remarks:

Gravel: 65.1 **Sand:** 32.1 **Fines:** 2.8 Moisture % 7.4

Reviewed by:

BH5-23 @ 4'-5'

Engineering Ltd.
(604) Port Coquitlam (604) 945-9939
(250) Williams Lake (250) 398-8788
Terrace (250) 638-1090

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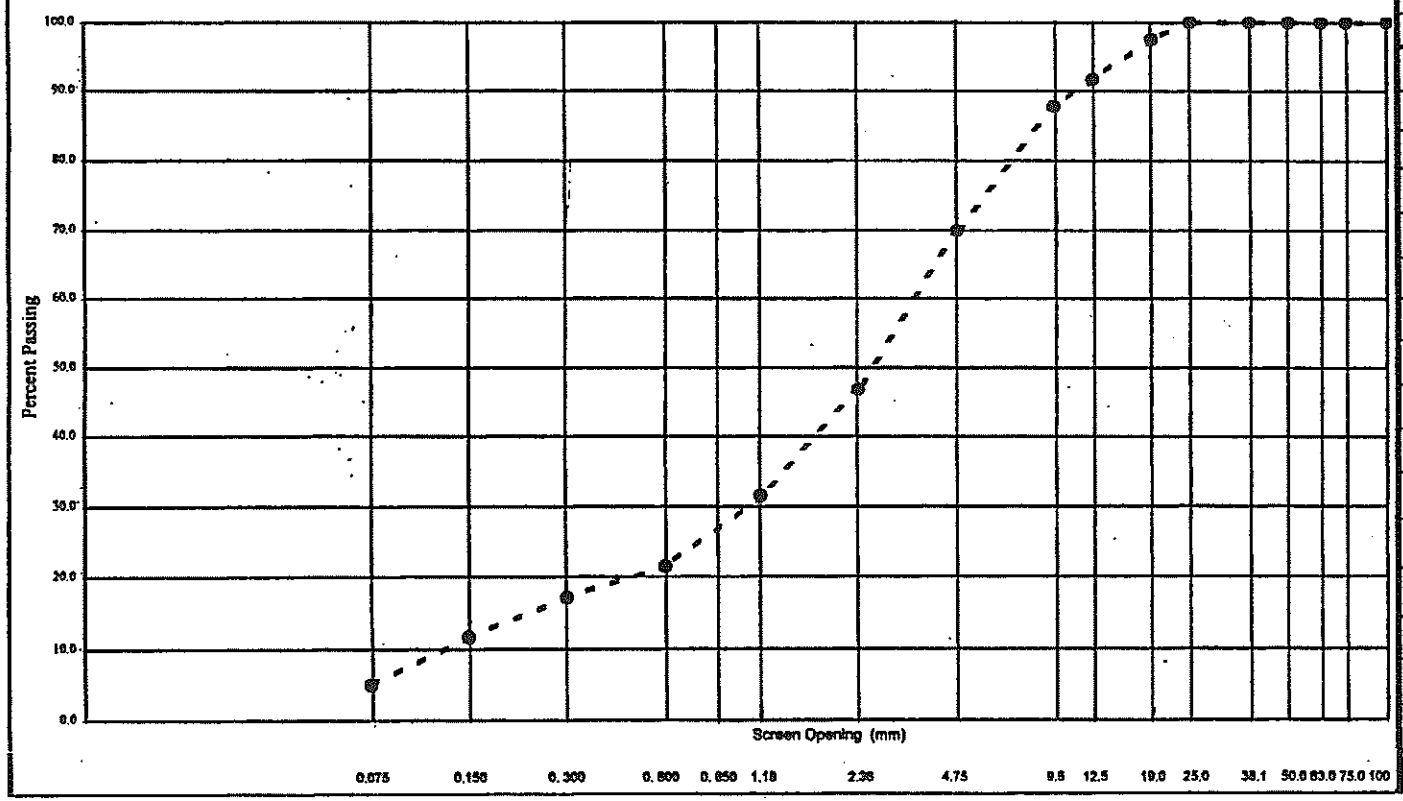
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-25 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 10-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	97.6		
12.5	91.7		
9.50	87.8		
4.75	69.9		
2.36	46.8		
1.180	31.4		
0.600	21.5		
0.300	17.1		
0.150	11.6		
0.075	5.0		

Remarks:

Gravel: 30.1 **Sand:** 65.0 **Fines:** 5.0 Moisture % 6.9

Reviewed by:

Terra Engineering Ltd.
(604 245 Port Coquitlam (604) 945-9939
) 37 Williams Lake (250) 398-8788
39-6 Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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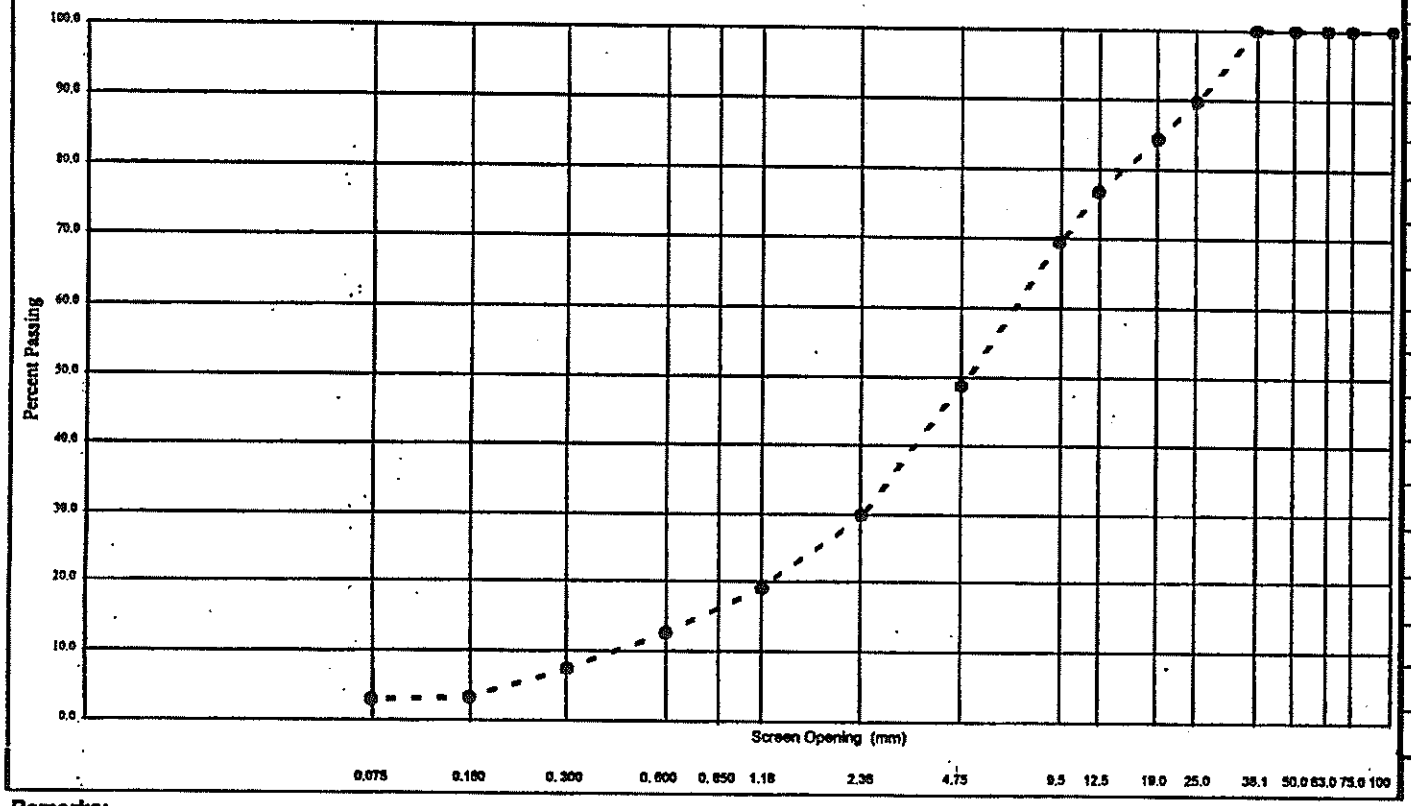
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-28 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	89.7		
19.0	84.4		
12.5	76.6		
9.50	69.4		
4.75	48.7		
2.36	29.9		
1.180	19.0		
0.600	12.6		
0.300	7.4		
0.150	3.2		
0.075	2.9		

Remarks:

Gravel: 51.3 **Sand:** 45.9 **Fines:** 2.9 Moisture % 2.8

Reviewed by:

BH5-28 @ 4'-5'

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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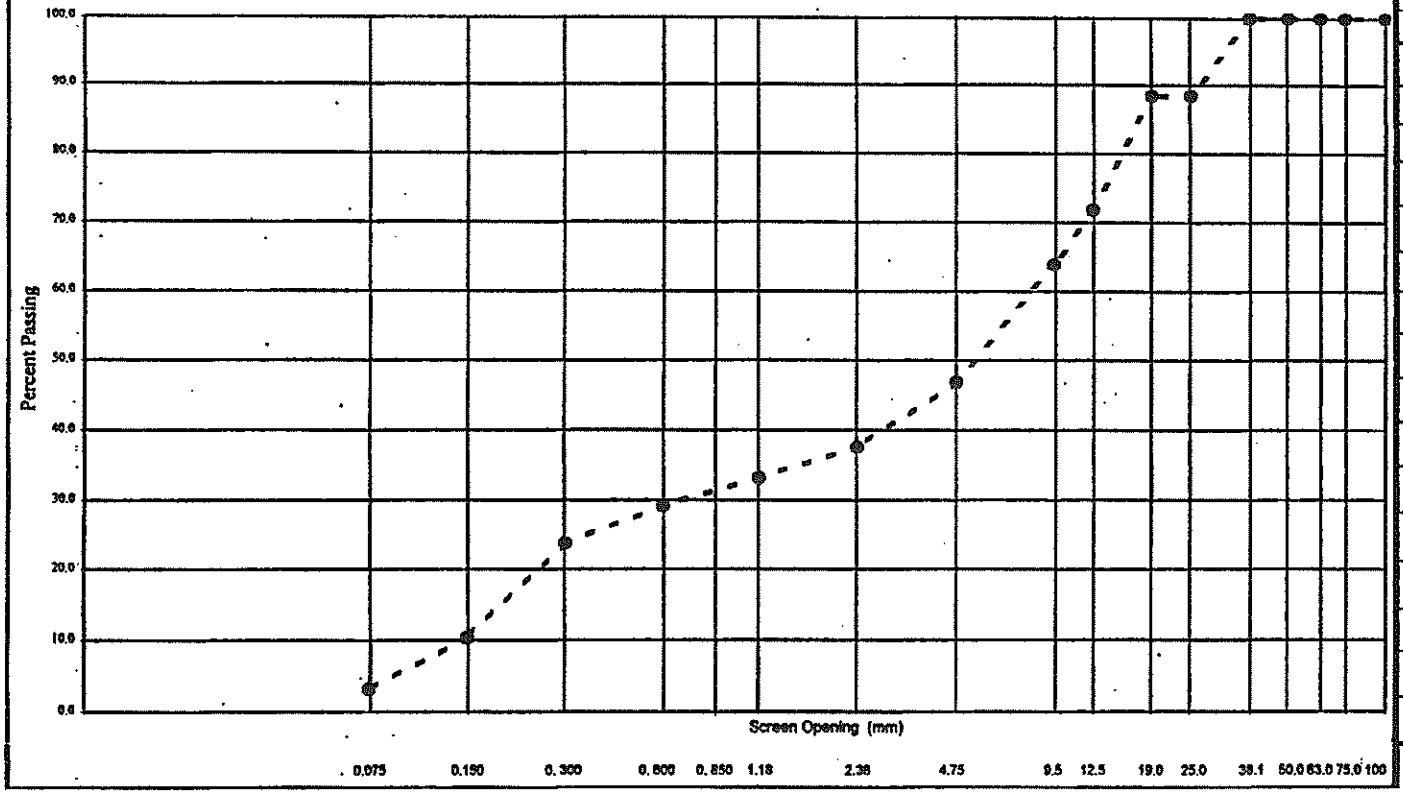
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-29 @ 4'-5'
Specified Limits:

Sampled by: CB Date: 11-Jun-99
Tested by: EA Date: 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	88.4		
19.0	88.4		
12.5	71.8		
9.50	63.9		
4.75	46.9		
2.36	37.6		
1.180	33.1		
0.600	29.2		
0.300	23.7		
0.150	10.3		
0.075	3.2		

Remarks:

Gravel: 53.1 **Sand:** 43.7 **Fines:** 3.2 Moisture % 7.1

Reviewed by:

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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cc:
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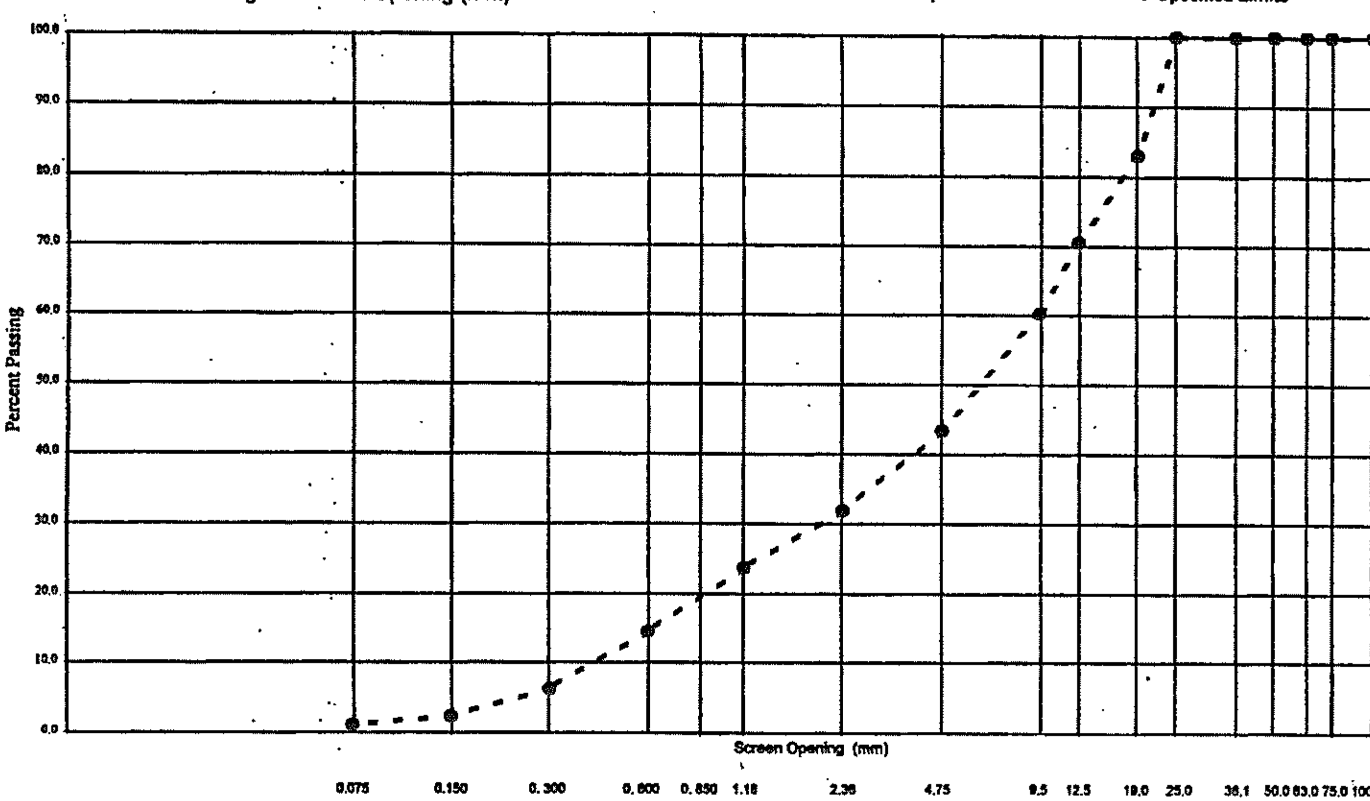
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-31 @ 3.5'-4.5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	83.0		
12.5	70.5		
9.50	60.2		
4.75	43.4		
2.36	31.8		
1.180	23.7		
0.600	14.5		
0.300	6.2		
0.150	2.3		
0.075	1.1		

Remarks:

Gravel: 56.6 **Sand:** 42.3 **Fines:** 1.1 Moisture % 1.8

Reviewed by:

BH5-31 @ 3.5'-4.5'

engineering Ltd
(604) 945-9939
(250) 398-8788
(250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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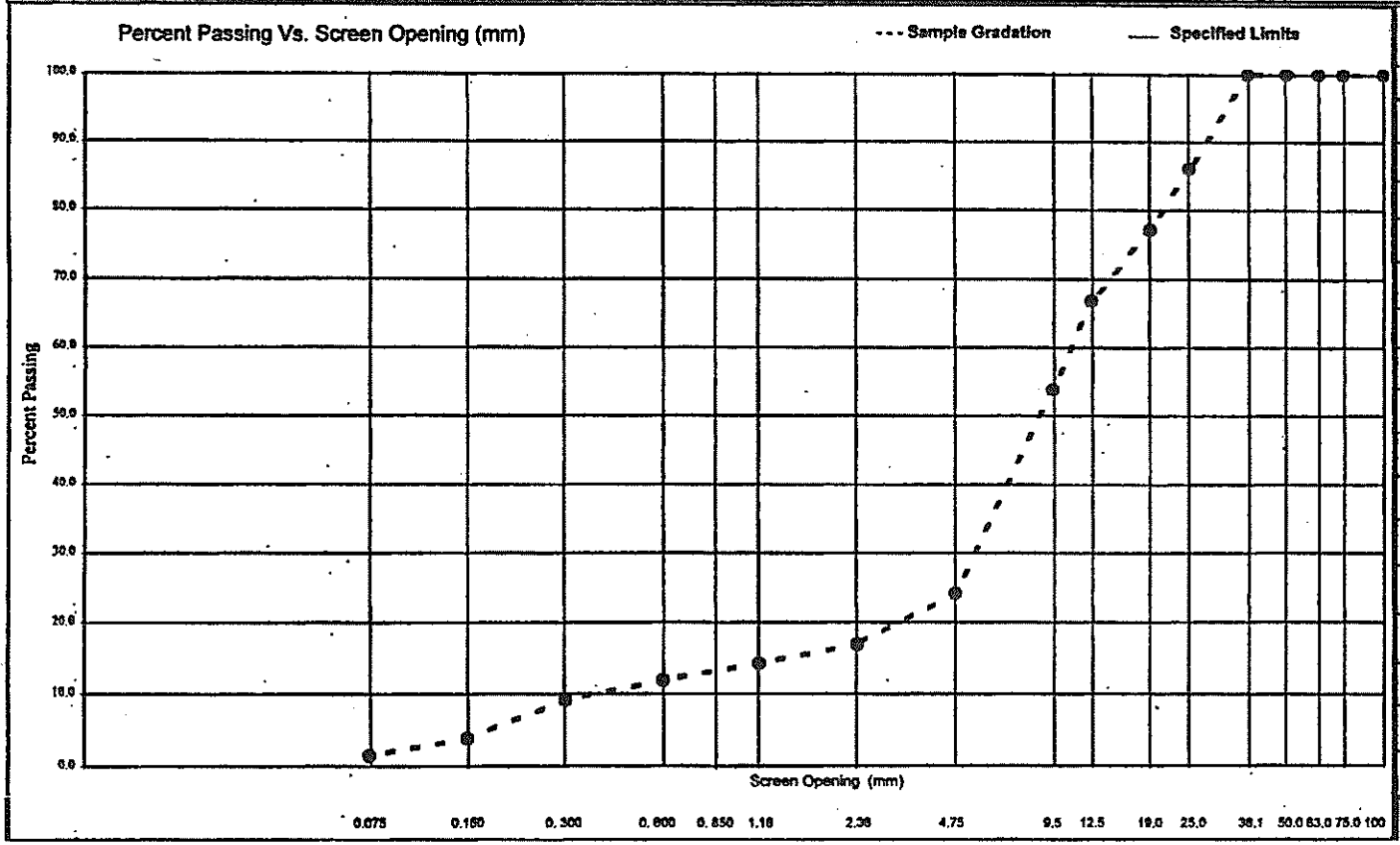
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-32 @ 0.5'-1.5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	86.1		
19.0	77.1		
12.5	66.9		
9.50	53.8		
4.75	24.2		
2.36	17.0		
1.180	14.2		
0.600	11.8		
0.300	9.1		
0.150	3.8		
0.075	1.4		

Remarks:

Gravel: 75.8 **Sand:** 22.7 **Fines:** 1.4 Moisture % 2.2

Reviewed by:

BH5-32 @ 0.5'-1.5'

Cyrra Engineering Ltd.
(604) 945-9939 Port Coquitlam
(250) 398-8788 Williams Lake
(250) 638-1090 Terrace

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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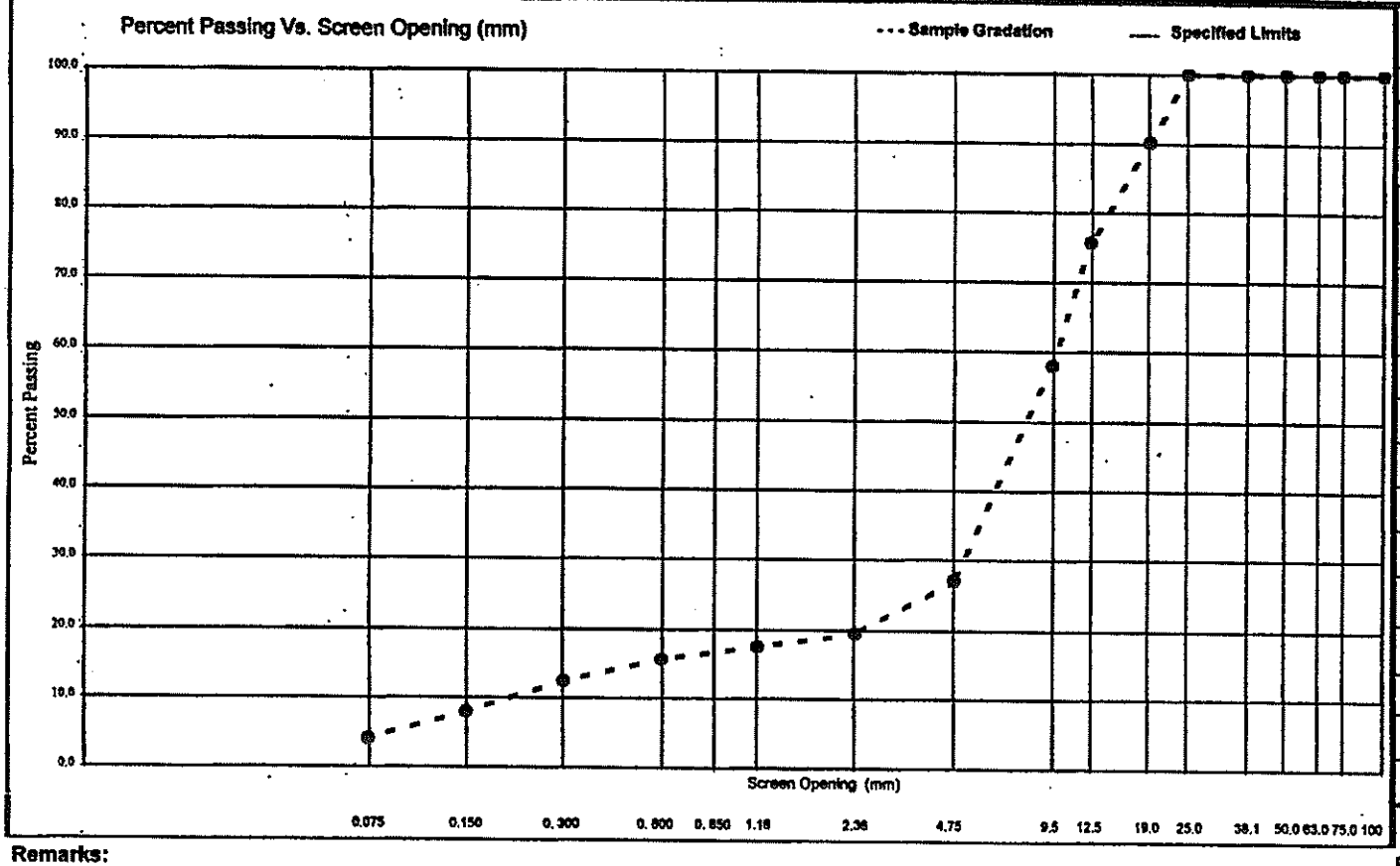
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-33 @ 3'-4'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	90.2		
12.5	75.7		
9.50	58.0		
4.75	27.1		
2.36	19.5		
1.180	17.6		
0.600	15.6		
0.300	12.4		
0.150	7.9		
0.075	4.0		

Remarks:

Gravel: 72.9 **Sand:** 23.0 **Fines:** 4.0 Moisture % 4.6

Reviewed by:

EBA Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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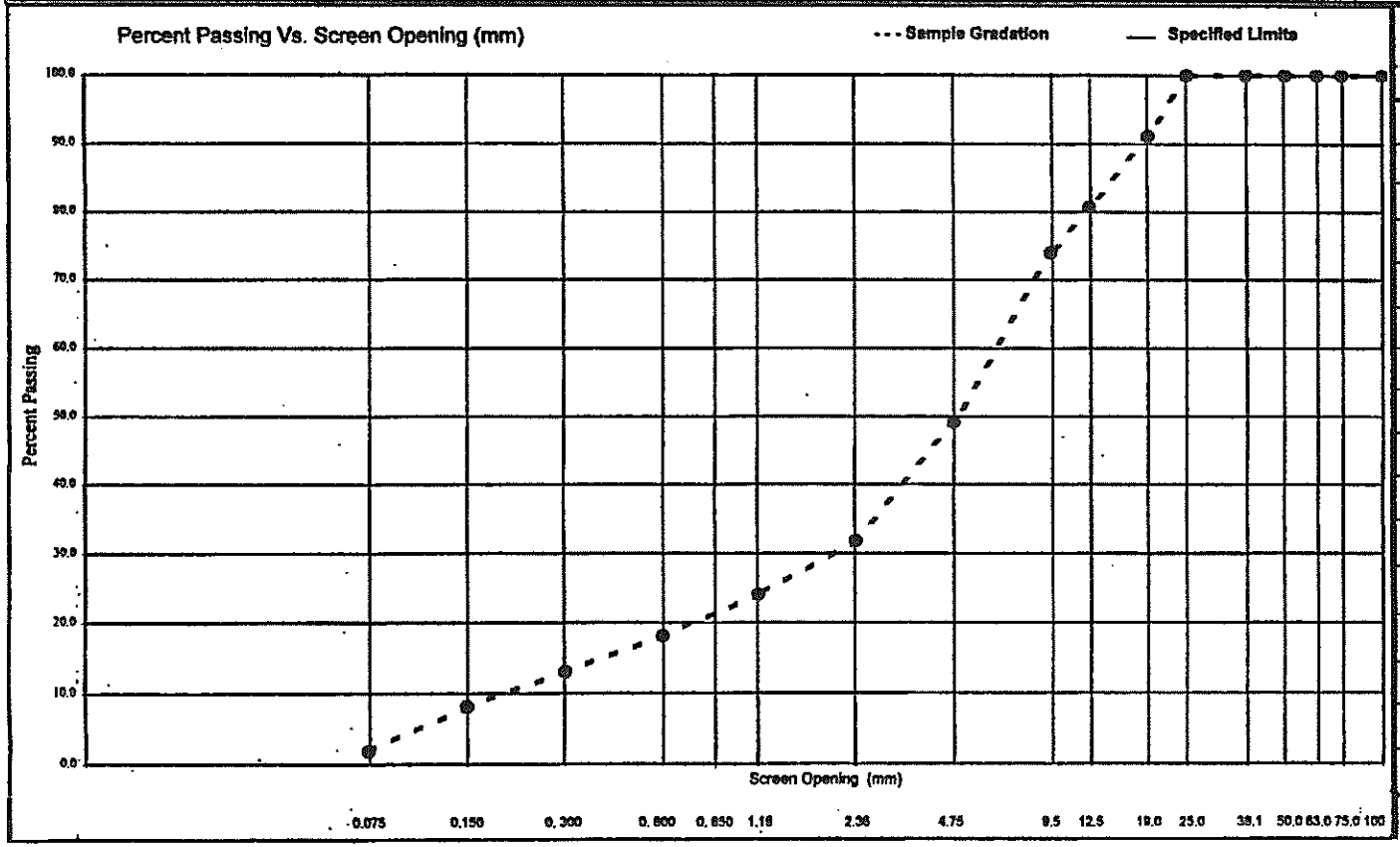
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-34 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	91.2		
12.5	80.7		
9.50	74.0		
4.75	49.1		
2.36	31.8		
1.180	24.0		
0.600	18.1		
0.300	13.0		
0.150	8.1		
0.075	1.8		

Remarks:

Gravel: 50.9 **Sand:** 47.3 **Fines:** 1.8 Moisture % 3.0

Reviewed by:

BH5-34 @ 4'-5'

VTR Engineering Ltd.
Vancouver (604) [illegible]15
Port Coquitlam (604) 945-9939
Kamloops 372
Williams Lake (250) 398-8788
Abbotsford ([illegible]) [illegible]-84[illegible]
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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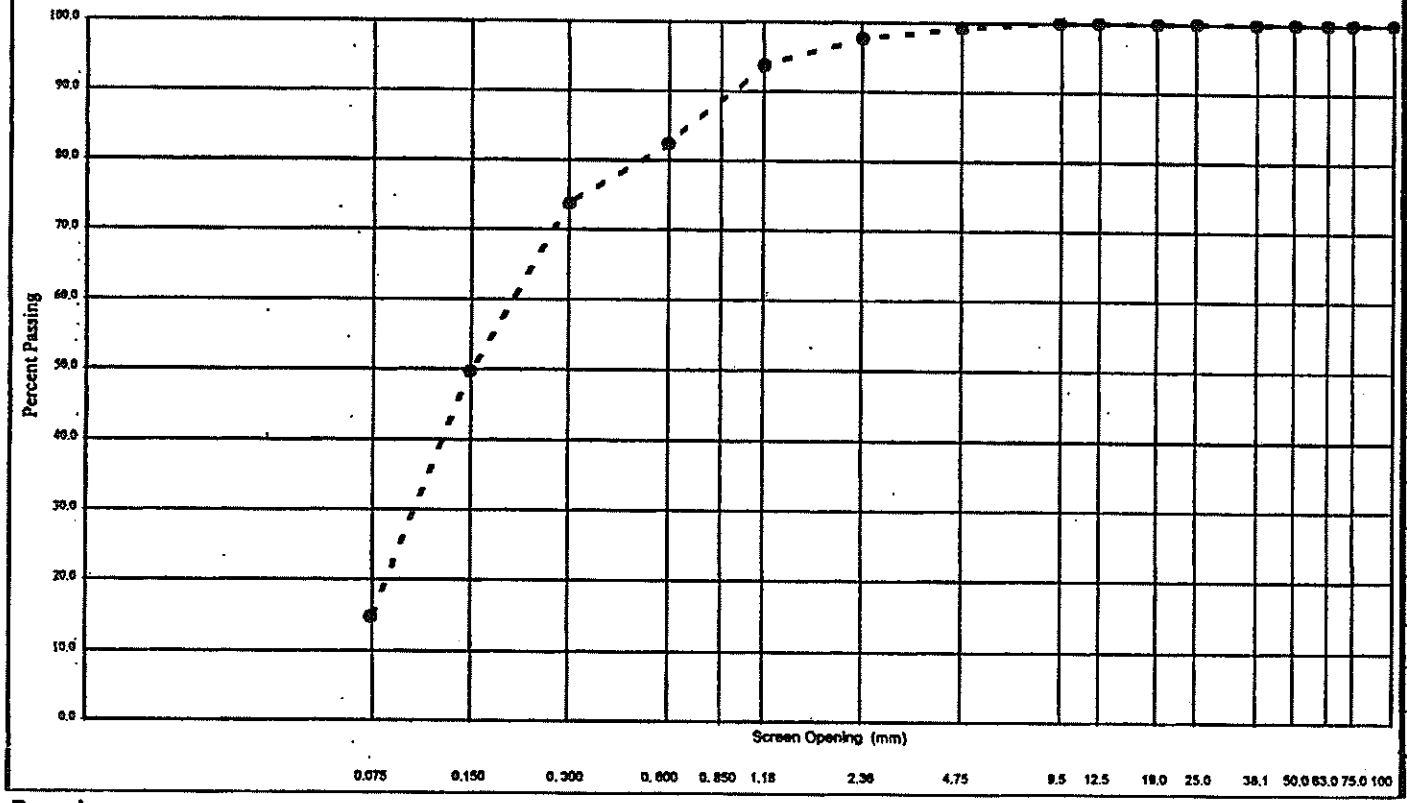
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Sand - some Silt
Sample No:
Source: BH5-35 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	99.2		
2.36	97.7		
1.180	93.8		
0.600	82.3		
0.300	73.8		
0.150	49.6		
0.075	14.8		

Remarks:

Gravel: 0.8 **Sand:** 84.4 **Fines:** 14.8 **Moisture %** 16.1

Reviewed by:

BH5-35 @ 4'-5'

Terra Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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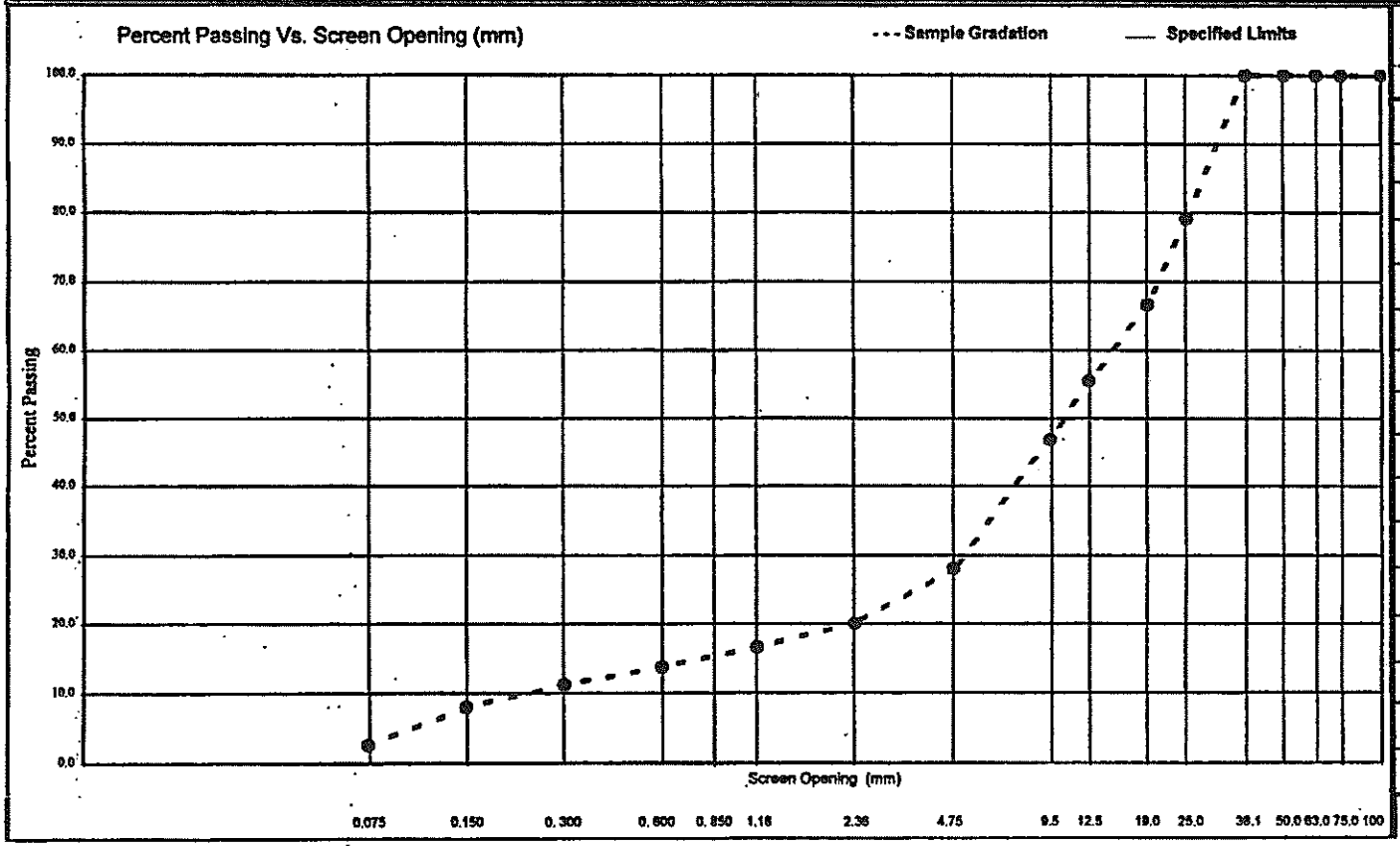
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 20-Jul-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-36 @ 4'-5'
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 11-Jun-99
Date: 20-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	79.1		
19.0	66.6		
12.5	55.5		
9.50	46.8		
4.75	28.1		
2.36	20.0		
1.180	16.6		
0.600	13.7		
0.300	11.1		
0.150	7.9		
0.075	2.6		

Remarks:

Gravel: 71.9 **Sand:** 25.5 **Fines:** 2.6 Moisture % 3.3

Reviewed by:

BH5-36 @ 4'-5'

Terra Engineering Ltd.
Vancouver (604) 245
Port Coquitlam (604) 945-9939
Kamloops (0) 37
Williams Lake (250) 398-8788
Abbotsford 59-6
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

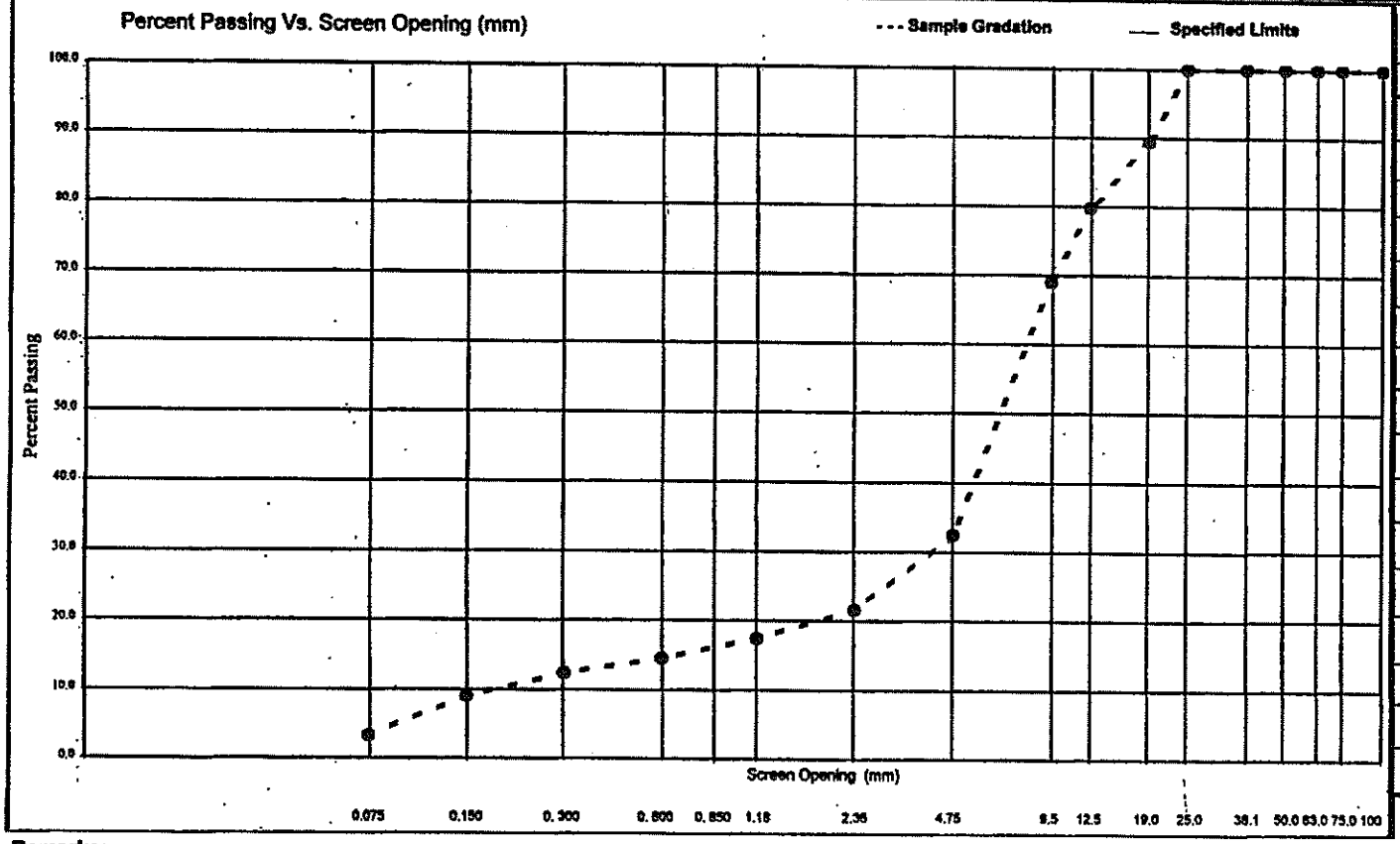
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-37 @ 0.5'-1.5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	89.4		
12.5	79.7		
9.50	68.9		
4.75	32.5		
2.36	21.5		
1.180	17.4		
0.600	14.5		
0.300	12.4		
0.150	9.0		
0.075	3.2		

Remarks:

Gravel: 67.5 **Sand:** 29.3 **Fines:** 3.2 Moisture % 4.6

Reviewed by:

BH5-37 @ 0.5'-1.5'

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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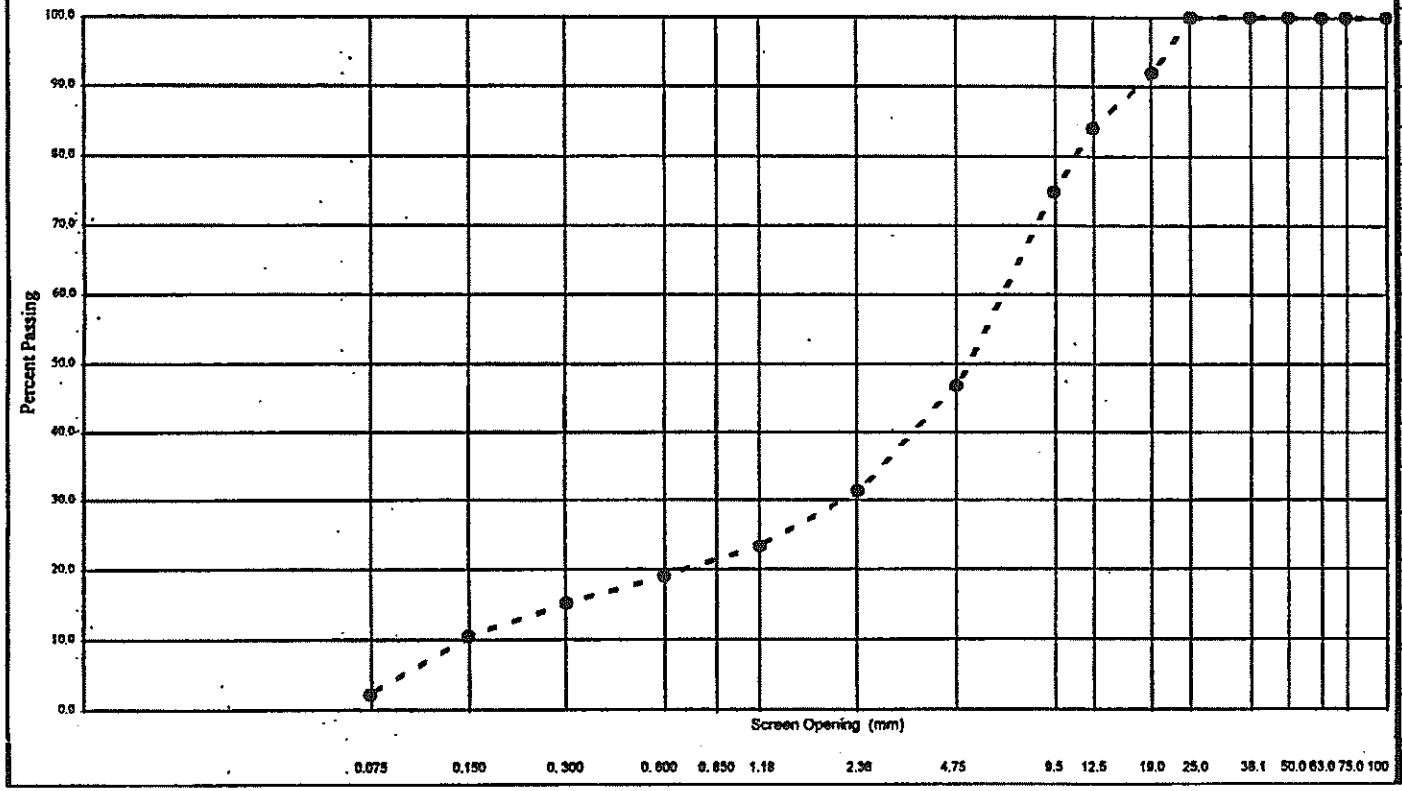
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-38 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	92.0		
12.5	84.0		
9.50	74.8		
4.75	46.8		
2.36	31.3		
1.180	23.3		
0.600	19.0		
0.300	15.2		
0.150	10.4		
0.075	2.1		

Remarks:

Gravel: 53.2 **Sand:** 44.6 **Fines:** 2.1 Moisture % 4.8

Reviewed by:

BH5-38 @ 4'-5'

Ltd. Port (604) 945-9939 (250) 398-8788 (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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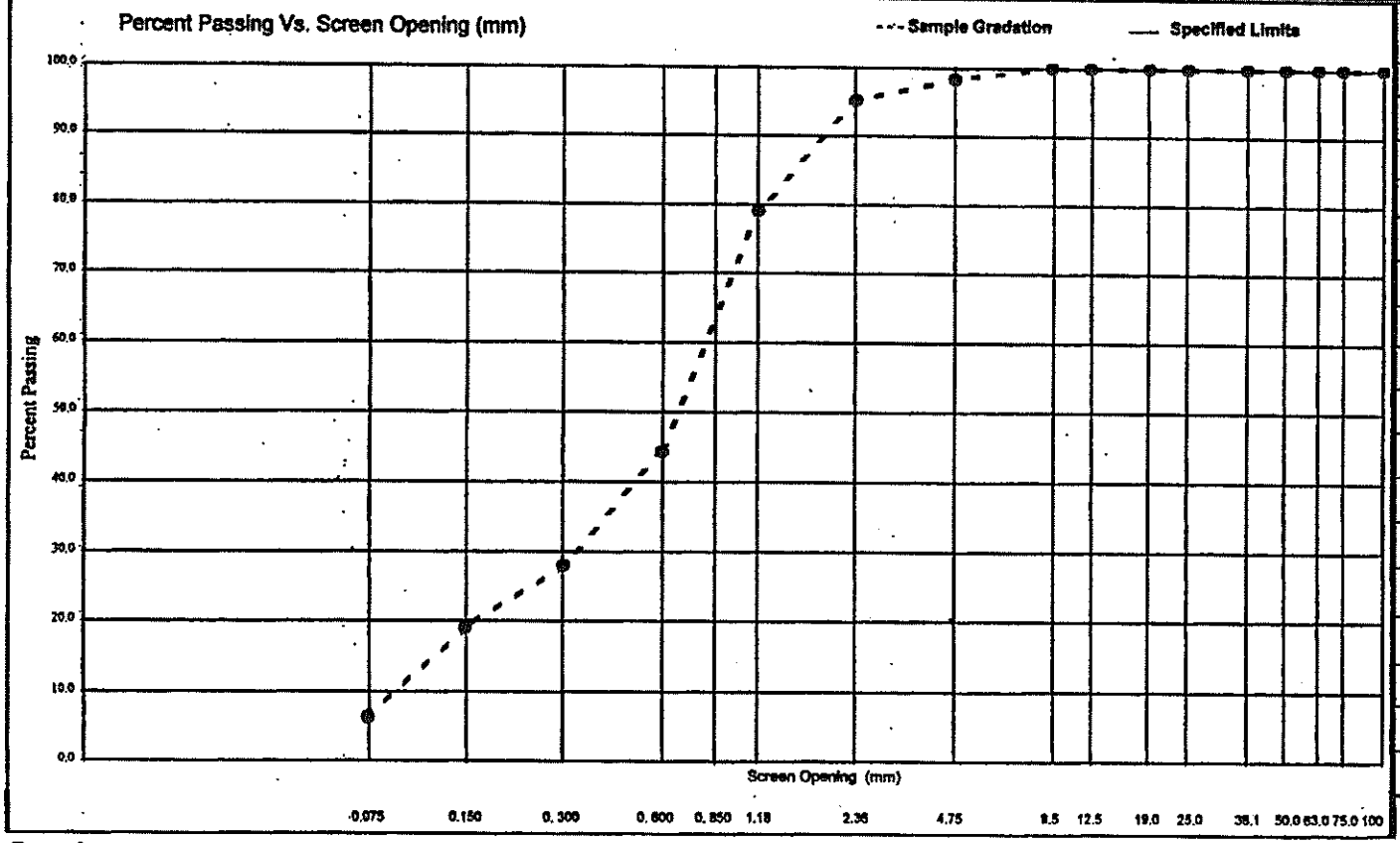
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Sand - trace Gravel, trace Silt
Sample No:
Source: BH5-39 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	98.3		
2.36	95.1		
1.180	79.1		
0.600	44.3		
0.300	28.1		
0.150	19.0		
0.075	6.3		

Remarks:

Gravel: 1.7 **Sand:** 92.0 **Fines:** 6.3 Moisture % 6.9

Reviewed by:

BH5-39 @ 4'-5'

Terra Engineering Ltd.
Vancouver (604) 874-1245 — Kamloops (250) 372-3321 — Richmond (604) 959-6402
Port Coquitlam (604) 945-9939 — Williams Lake (250) 398-8788 — Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 18-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES

cc:
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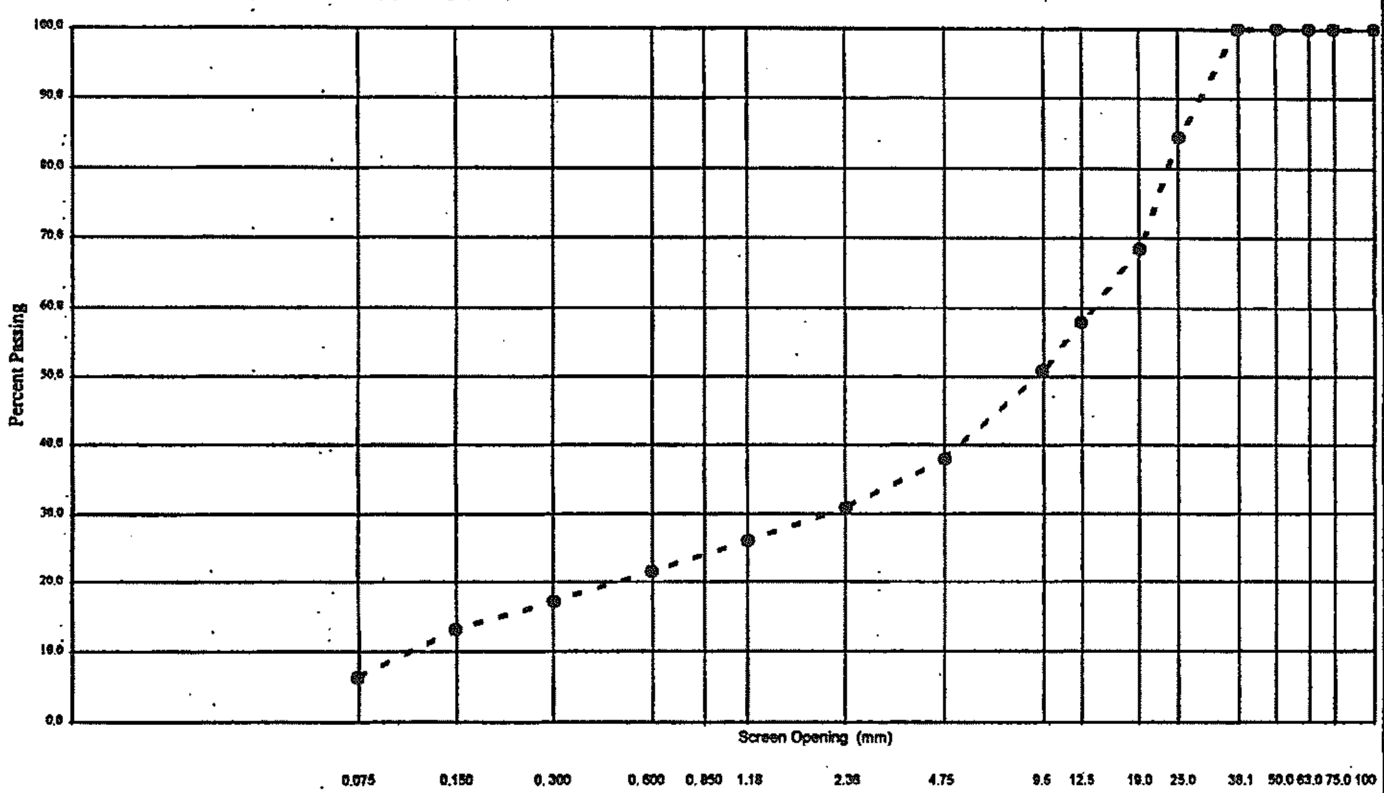
Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-40 @ 4'-5'
Specified Limits:

Sampled by: CB — **Date:** 11-Jun-99
Tested by: EA — **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	84.5		
19.0	68.4		
12.5	57.9		
9.50	50.8		
4.75	37.9		
2.36	30.9		
1.180	26.1		
0.600	21.5		
0.300	17.2		
0.150	13.1		
0.075	6.3		

Remarks:

Gravel: 62.1 **Sand:** 31.6 **Fines:** 6.3 Moisture % 1.9

Reviewed by:

BH5-40 @ 4'-5'

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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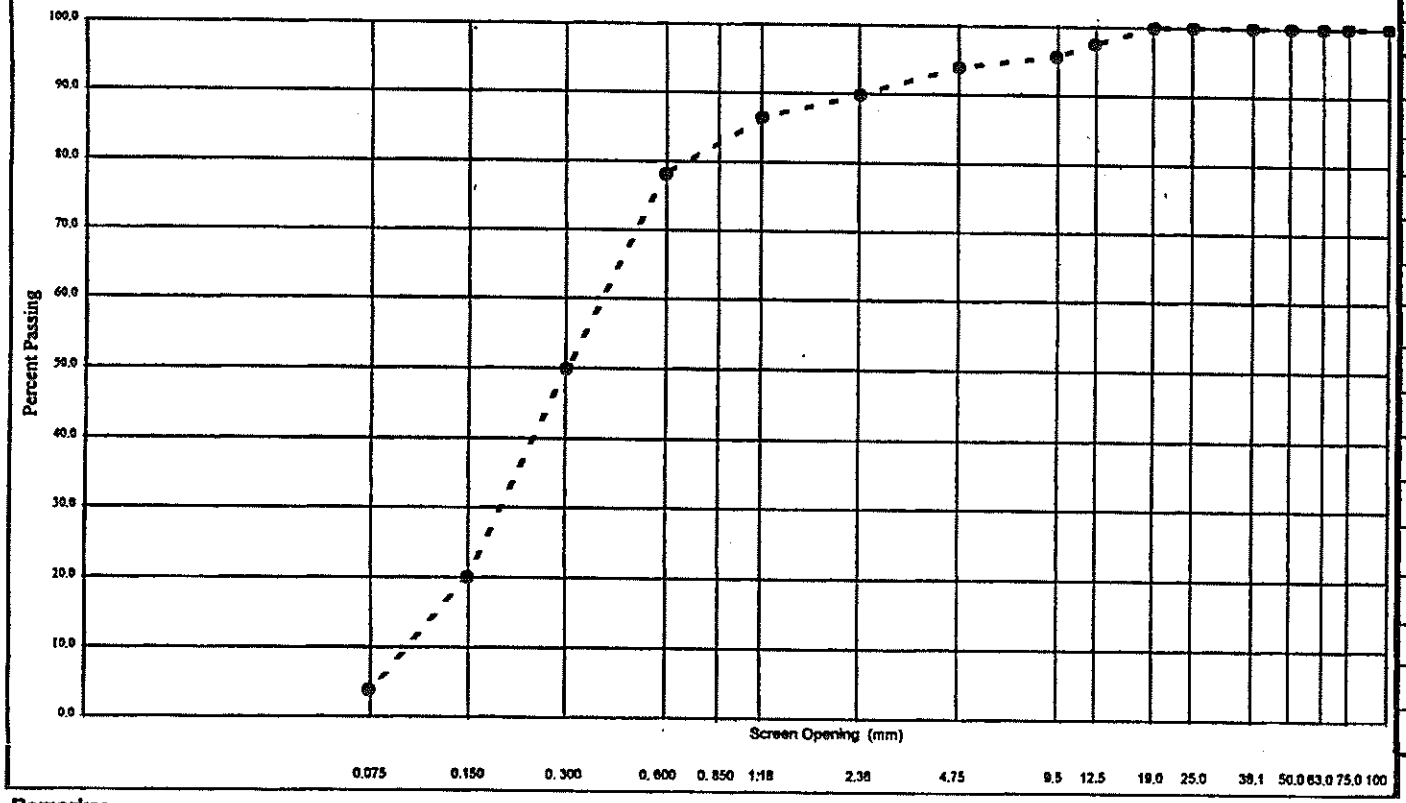
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Sand - trace Silt, trace Gravel
Sample No:
Source: BH5-41 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	97.5		
9.50	95.7		
4.75	94.0		
2.36	89.8		
1.180	86.4		
0.600	78.1		
0.300	49.9		
0.150	20.0		
0.075	3.8		

Remarks:

Gravel: 6.0 **Sand:** 90.2 **Fines:** 3.8 Moisture % 3.1

Reviewed by:

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 18-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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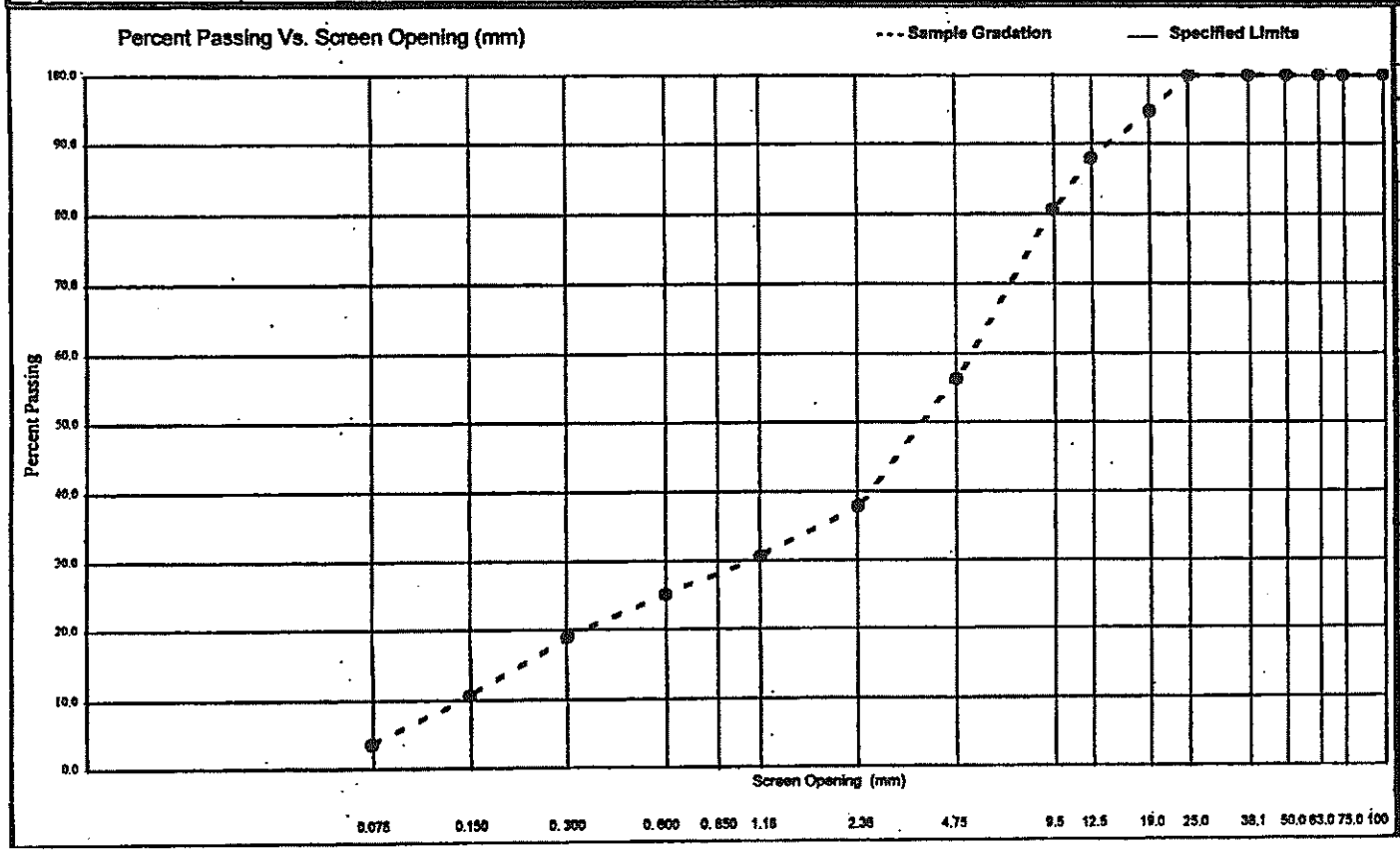
Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-42 @ 2.5'-3.5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	94.7		
12.5	87.9		
9.50	80.6		
4.75	56.3		
2.36	37.9		
1.180	30.6		
0.600	25.0		
0.300	18.9		
0.150	10.6		
0.075	3.5		

Reviewed by:

Remarks:

Gravel: 43.7 **Sand:** 52.8 **Fines:** 3.5 Moisture %: 4.1

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Terrace (250) 638-1090

Report of. Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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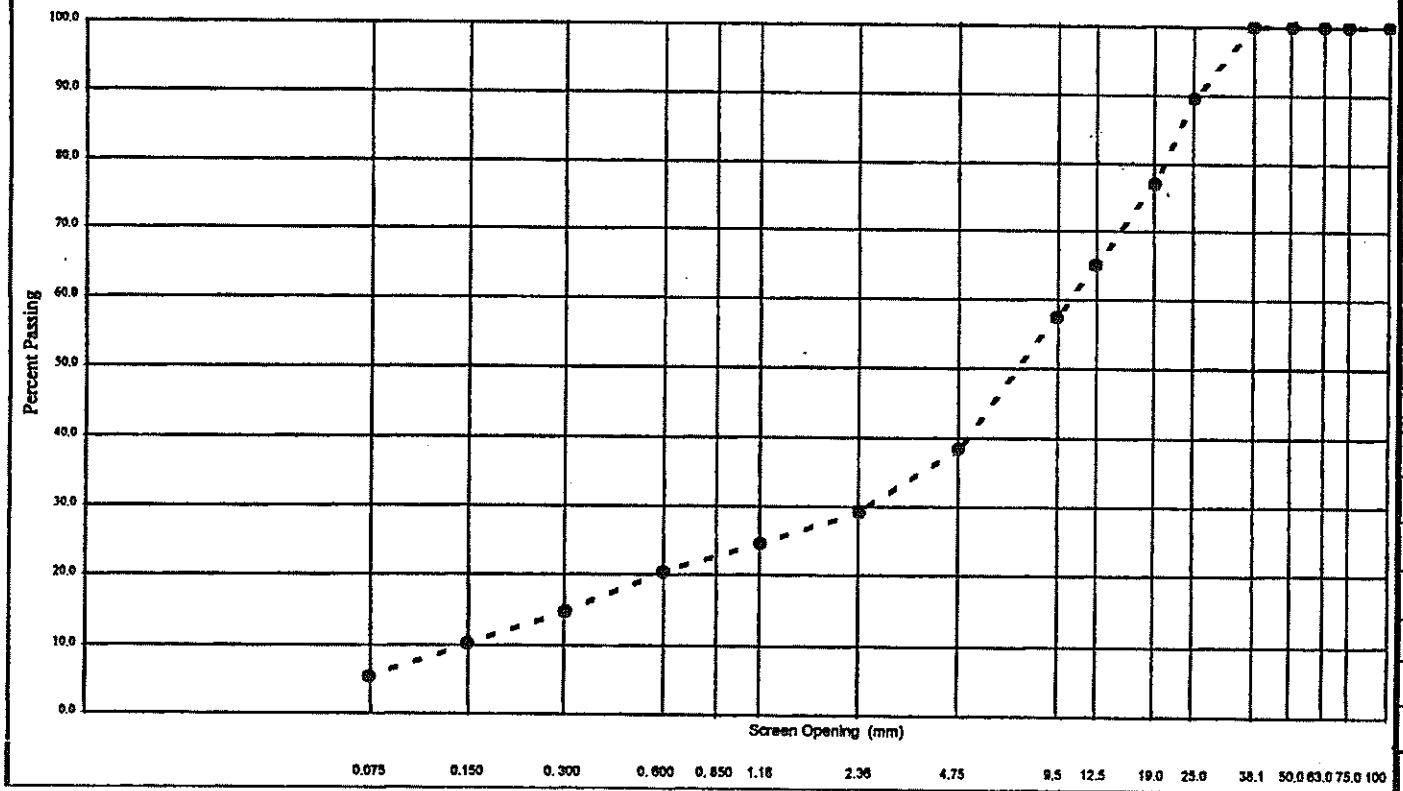
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel - Sandy, trace Clay
Sample No:
Source: BH5-45 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	89.6		
19.0	77.1		
12.5	65.0		
9.50	57.4		
4.75	38.4		
2.36	29.2		
1.180	24.5		
0.600	20.4		
0.300	14.8		
0.150	10.2		
0.075	5.3		

Remarks:

Gravel: 61.6 **Sand:** 33.1 **Fines:** 5.3 Moisture % 2.7

Reviewed by:

Terra Engineering Ltd.
Vancouver (604) 245
Port Coquitlam (604) 945-9939
Kamloops (250) 37
Williams Lake (250) 398-8788
Aldergrove 59-8
Terrace (250) 638-1090

Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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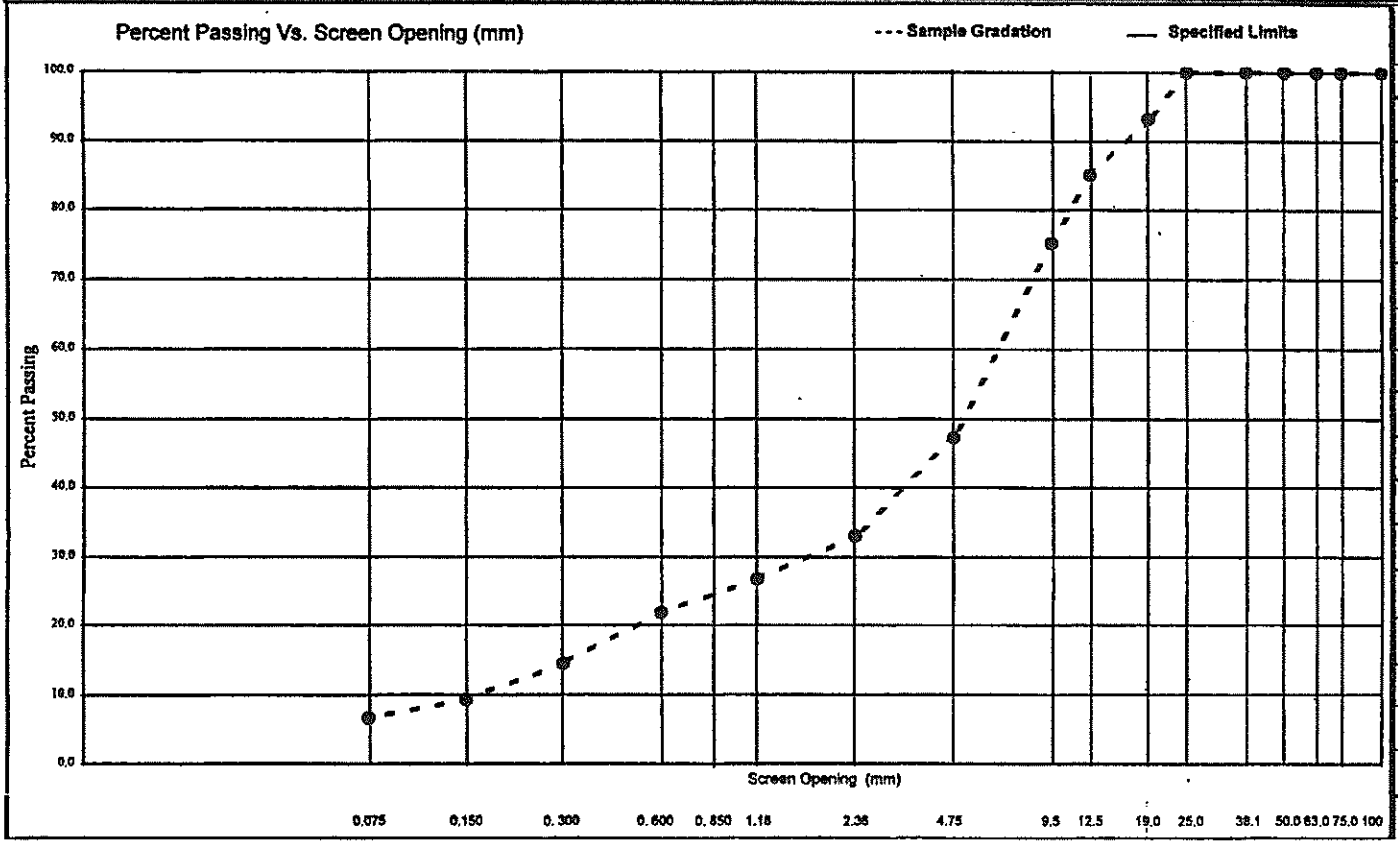
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel and Sand- trace Silt
Sample No:
Source: BH5-46 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	93.2		
12.5	85.0		
9.50	75.1		
4.75	47.2		
2.36	33.0		
1.180	26.8		
0.600	21.8		
0.300	14.4		
0.150	9.3		
0.075	6.6		

Remarks:

Gravel: 52.8 **Sand:** 40.6 **Fines:** 6.6 Moisture % 10.1

Reviewed by:

BH5-46 @ 4'-5'.xls

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 18-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
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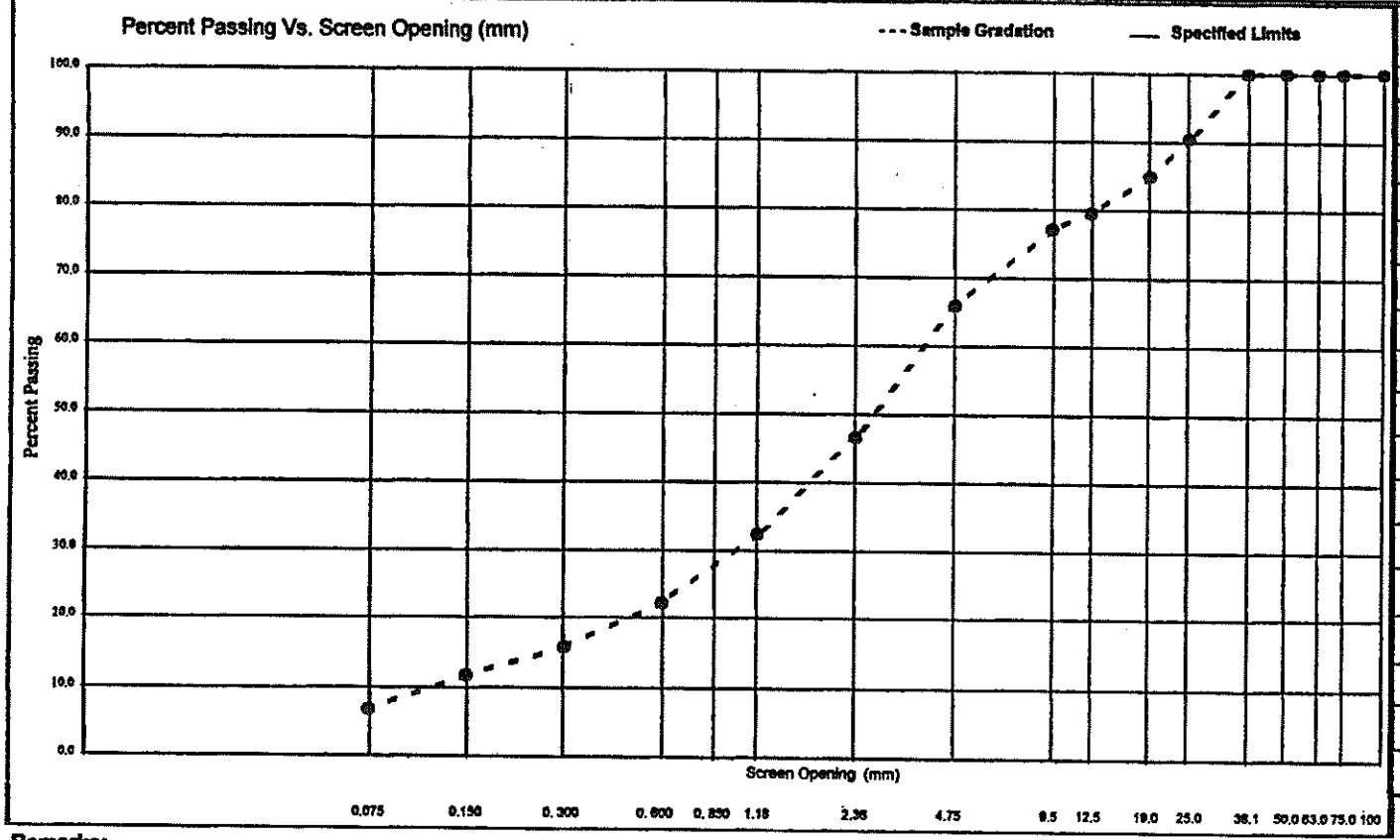
Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-47 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	90.5		
19.0	85.0		
12.5	79.4		
9.50	77.1		
4.75	65.9		
2.36	46.6		
1.180	32.5		
0.600	22.2		
0.300	15.8		
0.150	11.7		
0.075	6.8		

Remarks:

Gravel: 34.1 **Sand:** 59.1 **Fines:** 6.8 **Moisture %** 6.2

Reviewed by:

Kerr Engineering Ltd.
Vanc (60 1245 Port Coquitlam (604) 945-9939
kooc 50) 3. 1 Williams Lake (250) 398-8788
A ird 859-€ Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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cc:
cc:
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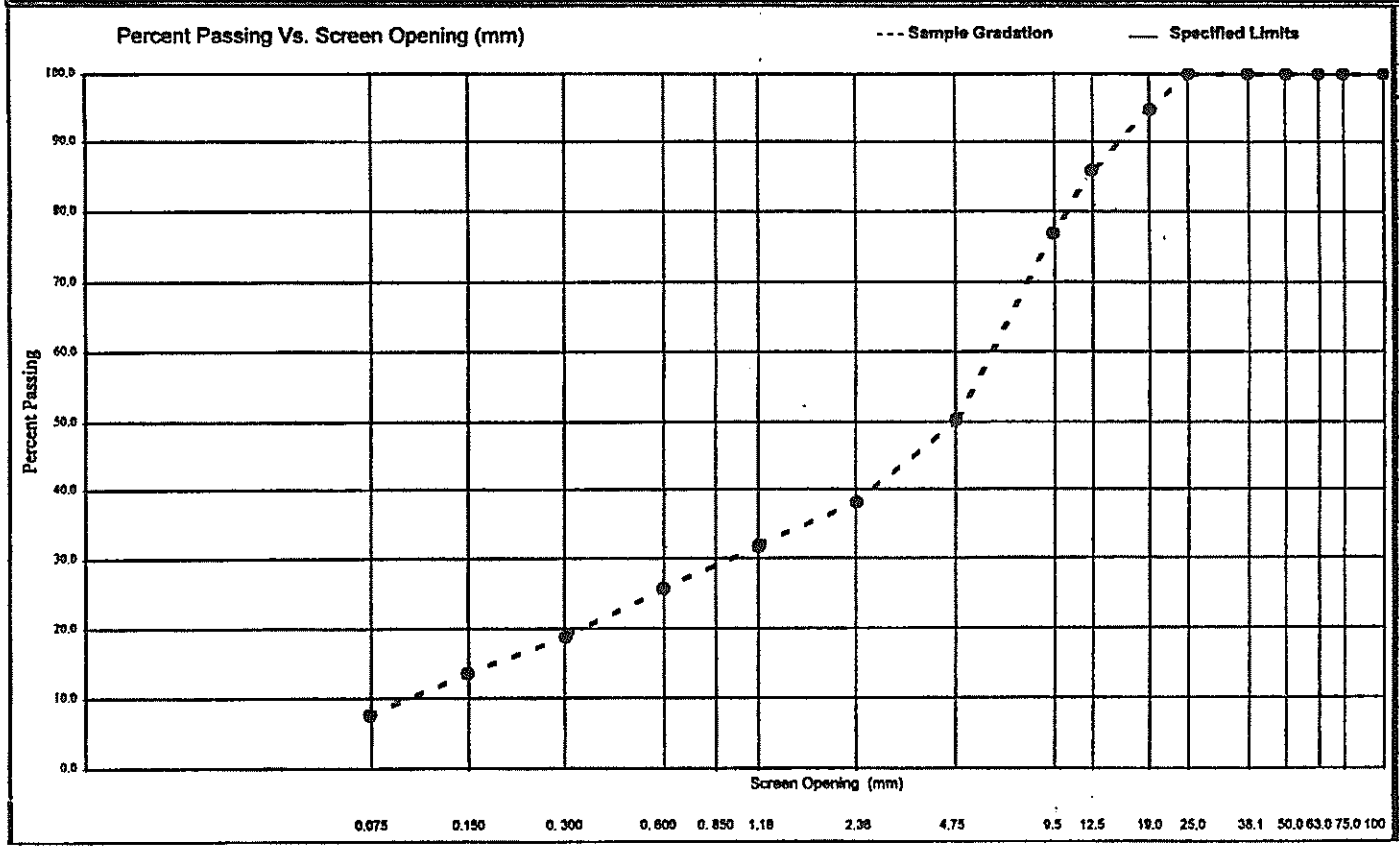
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-48 @ 3.5'-4.5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	94.7		
12.5	85.9		
9.50	76.8		
4.75	50.2		
2.36	38.0		
1.180	31.6		
0.600	25.7		
0.300	18.8		
0.150	13.5		
0.075	7.6		

Remarks:

Gravel: 49.8 **Sand:** 42.6 **Fines:** 7.6 Moisture % 5.0

Reviewed by:

BH5-48 @ 3.5'-4.5'.xls

Vancouver (604) 874-1245
Port ... (604) 945-9939
Kamloops (250) 372-5321
... (250) 396-8786
Abbotsford (604) 859-6403
... (250) 638-1090

Report of Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
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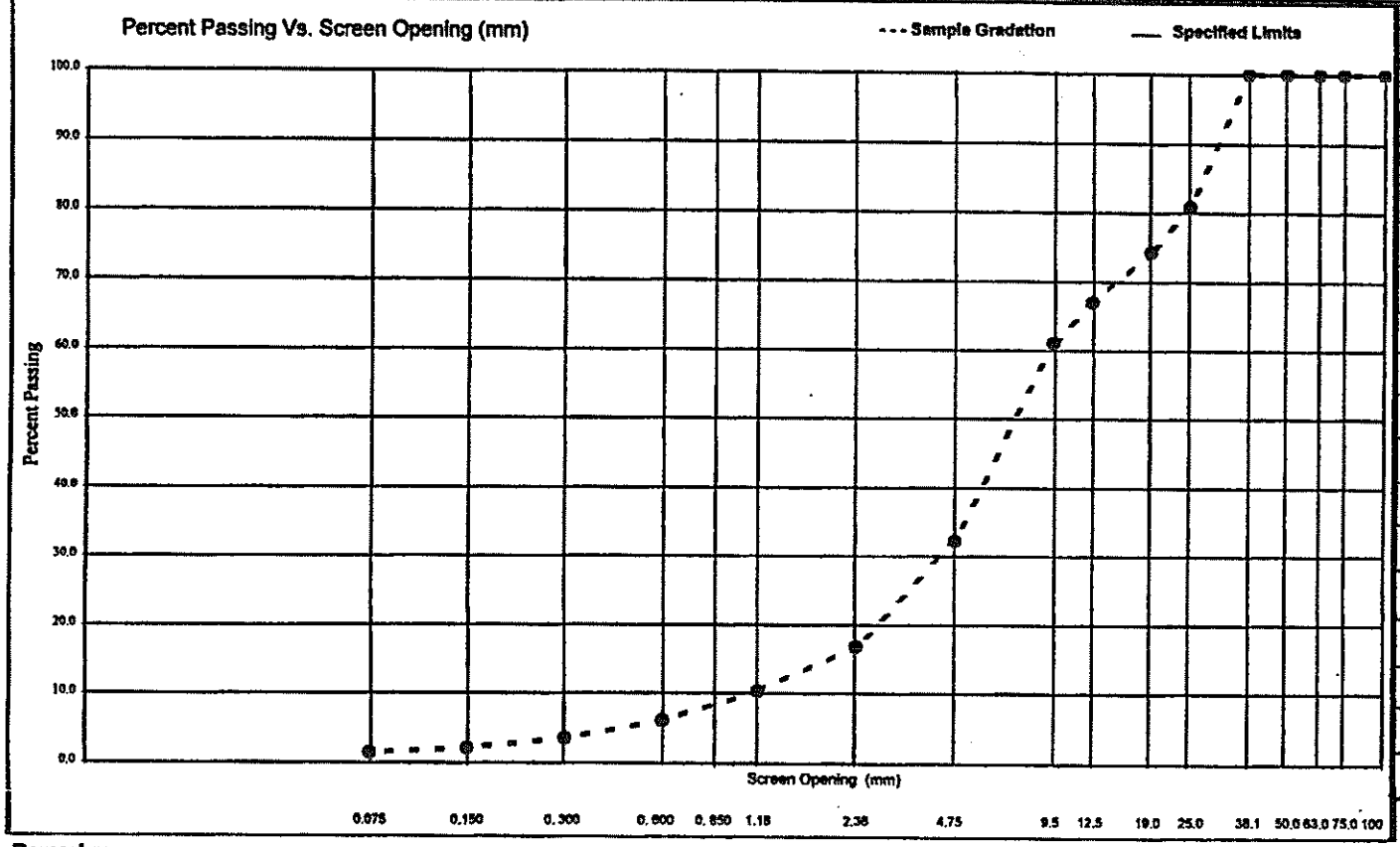
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-49 @ 0.5'-1.5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	80.8		
19.0	74.2		
12.5	67.0		
9.50	61.1		
4.75	32.2		
2.36	16.8		
1.180	10.2		
0.600	6.1		
0.300	3.5		
0.150	2.1		
0.075	1.4		

Remarks:

Gravel: 67.8 **Sand:** 30.7 **Fines:** 1.4 Moisture % 2.2

Reviewed by:

BH5-49 @ .5'-1.5'

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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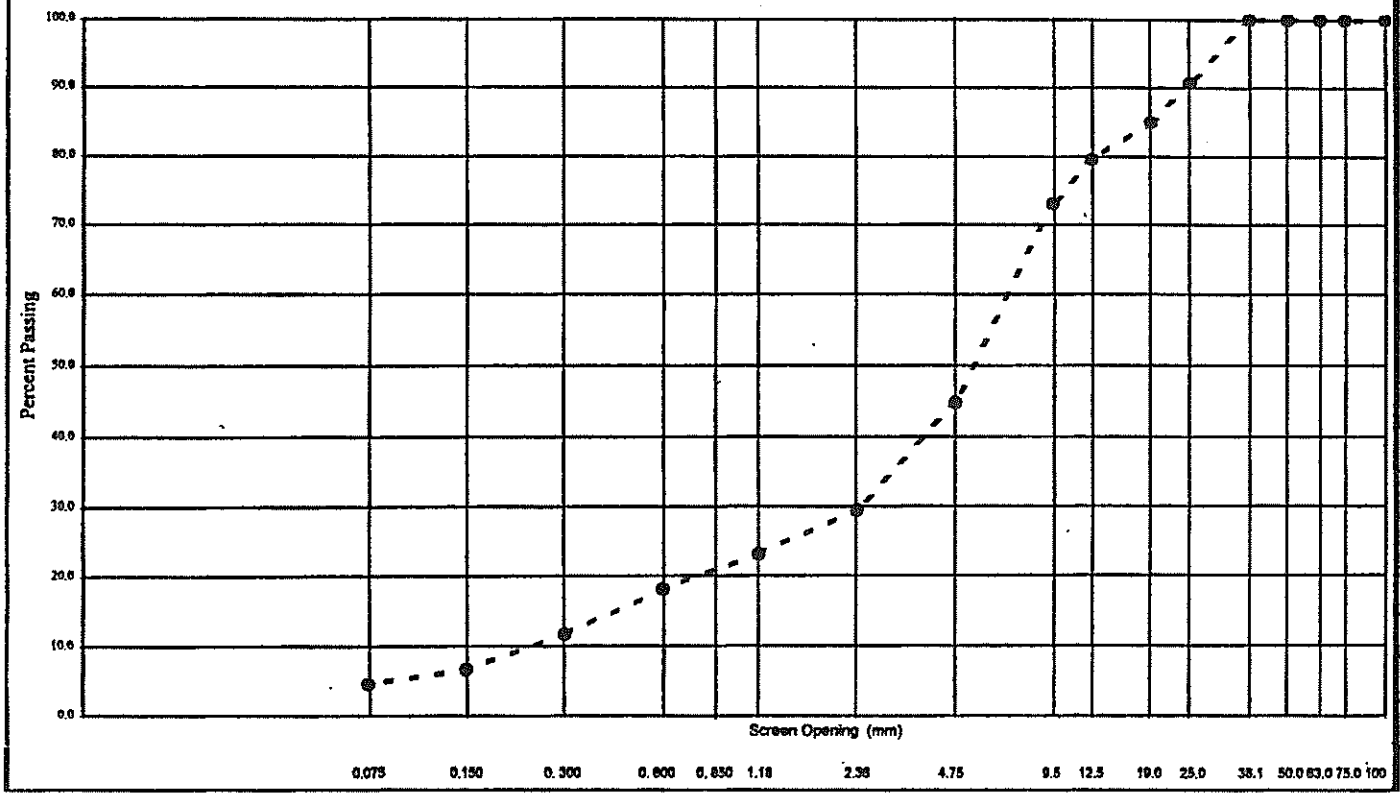
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-50 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	90.7		
19.0	85.0		
12.5	79.5		
9.50	73.0		
4.75	44.8		
2.36	29.5		
1.180	23.1		
0.600	18.1		
0.300	11.6		
0.150	6.6		
0.075	4.6		

Remarks:

Gravel: 55.2 **Sand:** 40.2 **Fines:** 4.6 **Moisture %** 5.6

Reviewed by:

BH5-50 @ 4'-5'

Kerr Engineering Ltd.
Van... (60... 1245 Port Coquitlam (604) 945-9939
...mloo... (250) 3...1 Williams Lake (250) 398-8788
...lord ...859-... Terrace (250) 638-1090

Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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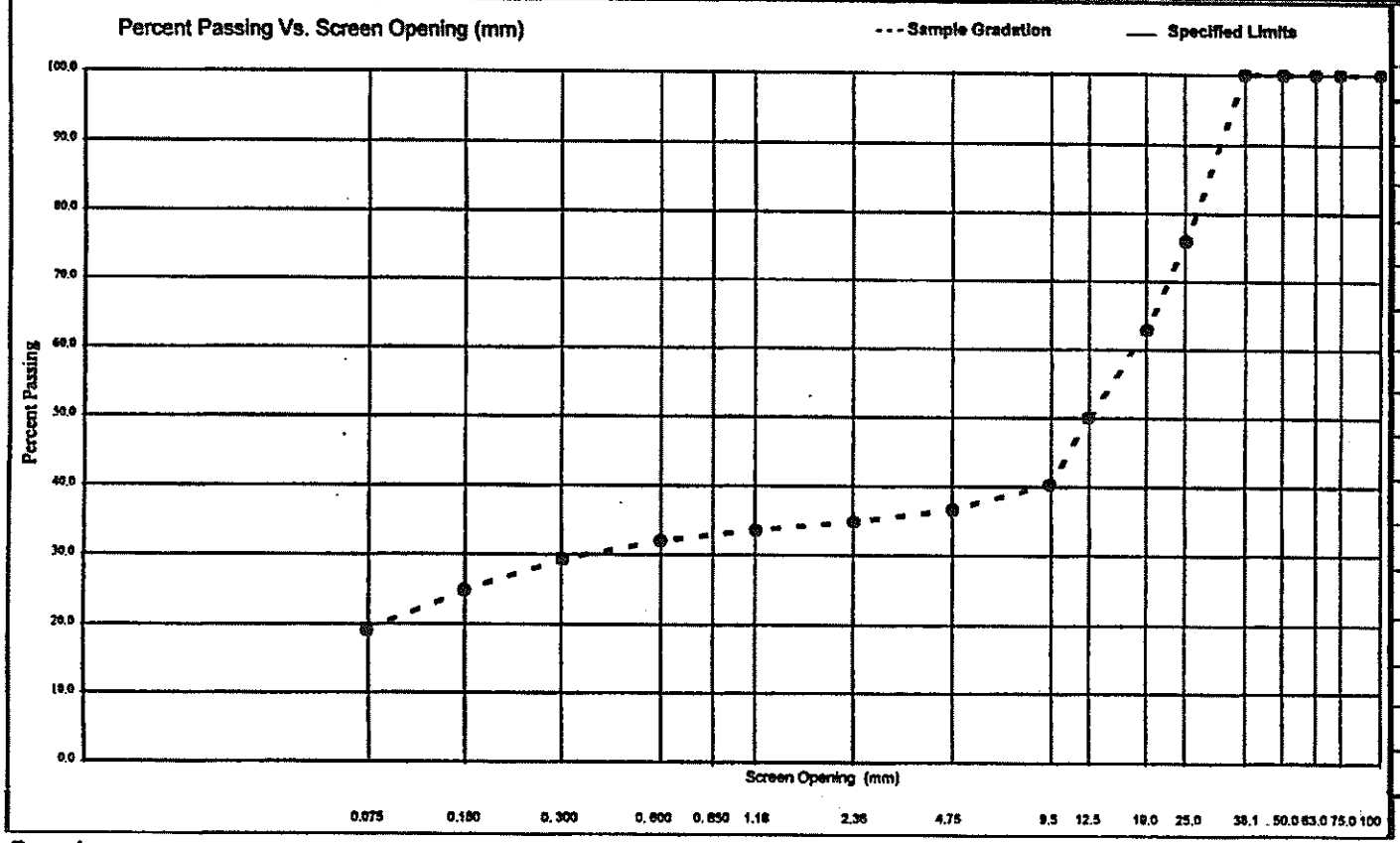
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Gravel - some Sand and Silt
Sample No:
Source: BH5-51 @ 0'-2'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	75.9		
19.0	62.8		
12.5	50.0		
9.50	40.3		
4.75	36.6		
2.36	34.8		
1.180	33.5		
0.600	31.9		
0.300	29.3		
0.150	24.9		
0.075	19.1		

Remarks:

Gravel: 63.4 **Sand:** 17.5 **Fines:** 19.1 Moisture % 14.7

Reviewed by:

BH5-51 @ 0'-2'

Terra Engineering Ltd.
Vano... (604...1245 Port Coquitlam (604) 945-9939
...loops (250) 37... Williams Lake (250) 398-8788
A...rd ...159-6... Terrace (250) 638-1090

Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
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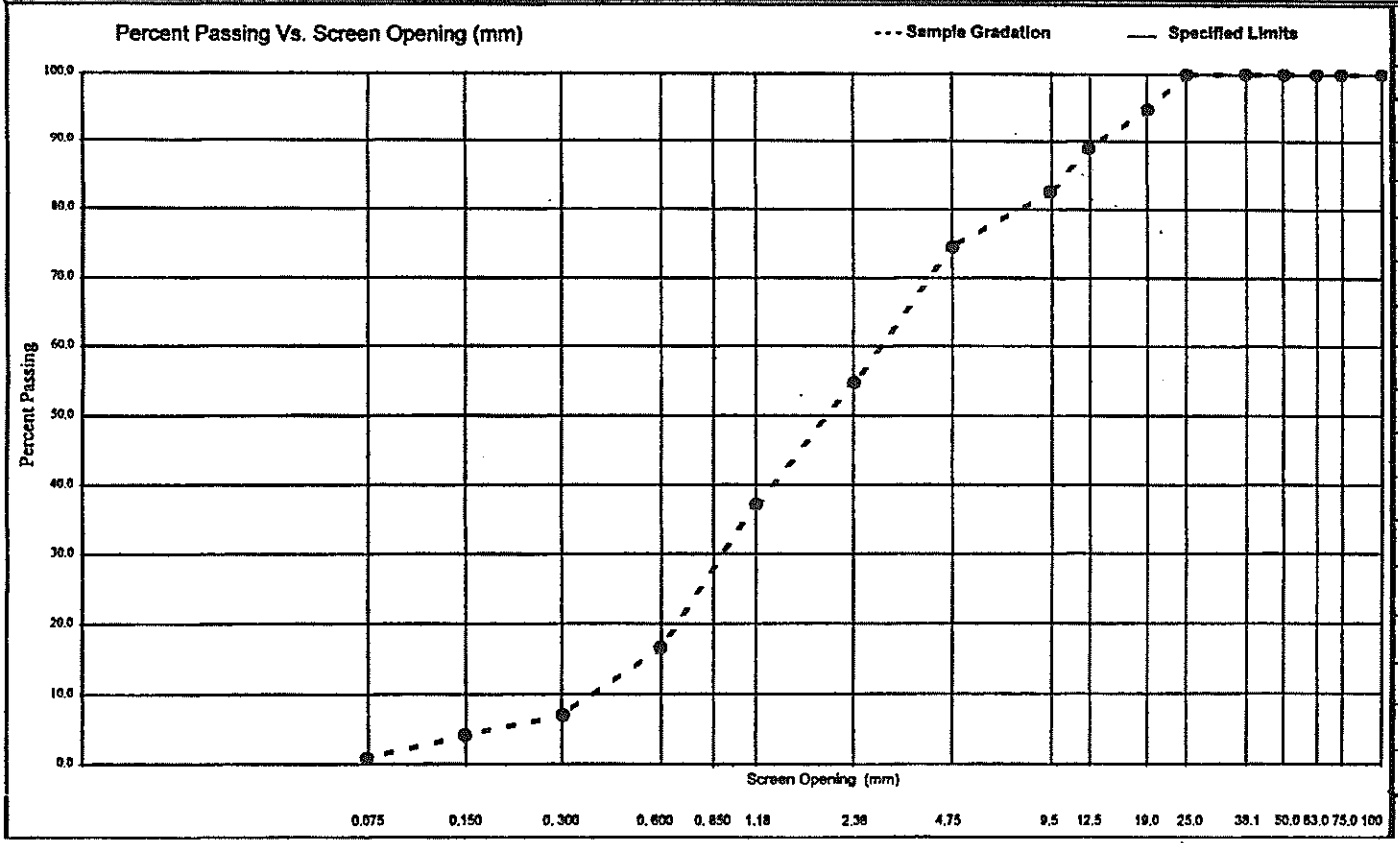
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Sand - gravely, trace Silt
Sample No:
Source: BH5-52 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 11-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	94.8		
12.5	89.0		
9.50	82.6		
4.75	74.5		
2.36	54.7		
1.180	37.1		
0.600	16.6		
0.300	7.0		
0.150	4.1		
0.075	0.8		

Remarks:

Gravel: 25.5 **Sand:** 73.7 **Fines:** 0.8 Moisture % 8.3

Reviewed by:

BH5-52 @ 4'-5'.xls

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(604) 945-9939
(250) 398-8788
(250) 638-1090

Report on Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
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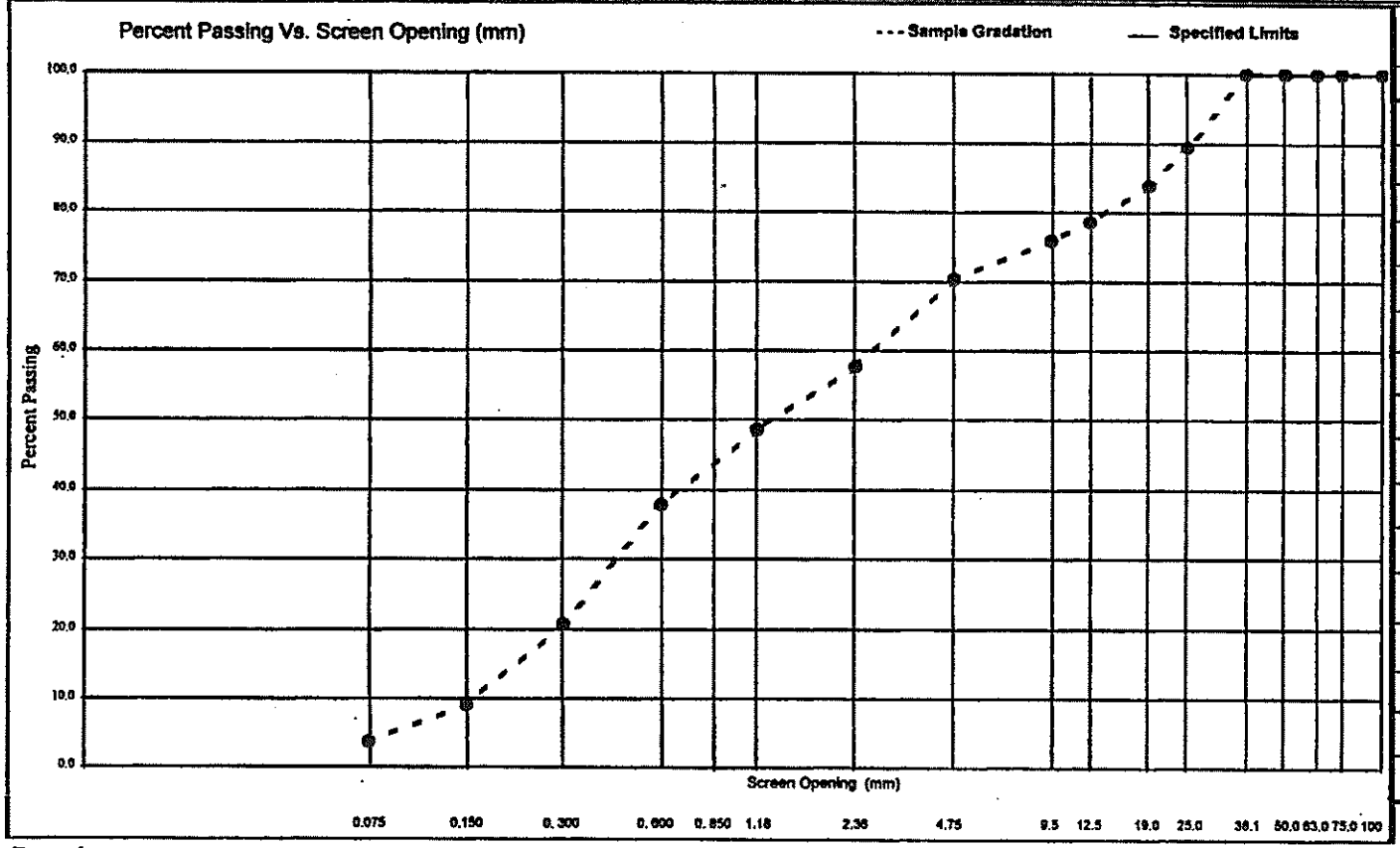
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-54 @ 4'-5'
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 12-Jun-99
Date: 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	89.5		
19.0	83.8		
12.5	78.5		
9.50	75.8		
4.75	70.4		
2.36	57.6		
1.180	48.5		
0.600	37.8		
0.300	20.7		
0.150	9.1		
0.075	3.6		

Remarks:

Gravel: 29.6 **Sand:** 66.7 **Fines:** 3.6 Moisture % 10.4

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BH5-54 @ 4'-5'

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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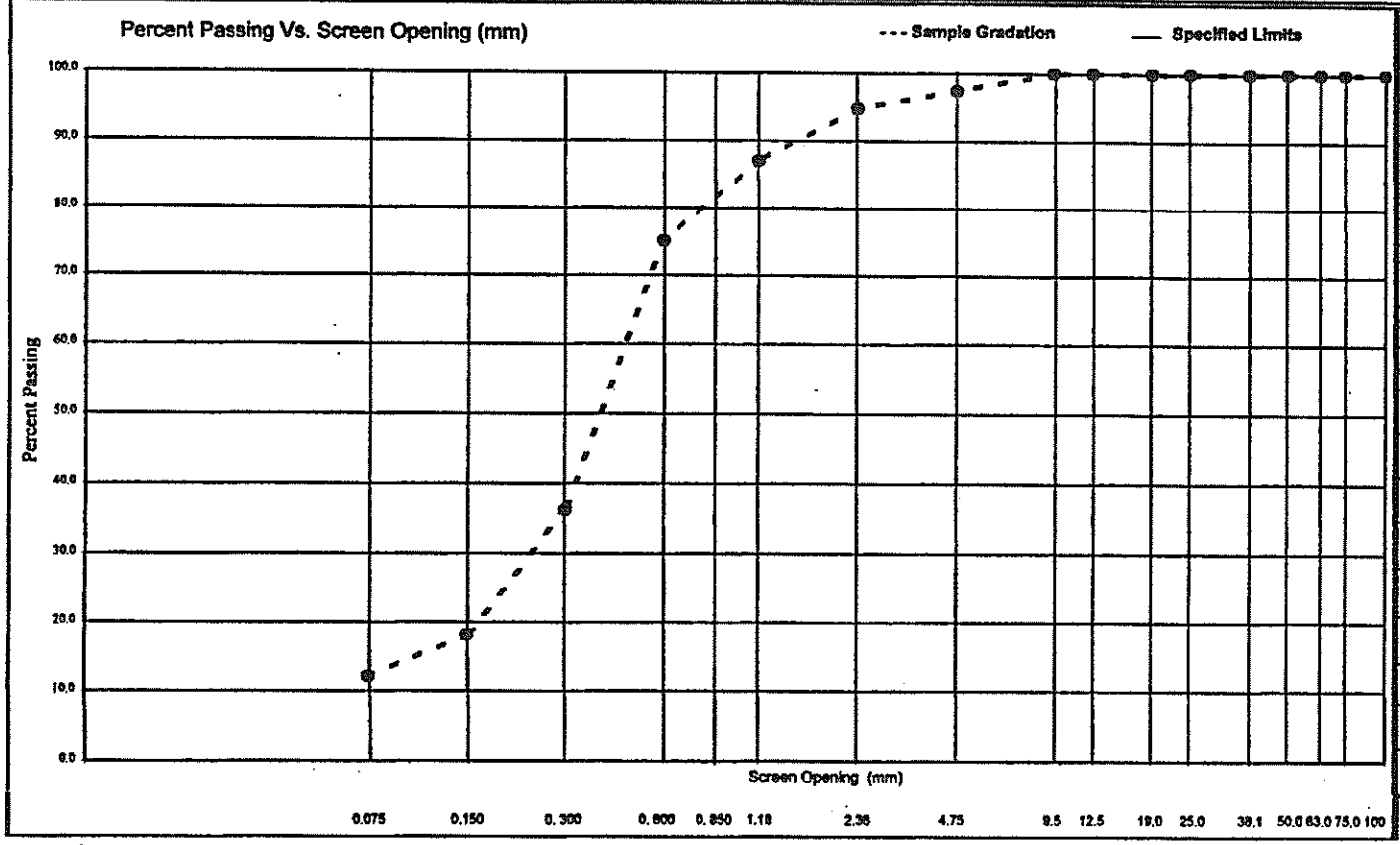
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 18-Jul-99

Type of Sample: Sand - some Silt, trace Gravel
Sample No:
Source: BH5-55 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 18-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	97.4		
2.36	94.8		
1.180	87.1		
0.600	75.0		
0.300	36.2		
0.150	18.1		
0.075	12.1		

Remarks:

Gravel: 2.6 **Sand:** 85.3 **Fines:** 12.1 Moisture % 28.4

Reviewed by:

BH5-55 @ 4'-5'

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Port Coquitlam (604) 945-9939 | Williams Lake (250) 398-8788 | Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 16-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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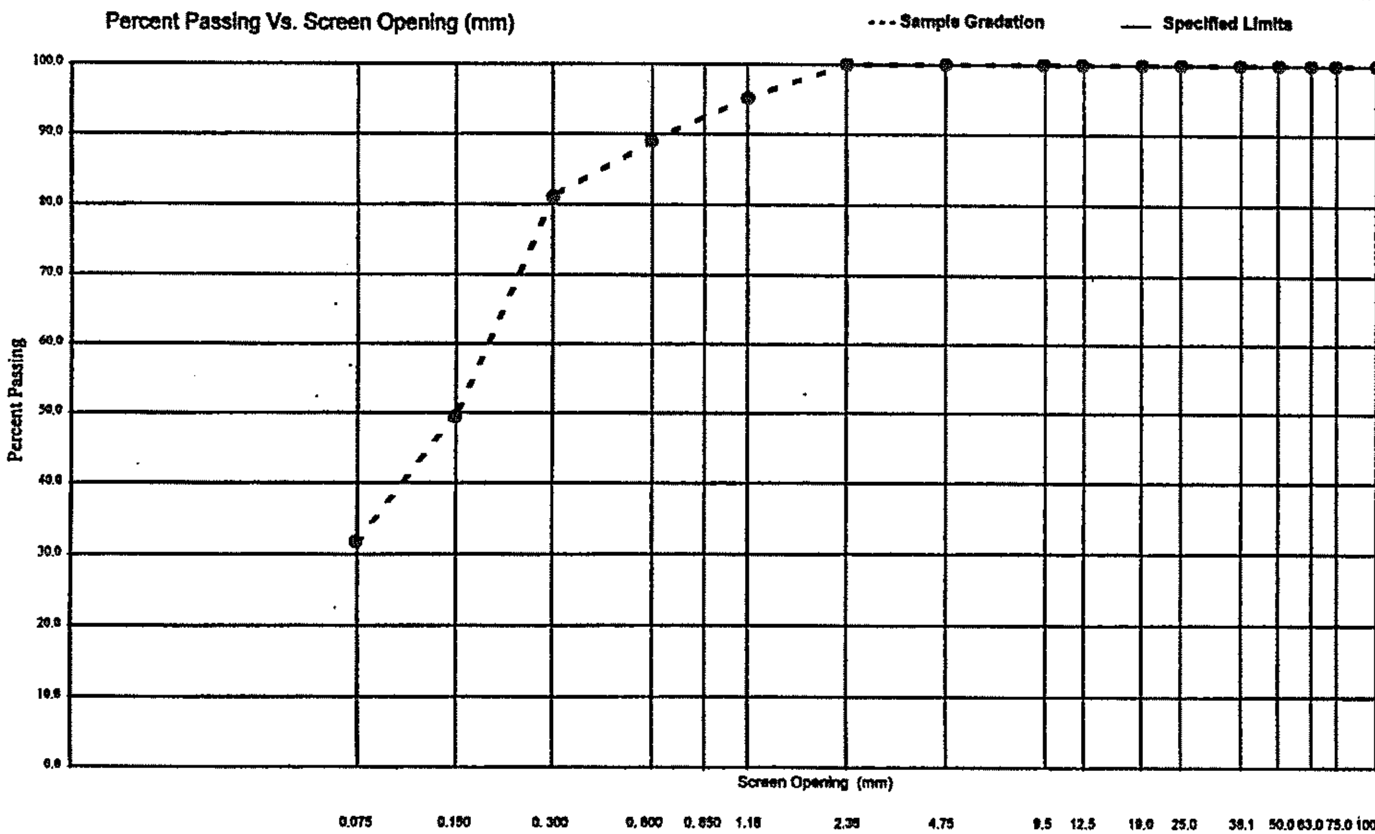
Type of Sample: Sand - Silty
Sample No:
Source: BH5-56 @ 2'-3'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	100.0		
1.180[1]	95.1		
0.600	89.0		
0.300	81.1		
0.150	49.4		
0.075	31.7		

Remarks:

Gravel: 0.0 **Sand:** 68.3 **Fines:** 31.7 Moisture % 37.2

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Kloop 50) 37 Williams Lake (250) 398-8788
rd 359-6 Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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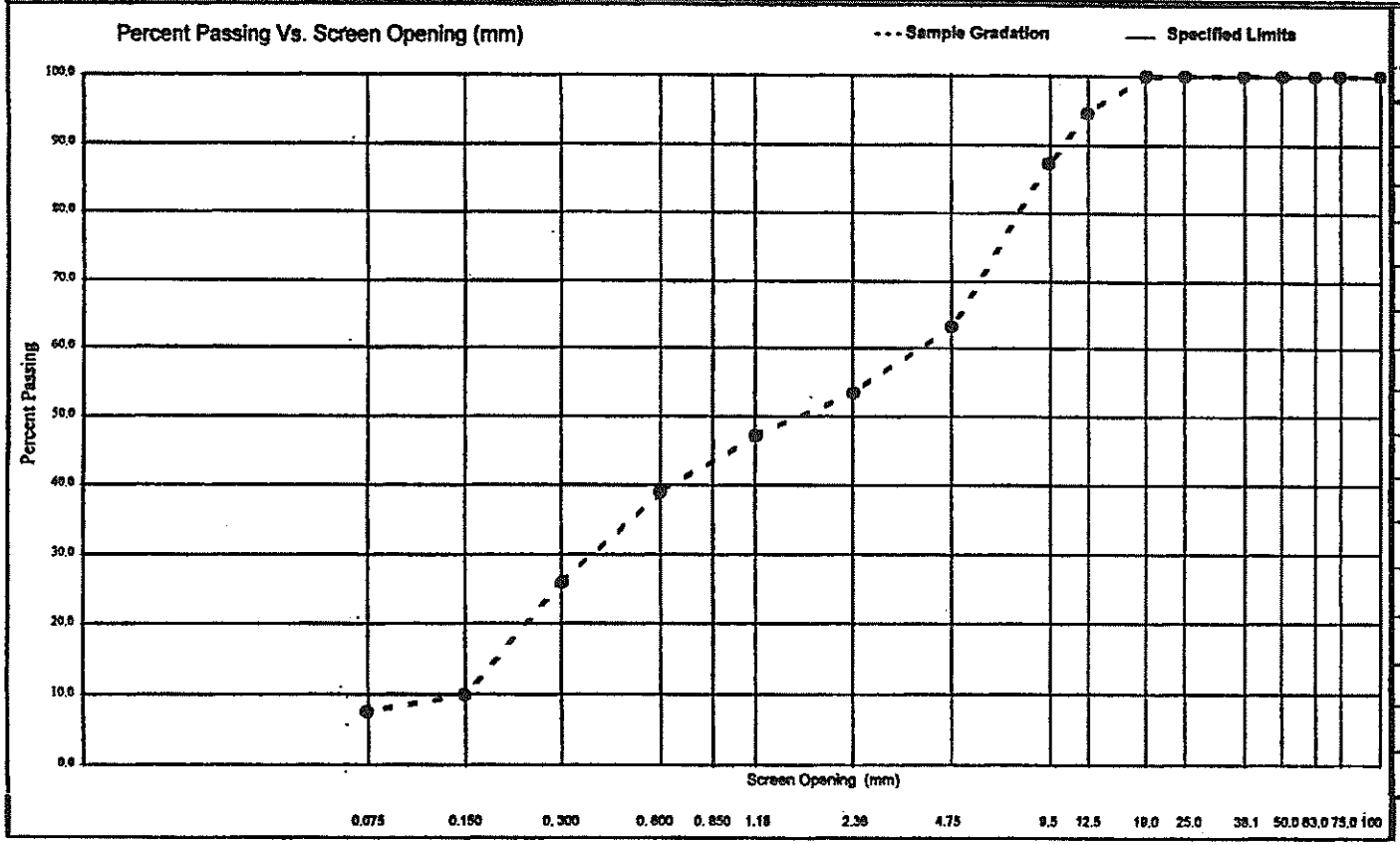
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-57 @ 3'-4'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	94.6		
9.50	87.3		
4.75	63.2		
2.36	53.4		
1.180	47.2		
0.600	38.9		
0.300	25.9		
0.150	9.8		
0.075	7.5		

Remarks:

Gravel: 36.8 **Sand:** 55.7 **Fines:** 7.5 **Moisture %** 9.4

Reviewed by:

BH5-57 @ 3'-4'

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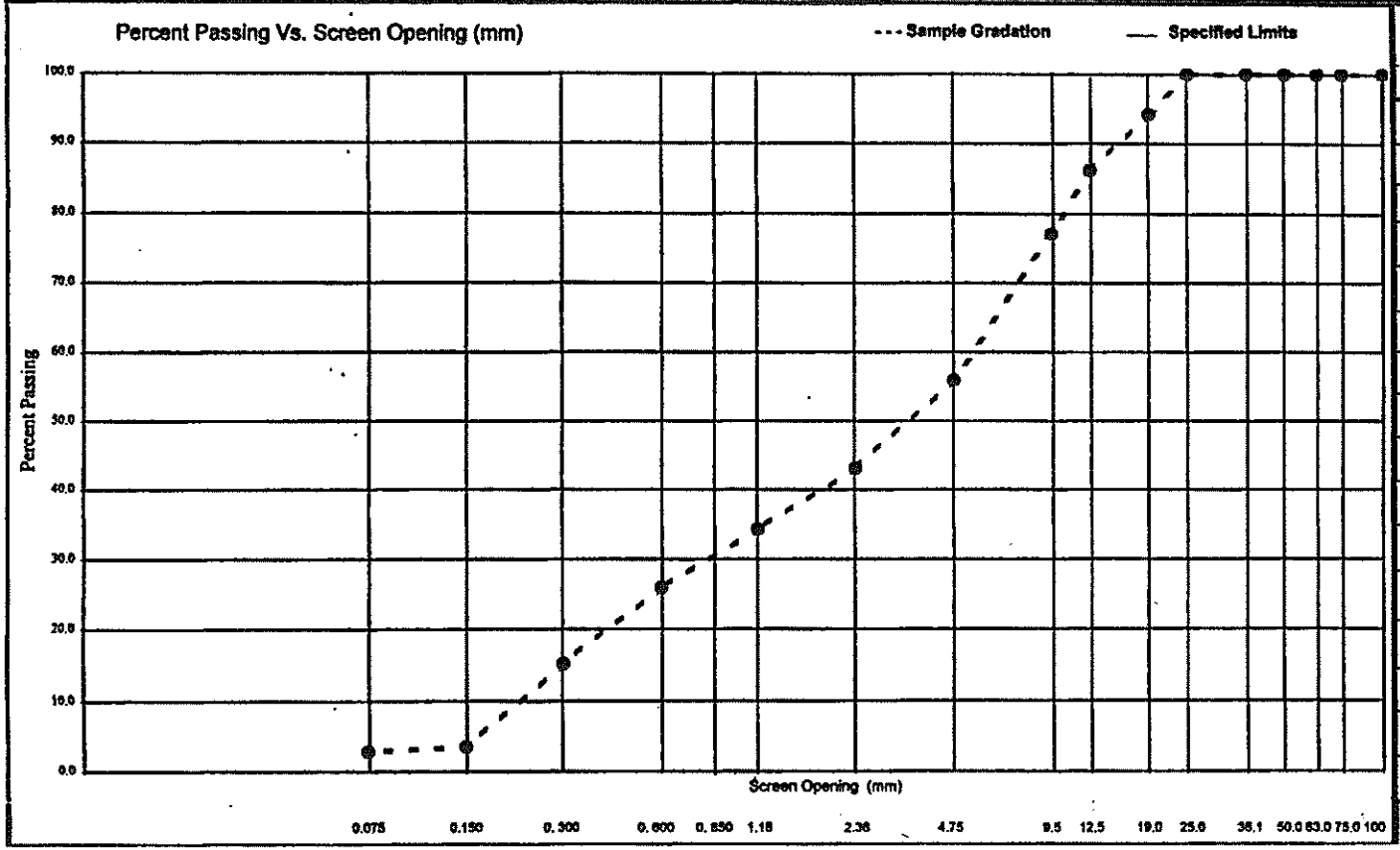
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-58 @ 4'-5'
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 12-Jun-99
Date: 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	94.2		
12.5	86.1		
9.50	77.1		
4.75	55.9		
2.36	43.1		
1.180	34.3		
0.600	25.9		
0.300	15.1		
0.150	3.5		
0.075	2.8		

Remarks:

Gravel: 44.1 **Sand:** 53.1 **Fines:** 2.8 Moisture % 5.3

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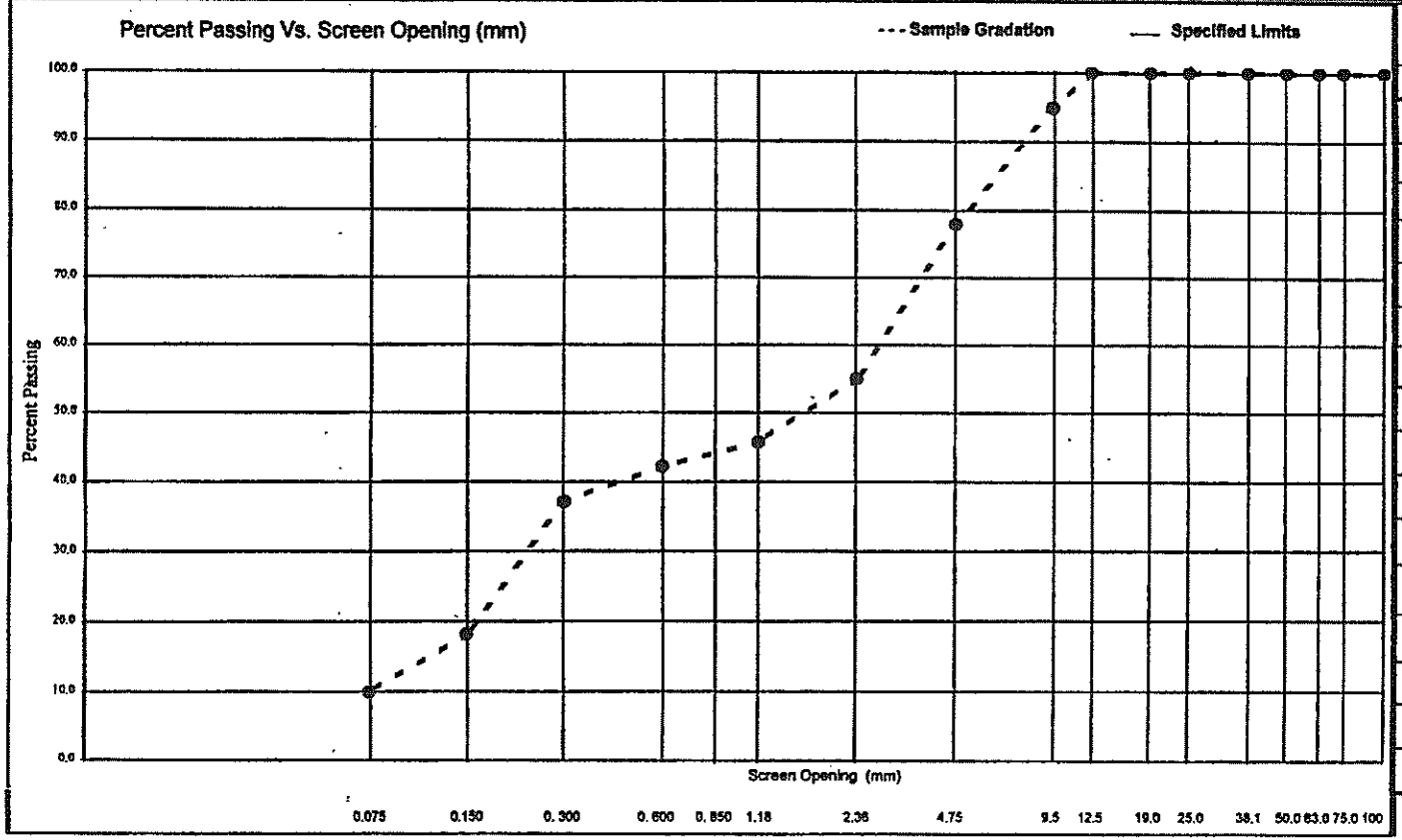
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-59 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	94.9		
4.75	78.0		
2.36	55.0		
1.180	45.7		
0.600	42.2		
0.300	37.1		
0.150	18.2		
0.075	9.9		

Remarks:

Gravel: 22.0 **Sand:** 68.1 **Fines:** 9.9 Moisture % 13.8

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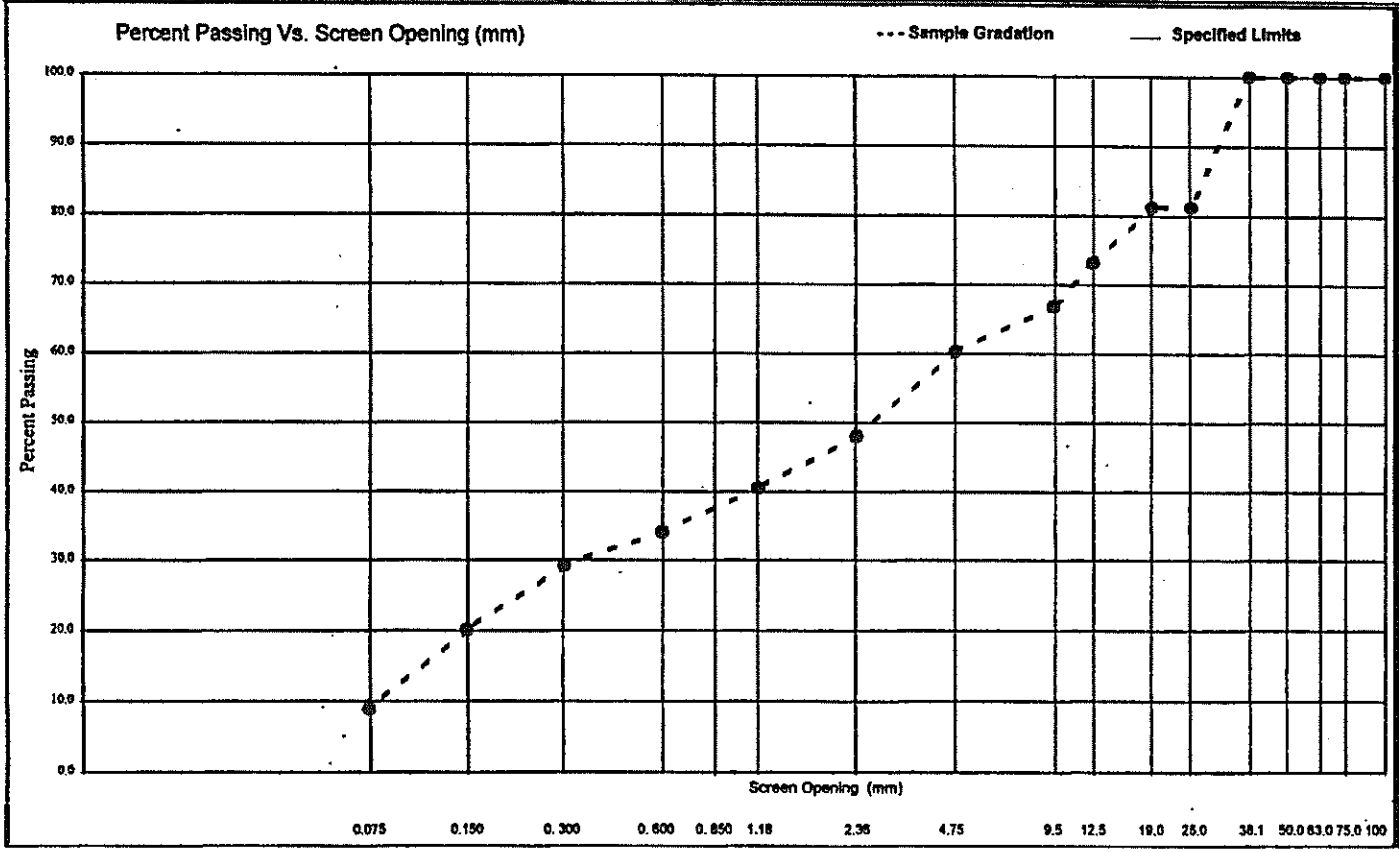
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Sand and Gravel - trace Clay
Sample No:
Source: BH5-60 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	81.2		
19.0	81.2		
12.5	73.1		
9.50	66.8		
4.75	60.3		
2.36	48.0		
1.180	40.5		
0.600	33.9		
0.300	29.2		
0.150	20.1		
0.075	8.9		

Remarks:

Gravel: 39.7 **Sand:** 51.4 **Fines:** 8.9 Moisture % 14.5

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Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

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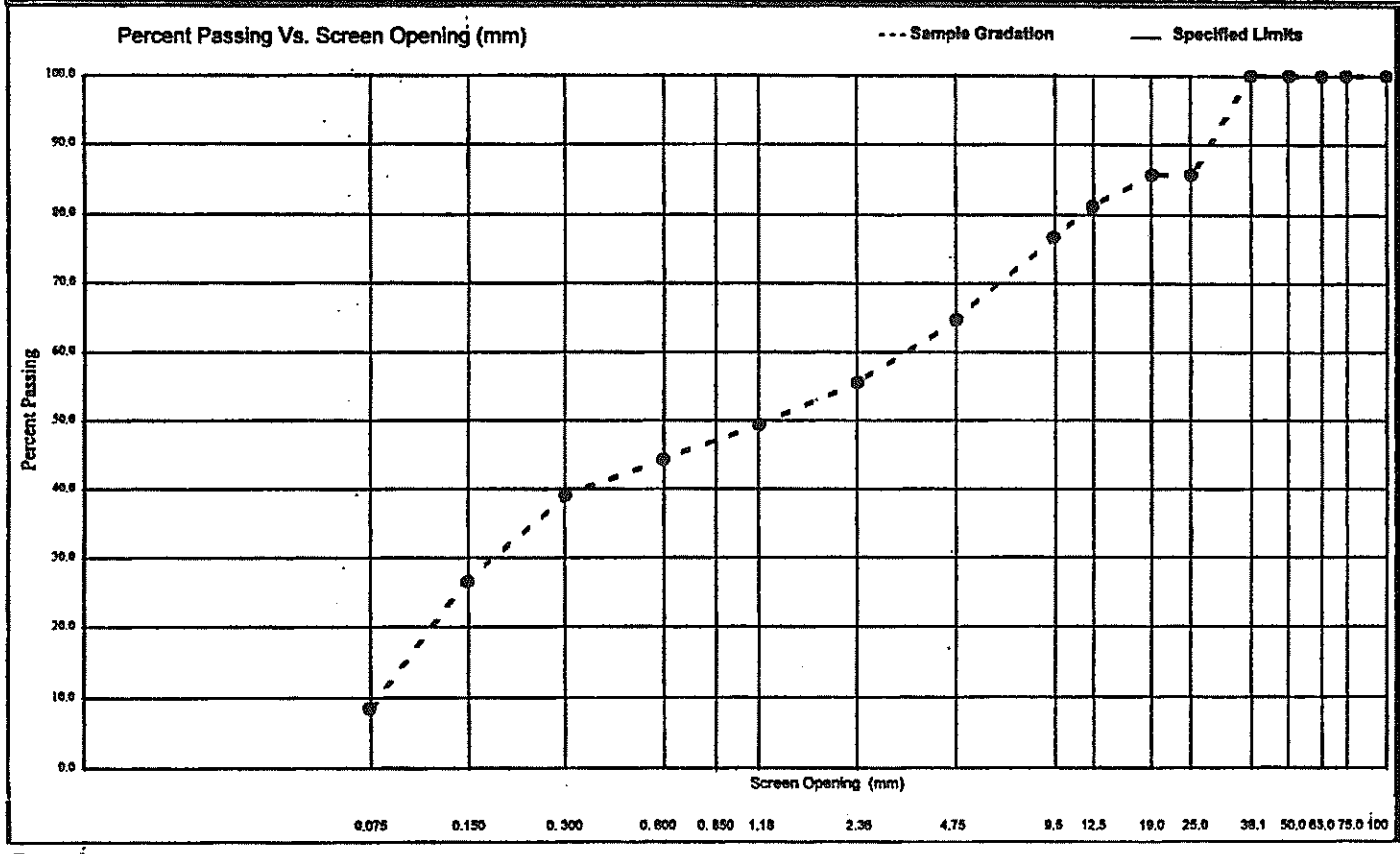
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-61 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	85.7		
19.0	85.7		
12.5	81.1		
9.50	76.8		
4.75	64.6		
2.36	55.6		
1.180	49.3		
0.600	44.2		
0.300	39.1		
0.150	26.5		
0.075	8.4		

Remarks:

Gravel: 35.4 **Sand:** 56.2 **Fines:** 8.4 Moisture % 13.1

Reviewed by:

BH5-61 @ 4'-5'

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Report of Aggregate Sieve Analysis

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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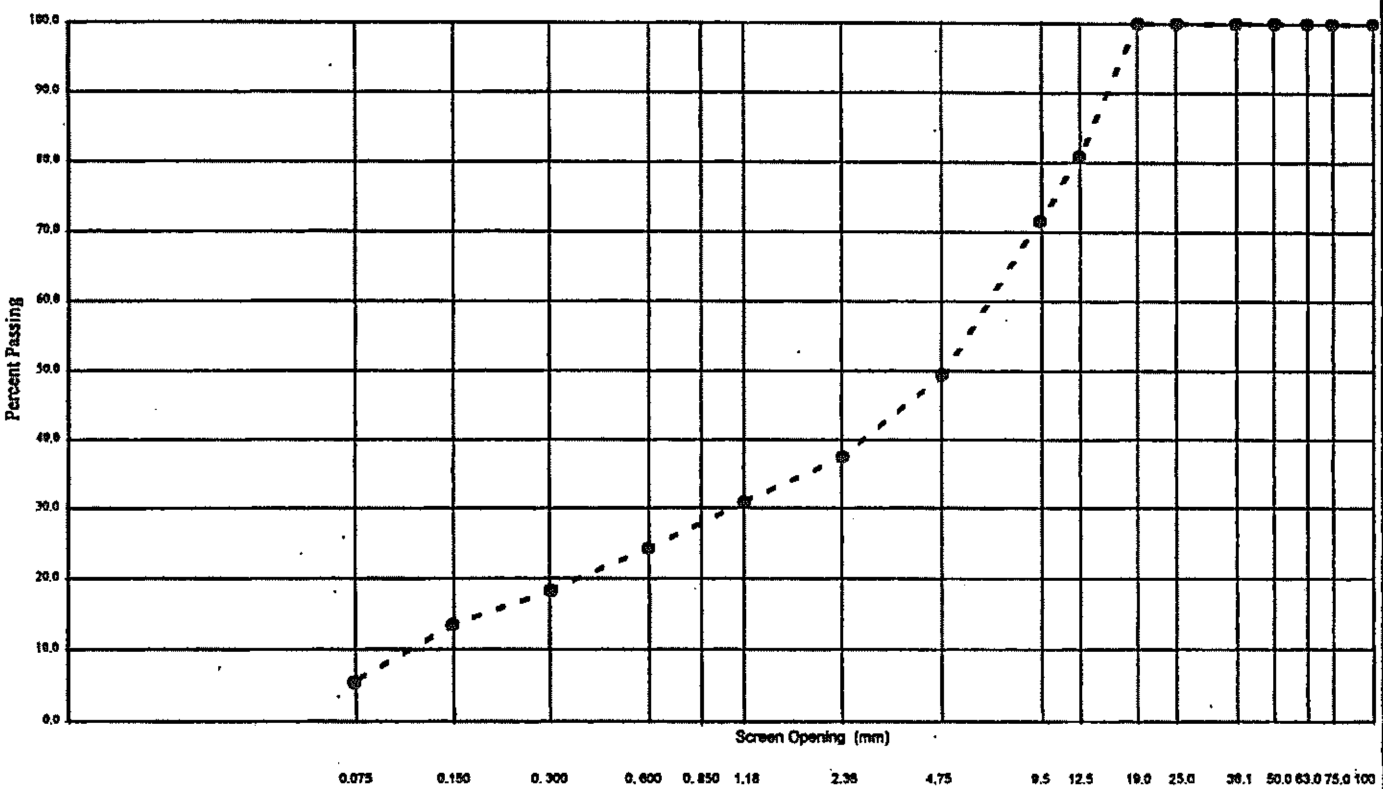
Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-62 @ 2'-3'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	80.8		
9.50	71.6		
4.75	49.4		
2.36	37.4		
1.180	30.8		
0.600	24.3		
0.300	18.3		
0.150	13.5		
0.075	5.4		

Remarks:

Gravel: 50.6 **Sand:** 44.0 **Fines:** 5.4 Moisture % 7.5

Reviewed by:

BH5-62 @ 2'-3'

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*Kamloops (250) 372-5321
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Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

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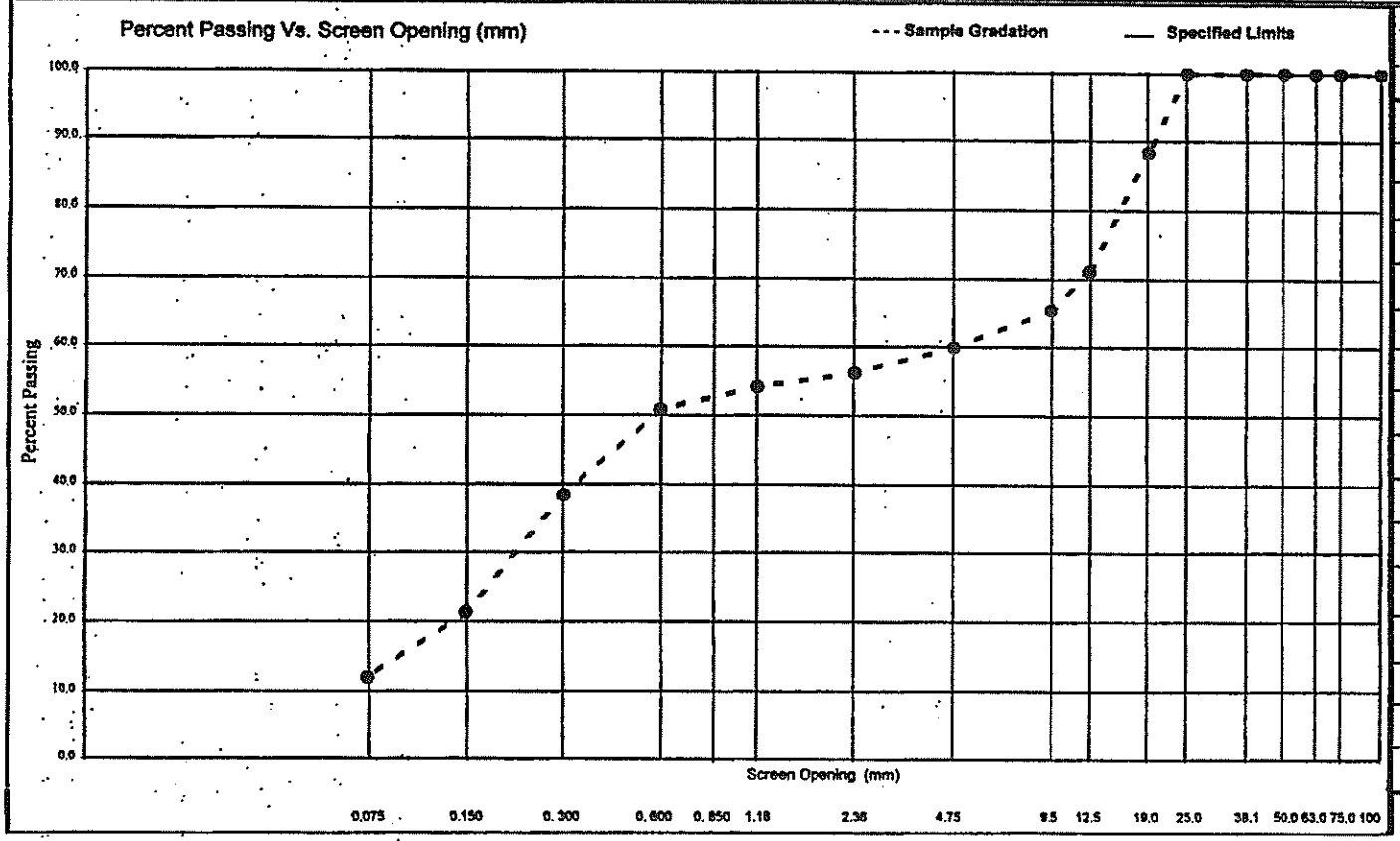
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Sand and Gravel - some Silt
Sample No:
Source: BH5-63 @ 1.5'-2.5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	88.3		
12.5	71.1		
9.50	65.5		
4.75	59.9		
2.36	56.1		
1.180	54.1		
0.600	50.8		
0.300	38.3		
0.150	21.3		
0.075	11.9		

Remarks:

Gravel: 40.1 **Sand:** 48.0 **Fines:** 11.9 Moisture % 7.9

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Report of Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 16-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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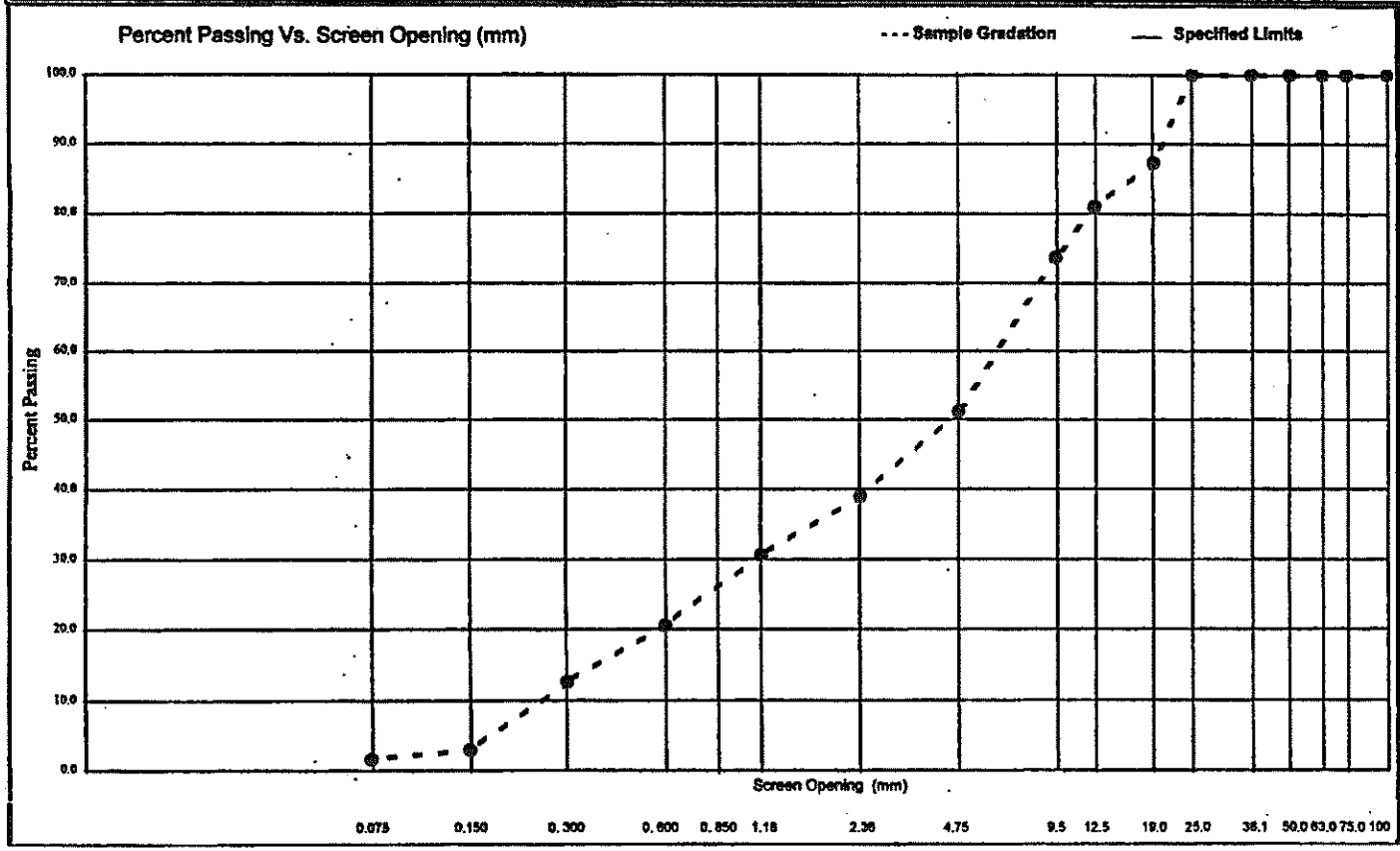
Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-64 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	87.2		
12.5	81.0		
9.50	73.6		
4.75	51.2		
2.36	39.0		
1.180	30.6		
0.600	20.5		
0.300	12.6		
0.150	2.9		
0.075	1.6		

Remarks:

Gravel: 48.8 **Sand:** 49.6 **Fines:** 1.6 Moisture % 6.5

Reviewed by:

BH5-64 @ 4'-5'

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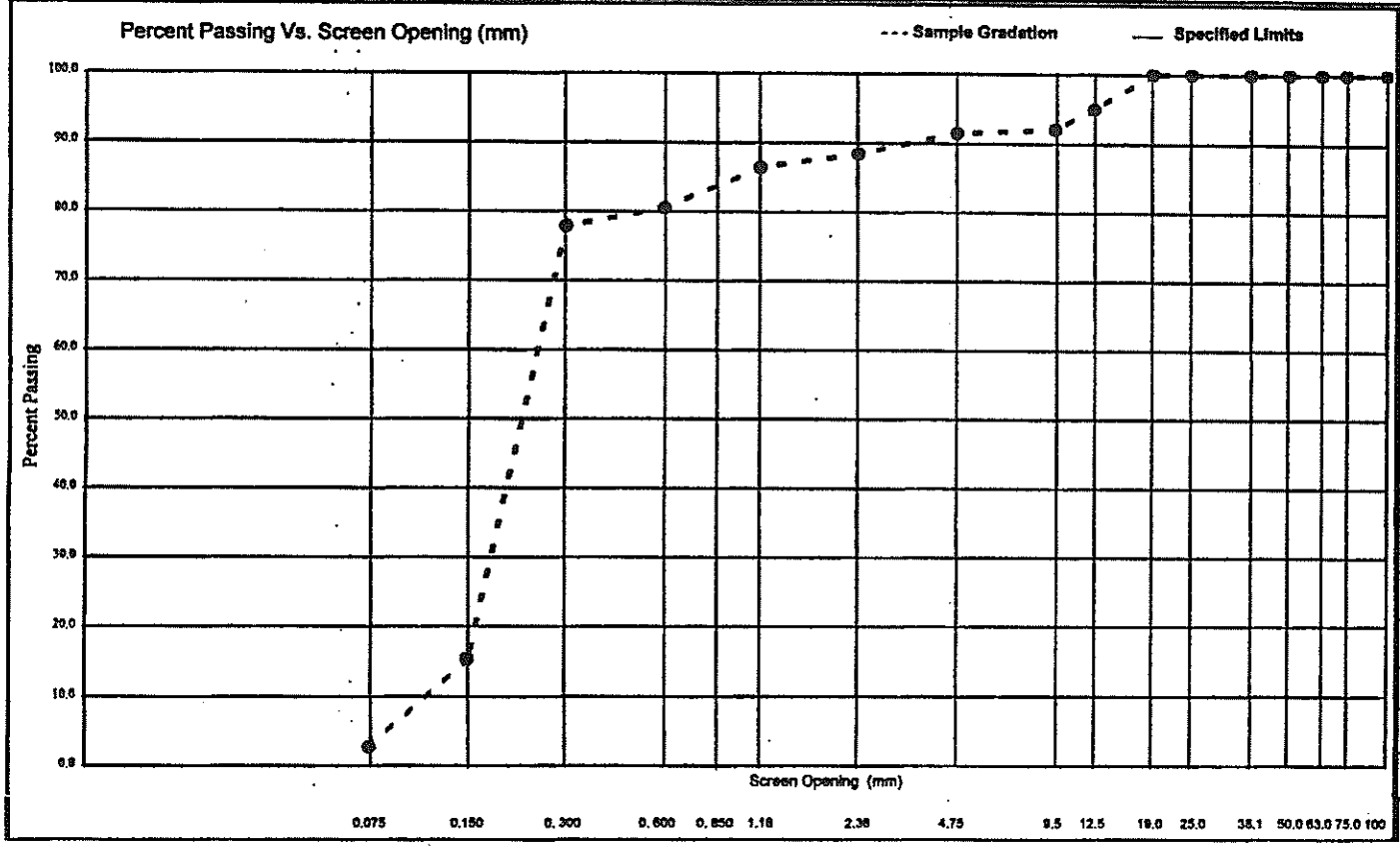
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Sand - trace Gravel, trace Silt
Sample No:
Source: BH5-65 @ 0.5'-1.5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	95.0		
9.50	92.0		
4.75	91.4		
2.36	88.5		
1.180	86.4		
0.600	80.5		
0.300	77.8		
0.150	15.4		
0.075	2.7		

Remarks:

Gravel: 8.6 **Sand:** 88.8 **Fines:** 2.7 Moisture % 20.1

Reviewed by:

Engineering Ltd
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Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 16-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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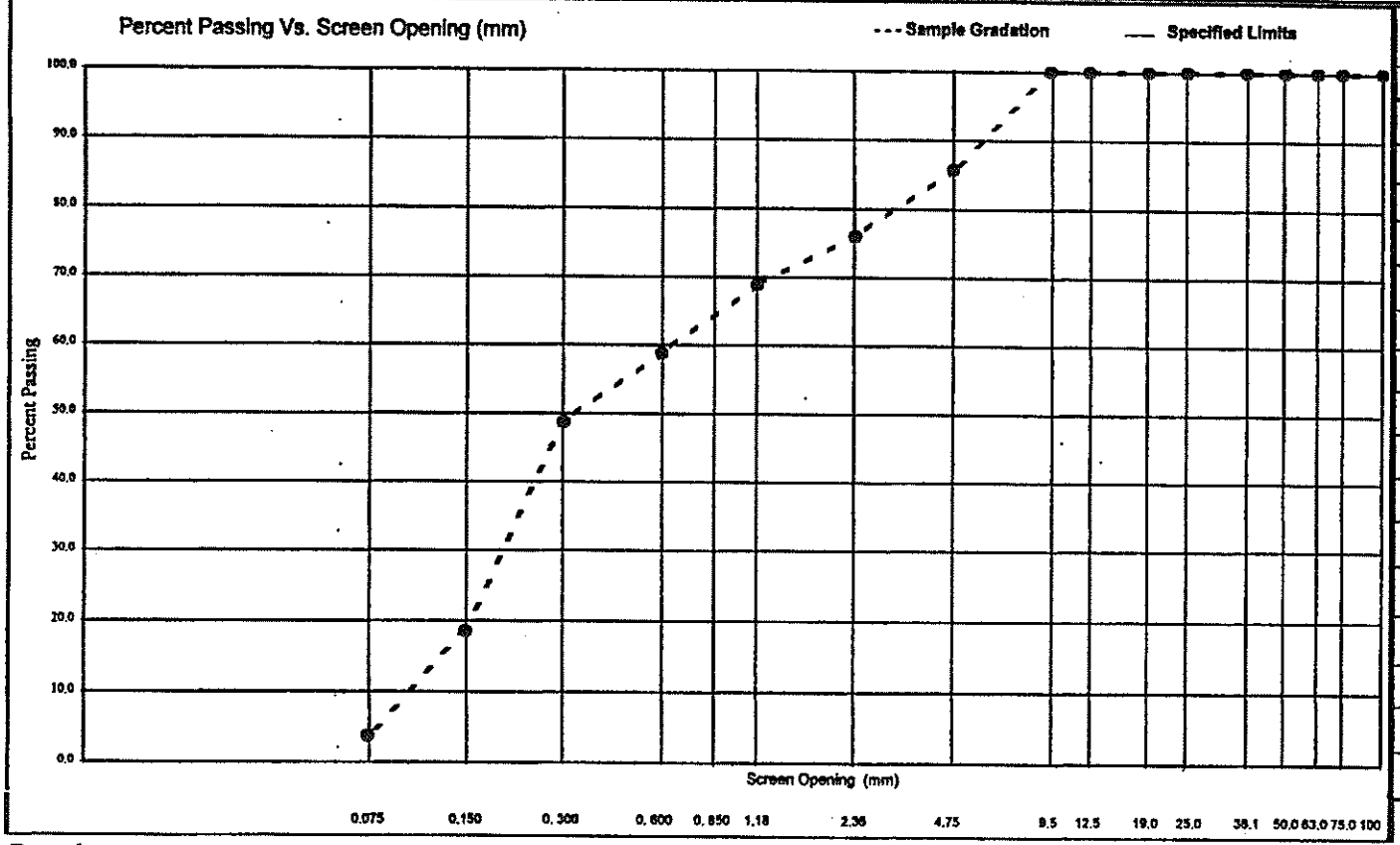
Type of Sample: Sand - some Gravel, trace Clay
Sample No:
Source: BH5-65 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	85.7		
2.36	76.1		
1.180	68.9		
0.600	58.8		
0.300	48.7		
0.150	18.5		
0.075	3.8		

Remarks:

Gravel: 14.3 **Sand:** 81.9 **Fines:** 3.8 Moisture % 27.0

Reviewed by:

BH5-65 @ 4'-5'.xls

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Report of Aggregate Sieve Analysis

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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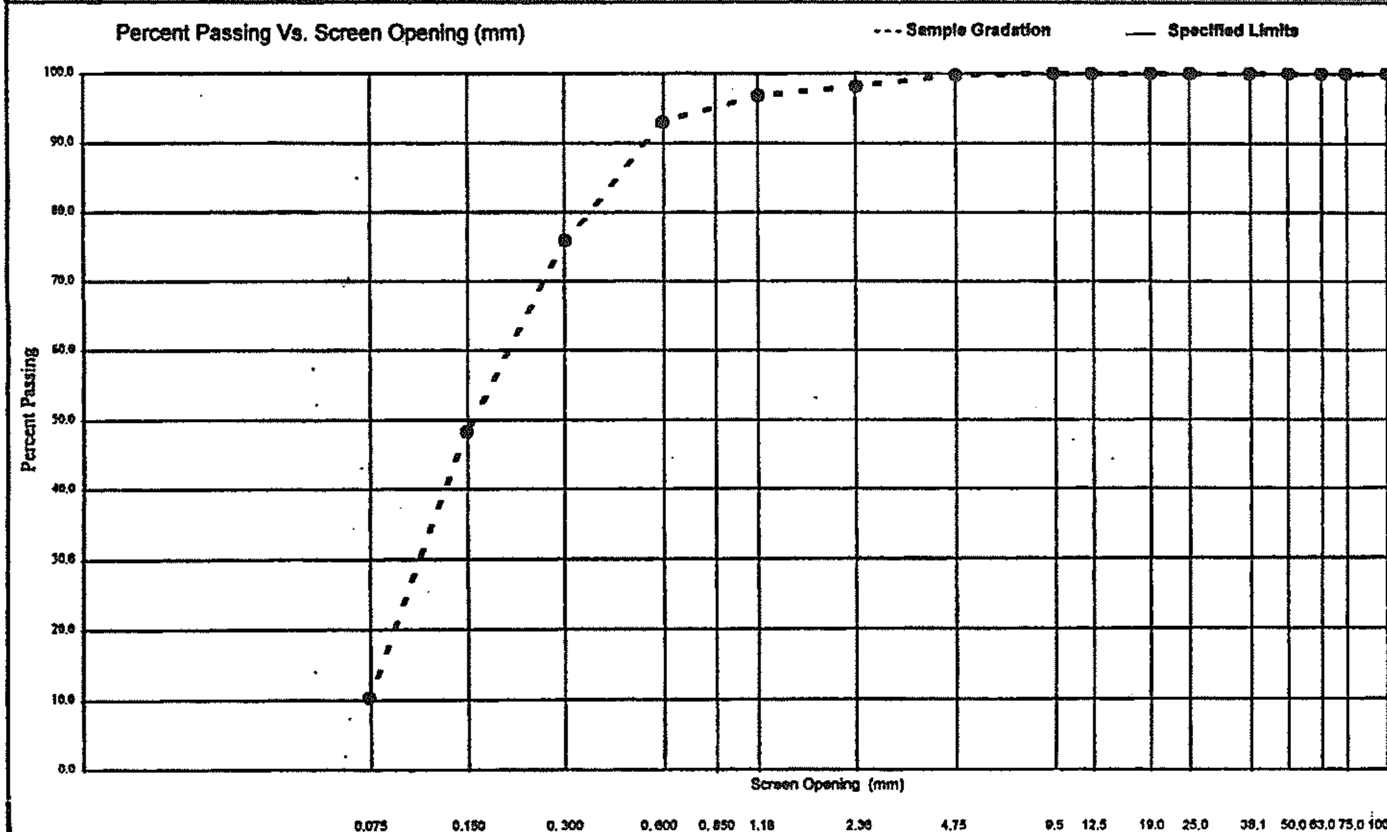
Type of Sample: Sand - some Silt
Sample No:
Source: BH5-66 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	99.7		
2.36	98.1		
1.180	96.7		
0.600	93.0		
0.300	75.9		
0.150	48.2		
0.075	10.3		

Remarks:

Gravel: 0.3 **Sand:** 89.4 **Fines:** 10.3 Moisture % 12.4

Reviewed by:

BH5-66 @ 4'-5'

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Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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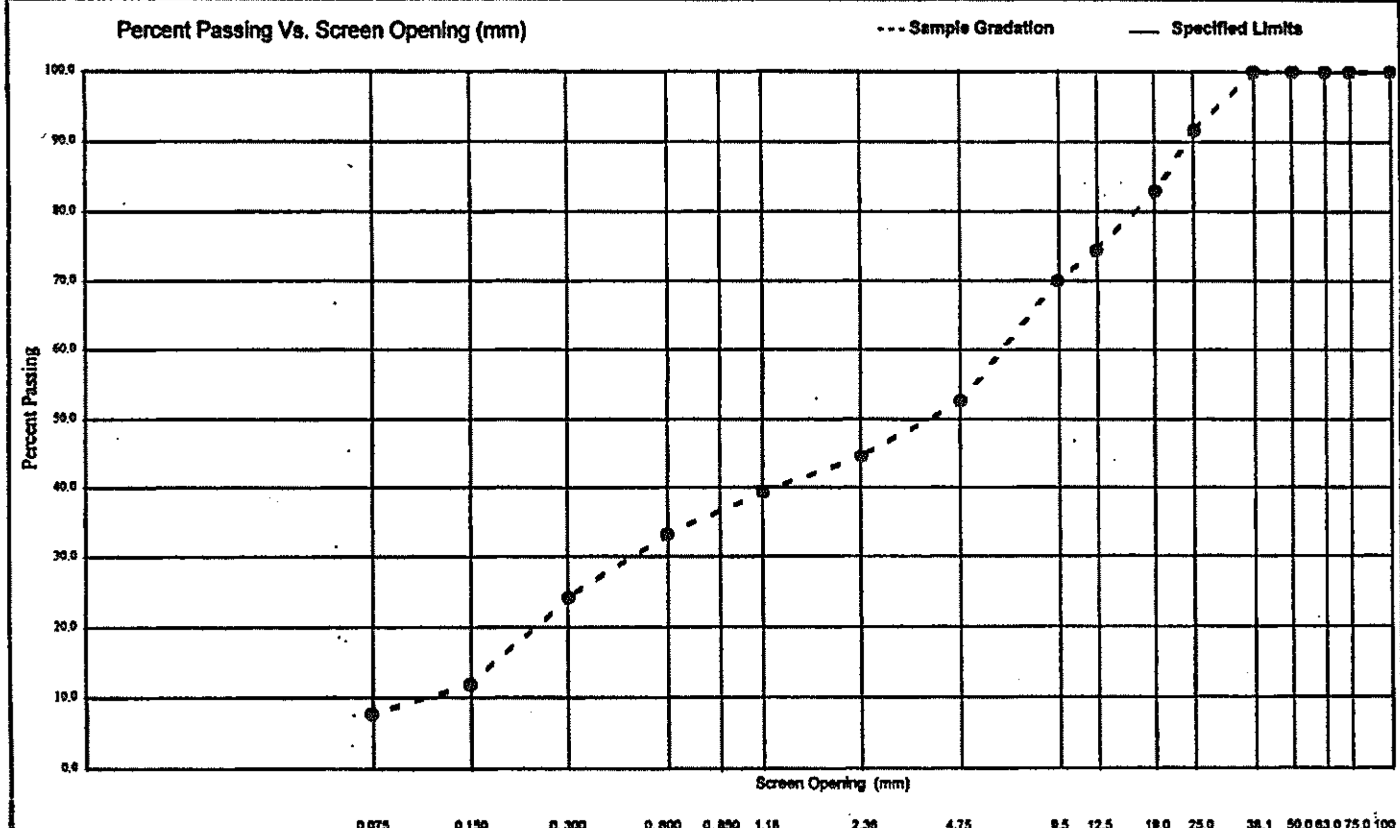
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-67 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	91.5		
19.0	82.9		
12.5	74.4		
9.50	69.9		
4.75	52.6		
2.36	44.5		
1.180	39.3		
0.600	33.1		
0.300	24.3		
0.150	11.8		
0.075	7.7		

Remarks:
Gravel: 47.4 **Sand:** 44.9 **Fines:** 7.7 Moisture % 6.0

Reviewed by:

BH5-67 @ 4'-5'

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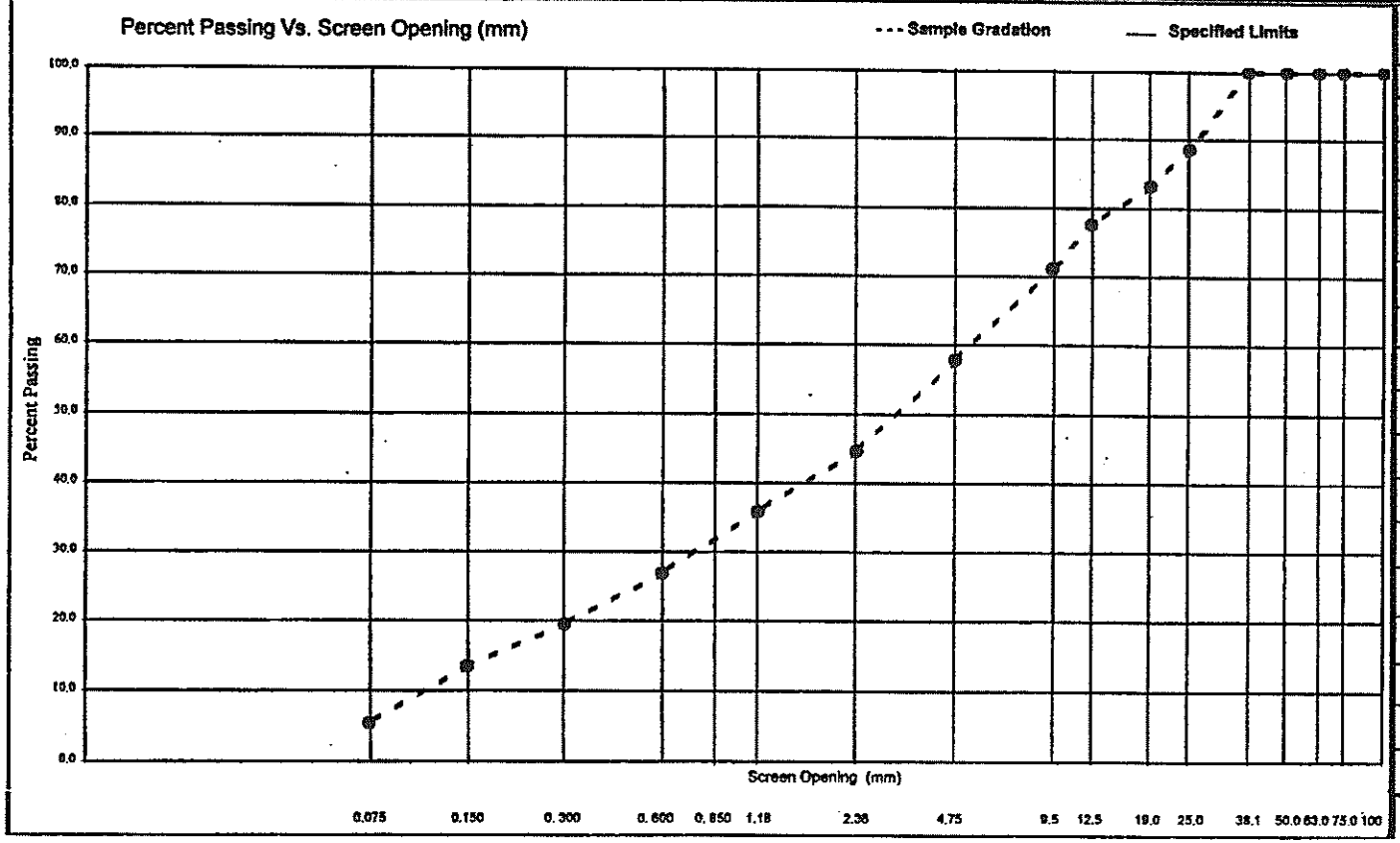
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Sand and Gravel - trace Clay
Sample No:
Source: BH5-68 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	88.6		
19.0	83.2		
12.5	77.6		
9.50	71.1		
4.75	57.8		
2.36	44.6		
1.180	35.9		
0.600	26.9		
0.300	19.5		
0.150	13.5		
0.075	5.4		

Remarks:

Gravel: 42.2 **Sand:** 52.5 **Fines:** 5.4 Moisture % 10.4

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Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

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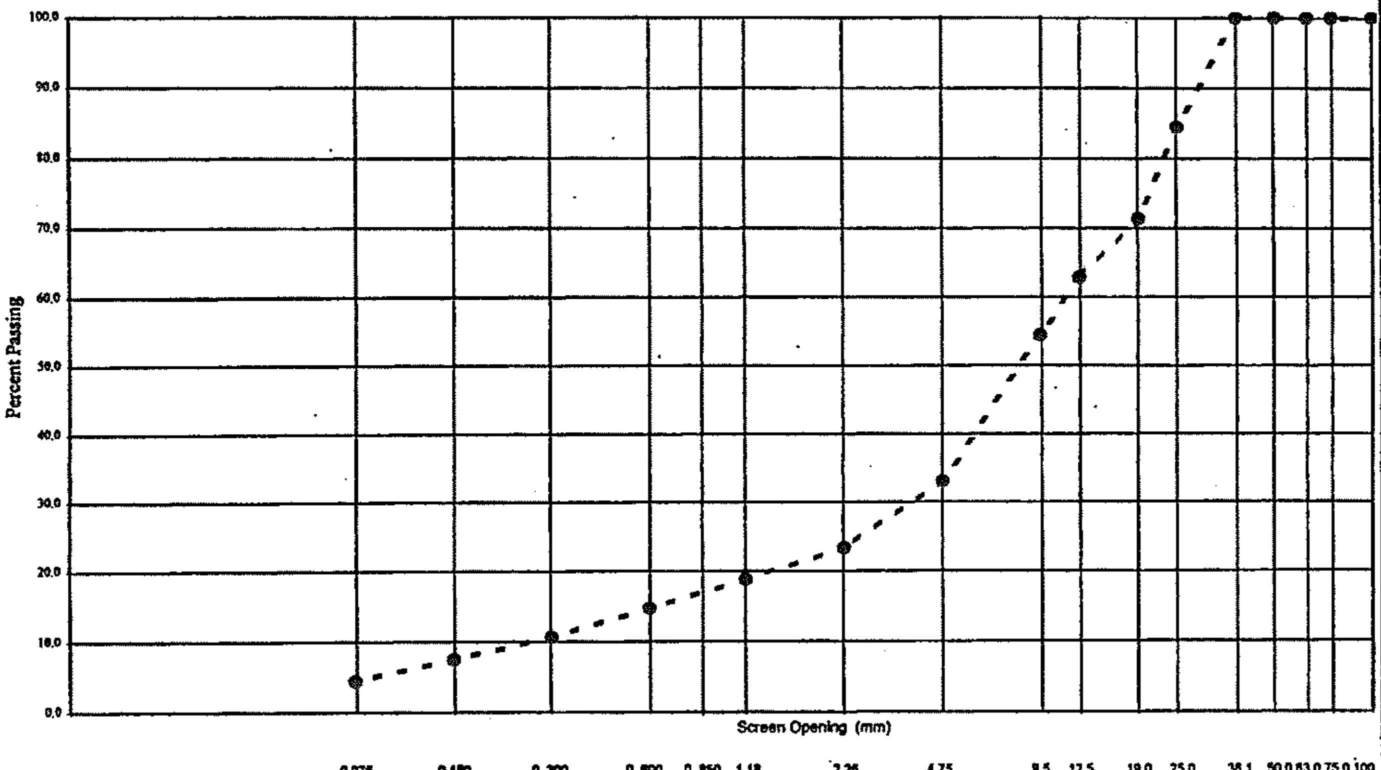
Type of Sample: Gravel - Sandy, trace Clay
Sample No:
Source: BH5-69 @ 4'-5'
Specified Limits:

Sampled by: CB — **Date:** 12-Jun-99
Tested by: EA — **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	84.3		
19.0	71.3		
12.5	62.9		
9.50	54.5		
4.75	33.0		
2.36	23.4		
1.180	18.8		
0.600	14.7		
0.300	10.6		
0.150	7.5		
0.075	4.3		

Remarks:
Gravel: 67.0 **Sand:** 28.7 **Fines:** 4.3 Moisture % 8.2

Reviewed by:

BH5-69 @ 4'-5'.xls

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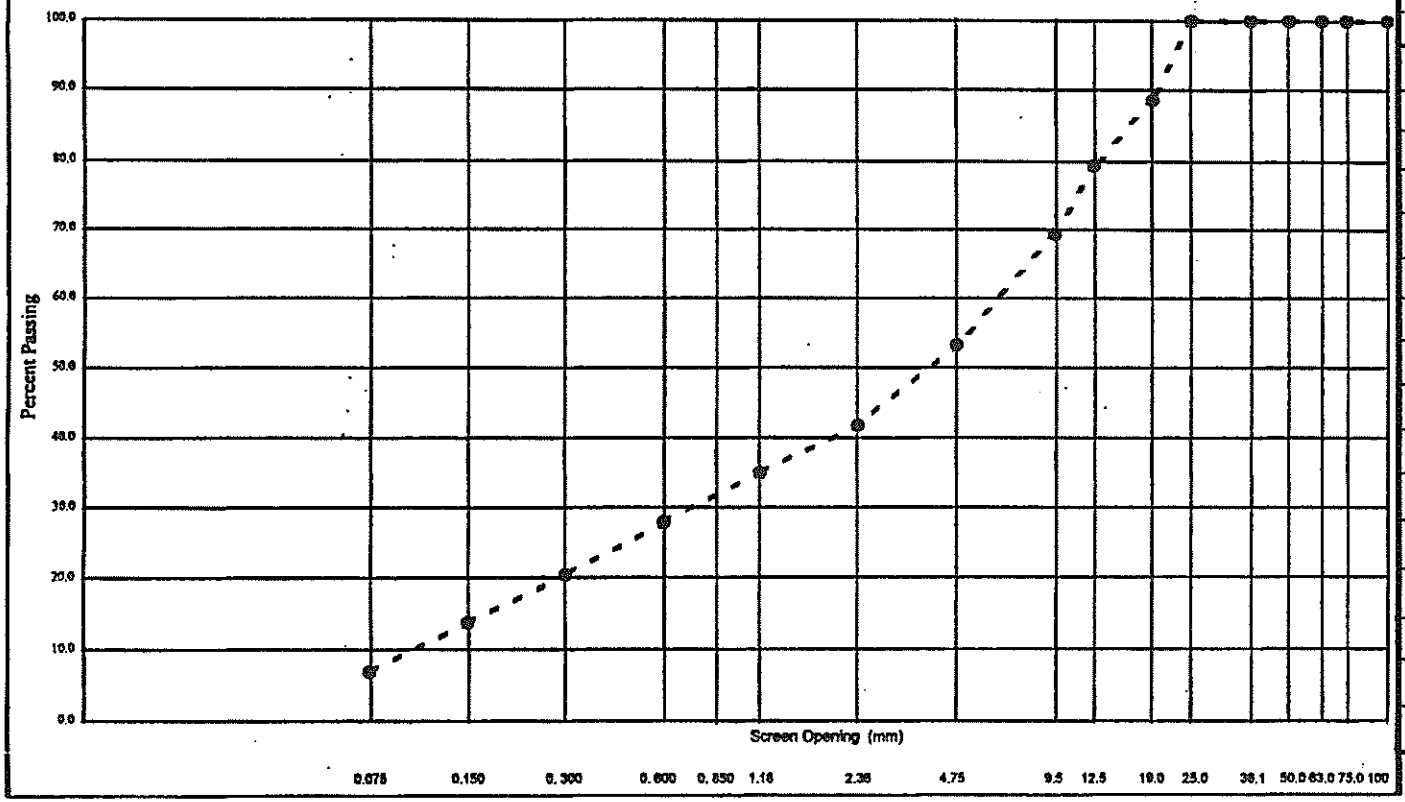
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-69 @ 9'-10'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	88.5		
12.5	79.4		
9.50	69.3		
4.75	53.2		
2.36	41.7		
1.180	34.9		
0.600	28.0		
0.300	20.4		
0.150	13.8		
0.075	6.9		

Remarks:

Gravel: 46.8 **Sand:** 46.3 **Fines:** 6.9 **Moisture %** 14.2

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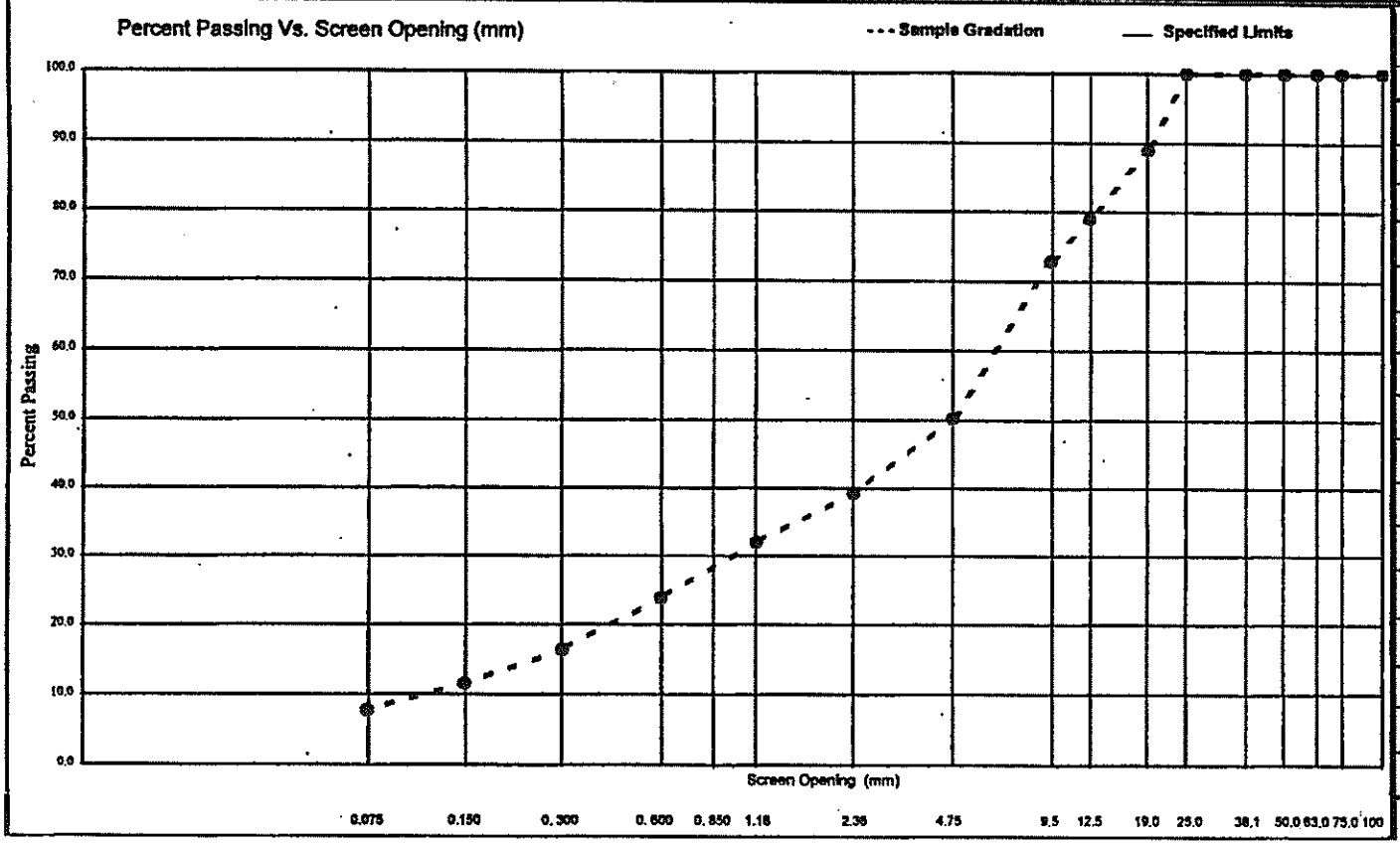
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 16-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-70 @ 6'-7'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 16-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	89.0		
12.5	79.0		
9.50	72.8		
4.75	50.3		
2.36	39.2		
1.180	32.1		
0.600	23.8		
0.300	16.4		
0.150	11.5		
0.075	7.7		

Remarks:

Gravel: 49.7 **Sand:** 42.6 **Fines:** 7.7 Moisture % 13.9

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BH5-70 @ 6'-7'

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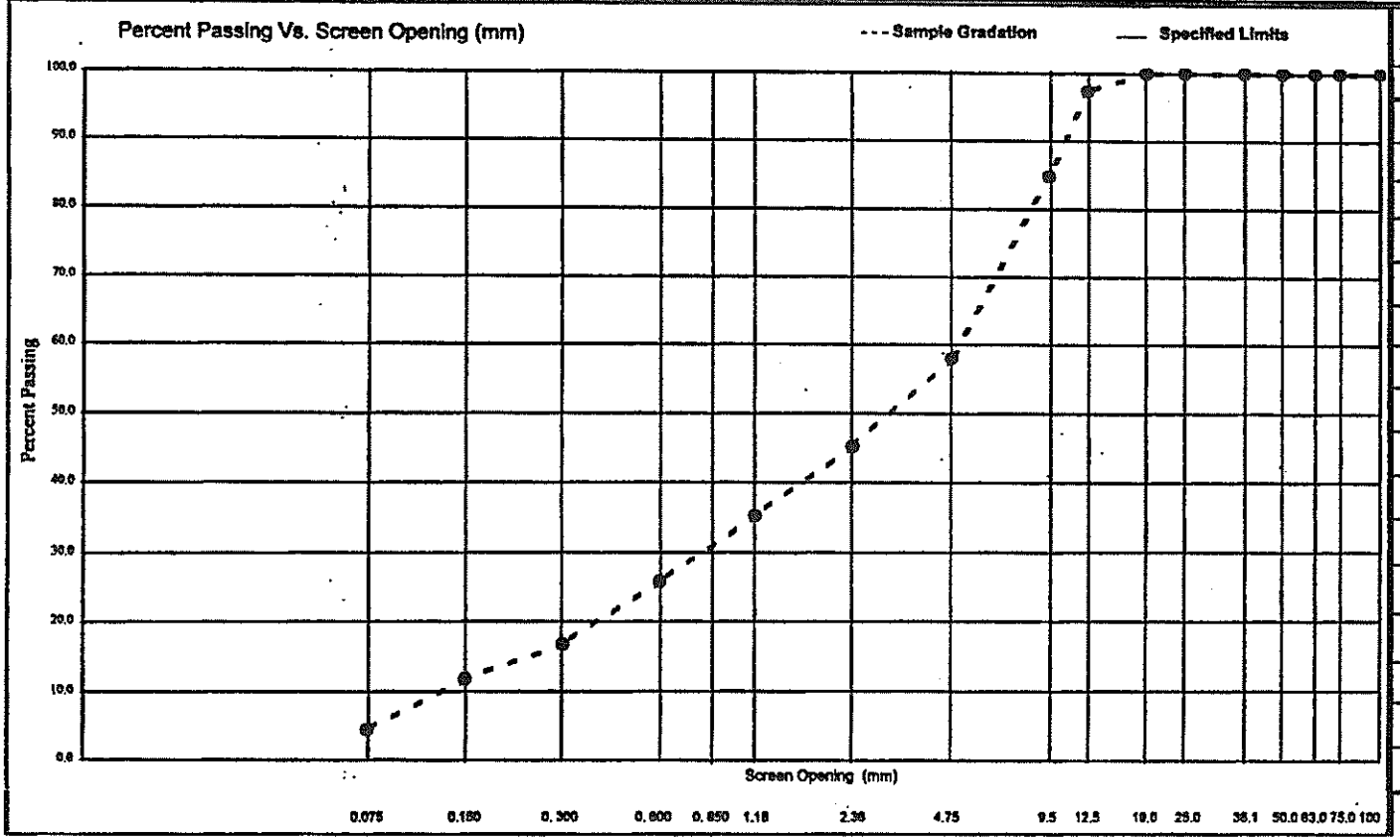
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-70 @ 9'-10'
Specified Limits:

Sampled by: CB Date: 12-Jun-99
Tested by: EA Date: 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	97.3		
9.50	84.8		
4.75	58.0		
2.36	45.2		
1.180	35.1		
0.600	25.8		
0.300	16.7		
0.150	11.8		
0.075	4.4		

Remarks:

Gravel: 42.0 **Sand:** 53.6 **Fines:** 4.4 Moisture % 13.0

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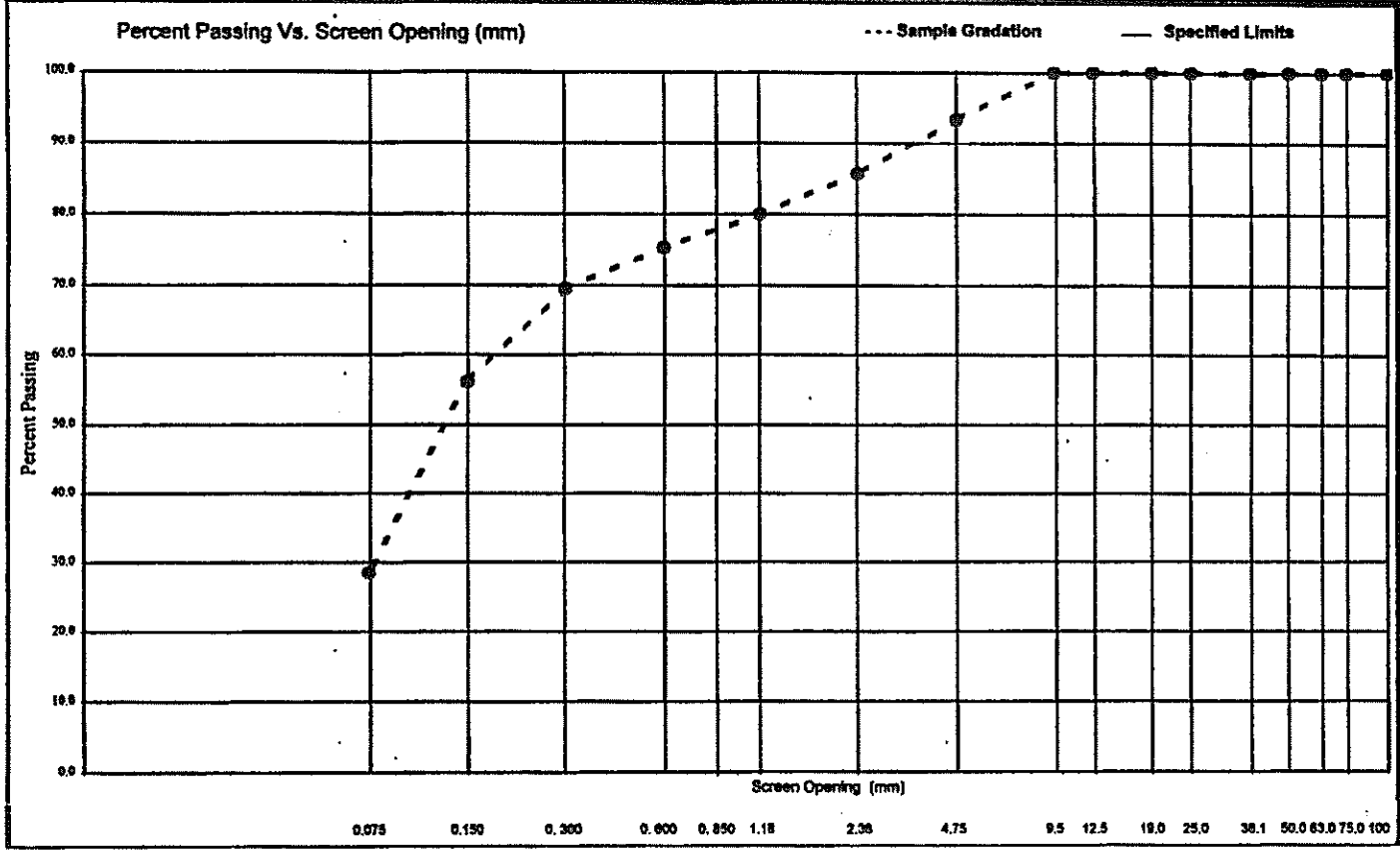
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Sand - Silty, trace Gravel
Sample No:
Source: BH5-71 @ 0.5'-1.5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	93.3		
2.36	85.7		
1.180	80.0		
0.600	75.2		
0.300	69.5		
0.150	56.2		
0.075	28.6		

Remarks:

Gravel: 6.7 **Sand:** 64.8 **Fines:** 28.6 Moisture % 18.6

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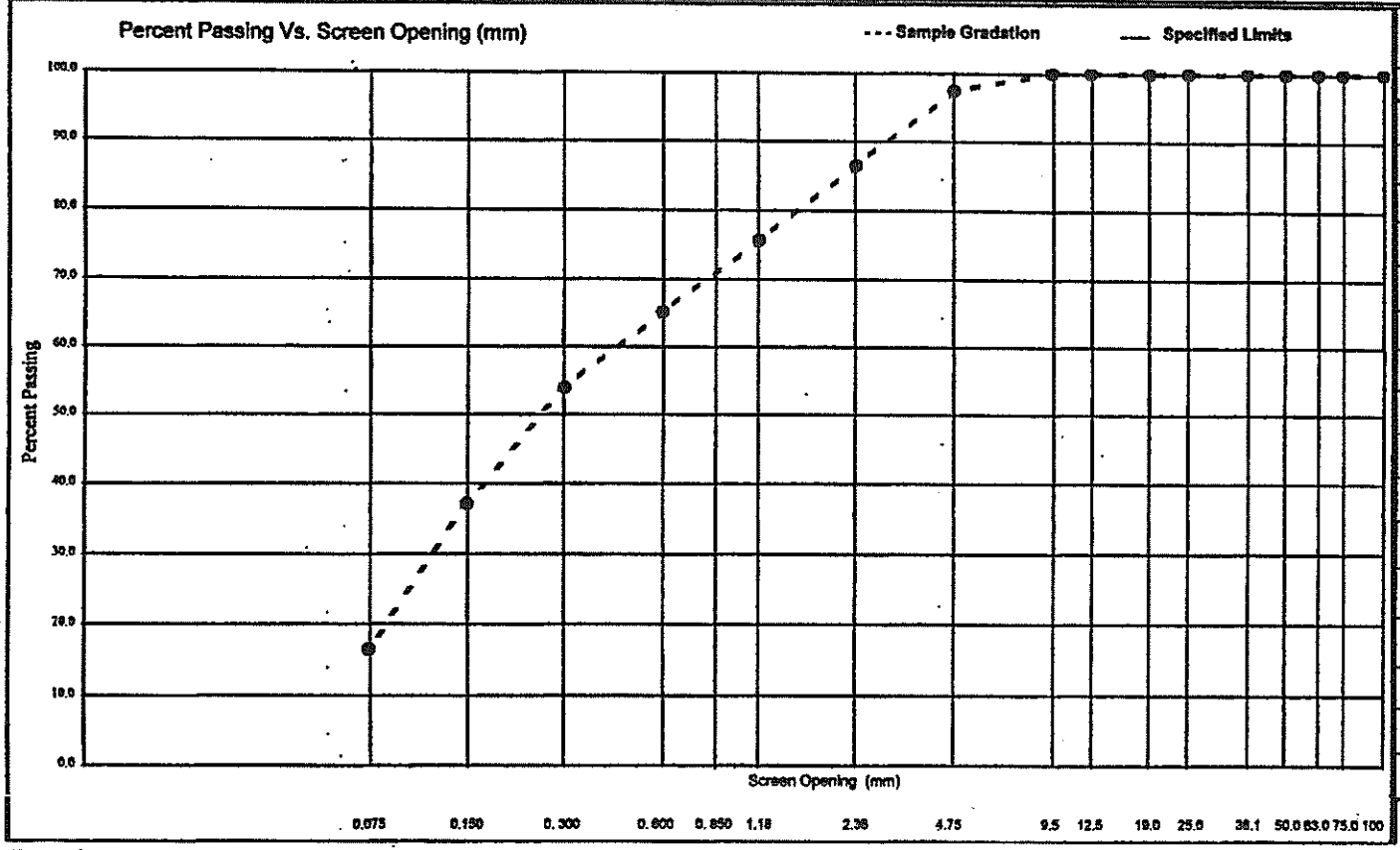
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Sand - some Silt, trace Gravel
Sample No:
Source: BH5-72 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	97.4		
2.36	86.5		
1.180	75.7		
0.600	65.2		
0.300	53.9		
0.150	37.1		
0.075	16.5		

Remarks:

Gravel: 2.6 **Sand:** 80.9 **Fines:** 16.5 **Moisture %** 28.6

Reviewed by:

BH5-72 @ 4'-5'

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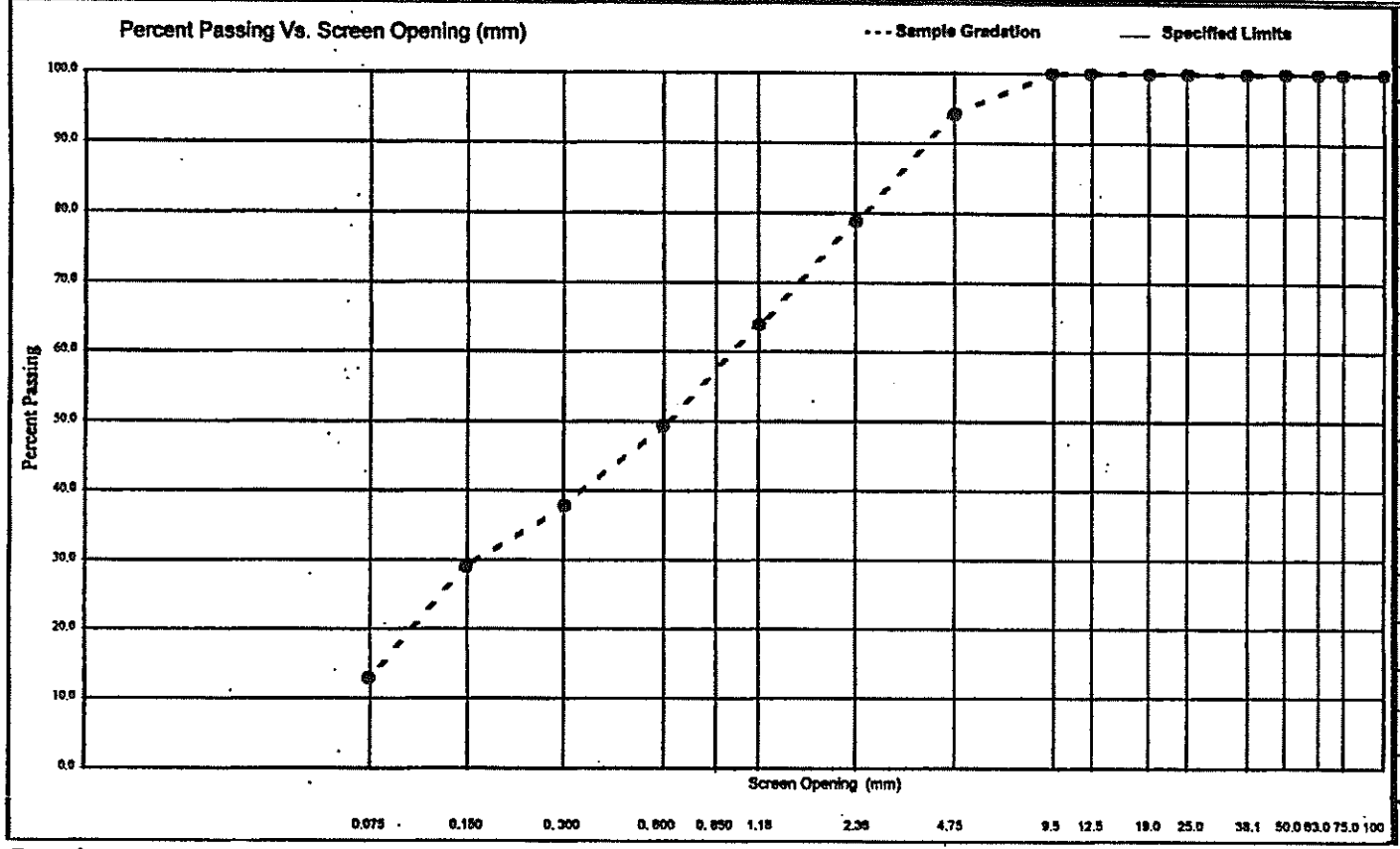
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Sand - some Silt, trace Gravel
Sample No:
Source: BH5-73 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	94.2		
2.36	78.8		
1.180	63.9		
0.600	49.4		
0.300	37.8		
0.150	29.0		
0.075	12.9		

Remarks:

Gravel: 5.8 **Sand:** 81.3 **Fines:** 12.9 Moisture % 23.5

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Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 15-Jul-99

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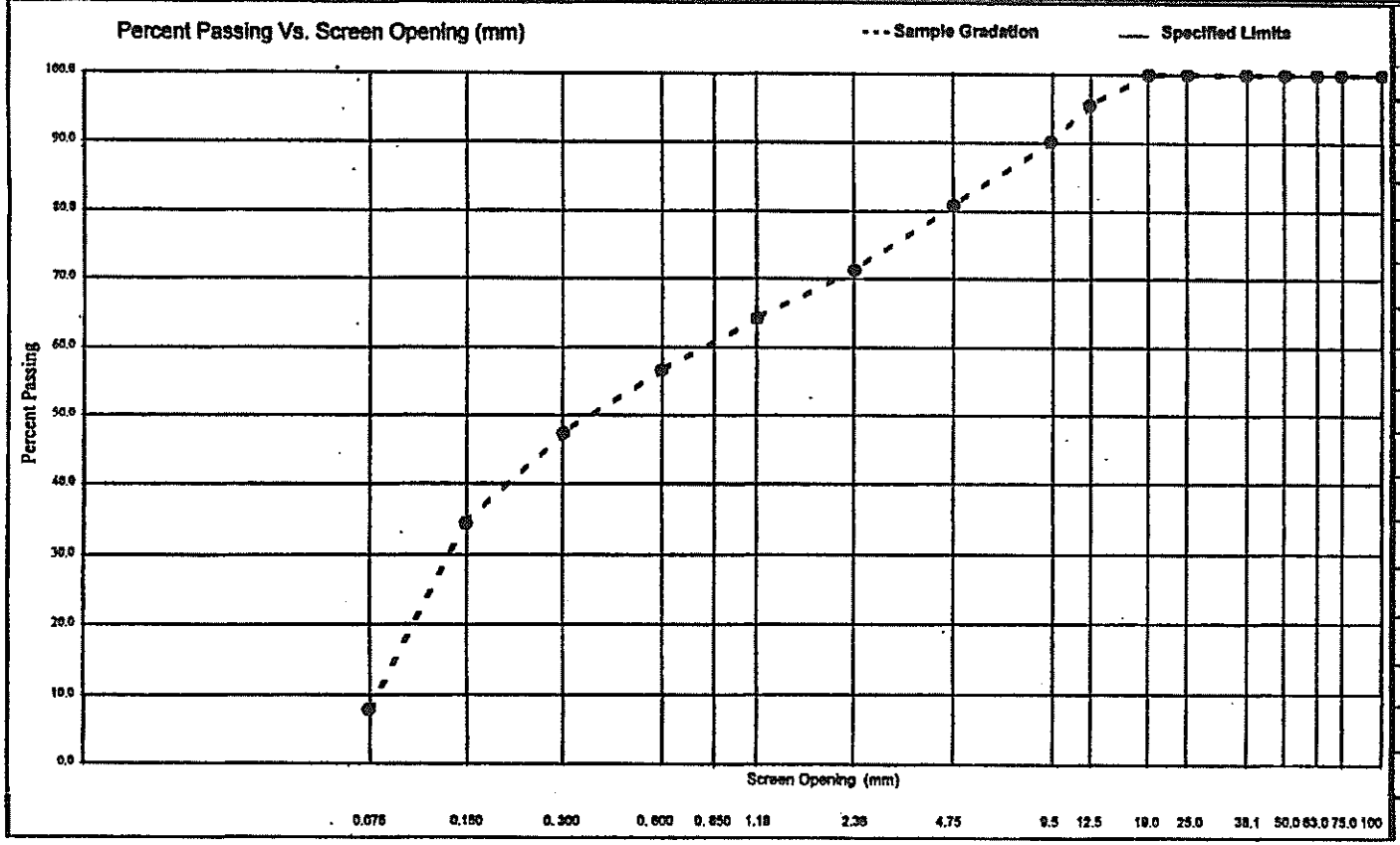
Type of Sample: Sand - some Gravel, trace Silt
Sample No:
Source: BH5-74 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	95.5		
9.50	90.1		
4.75	80.8		
2.36	71.3		
1.180	64.2		
0.600	56.6		
0.300	47.3		
0.150	34.4		
0.075	7.9		

Remarks:

Gravel: 19.2 **Sand:** 73.0 **Fines:** 7.9 Moisture % 18.6

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Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Sand and Gravel - trace Clay
Sample No:
Source: BH5-75 @ 3'-4'
Specified Limits:

Sampled by: CB **Date:** 12-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	91.8		
12.5	82.8		
9.50	77.0		
4.75	54.9		
2.36	44.5		
1.180	36.5		
0.600	27.5		
0.300	20.3		
0.150	13.5		
0.075	5.9		

Remarks:

Gravel: 45.1 **Sand:** 49.0 **Fines:** 5.9 Moisture % 24.3

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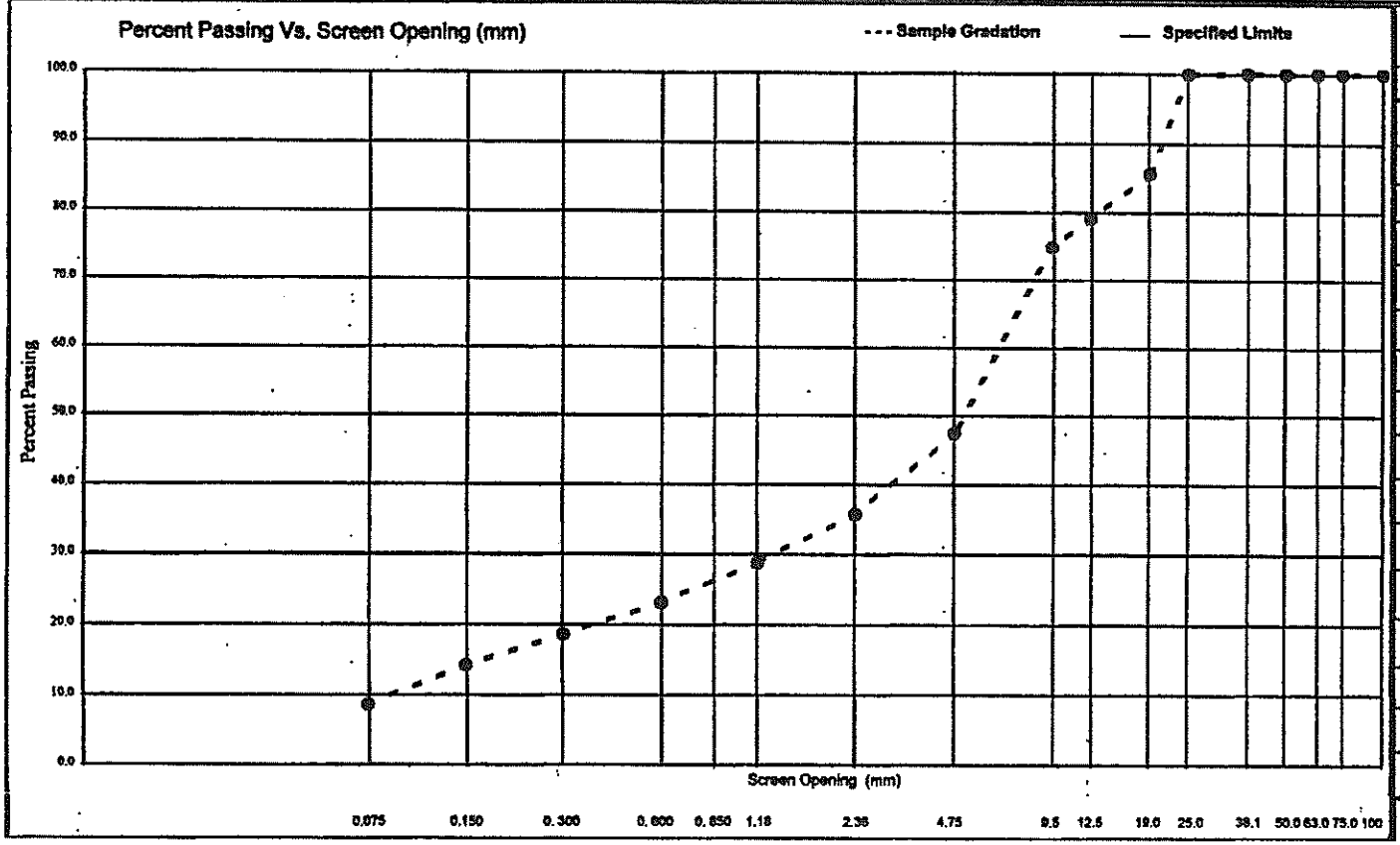
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-76 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 13-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	85.6		
12.5	79.1		
9.50	74.9		
4.75	47.5		
2.36	35.7		
1.180	28.8		
0.600	23.2		
0.300	18.6		
0.150	14.2		
0.075	8.6		

Remarks:

Gravel: 52.5 **Sand:** 38.8 **Fines:** 8.6 Moisture % 8.4

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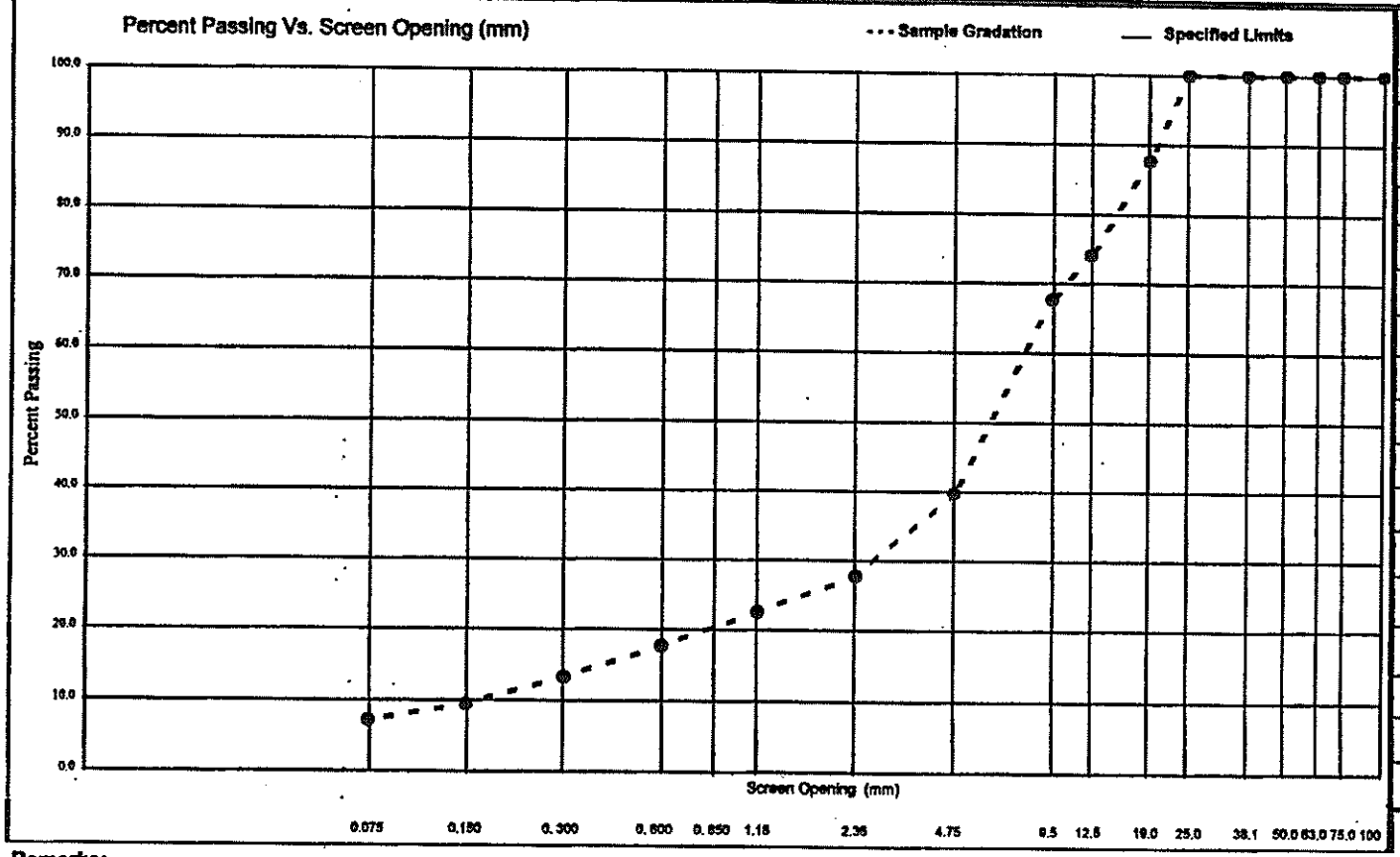
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-78 @ 3.5'-4.5'
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 13-Jun-99
Date: 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	87.6		
12.5	74.1		
9.50	67.7		
4.75	39.7		
2.36	27.8		
1.180	22.5		
0.600	17.7		
0.300	13.3		
0.150	9.4		
0.075	7.1		

Remarks:

Gravel: 60.3 **Sand:** 32.6 **Fines:** 7.1 **Moisture %** 6.2

Reviewed by:

BH5-77 @ 0.5'-1.5'

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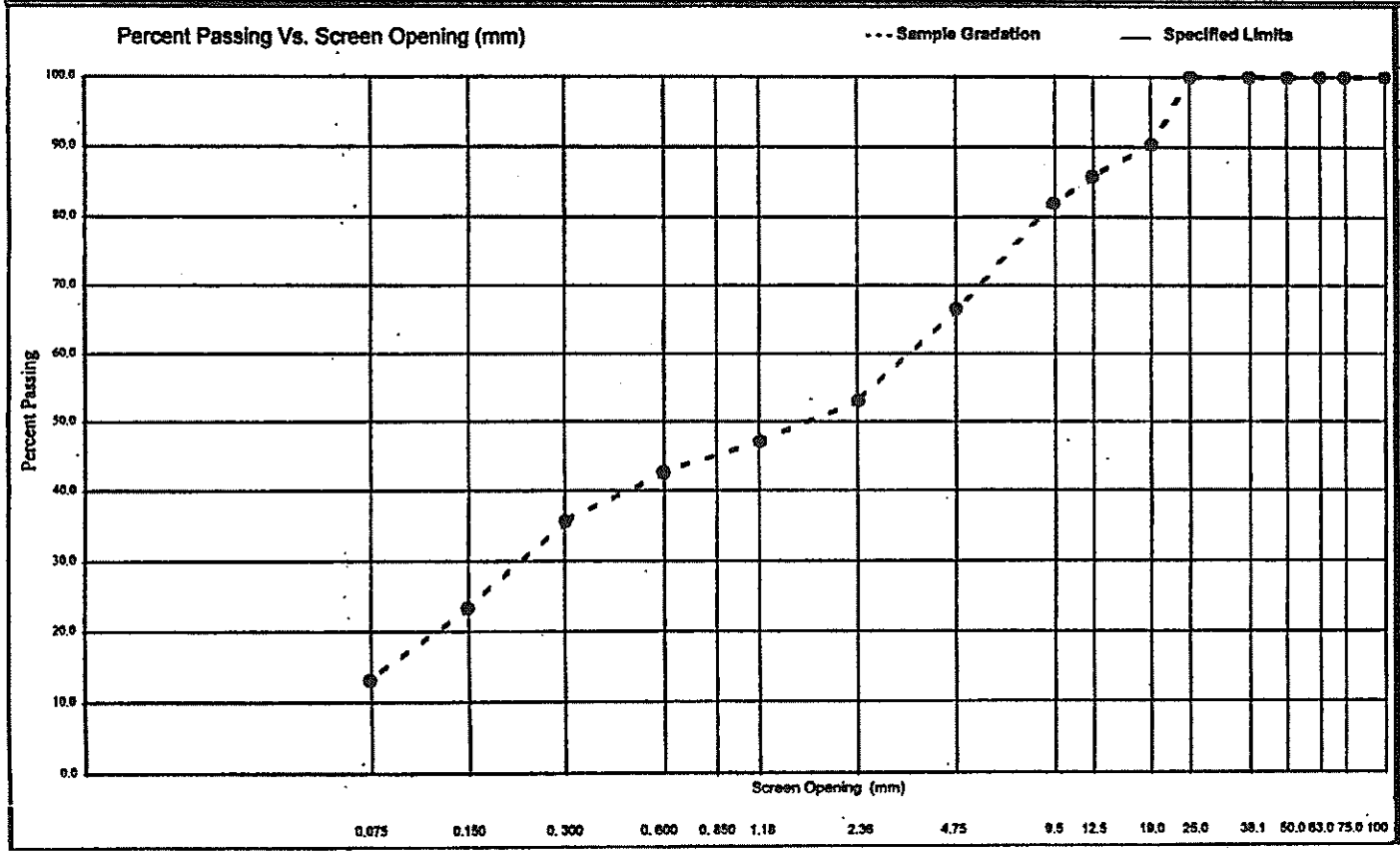
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Sand - Gravely, some Silt
Sample No:
Source: BH5-79 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 13-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	90.4		
12.5	85.8		
9.50	81.9		
4.75	66.5		
2.36	53.0		
1.180	47.0		
0.600	42.4		
0.300	35.7		
0.150	23.4		
0.075	13.0		

Remarks:

Gravel: 33.5 **Sand:** 53.5 **Fines:** 13.0 Moisture % 9.6

Reviewed by:

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Vanc (604) 45
Port Coquitlam (604) 945-9939
loops 3
Williams Lake (250) 398-8788
A yd 9-8
Terrace (250) 638-1090

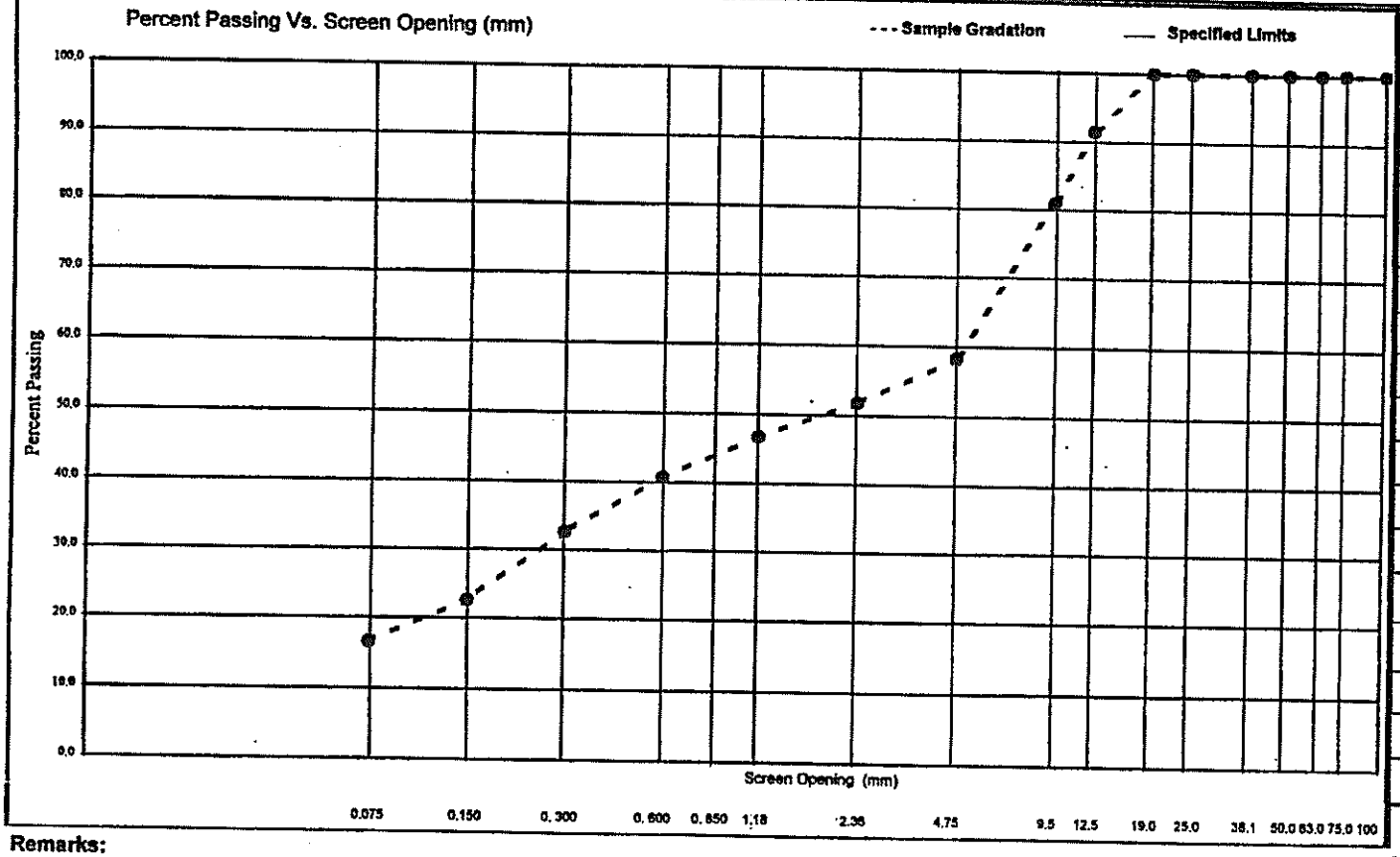
Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Gravel and Sand - some Silt
Sample No:
Source: BH5-81 @ 0.5'-1.5'
Specified Limits:

Sampled by: CB
Tested by: EA
Date: 13-Jun-99
Date: 15-Jul-99
Native Fill
Imported Fill
Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	91.5		
9.50	80.9		
4.75	58.3		
2.36	51.8		
1.180	46.7		
0.600	40.7		
0.300	32.7		
0.150	22.6		
0.075	16.6		

Remarks:

Gravel: 41.7 **Sand:** 41.7 **Fines:** 16.6 Moisture % 21.7

Reviewed by:

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Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 15-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
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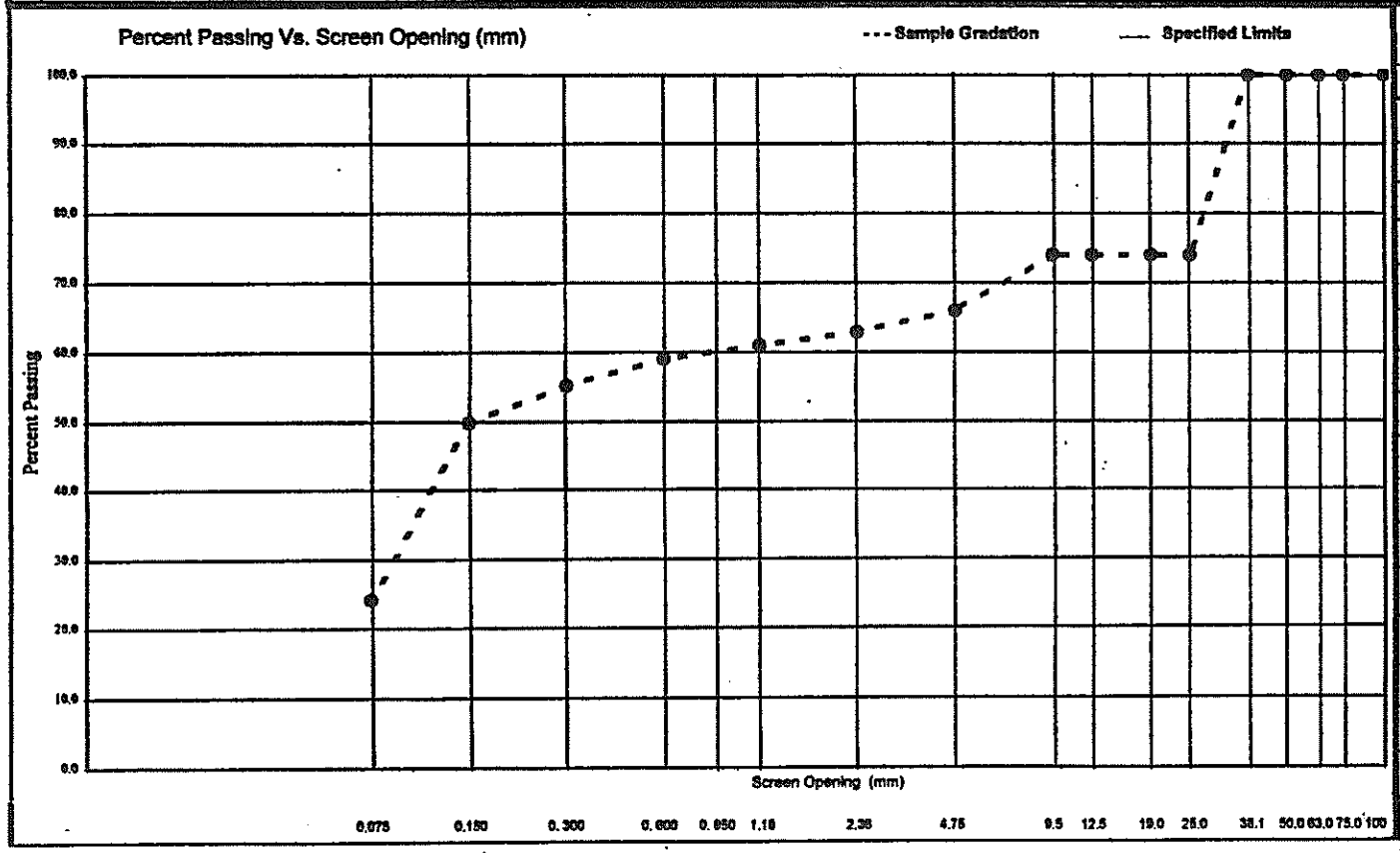
Type of Sample: Sand - Gravely, some Silt, some Clay
Sample No:
Source: BH5-82 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 13-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	73.9		
19.0	73.9		
12.5	73.9		
9.50	73.9		
4.75	65.9		
2.36	62.8		
1.180	60.9		
0.600	59.0		
0.300	55.2		
0.150	49.8		
0.075	24.1		

Remarks:

Gravel: 34.1 **Sand:** 41.8 **Fines:** 24.1 **Moisture %** 11.8

Reviewed by:

BH5-81 @ 3'-4'.xls

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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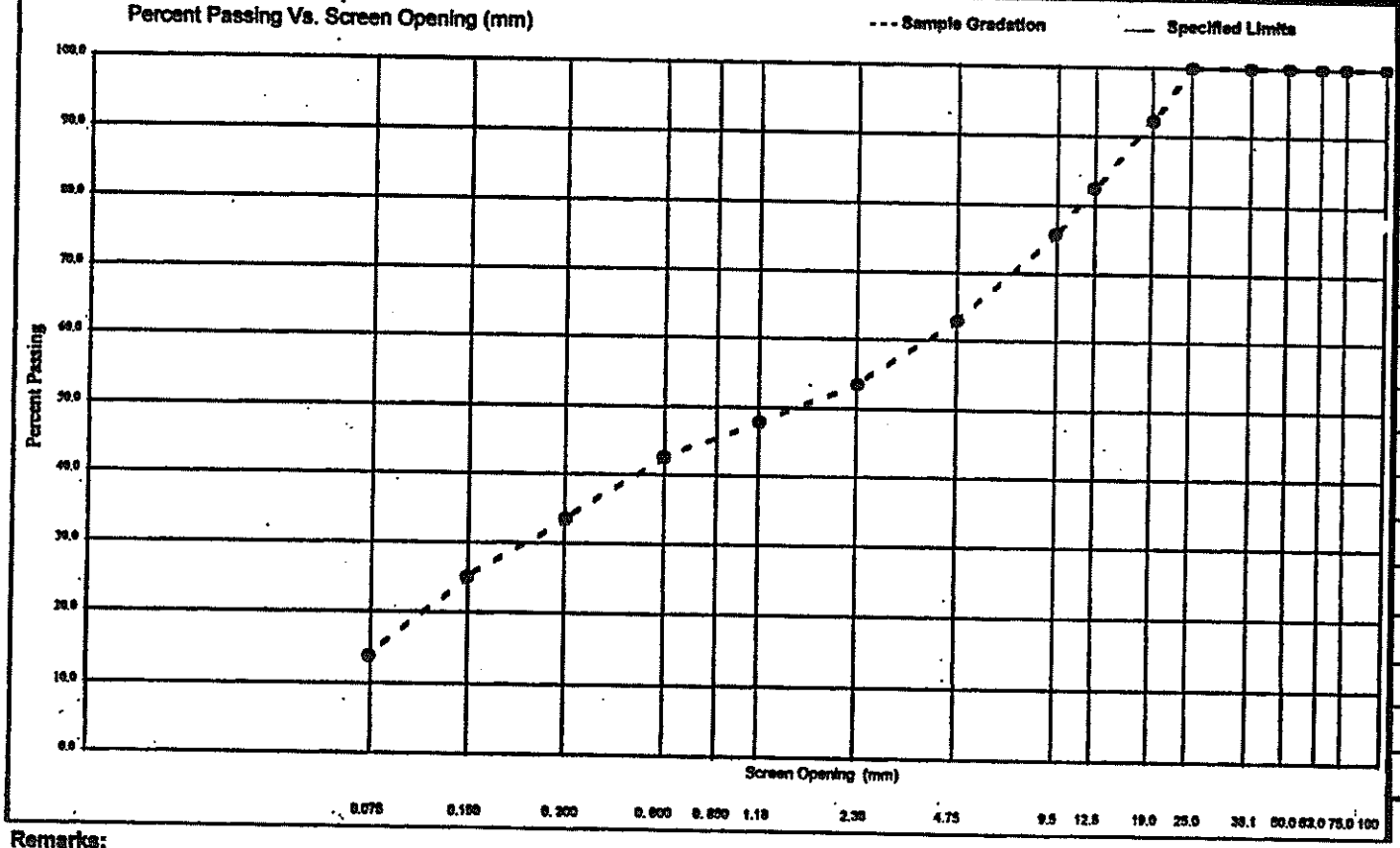
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Sand and Gravel, some Silt
Sample No:
Source: BH5-84 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 14-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	92.2		
12.5	82.5		
9.50	75.6		
4.75	62.8		
2.36	53.4		
1.180	47.8		
0.600	42.5		
0.300	33.4		
0.150	25.0		
0.075	13.8		

Remarks:

Gravel: 37.2 **Sand:** 49.1 **Fines:** 13.8 **Moisture %** 8.0

Reviewed by:

BH5-82 @ 4'-5'

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Port Coquitlam (604) 945-9939
Kamloops [illegible] 372 [illegible]
Williams Lake (250) 398-8788
Abbotsford [illegible] 59-64[illegible]
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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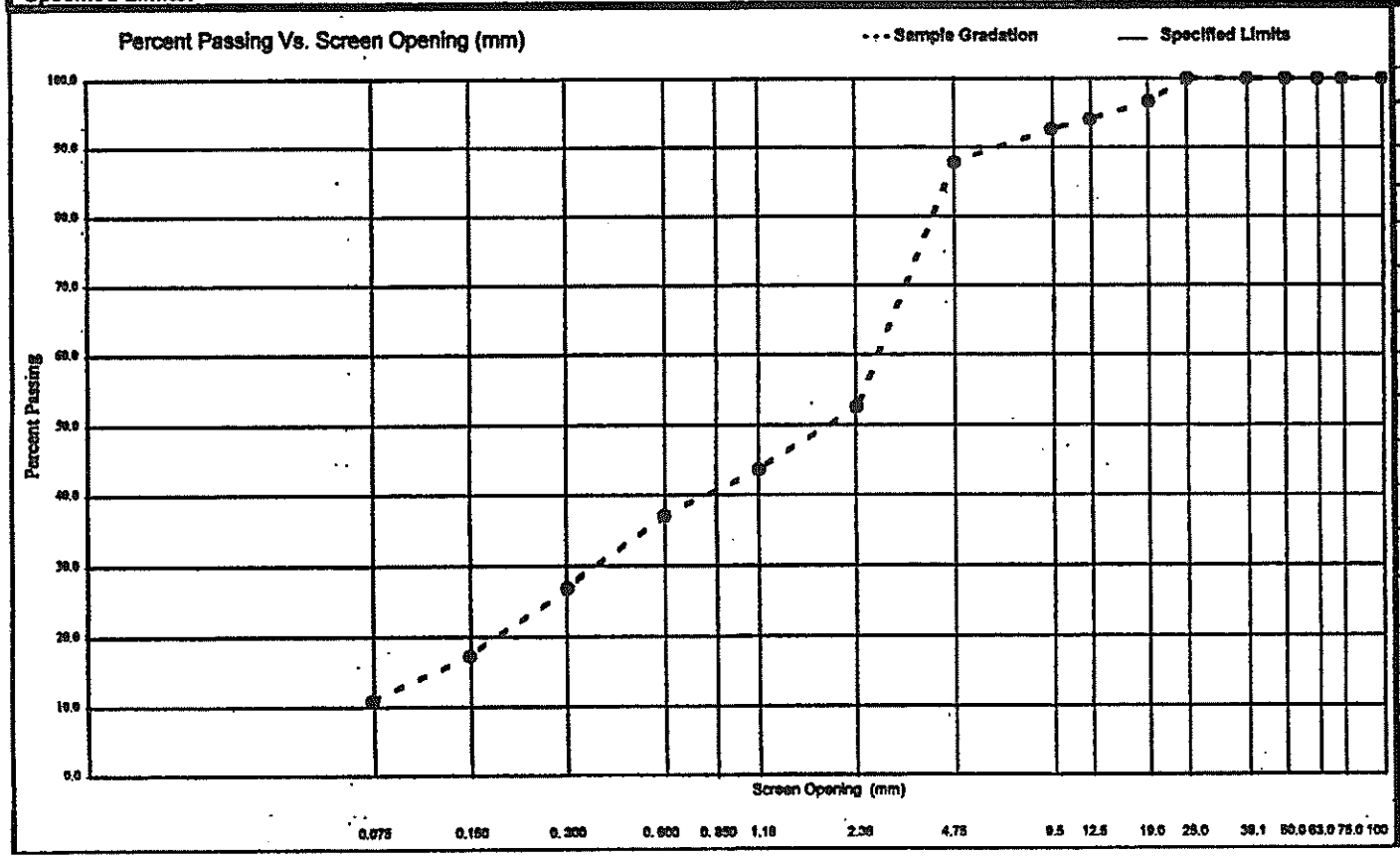
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 15-Jul-99

Type of Sample: Sand - some Gravel, some Silt
Sample No:
Source: BH5-85 @ 3'-4'
Specified Limits:

Sampled by: CB **Date:** 14-Jun-99
Tested by: EA **Date:** 15-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	96.7		
12.5	94.1		
9.50	92.7		
4.75	87.8		
2.36	52.5		
1.18	43.6		
0.600	37.0		
0.300	27.1		
0.150	17.3		
0.075	10.8		

Remarks:

Gravel: 12.2 **Sand:** 77.0 **Fines:** 10.8 **Moisture %** 3.4

Reviewed by:

BH5-84 @ 4'-5'

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Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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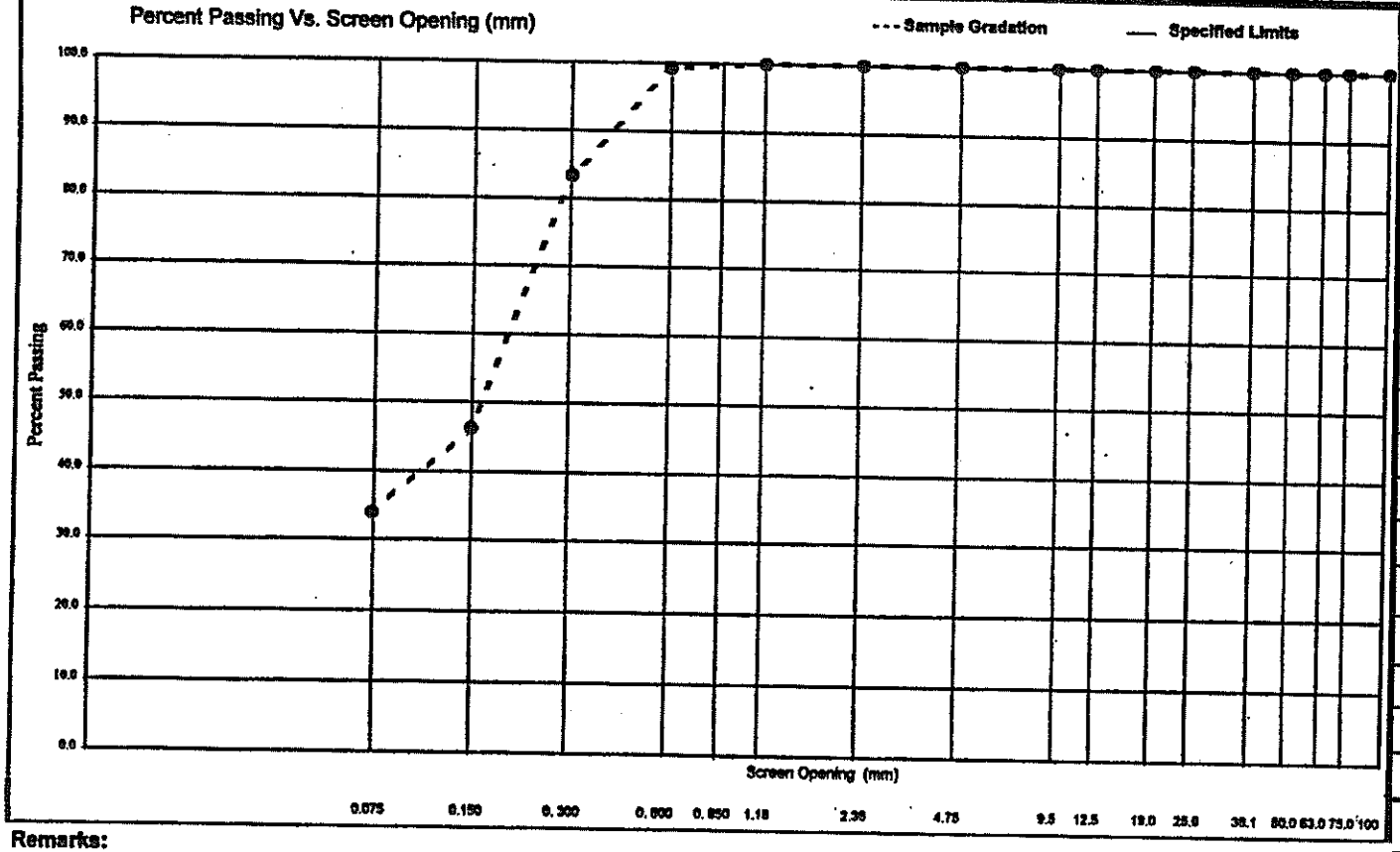
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 14-Jul-99

Type of Sample: Sand - Silty
Sample No:
Source: BH5-87 @ 4' - 5'
Specified Limits:

Sampled by: CB **Date:** 14-Jun-99
Tested by: EA **Date:** 14-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	100.0		
1.180	100.0		
0.600	99.2		
0.300	83.4		
0.150	46.2		
0.075	33.9		

Remarks:

Gravel: 0.0 **Sand:** 66.1 **Fines:** 33.9 **Moisture %** 14.6

Reviewed by:

BH5-87 @ 0.5'-1.5'.xls

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Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 13-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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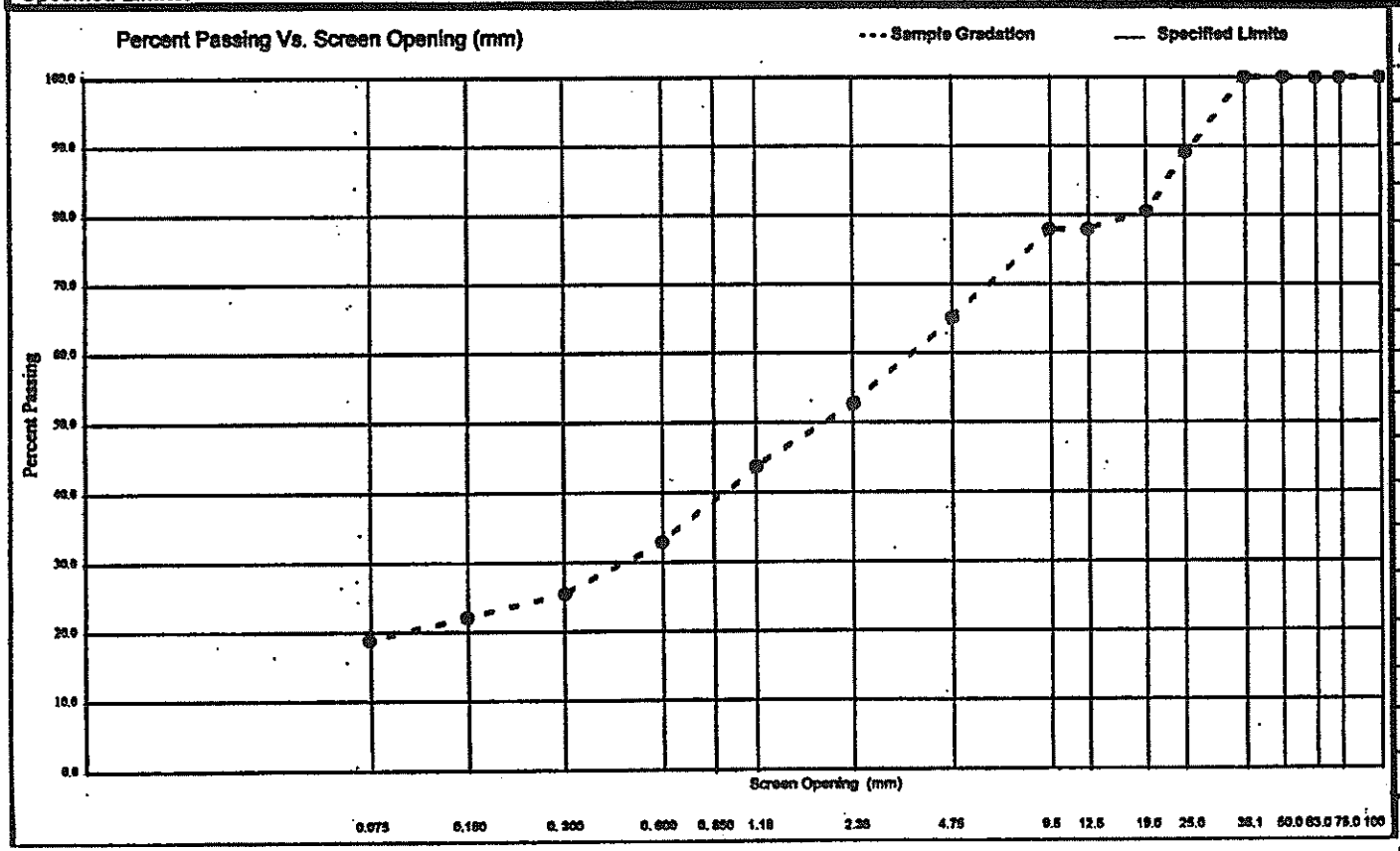
Type of Sample: Sand- Gravely, some Silt
Sample No:
Source: BH5-94 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 14-Jun-99
Tested by: EA **Date:** 13-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	89.1		
19.0	80.5		
12.5	77.9		
9.50	77.9		
4.75	65.1		
2.36	52.7		
1.180	43.7		
0.600	32.8		
0.300	25.5		
0.150	22.1		
0.075	18.8		

Remarks:

Gravel: 34.9 **Sand:** 46.3 **Fines:** 18.8 **Moisture %** 13.7

Reviewed by:

BH5-94 @ 4'-5'

Vancouver (6[illegible]-124 Port Coquitlam (604) 945-9939
Kamloops (250)[illegible]-21 Williams Lake (250) 398-8788
Abbotsford [illegible]) 859 Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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cc:
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Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 13-Jul-99

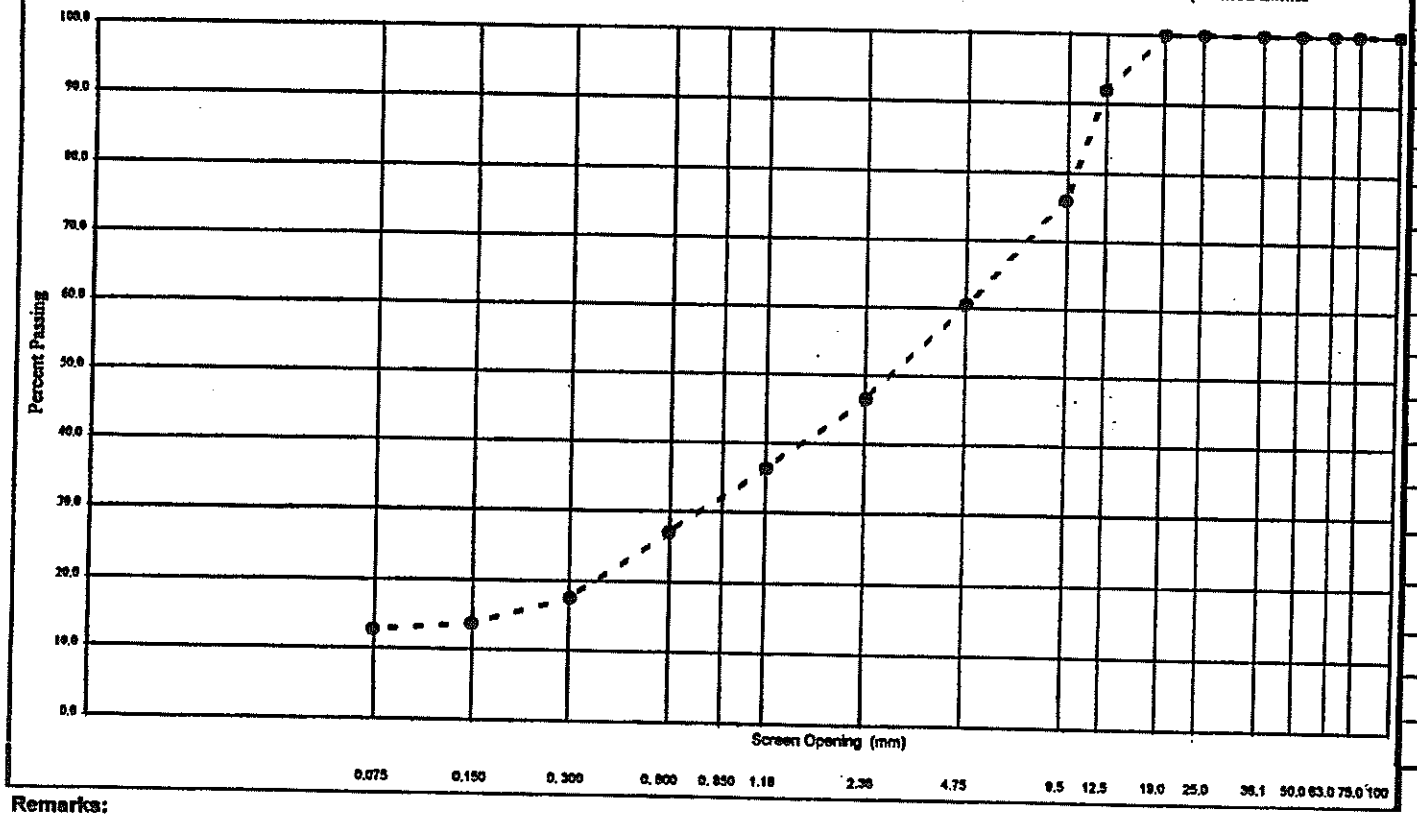
Type of Sample: Sand and Gravel - some Silt
Sample No:
Source: BH5-96 @ 4'-5'
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 14-Jun-99
Date: 13-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	91.9		
9.50	75.9		
4.75	60.5		
2.36	46.5		
1.180	36.2		
0.600	27.0		
0.300	17.6		
0.150	13.8		
0.075	12.7		

Remarks:

Gravel: 39.5 Sand: 47.8 Fines: 12.7 Moisture % 6.6

Reviewed by:

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Williams Lake (250) 398-8788
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Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 13-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES

cc:
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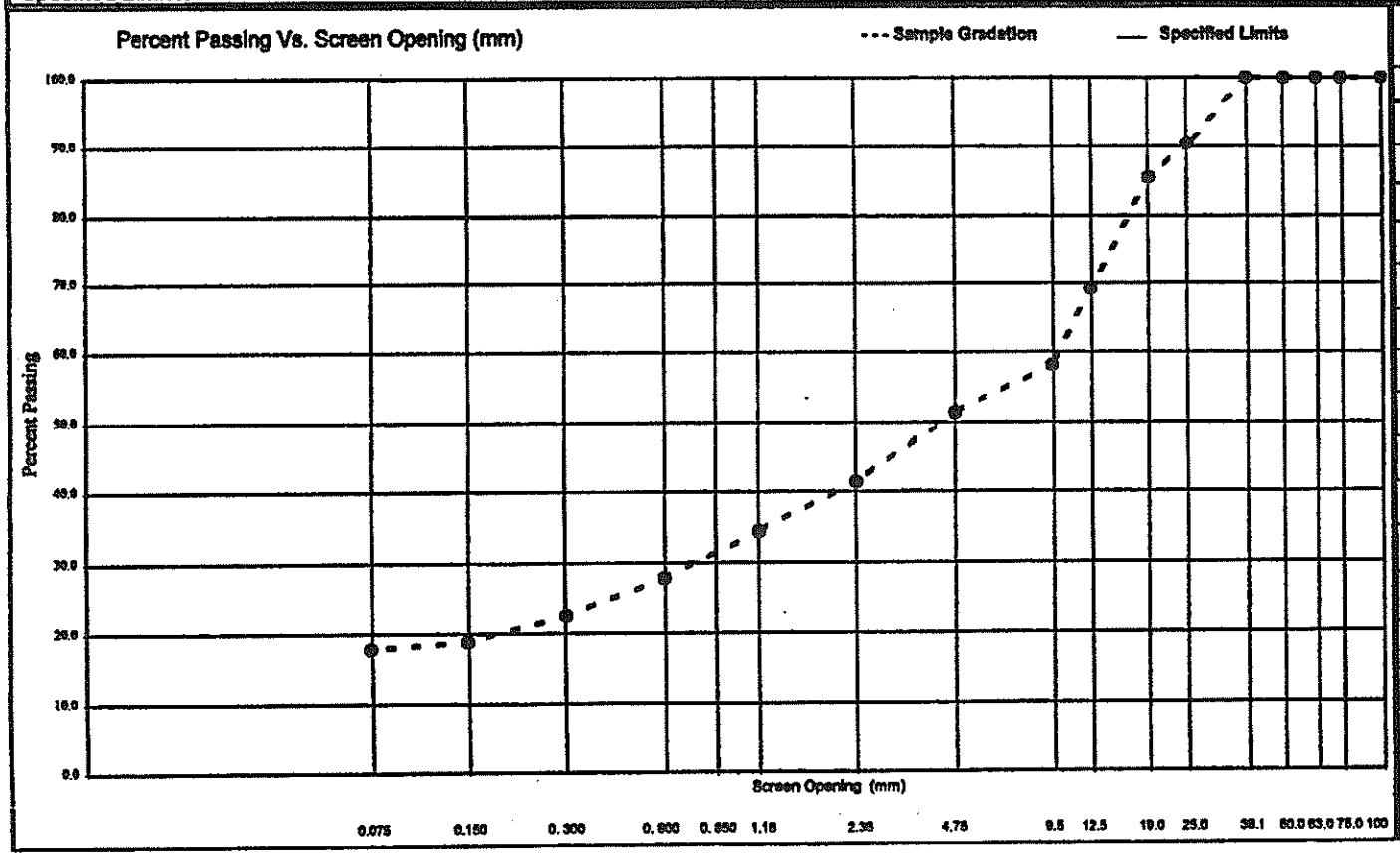
Type of Sample: Gravel- Sandy, some Silt
Sample No:
Source: BH5-100 @ 0'-2'
Specified Limits:

Sampled by: CB **Date:** 14-Jun-99
Tested by: EA **Date:** 13-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	90.5		
19.0	85.5		
12.5	69.2		
9.50	58.1		
4.75	51.4		
2.36	41.4		
1.180	34.3		
0.600	27.8		
0.300	22.6		
0.150	18.8		
0.075	17.8		

Reviewed by:

Remarks:

Gravel: 48.6 **Sand:** 33.6 **Fines:** 17.8 **Moisture %** 6.3

BH5-98 @ 4'-5'

Terra Engineering Ltd
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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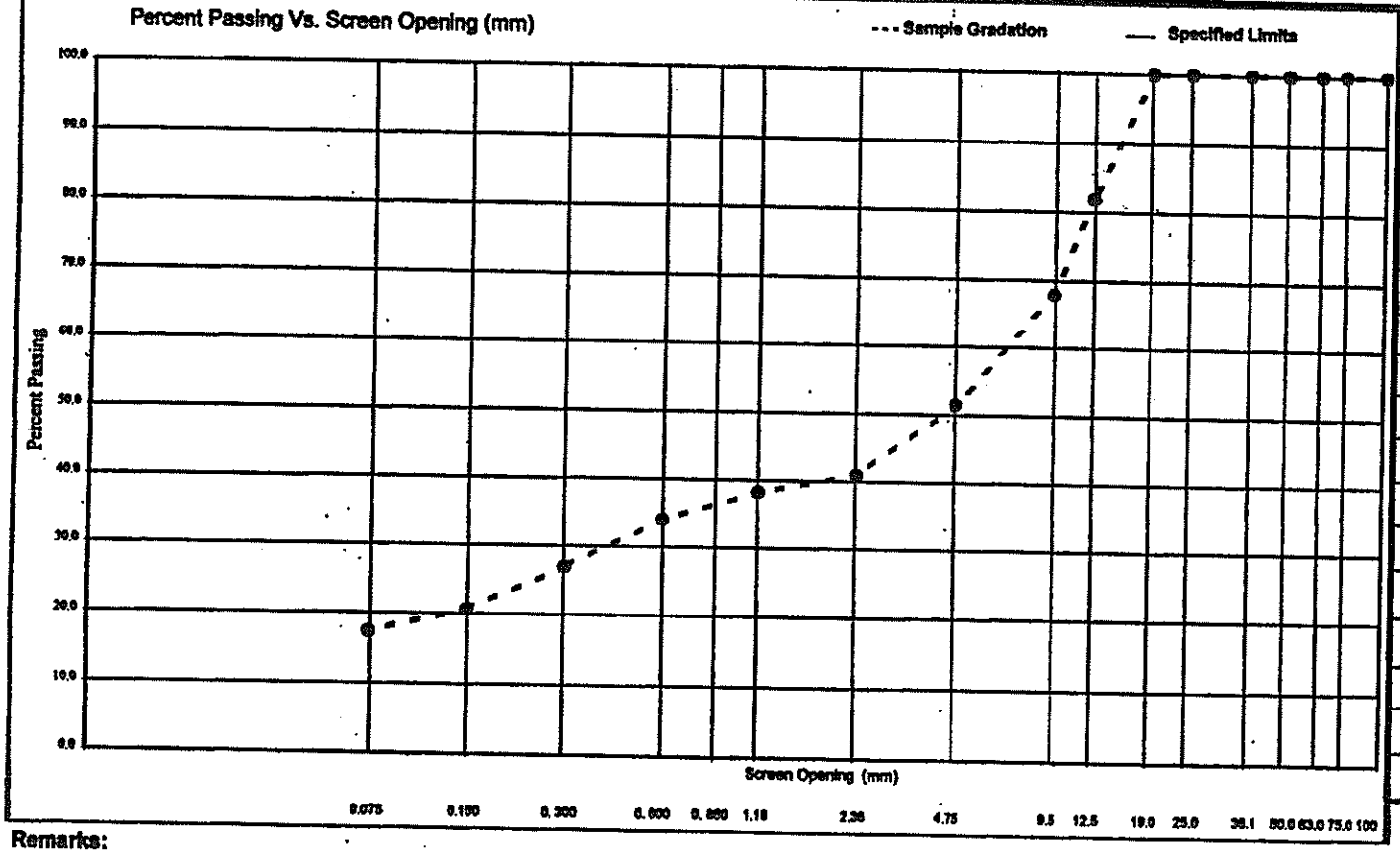
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 13-Jul-99

Type of Sample: Gravel- Sandy, some Silt
Sample No:
Source: BH5-103 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 14-Jun-99
Tested by: EA **Date:** 13-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	81.8		
9.50	67.8		
4.75	51.5		
2.36	40.9		
1.180	38.3		
0.600	34.0		
0.300	26.9		
0.150	20.6		
0.075	17.4		

Remarks:

Gravel: 48.5 **Sand:** 34.0 **Fines:** 17.4 **Moisture %** 7.6

Reviewed by:

BH5-100 @ 0'-2'

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Williams Lake (250) 398-8788
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Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 13-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
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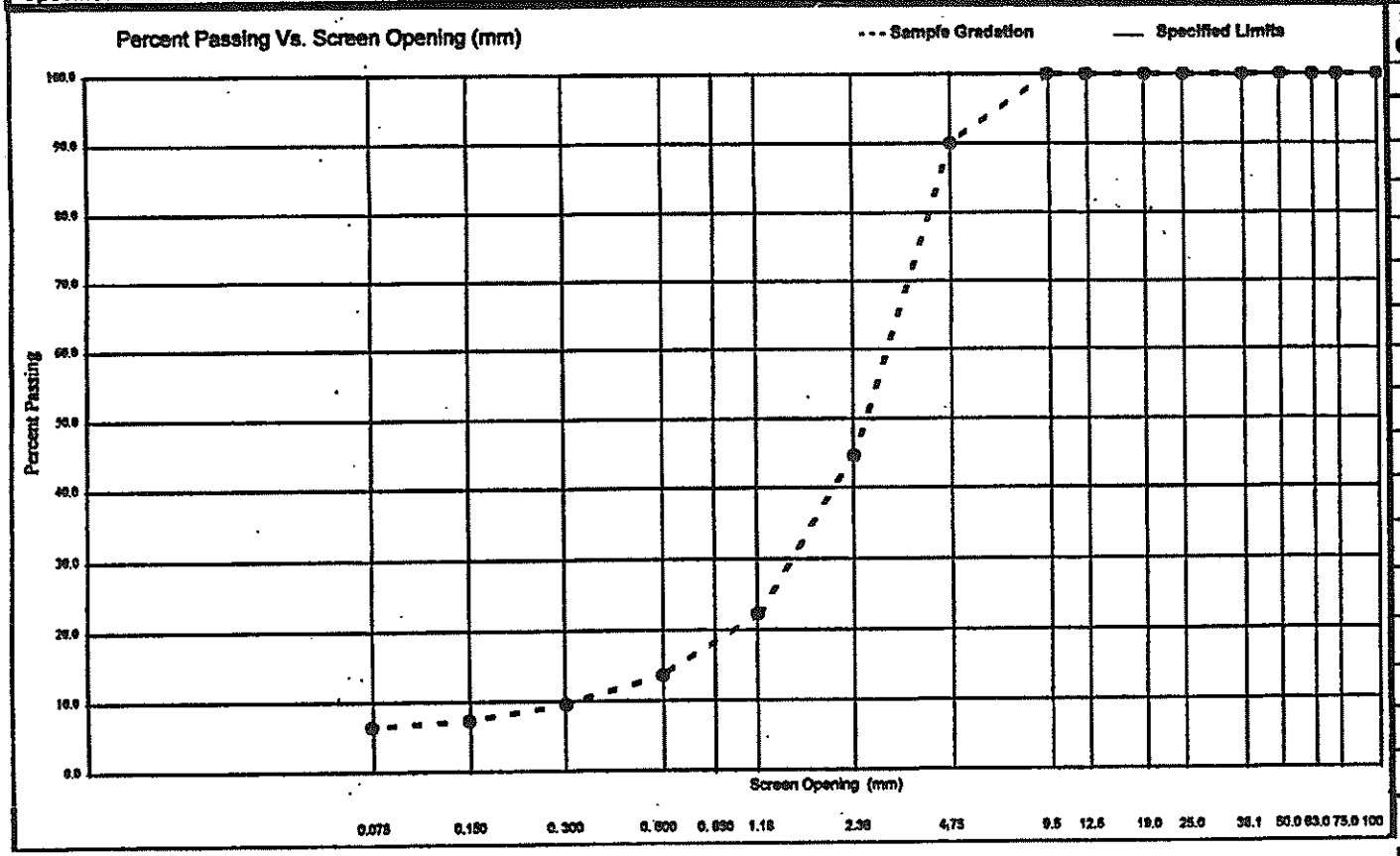
cc:

Type of Sample: Sand- some Gravel, trace Silt
Sample No:
Source: BH5-107 @ 3'- 4'
Specified Limits:

Sampled by: CB **Date:** 16-Jun-99
Tested by: EA **Date:** 13-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	90.0		
2.36	44.5		
1.180	22.3		
0.600	13.6		
0.300	9.5		
0.150	7.3		
0.075	6.4		

Remarks:

Gravel: 10.0 **Sand:** 83.6 **Fines:** 6.4 **Moisture %** 6.0

Reviewed by:

BH5-103 @ 4'-5'

Sperling Hansen Engineering Ltd.
Vanc (604) 45
Port Coquitlam (604) 945-9939
loops 371
Williams Lake (250) 398-8788
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Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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cc:
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Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 13-Jul-99

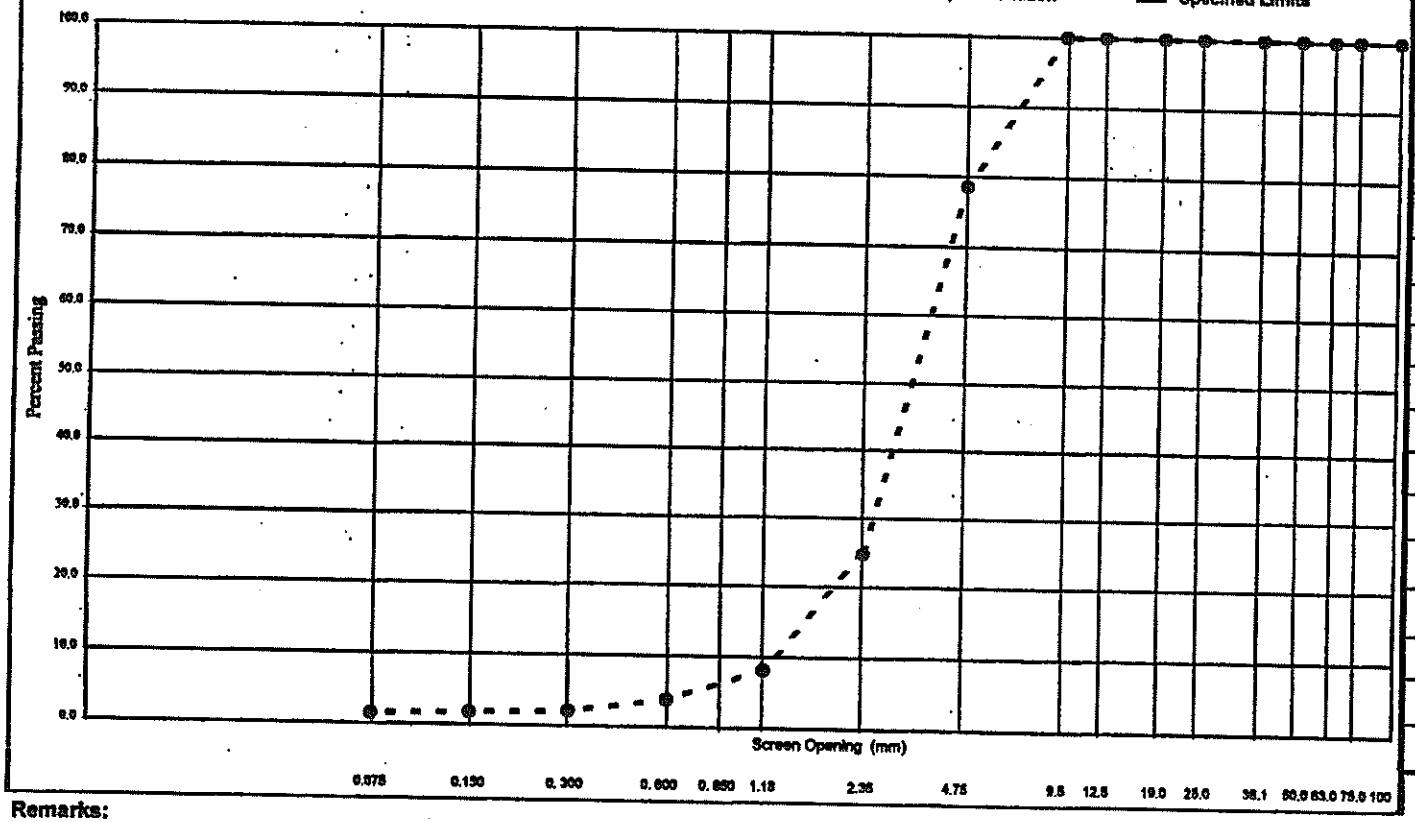
Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-108 @ 8.5'-9.5'
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 17-Jun-99
Date: 13-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	78.5		
2.36	24.7		
1.180	8.1		
0.600	3.8		
0.300	2.0		
0.150	1.7		
0.075	1.5		

Remarks:

Gravel: 21.5 **Sand:** 77.0 **Fines:** 1.5 Moisture % 0.6

Reviewed by:

BH5-107 @ 3'- 4'

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Williams Lake (250) 398-8788
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Report on: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 13-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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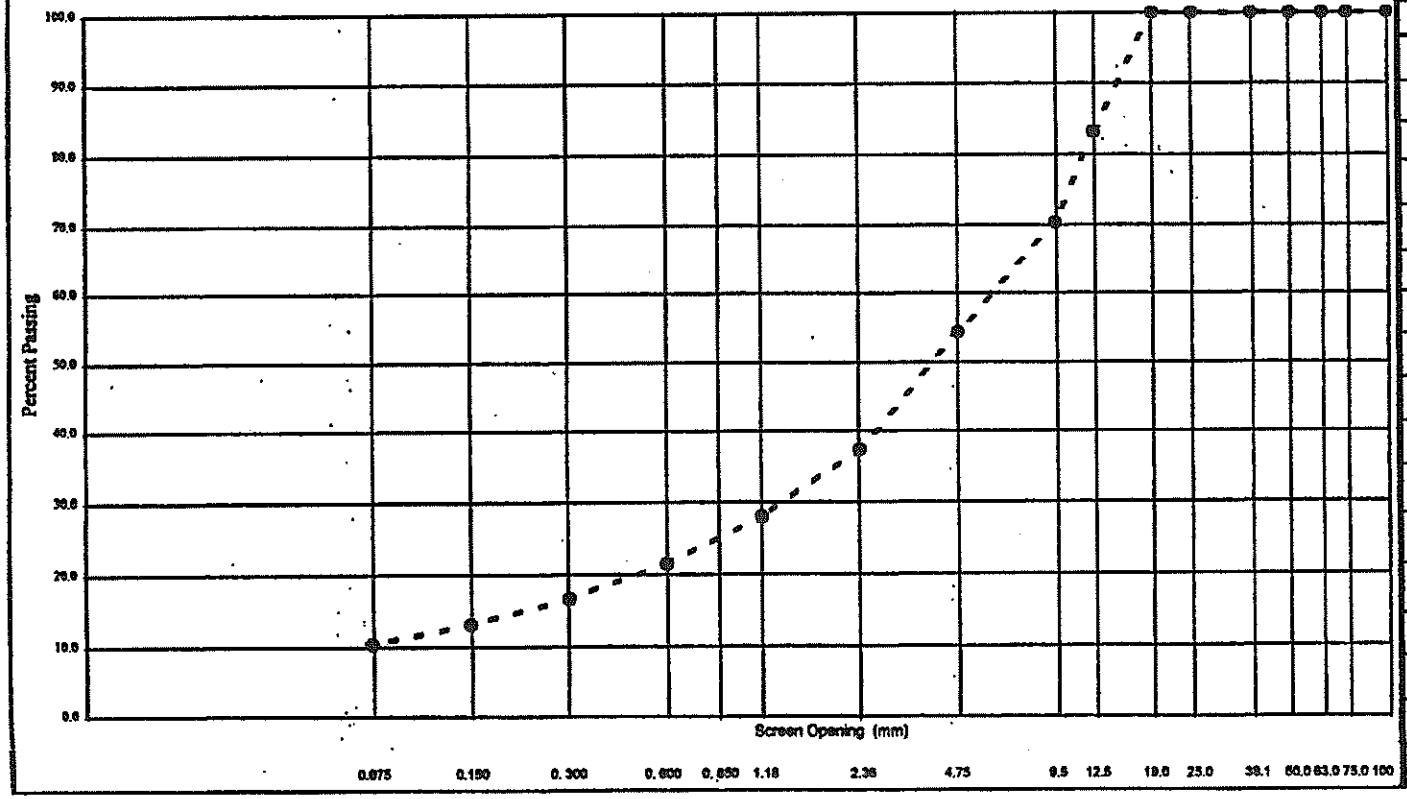
Type of Sample: Gravel and Sand - some Silt
Sample No:
Source: BH5-110 @ 9'-10'
Specified Limits:

Sampled by: CB **Date:** 17-Jun-99
Tested by: EA **Date:** 13-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)

--- Sample Gradation —— Specified Limits



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	83.2		
9.50	70.3		
4.75	54.3		
2.36	37.3		
1.180	28.0		
0.600	21.5		
0.300	16.6		
0.150	13.1		
0.075	10.3		

Remarks:

Gravel: 45.7 **Sand:** 44.0 **Fines:** 10.3 Moisture % 5.8

Reviewed by:

BH5-110 @ 9'-10'

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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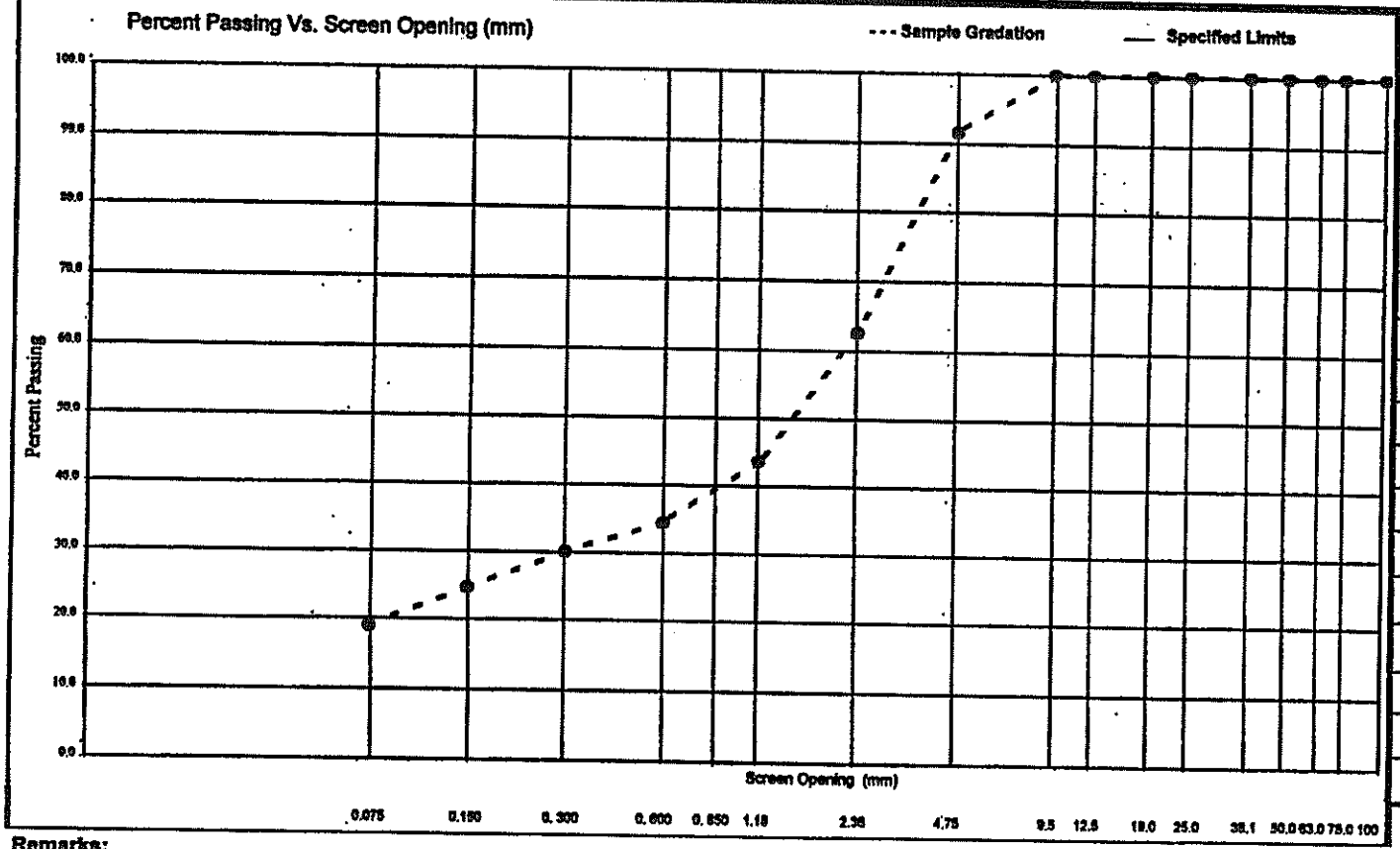
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 12-Jul-99

Type of Sample: Sand - some Silt, trace Gravel
Sample No:
Source: BH5-115 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 17-Jun-99
Tested by: EA **Date:** 12-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	91.6		
2.36	62.6		
1.180	43.6		
0.600	34.4		
0.300	30.1		
0.150	24.7		
0.075	19.0		

Remarks:

Gravel: 8.4 **Sand:** 72.6 **Fines:** 19.0 **Moisture %** 1.3

Reviewed by:

Terra Engineering Ltd.
*Vancouver (604) 874-1245
Port Coquitlam (604) 945-9939
*Kamloops (250) 372-5321
Williams Lake (250) 398-8788
Abbotsford (604) 859-8403
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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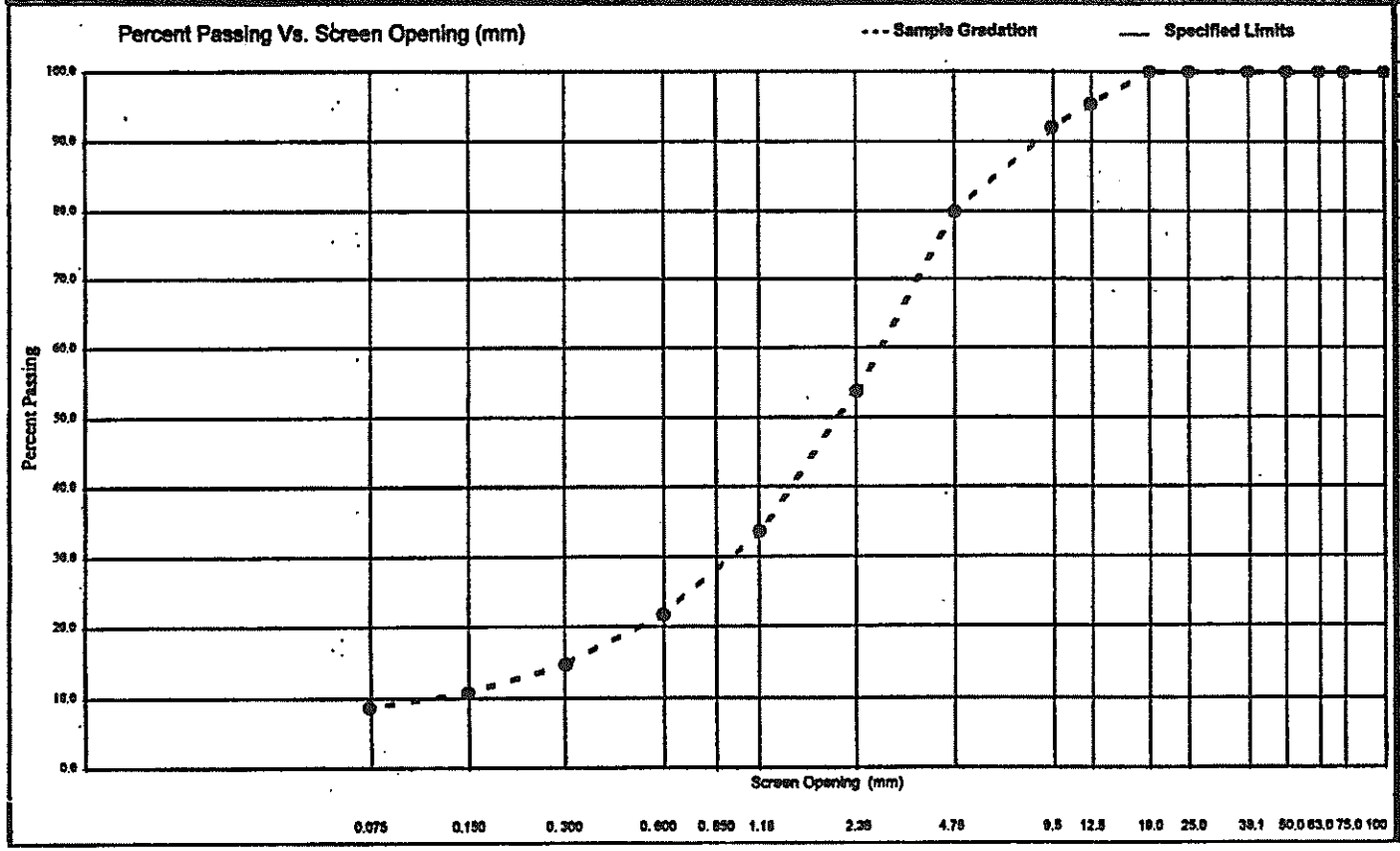
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 07-Jul-99

Type of Sample: Sand - Gravelly, trace Silt
Sample No:
Source: BH5-120 @ 5'-6'
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 07-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	95.3		
9.50	92.0		
4.75	79.9		
2.36	53.7		
1.180	33.6		
0.600	21.7		
0.300	14.7		
0.150	10.7		
0.075	8.7		

Remarks:

Gravel: 20.1 **Sand:** 71.2 **Fines:** 8.7 **Moisture %** 2.5

Reviewed by:

BH5-120 @ .5-1.5

Terra Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 08-Jul-99

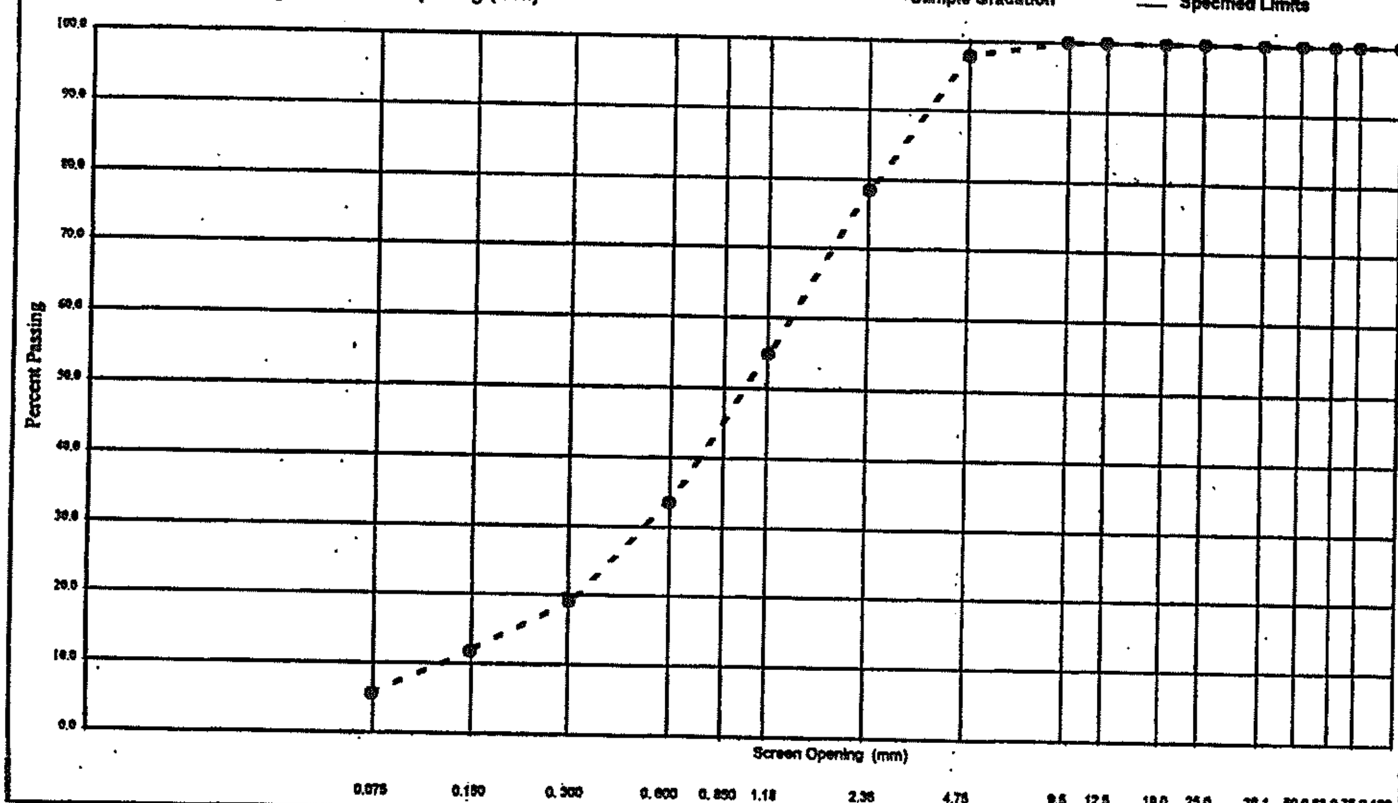
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Type of Sample: Sand - trace Silt and Gravel
Sample No:
Source: BH5-120@6.5'-7.5'
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 08-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	97.9		
2.36	78.5		
1.180	54.8		
0.600	33.4		
0.300	19.1		
0.150	11.7		
0.075	5.6		

Remarks:

Gravel: 2.1 **Sand:** 92.3 **Fines:** 5.6 Moisture % 1.3

Reviewed by:

BH5-120 @ 6.5'-7.5'

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

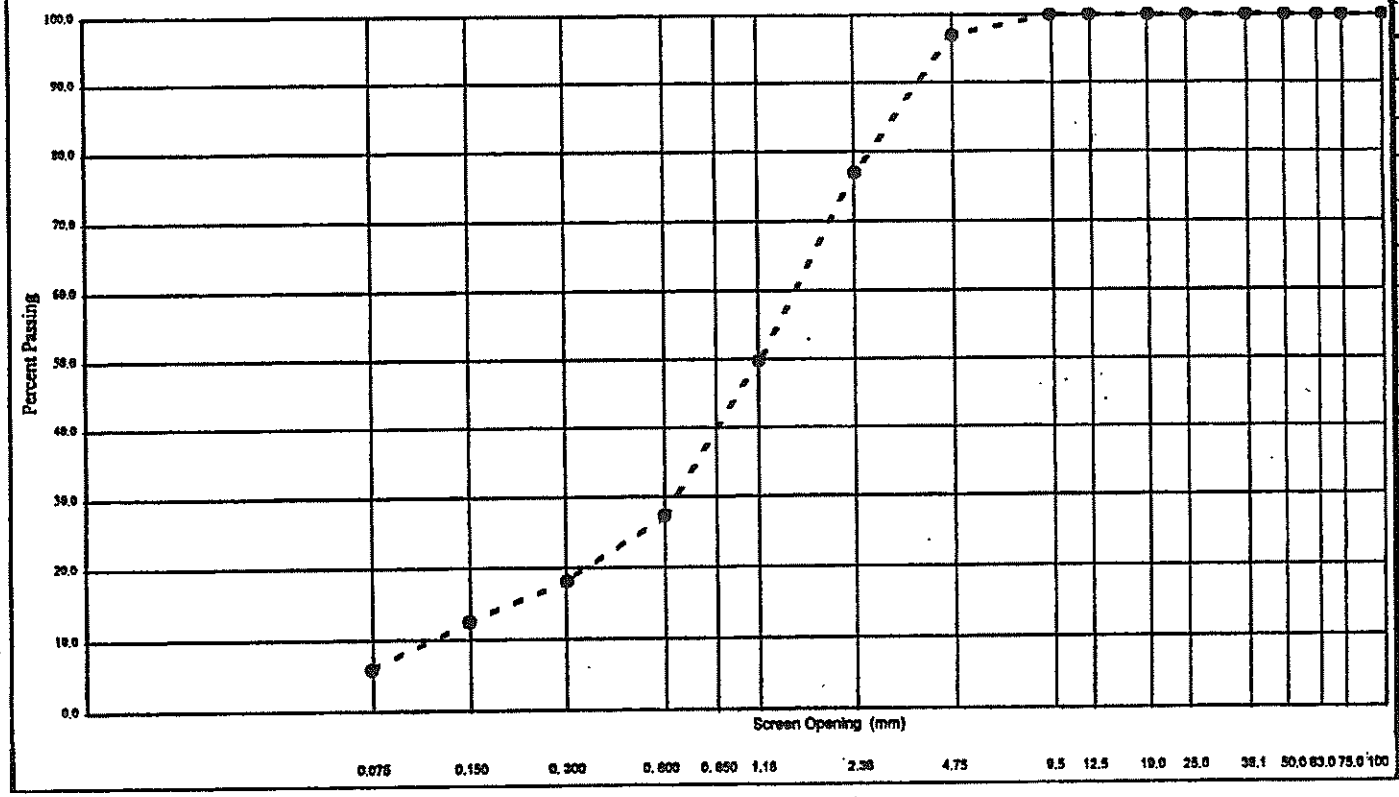
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 08-Jul-99

Type of Sample: Sand - trace Silt, trace Gravel
Sample No:
Source: BH5-120 @ 9'-10'
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 8-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	97.0		
2.36	77.0		
1.180	49.7		
0.600	27.4		
0.300	18.1		
0.150	12.5		
0.075	5.8		

Reviewed by:

Remarks:

Gravel: 3.0 **Sand:** 91.2 **Fines:** 5.8 Moisture % 2.3

BH5-124 @ 115'-116'.xls

Terra Engineering Ltd
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

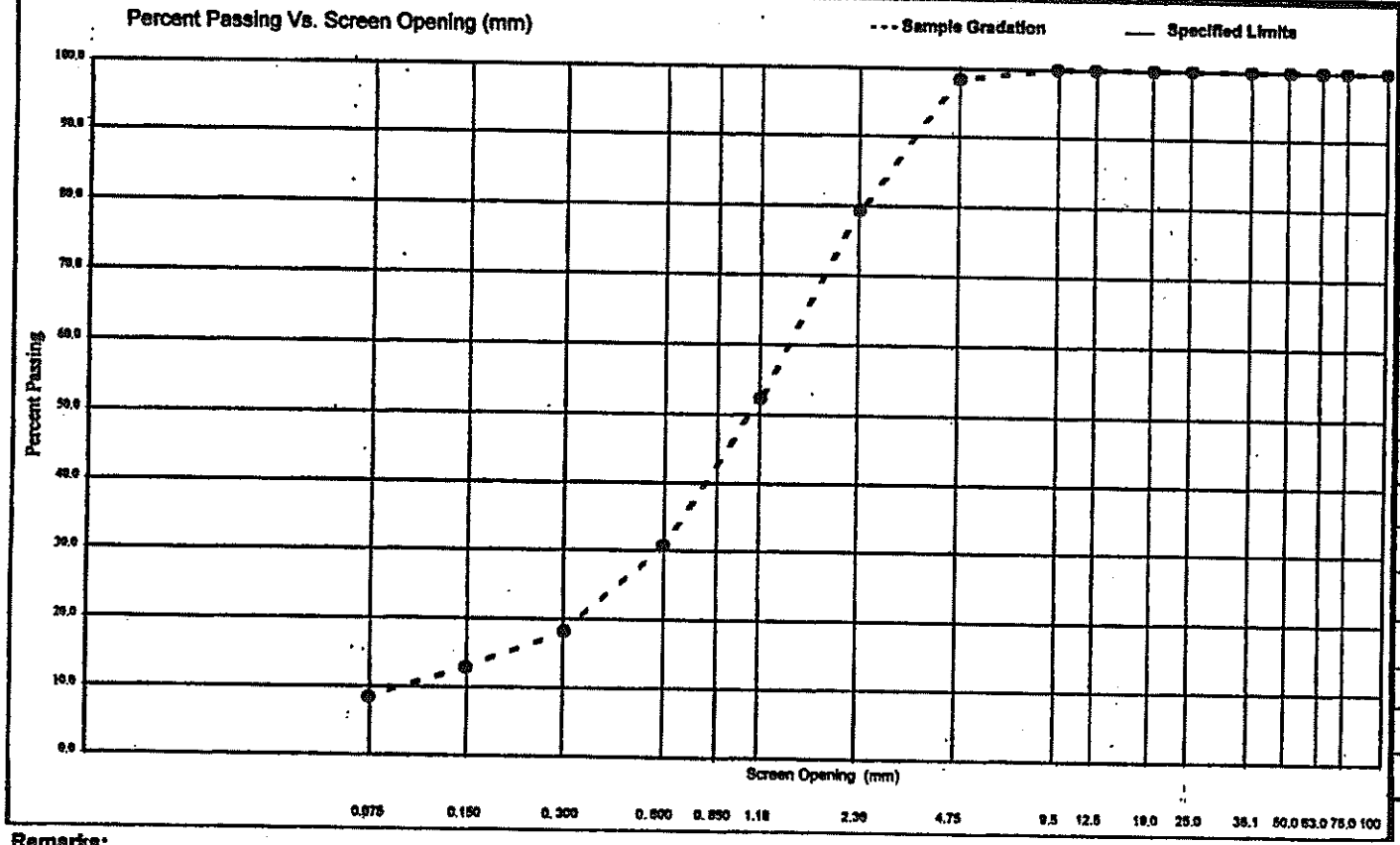
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 08-Jul-99

Type of Sample: Sand - trace Silt and Gravel
Sample No:
Source: BH5-120 @ 13-14
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 08-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	98.5		
2.36	79.3		
1.180	52.3		
0.600	30.7		
0.300	18.2		
0.150	12.9		
0.075	8.5		

Remarks:

Gravel: 1.5 **Sand:** 90.0 **Fines:** 8.5 **Moisture %** 0.9

Reviewed by:

BH5-120 @ 13'-14'

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Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

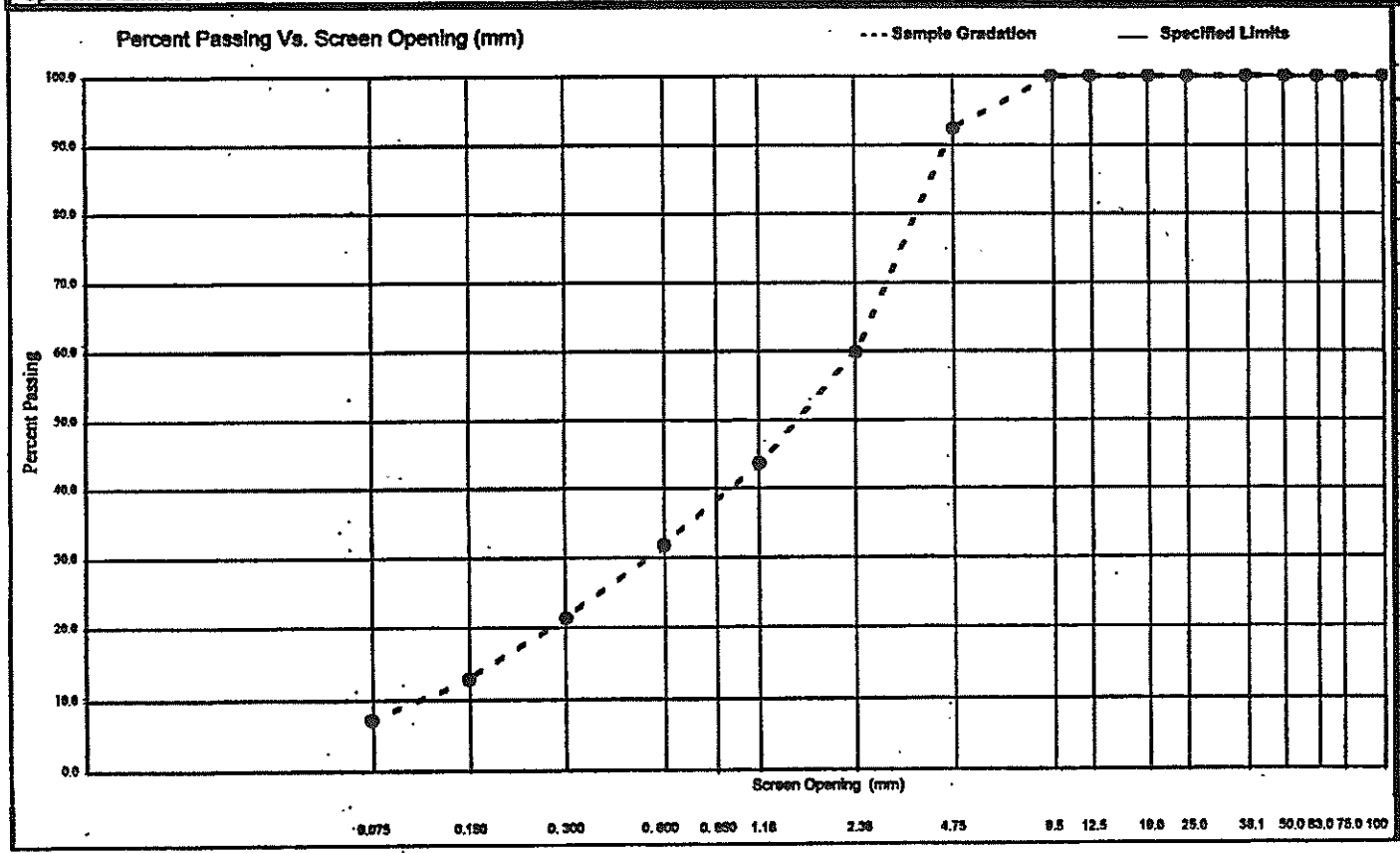
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 09-Jul-99

Type of Sample: Sand - trace Gravel, trace Silt
Sample No:
Source: BH5-121 @ 4'-5'
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 09-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	92.4		
2.36	59.9		
1.180	43.6		
0.600	31.7		
0.300	21.4		
0.150	12.8		
0.075	7.2		

Remarks:

Gravel: 7.6 **Sand:** 65.2 **Fines:** 7.2 **Moisture %** 2.6

Reviewed by:

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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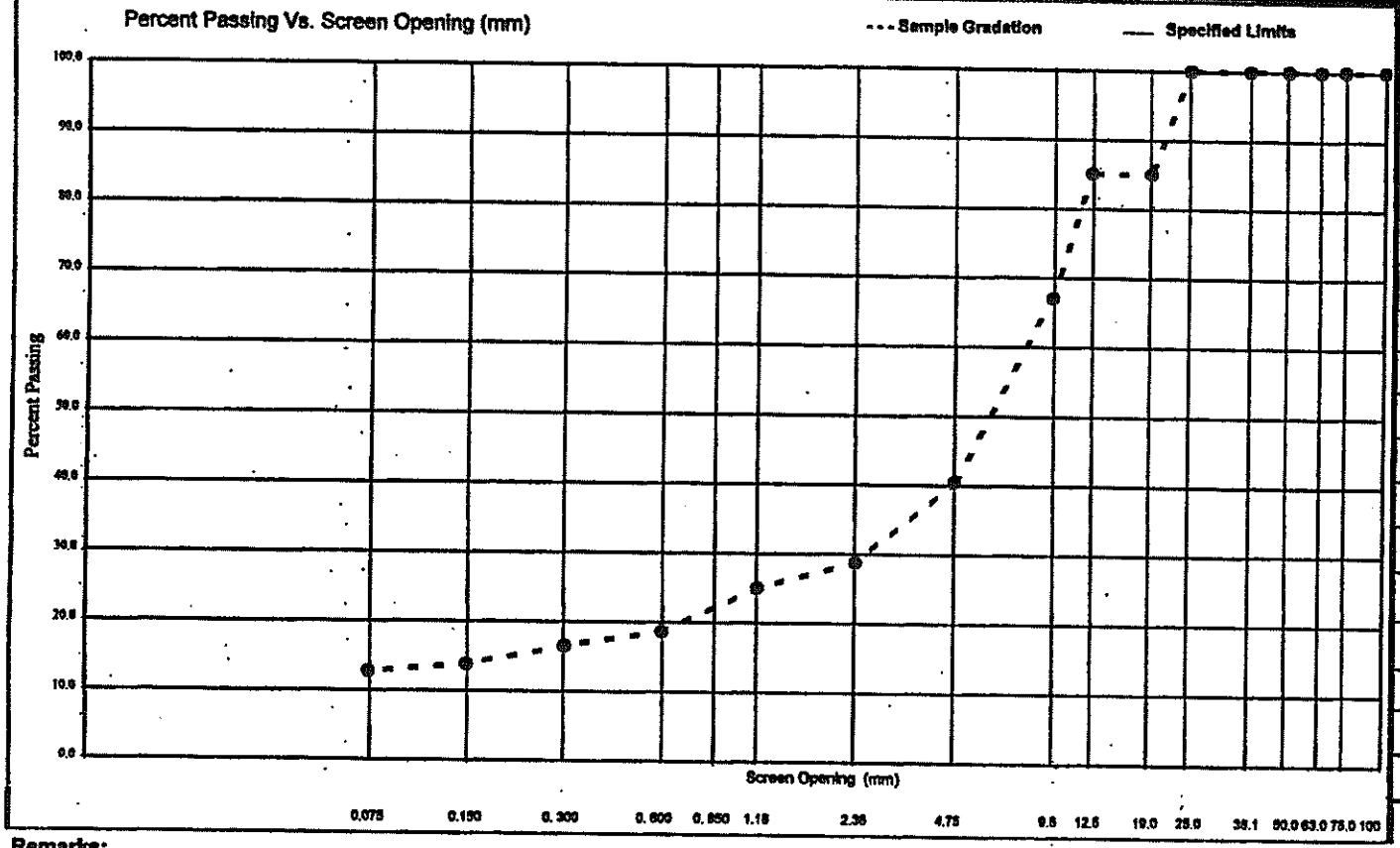
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 07-Jul-99

Type of Sample: Gravel - Sandy,some Silt
Sample No:
Source: BH5-121 @ 5'-5.5"
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 07-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	85.1		
12.5	85.1		
9.50	67.0		
4.75	40.4		
2.36	28.7		
1.180	25.0		
0.600	18.6		
0.300	16.5		
0.150	13.8		
0.075	12.8		

Remarks:

Gravel: 59.6 **Sand:** 27.7 **Fines:** 12.8 **Moisture %** 1.6

Reviewed by:

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Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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cc:
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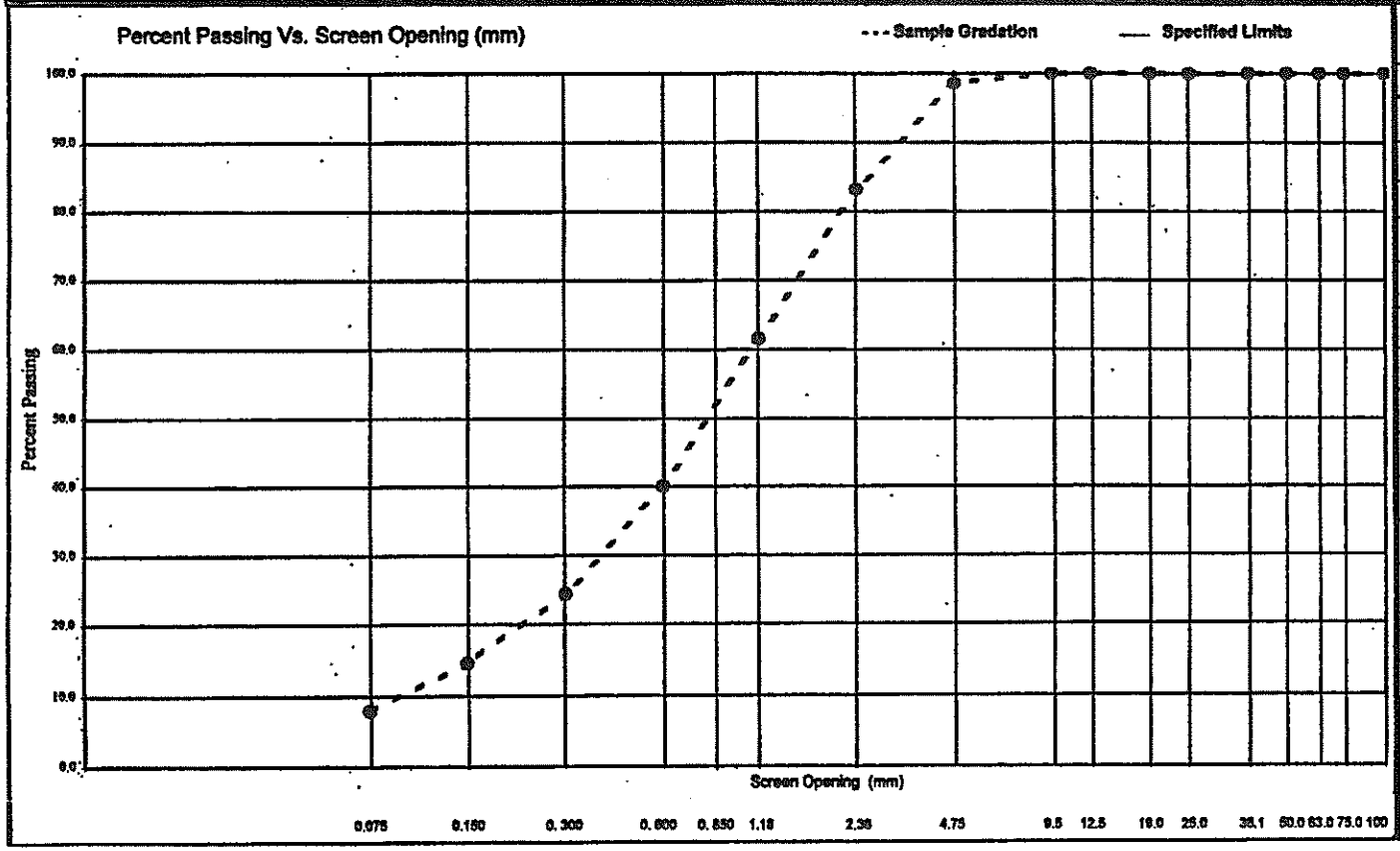
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 07-Jul-99

Type of Sample: Sand - trace Silt and Gravel
Sample No:
Source: BH5-121@ 7.5' - 8.5'
Specified Limits:

Sampled by: CB **Date:** 16-Jun-99
Tested by: EA **Date:** 07-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	98.6		
2.36	83.2		
1.180	61.6		
0.600	40.0		
0.300	24.4		
0.150	14.6		
0.075	7.9		

Remarks:

Gravel: 1.4 **Sand:** 90.7 **Fines:** 7.9 **Moisture %** 1.6

Reviewed by:

BH5-121 @ 7.5 - 8.5'

Byrne Engineering Ltd.
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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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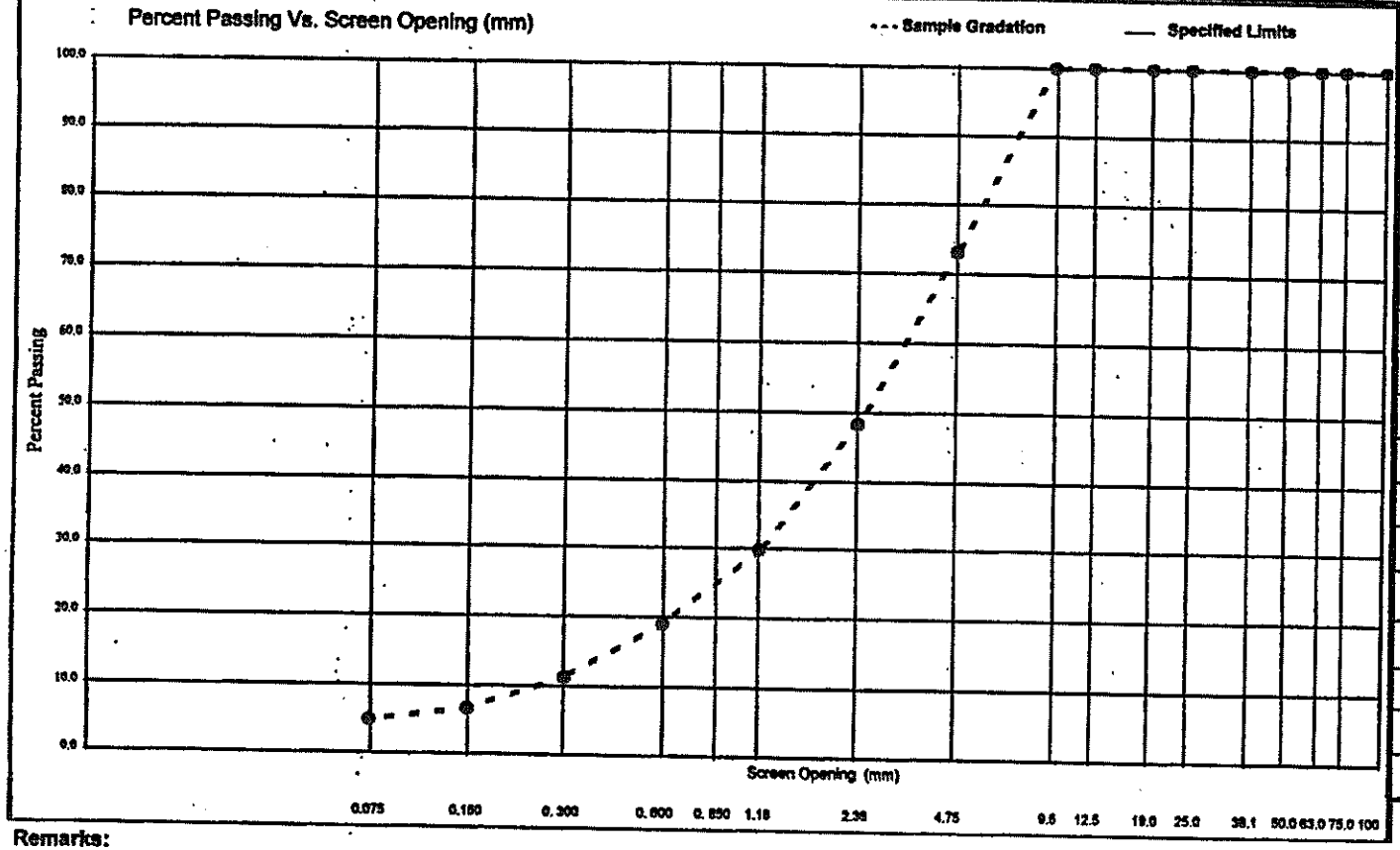
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 08-Jul-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-121 @. 10-11
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 18-Jun-99
Date: 08-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	73.1		
2.36	48.3		
1.180	29.8		
0.600	19.0		
0.300	11.3		
0.150	6.6		
0.075	4.9		

Remarks:

Gravel: 26.9 **Sand:** 68.2 **Fines:** 4.9 **Moisture %** 2.8

Reviewed by:

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Williams Lake (250) 398-8788
(250) 638-1090

Report On: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 07-Jul-99

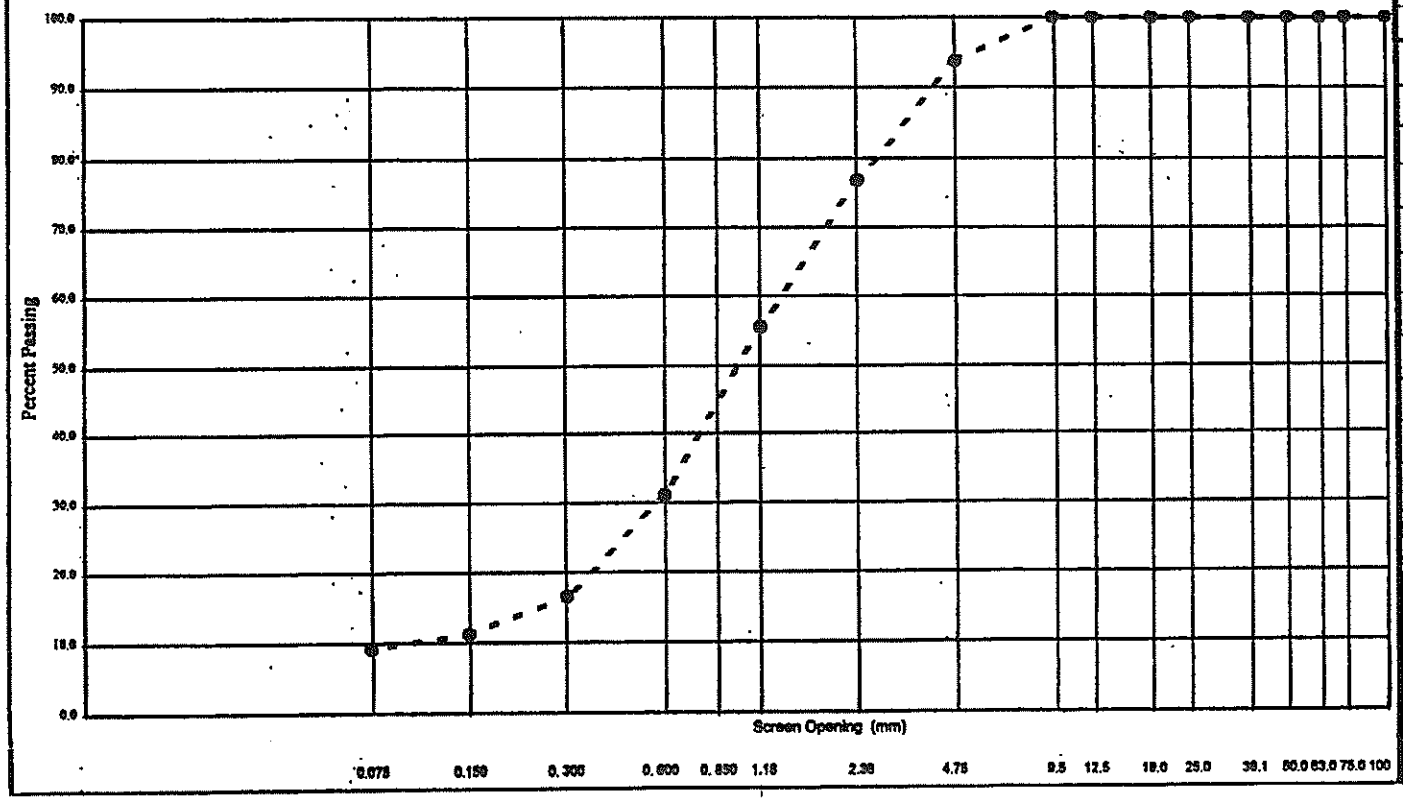
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Type of Sample: Sand - trace silt and gravel
Sample No:
Source: BH5-121 @ 14'-15'
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 07-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	93.8		
2.36	76.8		
1.180	55.6		
0.600	31.0		
0.300	16.5		
0.150	11.2		
0.075	9.2		

Reviewed by:

Remarks:

Gravel: 6.3 **Sand:** 84.6 **Fines:** 9.2 Moisture % 0.9

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

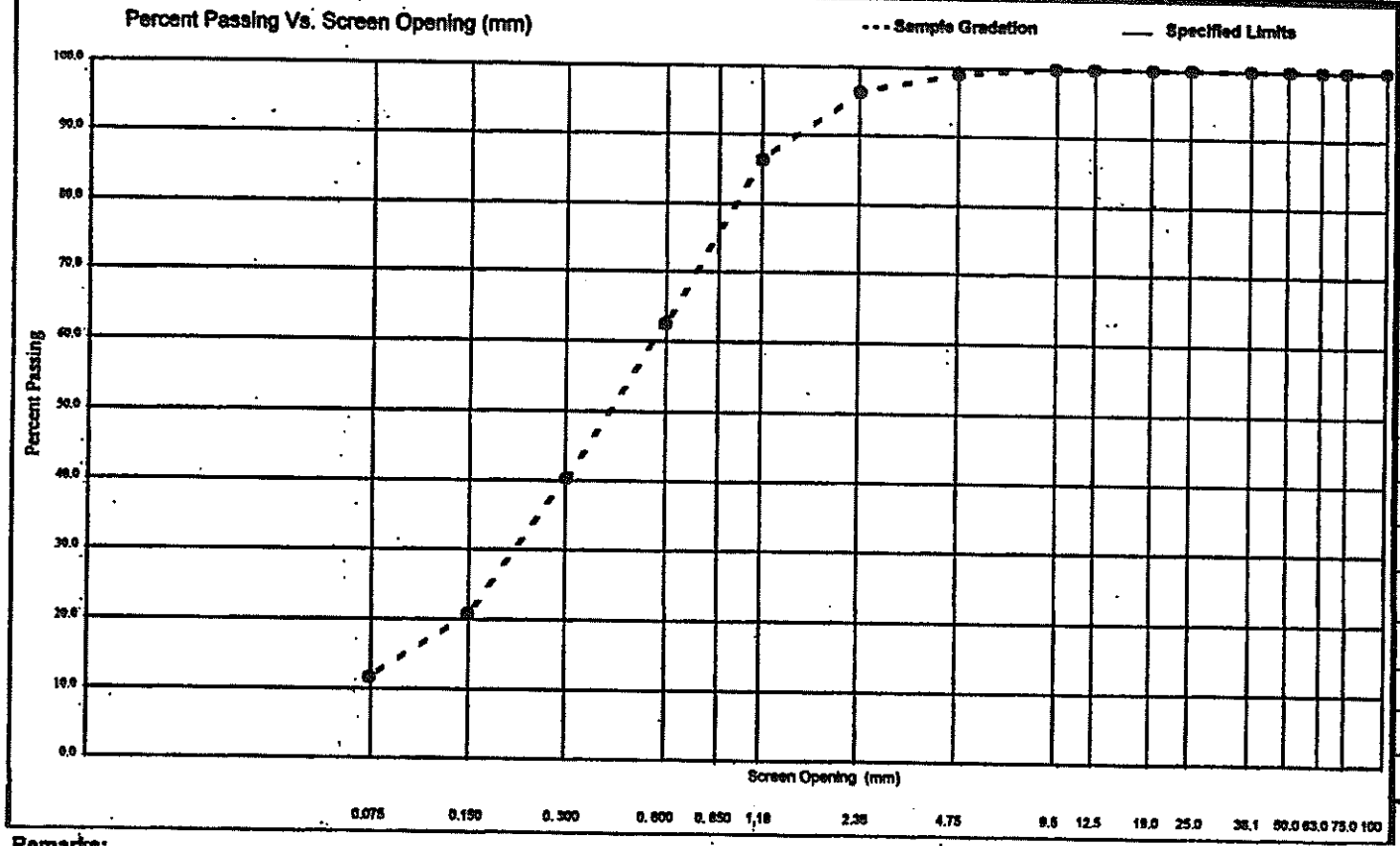
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 07-Jul-99

Type of Sample: Sand - some Silt
Sample No:
Source: BH5-121 @ 16-17
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 07-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	99.1		
2.36	96.3		
1.180	86.3		
0.600	62.5		
0.300	40.3		
0.150	20.8		
0.075	11.6		

Remarks:

Gravel: 0.9 **Sand:** 87.5 **Fines:** 11.6 **Moisture %** 3.8

Reviewed by:

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 08-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES

cc:

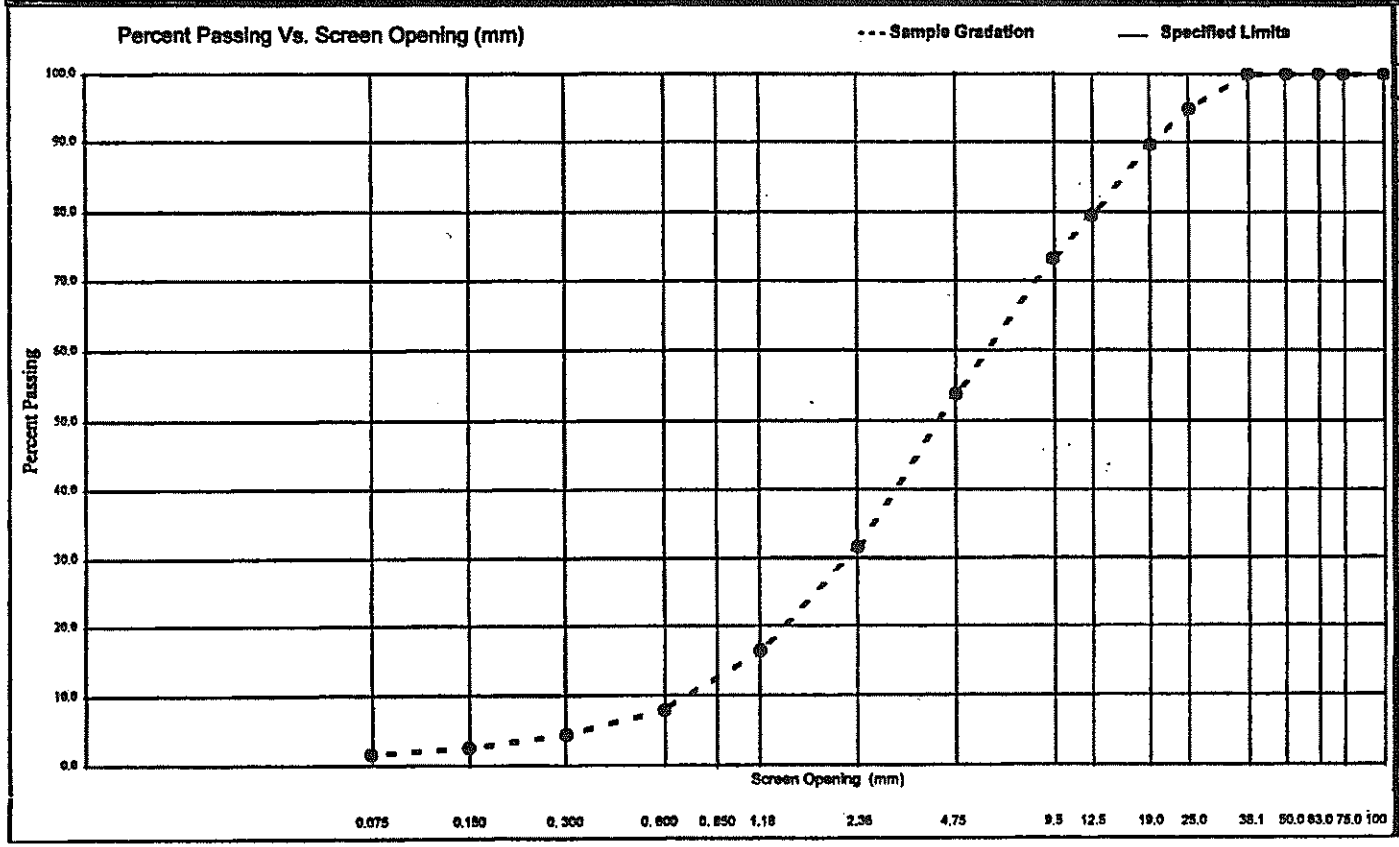
cc:

cc:

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-122@.5'-1.5'
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 8-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	94.8		
19.0	89.6		
12.5	79.5		
9.50	73.3		
4.75	53.7		
2.36	31.5		
1.180	16.4		
0.600	7.8		
0.300	4.4		
0.150	2.5		
0.075	1.6		

Remarks:

Gravel: 46.3 **Sand:** 52.1 **Fines:** 1.6 **Moisture %** 3.4

Reviewed by:

BH5-122 @ .5'-1.5'.xls

Engineering Ltd
Port Coquitlam (604) 945-9939
Whitehorse (250) 668-6788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

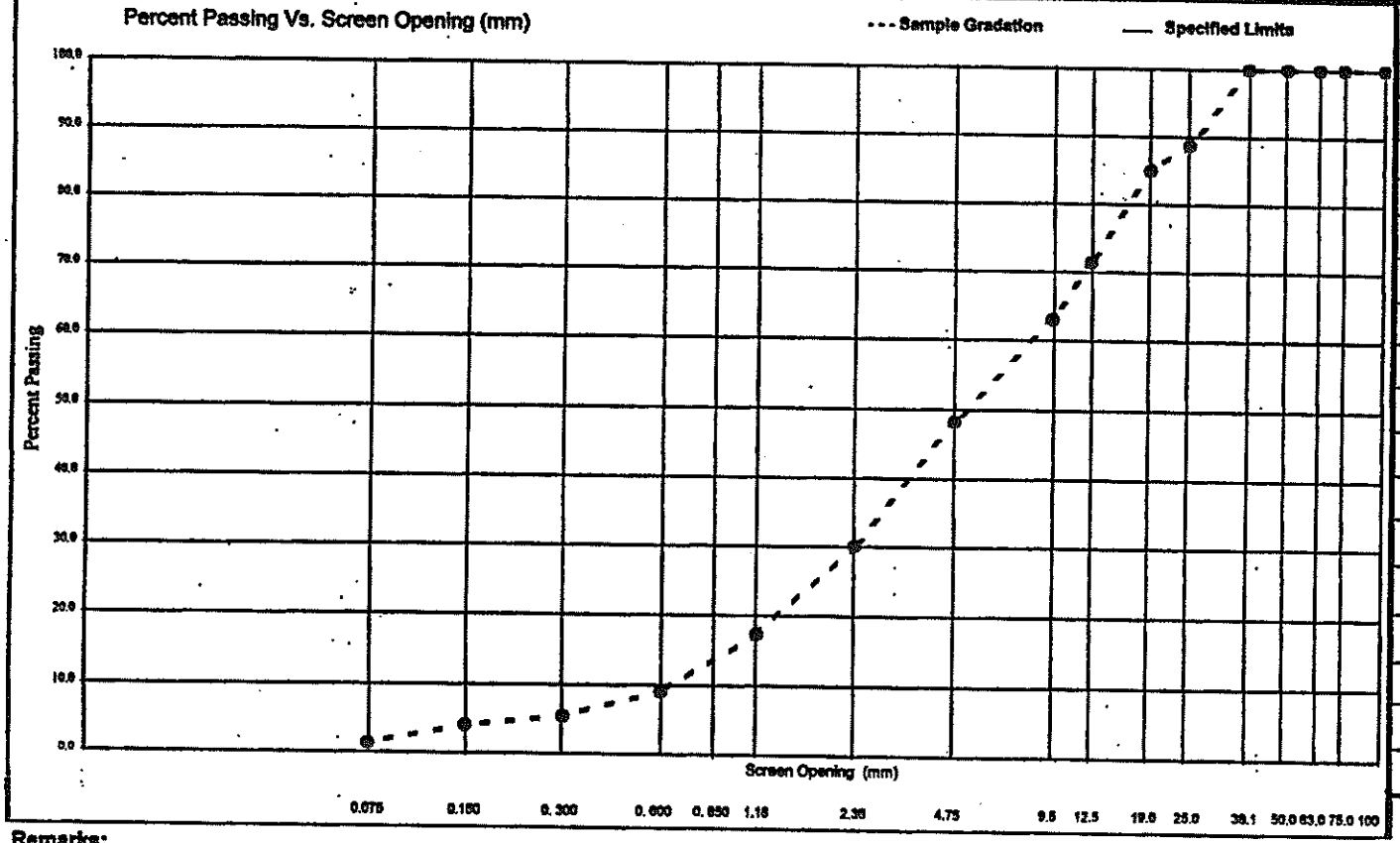
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 08-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-122 @ 4-5
Specified Limits:

Sampled by: CB **Date:** 16-Jun-99
Tested by: EA **Date:** 08-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	88.8		
19.0	85.0		
12.5	71.3		
9.50	62.9		
4.75	48.2		
2.36	30.1		
1.180	17.3		
0.600	9.1		
0.300	5.5		
0.150	4.1		
0.075	1.3		

Remarks:

Gravel: 51.8 **Sand:** 46.9 **Fines:** 1.3 Moisture % 6.5

Reviewed by:

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

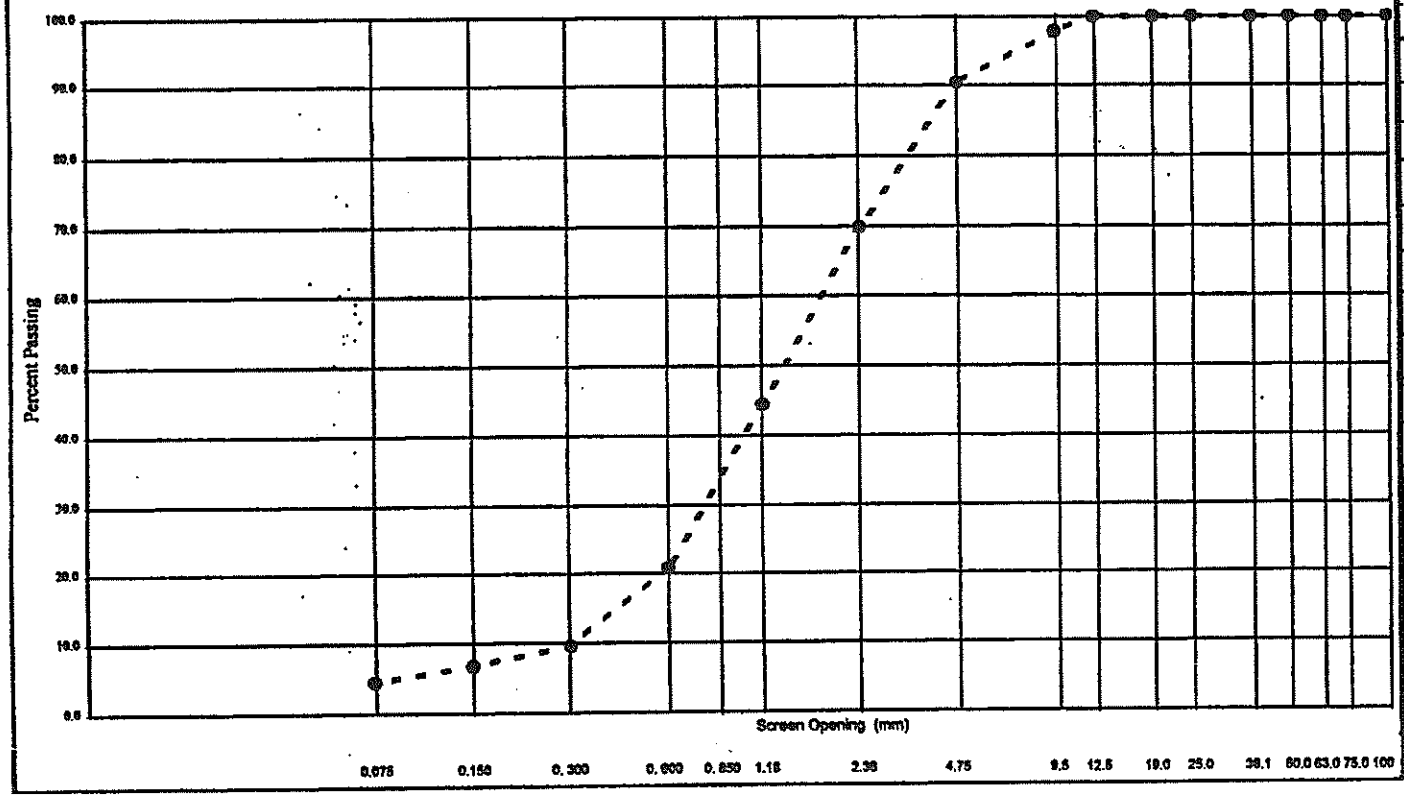
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 07-Jul-99

Type of Sample: Sand - trace Gravel and Silt
Sample No:
Source: BH5-122 @ 6.5'-7.5'
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 07-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	97.9		
4.75	90.4		
2.36	69.9		
1.180	44.4		
0.600	20.8		
0.300	9.6		
0.150	6.7		
0.075	4.5		

Reviewed by:

Remarks:

Gravel: 9.6 **Sand:** 85.9 **Fines:** 4.5 **Moisture %** 5.1

BTL Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

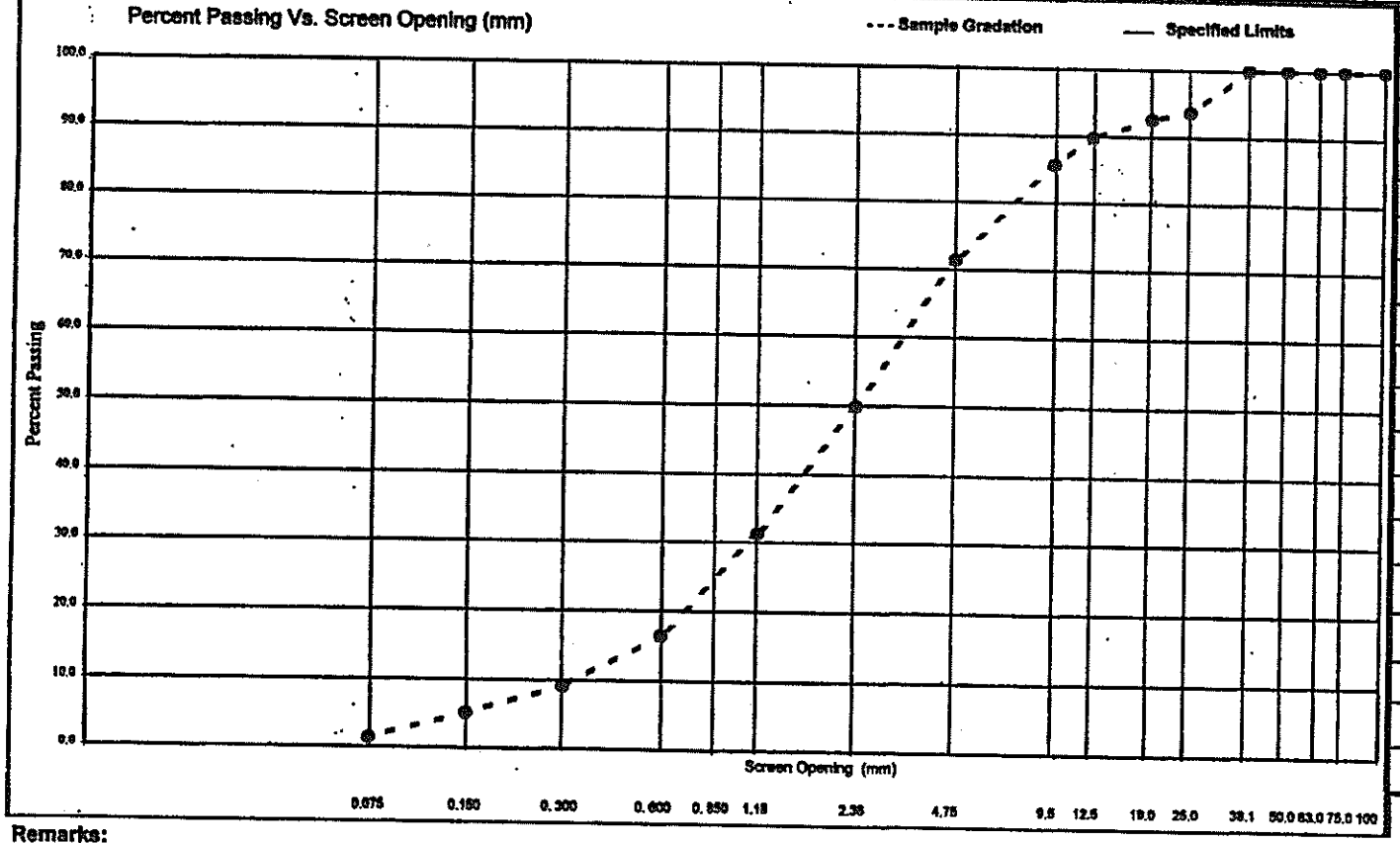
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 08-Jul-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-122 @ 10.5-11.5
Specified Limits:

Sampled by: CB
Tested by: EA

Date: 18-Jun-99
Date: 08-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	93.7		
19.0	92.5		
12.5	89.8		
9.50	85.7		
4.75	71.4		
2.36	49.8		
1.180	31.3		
0.600	16.4		
0.300	9.1		
0.150	5.1		
0.075	1.4		

Remarks:

Gravel: 28.6 **Sand:** 70.0 **Fines:** 1.4 **Moisture %** 2.7

Reviewed by:

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

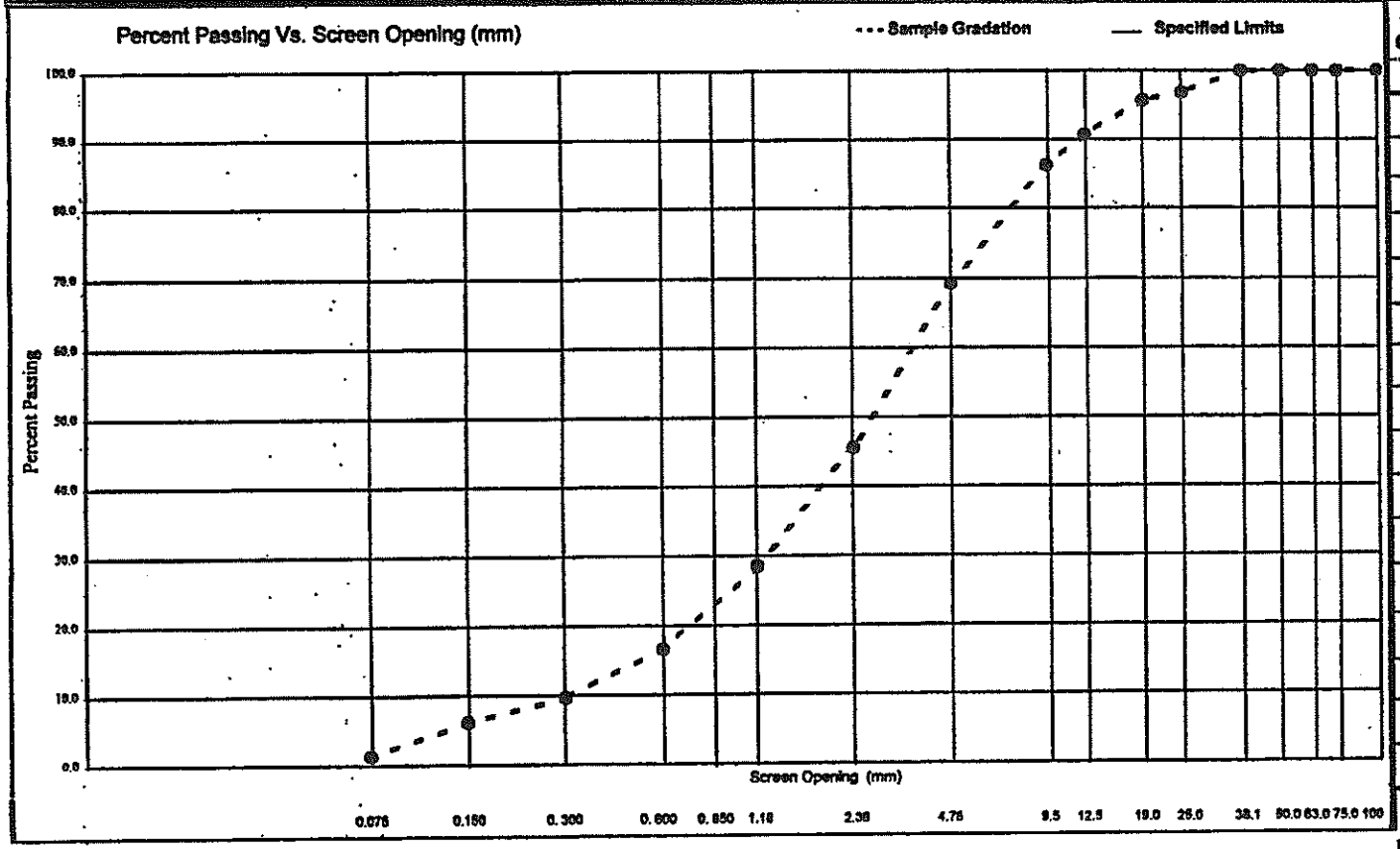
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 08-Jul-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-122 @ 14-15
Specified Limits:

Sampled by: CB **Date:** 18-Jun-99
Tested by: EA **Date:** 08-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	96.8		
19.0	95.7		
12.5	90.7		
9.50	86.3		
4.75	69.2		
2.36	45.6		
1.180	28.6		
0.600	16.6		
0.300	9.6		
0.150	6.1		
0.075	1.3		

Remarks:

Gravel: 30.8 **Sand:** 67.9 **Fines:** 1.3 **Moisture %** 3.5

Reviewed by:

BH5-122 @ 14-15'

Terra Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 12-Jul-99

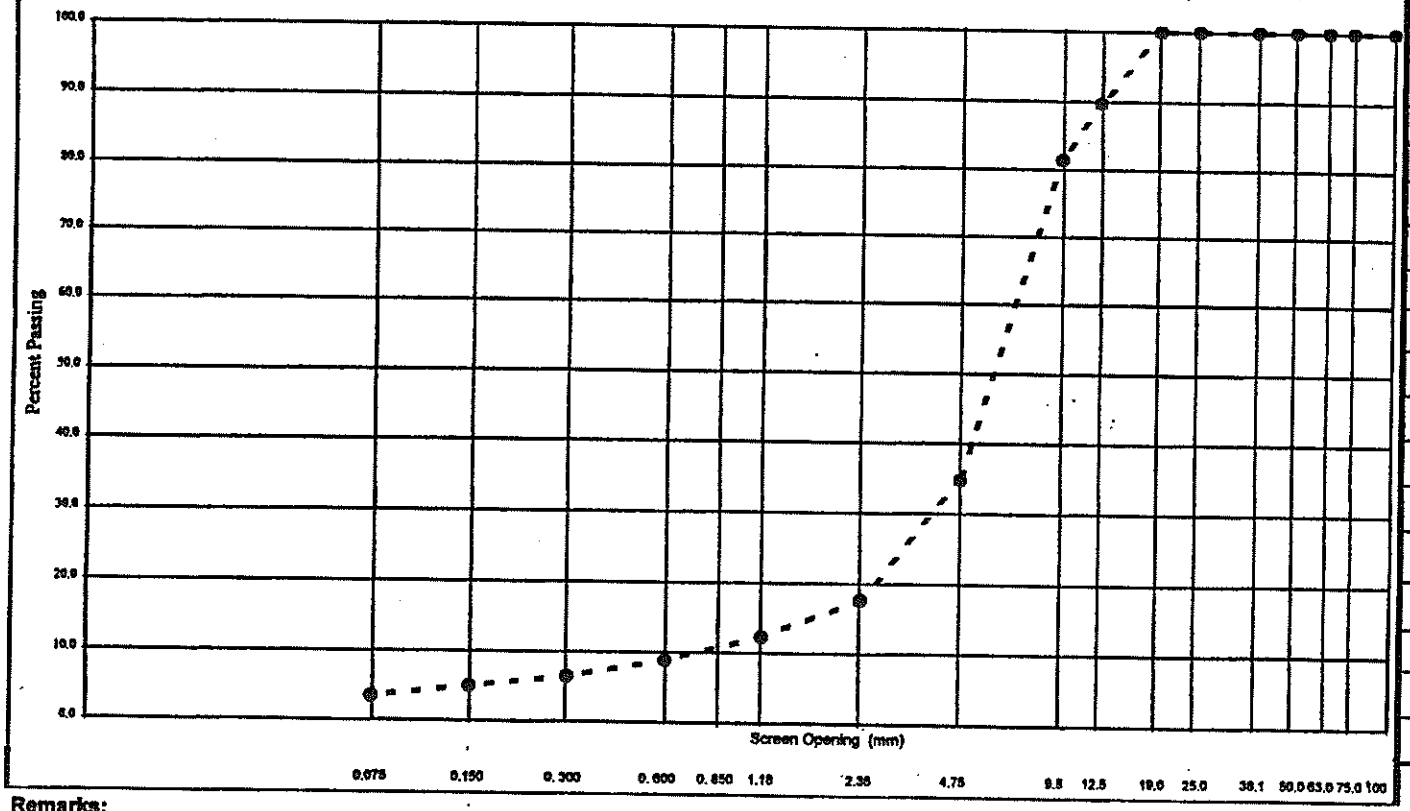
Type of Sample: Gravel - Sandy, trace Silt.
Sample No:
Source: BH5-123 @ 5'-6.5'
Specified Limits:

Sampled by: RW
Tested by: EA

Date: 9-Jul-99
Date: 12-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	89.7		
9.50	81.4		
4.75	34.8		
2.36	17.6		
1.180	12.3		
0.600	8.8		
0.300	6.4		
0.150	4.9		
0.075	3.4		

Remarks:

Gravel: 65.2 **Sand:** 31.4 **Fines:** 3.4 **Moisture %** 1.9

Reviewed by:

BH5-123 @ 5'-7.5'.xls

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Vancouver (60[illegible]-1245 | Kamloops [illegible]50) 3[illegible]1 | Abbotsford [illegible] 859-[illegible]
Port Coquitlam (604) 945-9939 | Williams Lake (250) 398-8788 | Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

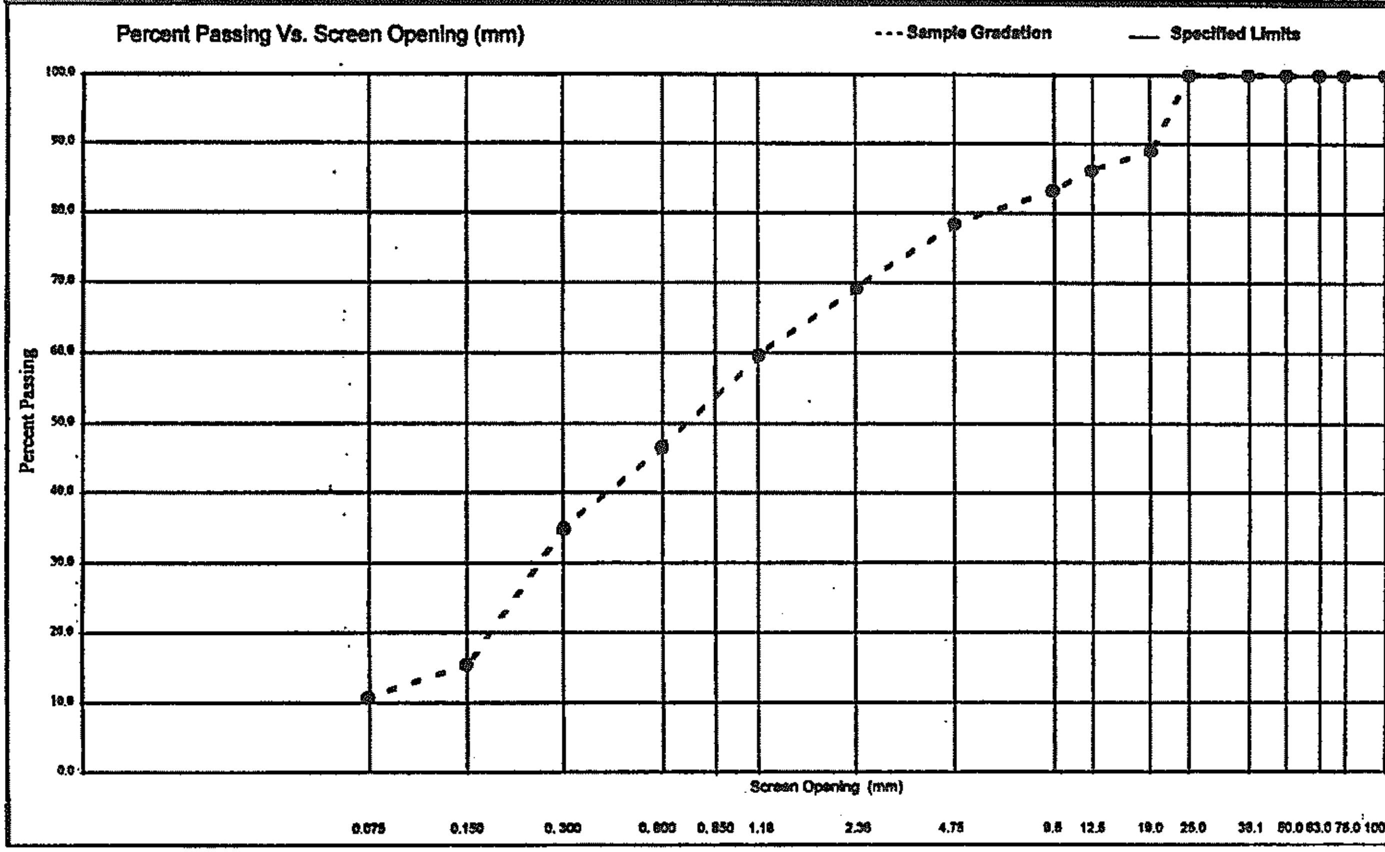
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Type of Sample: Sand - Gravely, some Silt
Sample No:
Source: BH5-150 @ 9'-10'
Specified Limits:

Sampled by: RW — **Date:** 22-Jul-99
Tested by: EA — **Date:** 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	89.0		
12.5	86.1		
9.50	83.2		
4.75	78.4		
2.36	69.2		
1.180	59.7		
0.600	46.5		
0.300	34.8		
0.150	15.4		
0.075	10.6		

Remarks:

Gravel: 21.6 **Sand:** 67.8 **Fines:** 10.6 Moisture % 11.4

Reviewed by:

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
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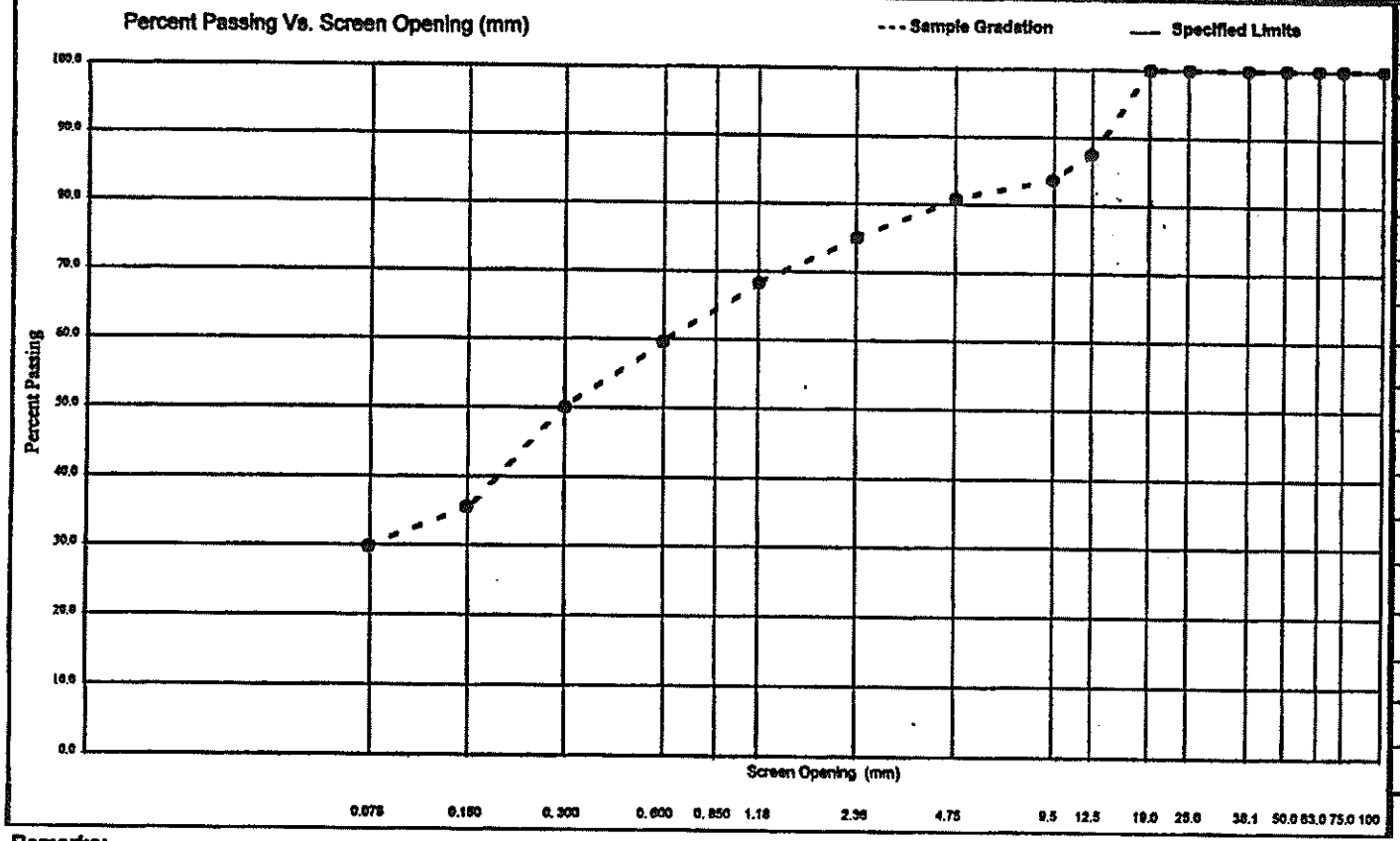
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 02-Aug-99

Type of Sample: Sand -some Gravel, some Silt, trace Clay
Sample No:
Source: BH5-151 @ 0'-1'
Specified Limits:

Sampled by: RW
Tested by: EA

Date: 22-Jul-99
Date: 02-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	87.5		
9.50	83.7		
4.75	80.8		
2.36	75.0		
1.180	68.3		
0.600	59.6		
0.300	50.0		
0.150	35.6		
0.075	29.8		

Remarks:

Gravel: 19.2 **Sand:** 51.0 **Fines:** 29.8 **Moisture %** 55.2

Reviewed by:

Port Coquitlam (604) 945-9939 | Williams Lake (250) 398-8788 | Terrace (250) 638-1090

Report on: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 12-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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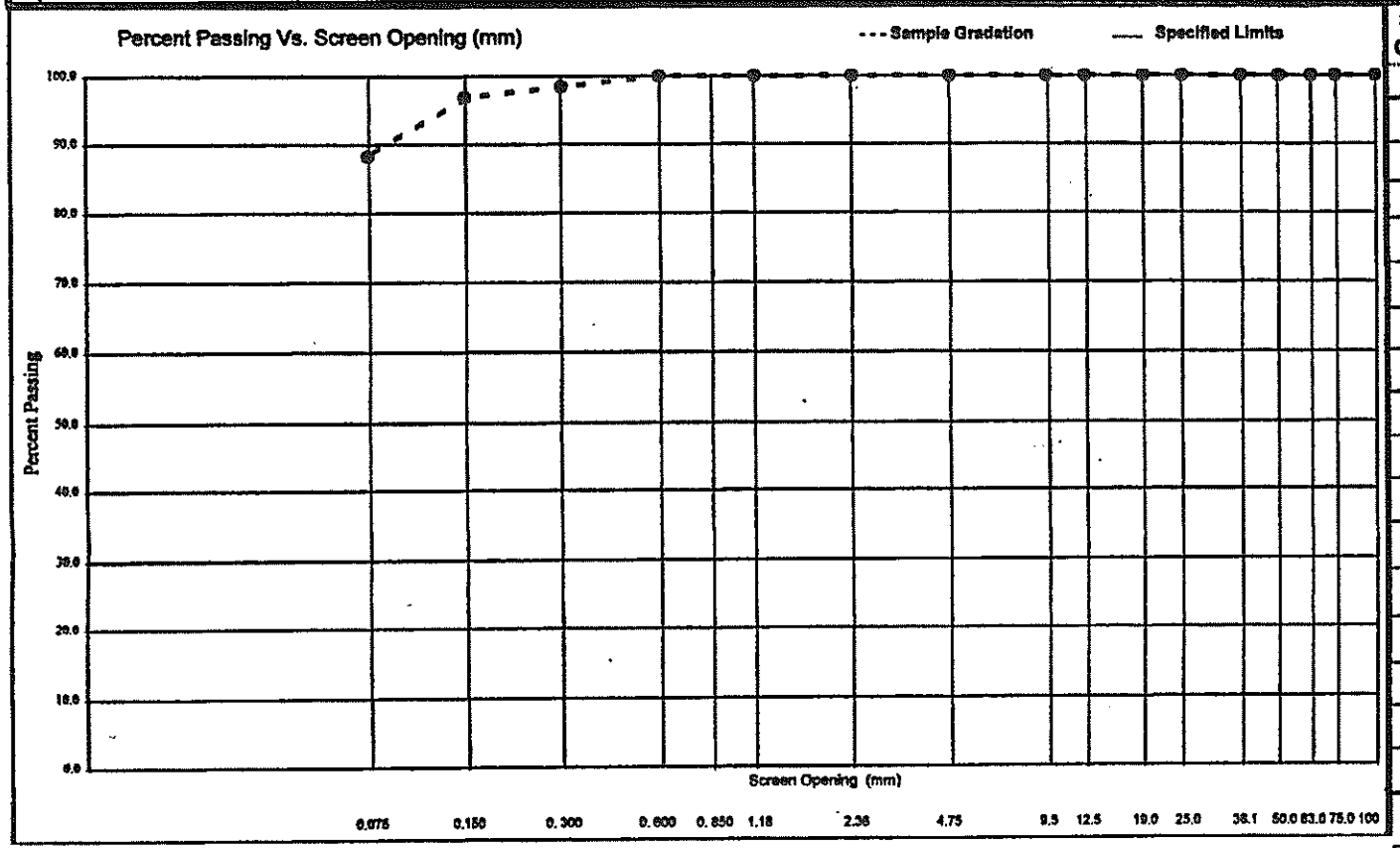
cc:

Type of Sample: Silt - some Sand, trace Clay
Sample No:
Source: BH5-123 @ 30'-30.5'
Specified Limits:

Sampled by: RW **Date:** 9-Jul-99
Tested by: EA **Date:** 12-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	100.0		
1.180	100.0		
0.600	100.0		
0.300	98.4		
0.150	96.9		
0.075	88.3		

Remarks:

Gravel: 0.0 **Sand:** 11.7 **Fines:** 88.3 **Moisture %** 11.7

Reviewed by:

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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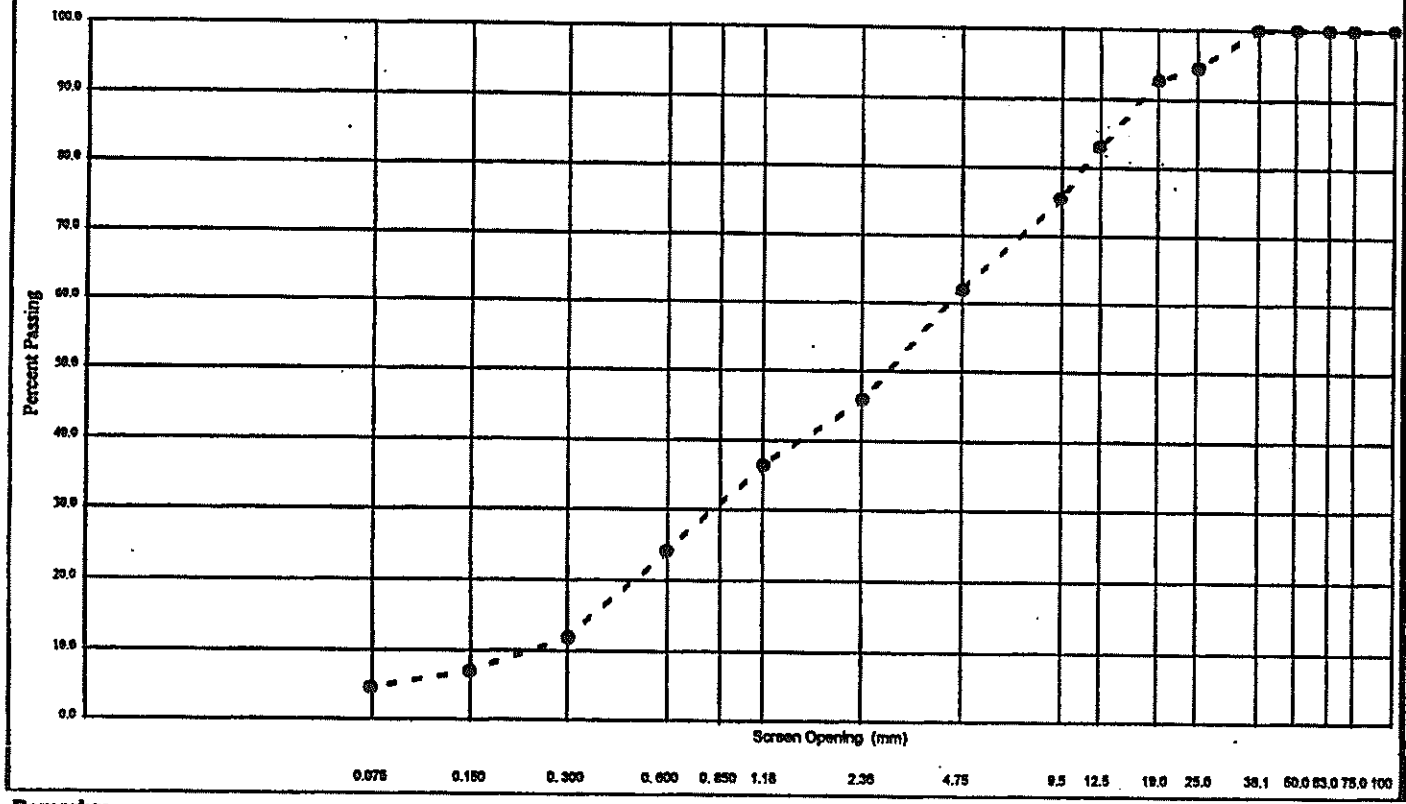
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 09-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-124 @ 6'-6.5'
Specified Limits:

Sampled by: RW **Date:** 06-Jul-99
Tested by: EA **Date:** 09-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	94.5		
19.0	92.7		
12.5	83.1		
9.50	75.5		
4.75	62.0		
2.36	45.9		
1.180	36.4		
0.600	24.2		
0.300	11.9		
0.150	7.0		
0.075	4.5		

Remarks:

Gravel: 38.0 **Sand:** 57.5 **Fines:** 4.5 **Moisture %** 1.9

Reviewed by:

BH5-124 @ 10'-11.5'

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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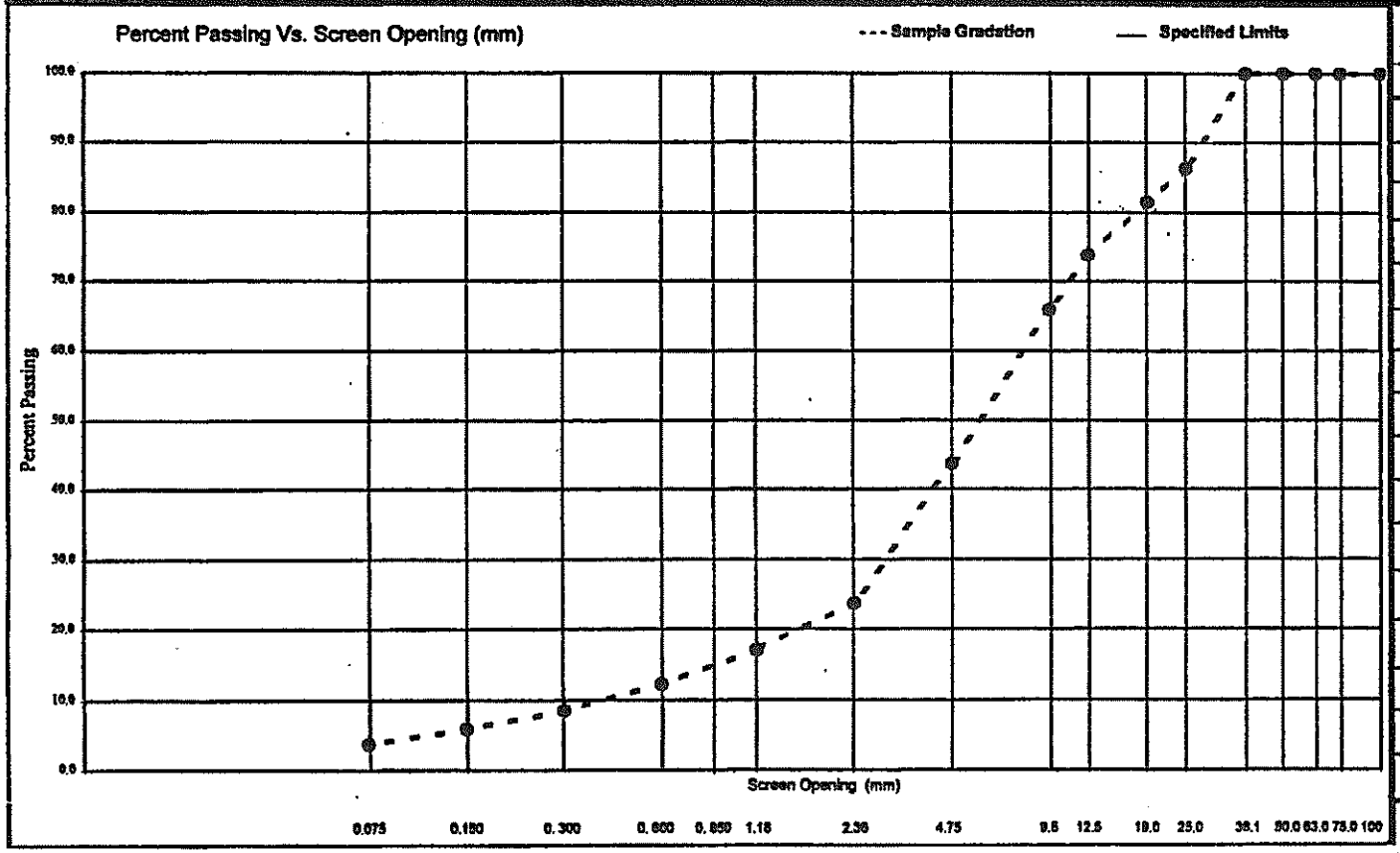
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 09-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-124 @ 20'-21'
Specified Limits:

Sampled by: RW **Date:** 06-Jul-99
Tested by: EA **Date:** 09-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	86.3		
19.0	81.5		
12.5	73.7		
9.50	65.9		
4.75	43.7		
2.36	23.7		
1.180	17.0		
0.600	12.2		
0.300	8.5		
0.150	5.9		
0.075	3.7		

Remarks:

Gravel: 56.3 **Sand:** 40.0 **Fines:** 3.7 **Moisture %** 3.2

Reviewed by:

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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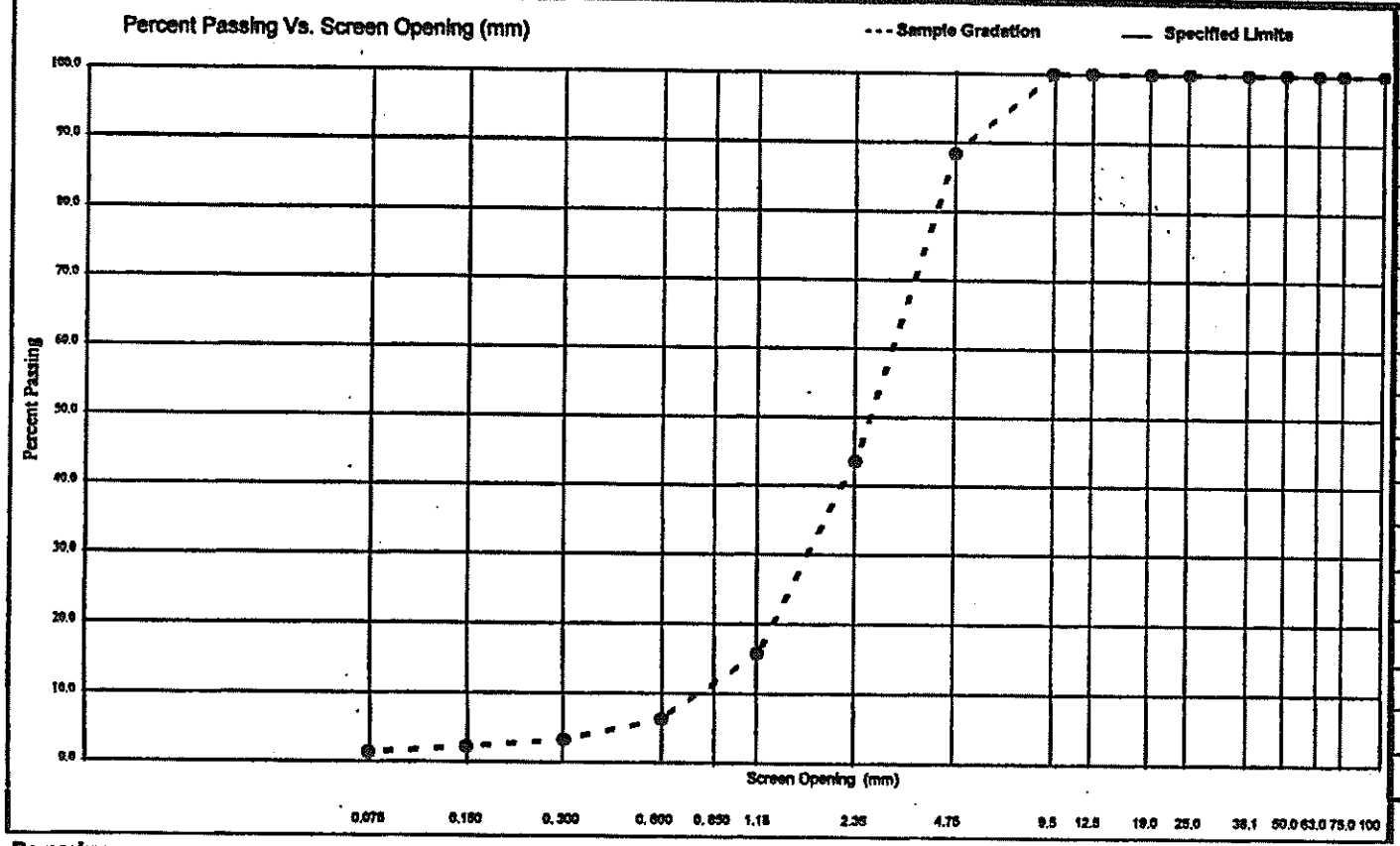
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 09-Jul-99

Type of Sample: Sand - some Gravel, trace Silt
Sample No:
Source: BH5-124 @ 40'-40.5'
Specified Limits:

Sampled by: RW **Date:** 06-Jul-99
Tested by: EA **Date:** 09-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	88.3		
2.36	43.5		
1.180	15.8		
0.600	6.3		
0.300	3.2		
0.150	2.2		
0.075	1.3		

Remarks:

Gravel: 11.7 **Sand:** 87.0 **Fines:** 1.3 **Moisture %** 0.9

Reviewed by:

BH5-124 @ 6'-6.5'

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Port Coquitlam (604) 945-9939
Kloop (250) 37
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 09-Jul-99

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-124 @ 60'-61'
Specified Limits:

Sampled by: RW **Date:** 06-Jul-99
Tested by: EA **Date:** 09-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	89.9		
19.0	74.9		
12.5	65.8		
9.50	59.6		
4.75	48.6		
2.36	36.9		
1.180	28.4		
0.600	21.3		
0.300	15.3		
0.150	10.7		
0.075	8.7		

Remarks:

Gravel: 51.4 **Sand:** 39.9 **Fines:** 8.7 **Moisture %** 4.9

Reviewed by:

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Port Coquitlam (604) 945-9939
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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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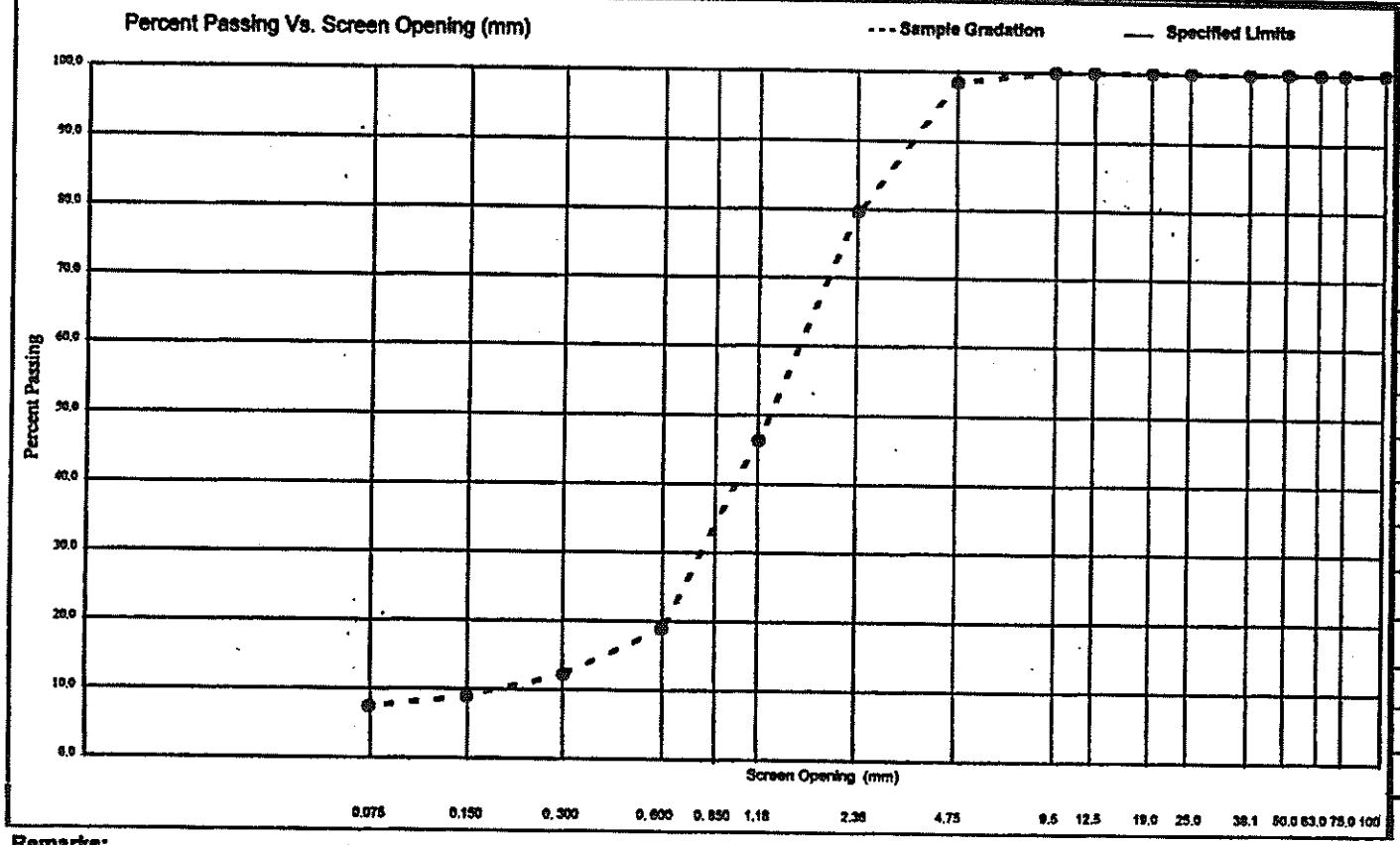
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 09-Jul-99

Type of Sample: Sand - trace Silt and Gravel
Sample No:
Source: BH5-124 @ 90-91.5
Specified Limits:

Sampled by: CB **Date:** 08-Jul-99
Tested by: EA **Date:** 09-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	98.5		
2.36	79.7		
1.180	46.3		
0.600	19.0		
0.300	12.2		
0.150	8.9		
0.075	7.4		

Remarks:

Gravel: 1.5 **Sand:** 91.1 **Fines:** 7.4 **Moisture %** 1.7

Reviewed by:

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Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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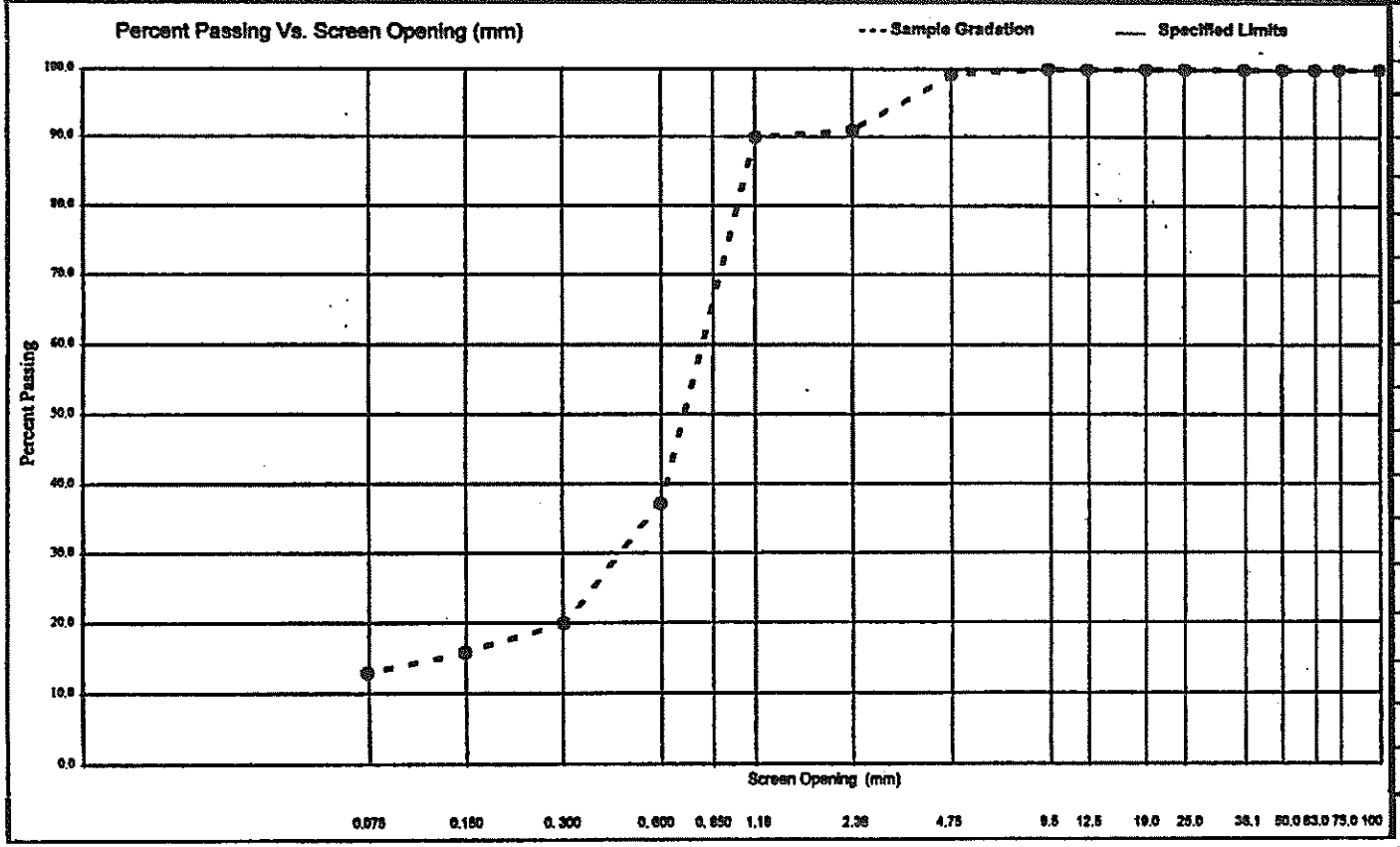
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 09-Jul-99

Type of Sample: Sand, some Silt
Sample No:
Source: BH5-124 @ 115'-116'
Specified Limits:

Sampled by: RW **Date:** 08-Jul-99
Tested by: EA **Date:** 09-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	99.2		
2.36	90.9		
1.180	89.9		
0.600	37.1		
0.300	19.9		
0.150	15.8		
0.075	12.8		

Remarks:

Gravel: 0.8 **Sand:** 86.4 **Fines:** 12.8 **Moisture %** 2.3

Reviewed by:

BH5-124 @ 40'-40.5'

Engineering Ltd.
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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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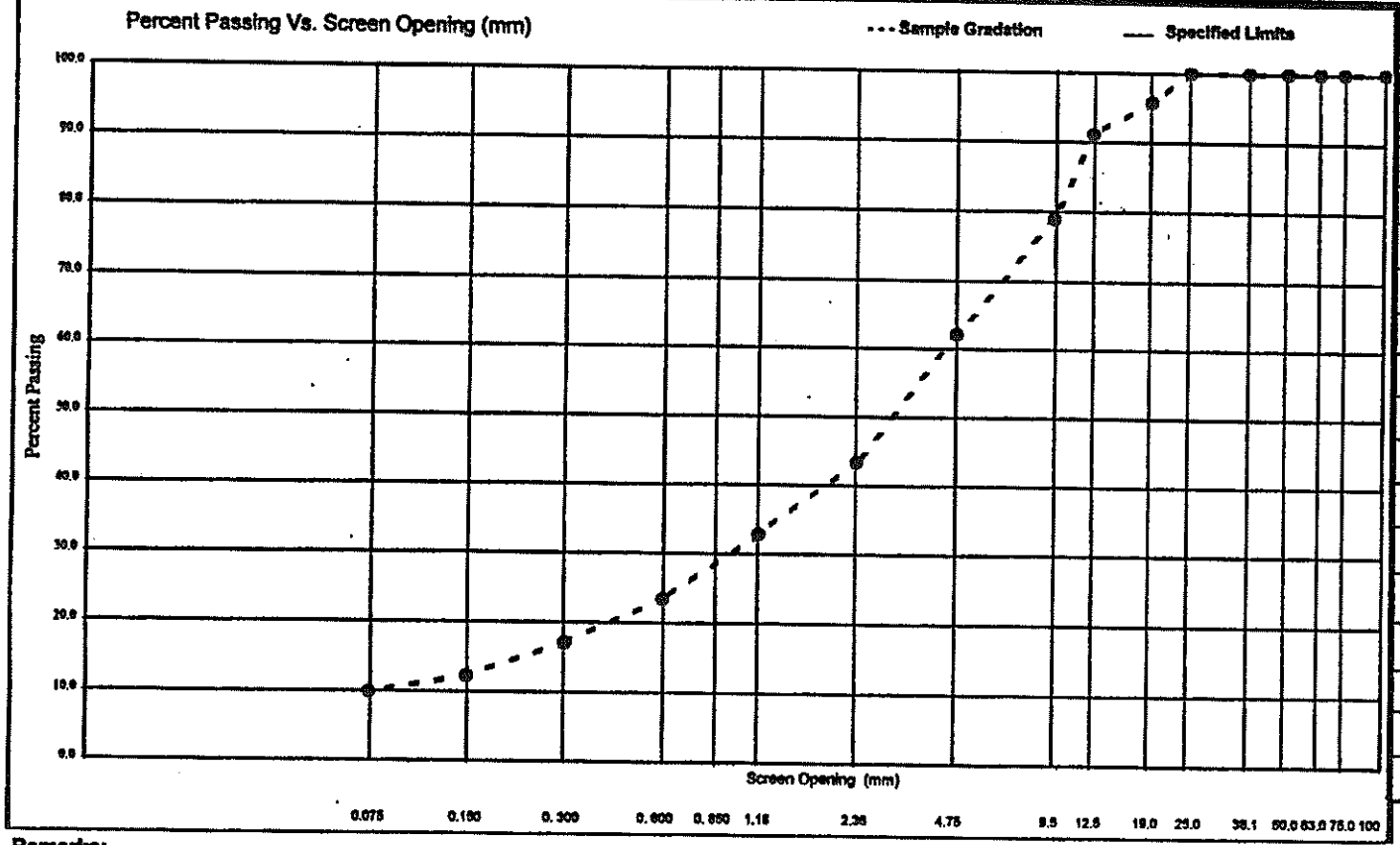
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 09-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-124 @ 130'-130.5'
Specified Limits:

Sampled by: RW **Date:** 09-Jul-99
Tested by: EA **Date:** 09-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	95.8		
12.5	91.2		
9.50	78.9		
4.75	62.0		
2.36	43.4		
1.180	32.7		
0.600	23.5		
0.300	17.1		
0.150	12.2		
0.075	9.8		

Remarks:

Gravel: 38.0 **Sand:** 52.2 **Fines:** 9.8 **Moisture %** 10.4

Reviewed by:

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Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 21-Jul-99

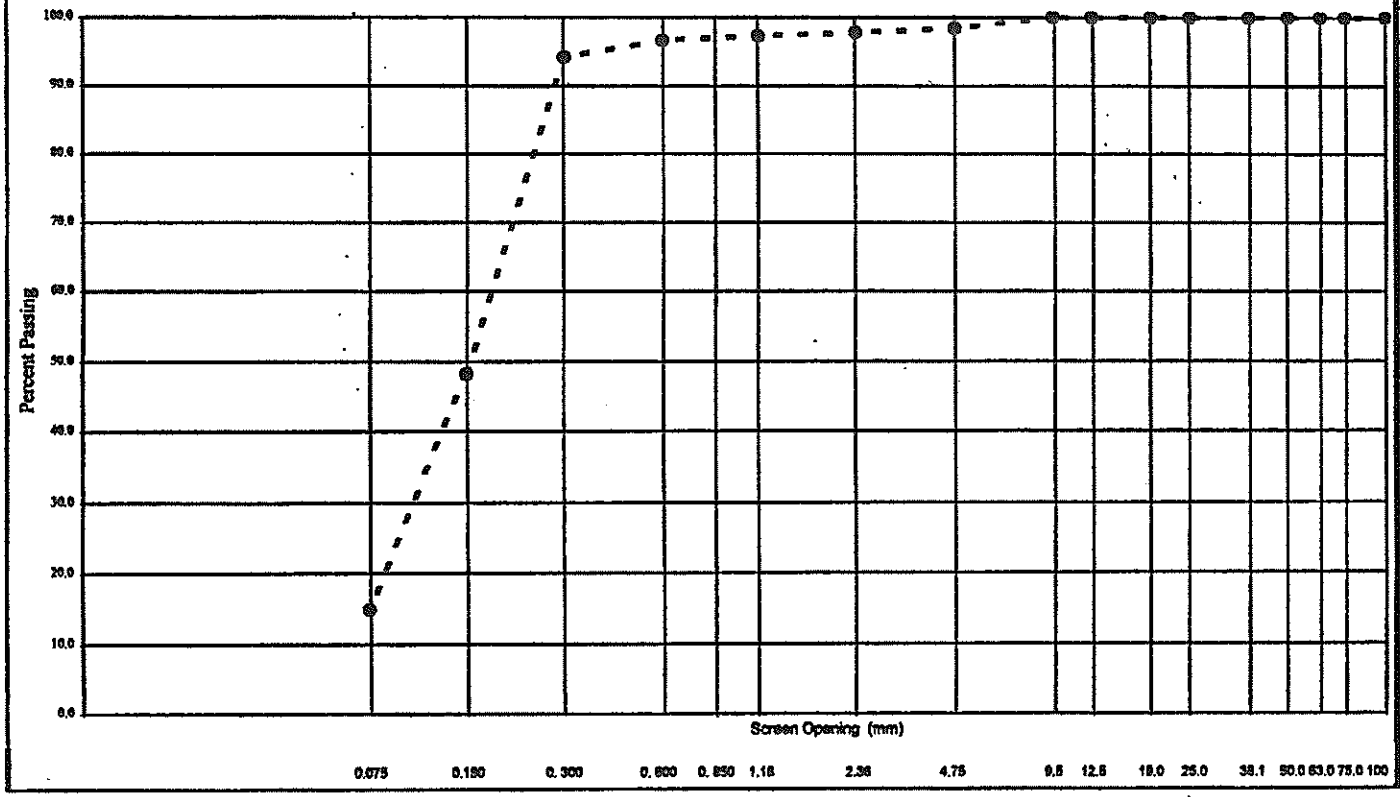
Type of Sample: Sand - some Silt, trace Gravel
Sample No:
Source: BH5-125 @ 35'-36'
Specified Limits:

Sampled by: RW **Date:** 11-Jul-99
Tested by: EA **Date:** 21-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)

--- Sample Gradation ___ Specified Limits



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	98.4		
2.36	97.8		
1.180	97.3		
0.600	96.7		
0.300	94.2		
0.150	48.2		
0.075	15.0		

Remarks:

Gravel: 1.6 **Sand:** 83.5 **Fines:** 15.0 **Moisture %** 6.3

Reviewed by:

BH5-125 @ 35'-36'

Engineering Ltd.
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Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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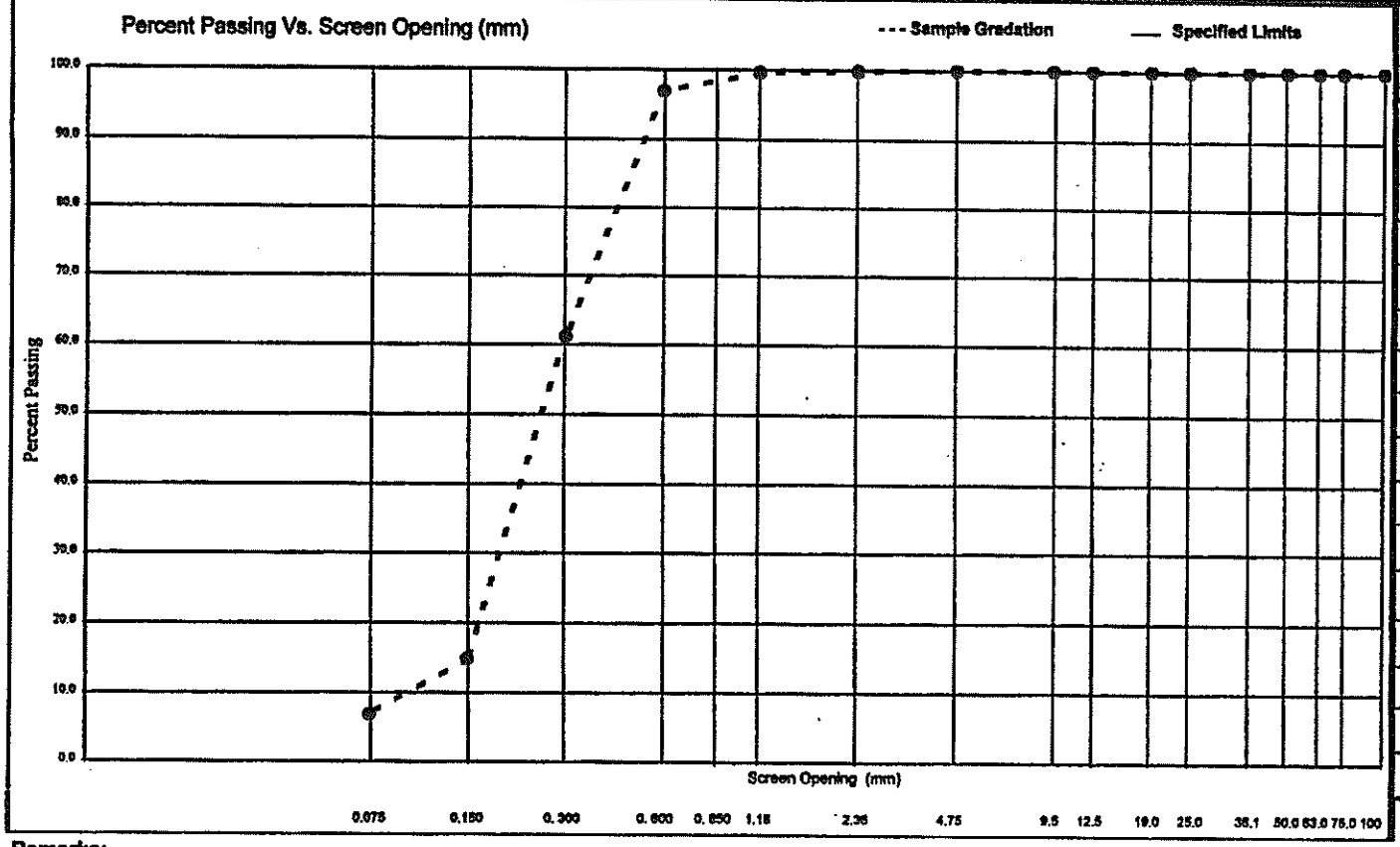
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 21-Jul-99

Type of Sample: Sand - trace Silt
Sample No:
Source: BH5-125 @ 75'-76'
Specified Limits:

Sampled by: RW **Date:** 12-Jul-99
Tested by: EA **Date:** 21-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	99.9		
1.180	99.6		
0.600	96.9		
0.300	61.2		
0.150	14.8		
0.075	6.9		

Remarks:

Gravel: 0.0 **Sand:** 93.1 **Fines:** 6.9 **Moisture %** 3.9

Reviewed by:

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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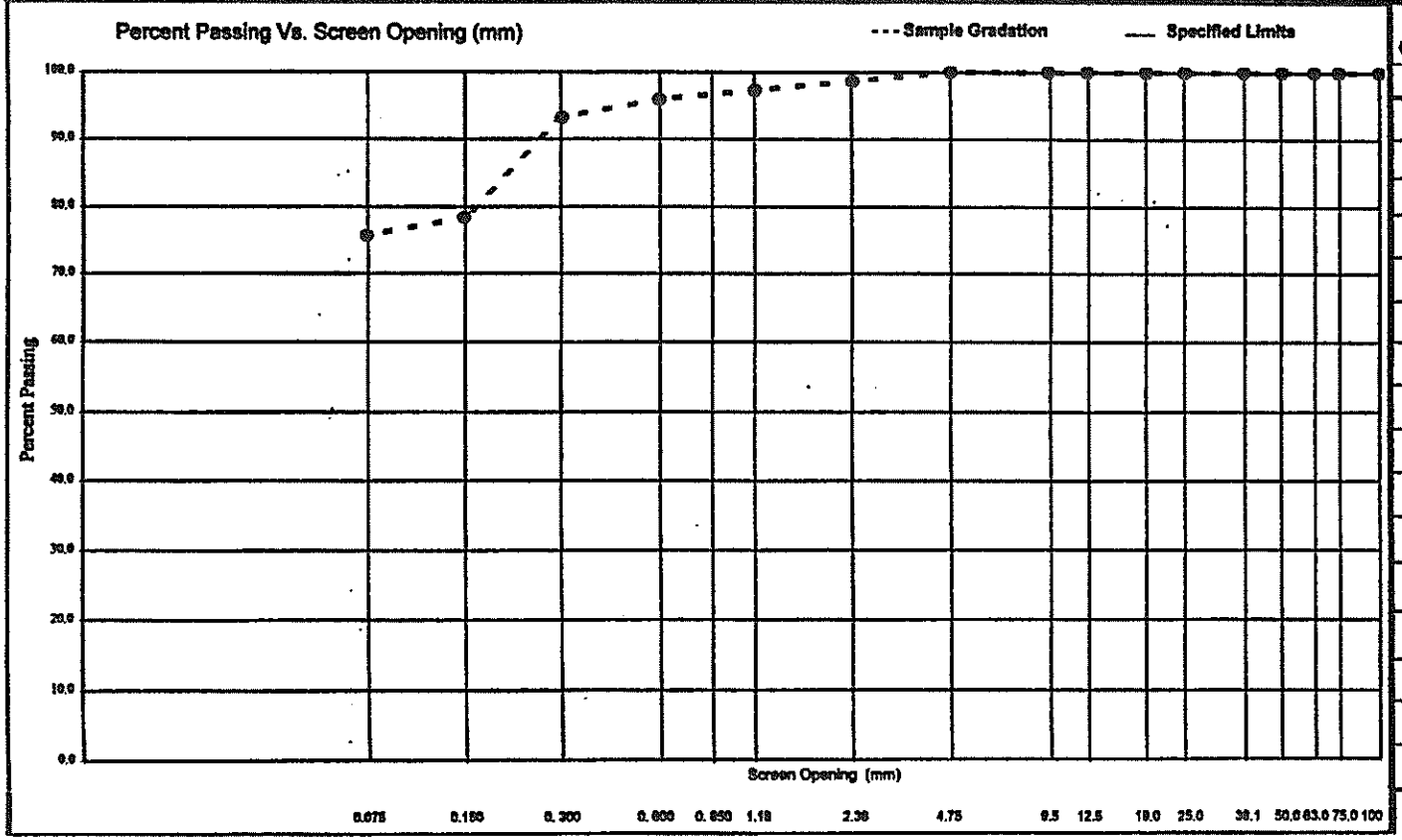
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 26-Jul-99

Type of Sample: Silt - Sandy, trace Clay
Sample No:
Source: BH5-126 @ 25'-26'
Specified Limits:

Sampled by: RW **Date:** 14-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	98.6		
1.180	97.3		
0.600	95.9		
0.300	93.2		
0.150	78.4		
0.075	75.7		

Remarks:

Gravel: 0.0 **Sand:** 24.3 **Fines:** 75.7 **Moisture %** 17.8

Reviewed by:

Ltd.
(604) 945-9939
(250) 398-8788
(250) 638-1090

Report on: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

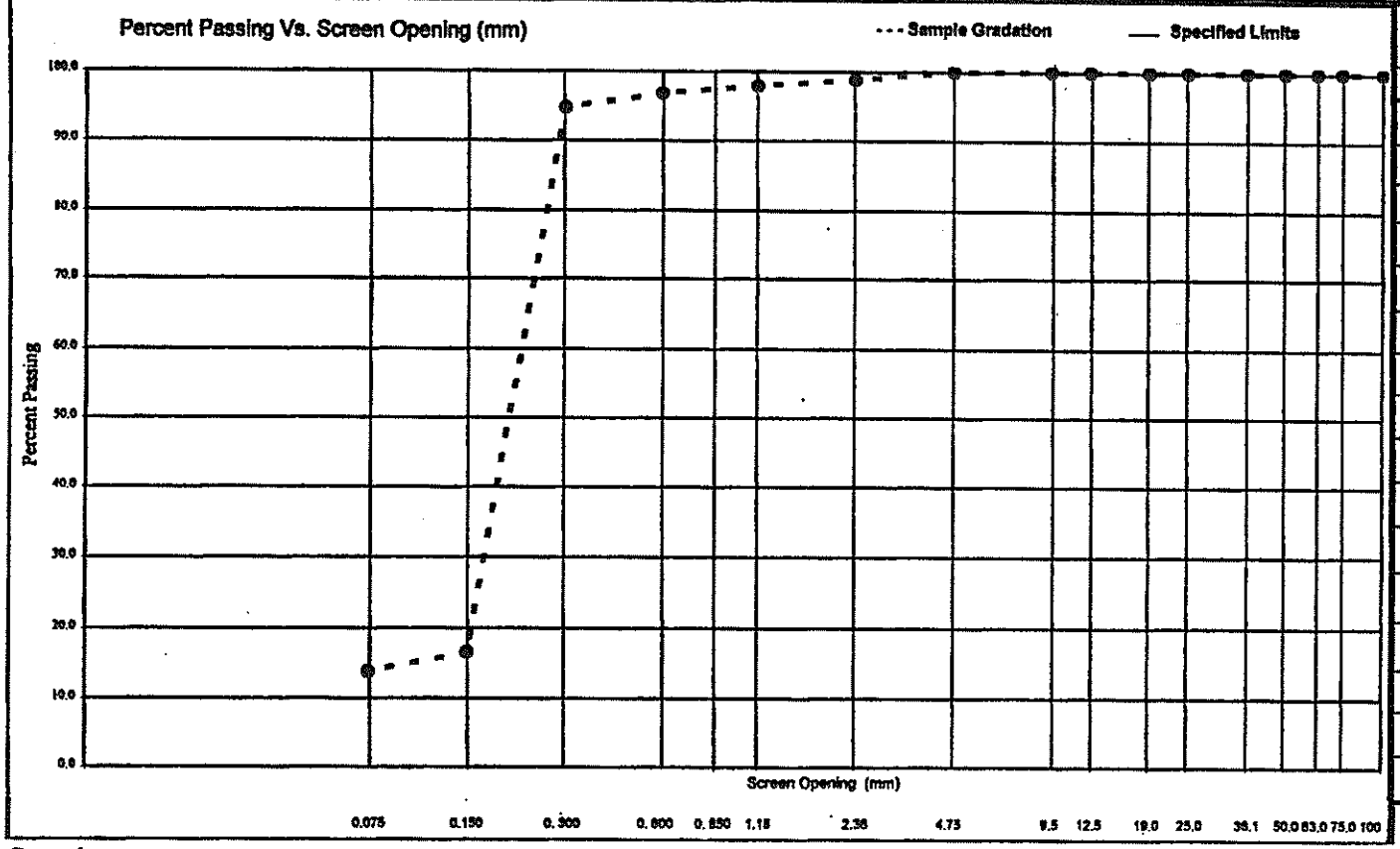
Date of Report: 26-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Type of Sample: Sand - some Silt
Sample No:
Source: BH5-126 @ 35'-36'
Specified Limits:

Sampled by: RW **Date:** 14-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	98.8		
1.180	97.9		
0.600	96.8		
0.300	94.7		
0.150	16.6		
0.075	13.8		

Remarks:

Gravel: 0.0 **Sand:** 86.2 **Fines:** 13.8 **Moisture %** 11.1

Reviewed by:

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report on: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 26-Jul-99

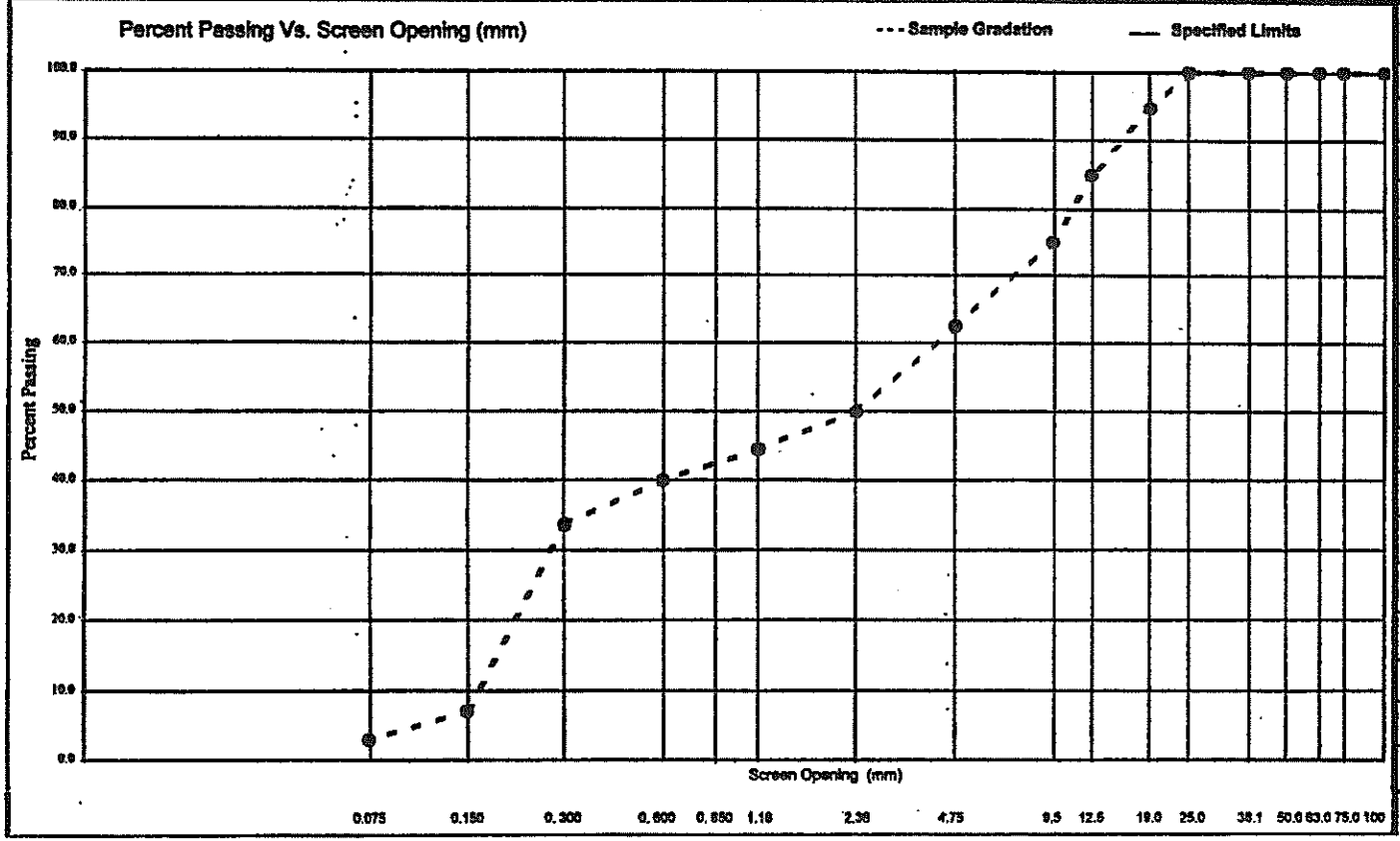
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES

cc:
cc:
cc:

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-127 @ 2'-3'
Specified Limits:

Sampled by: RW **Date:** 14-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	94.7		
12.5	84.9		
9.50	75.0		
4.75	62.5		
2.36	49.8		
1.180	44.3		
0.600	39.9		
0.300	33.6		
0.150	7.0		
0.075	2.9		

Remarks:

Gravel: 37.5 **Sand:** 59.6 **Fines:** 2.9 Moisture % 7.6

Reviewed by:

BH5-127 @ 2'-3'.xls

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Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 26-Jul-99

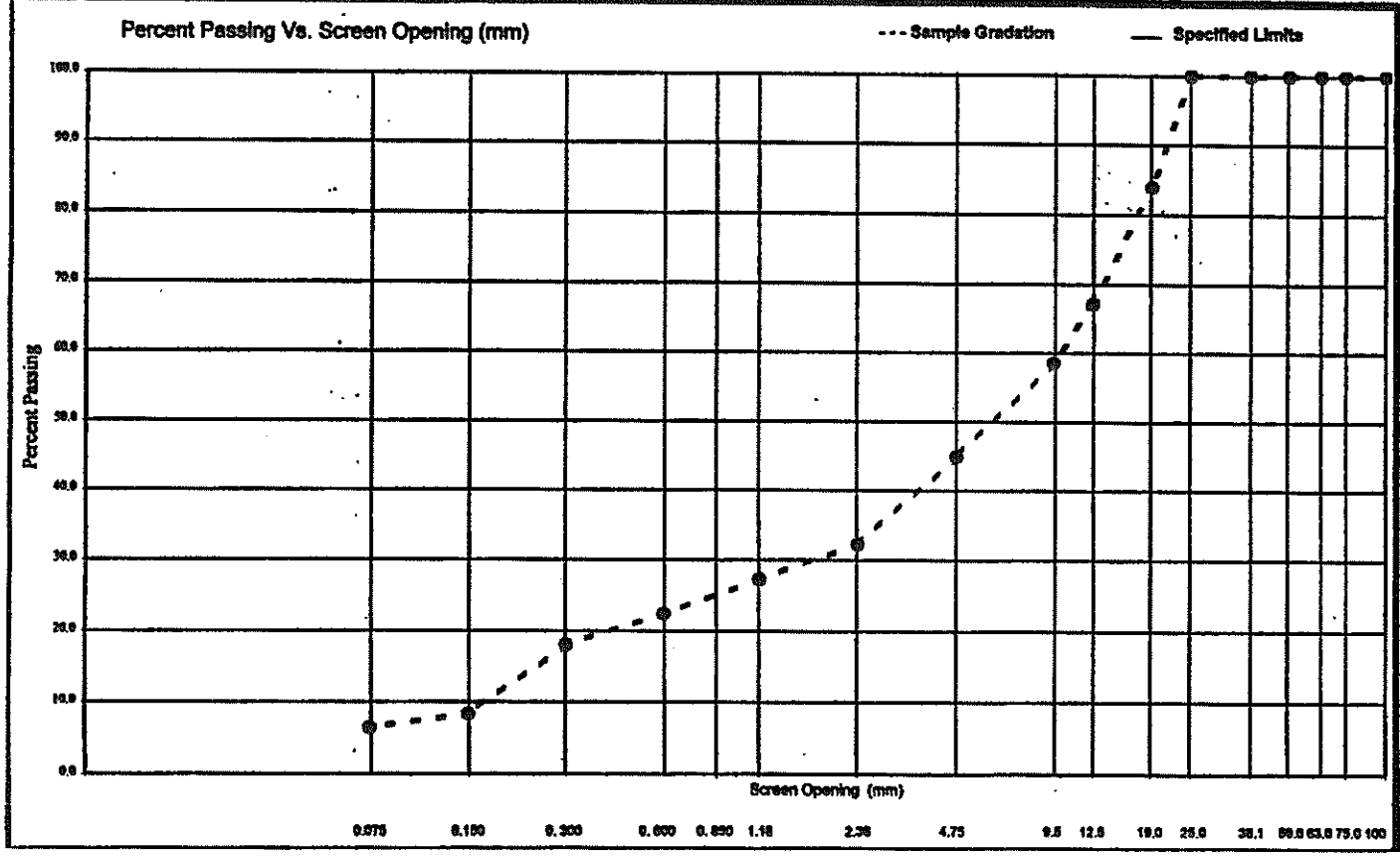
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES

cc:
cc:
cc:

Type of Sample: Gravel and Sand - trace Silt
Sample No:
Source: BH5-128 @ 2'-3'
Specified Limits:

Sampled by: RW **Date:** 14-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	83.9		
12.5	67.1		
9.50	58.5		
4.75	44.9		
2.36	32.2		
1.180	27.3		
0.600	22.4		
0.300	18.0		
0.150	8.3		
0.075	6.3		

Remarks:

Gravel: 55.1 **Sand:** 38.5 **Fines:** 6.3 **Moisture %** 11.4

Reviewed by:

BH5-128 @ 2'-3'

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Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

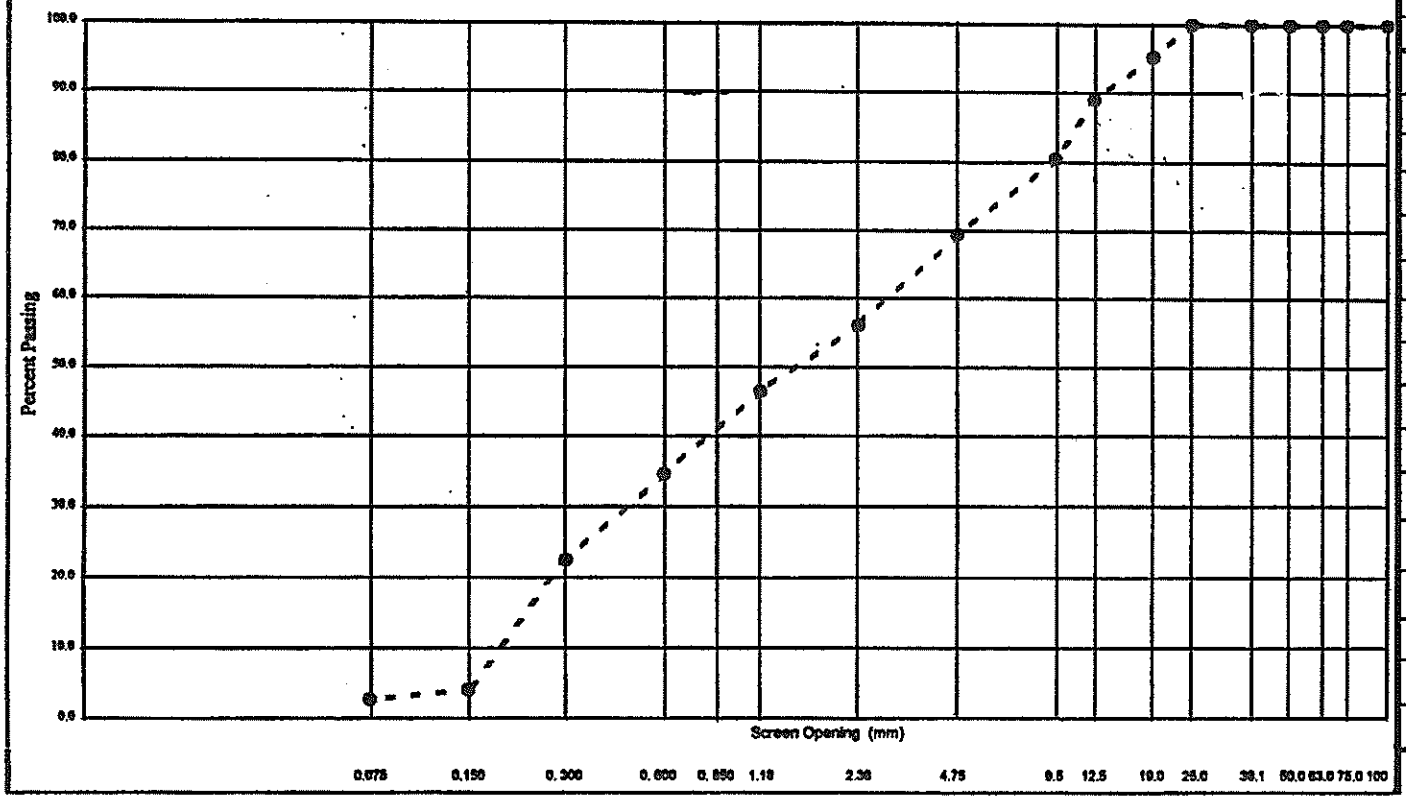
Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-130 @ 1'-2'
Specified Limits:

Sampled by: RW **Date:** 14-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)

--- Sample Gradation — Specified Limits



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	95.3		
12.5	89.0		
9.50	80.4		
4.75	69.4		
2.36	56.1		
1.180	46.4		
0.600	34.5		
0.300	22.5		
0.150	4.1		
0.075	2.7		

Remarks:

Gravel: 30.6 **Sand:** 66.7 **Fines:** 2.7 **Moisture %** 7.7

Reviewed by:

BH5-130 @ 1'-2'

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Williams Lake (250) 398-8788
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Report on: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
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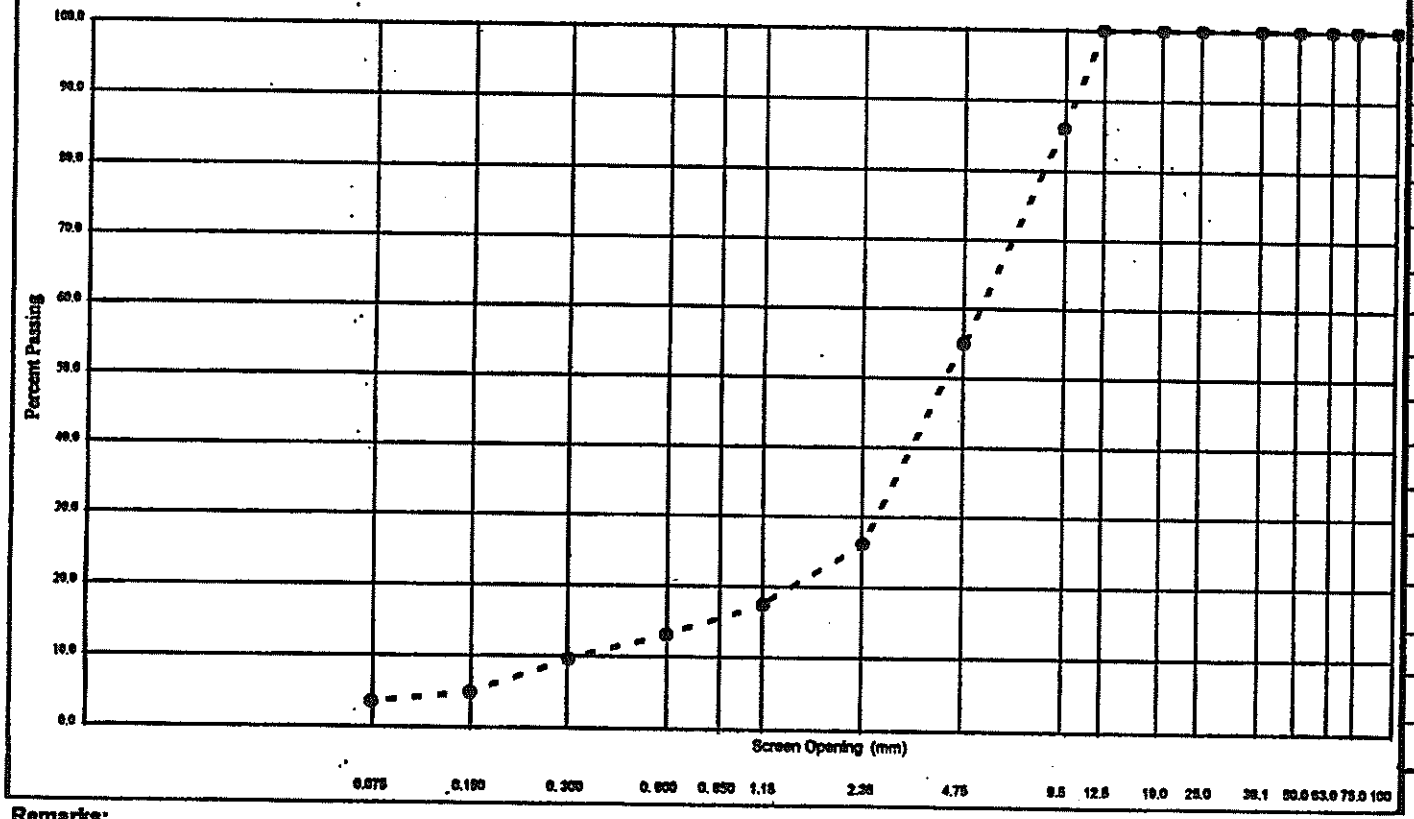
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 26-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-130 @ 10'-10.5'
Specified Limits:

Sampled by: RW **Date:** 15-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	86.0		
4.75	55.0		
2.36	26.2		
1.180	17.5		
0.600	13.1		
0.300	9.6		
0.150	4.8		
0.075	3.5		

Remarks:

Gravel: 45.0 **Sand:** 51.5 **Fines:** 3.5 **Moisture %** 1.3

Reviewed by:

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Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 26-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
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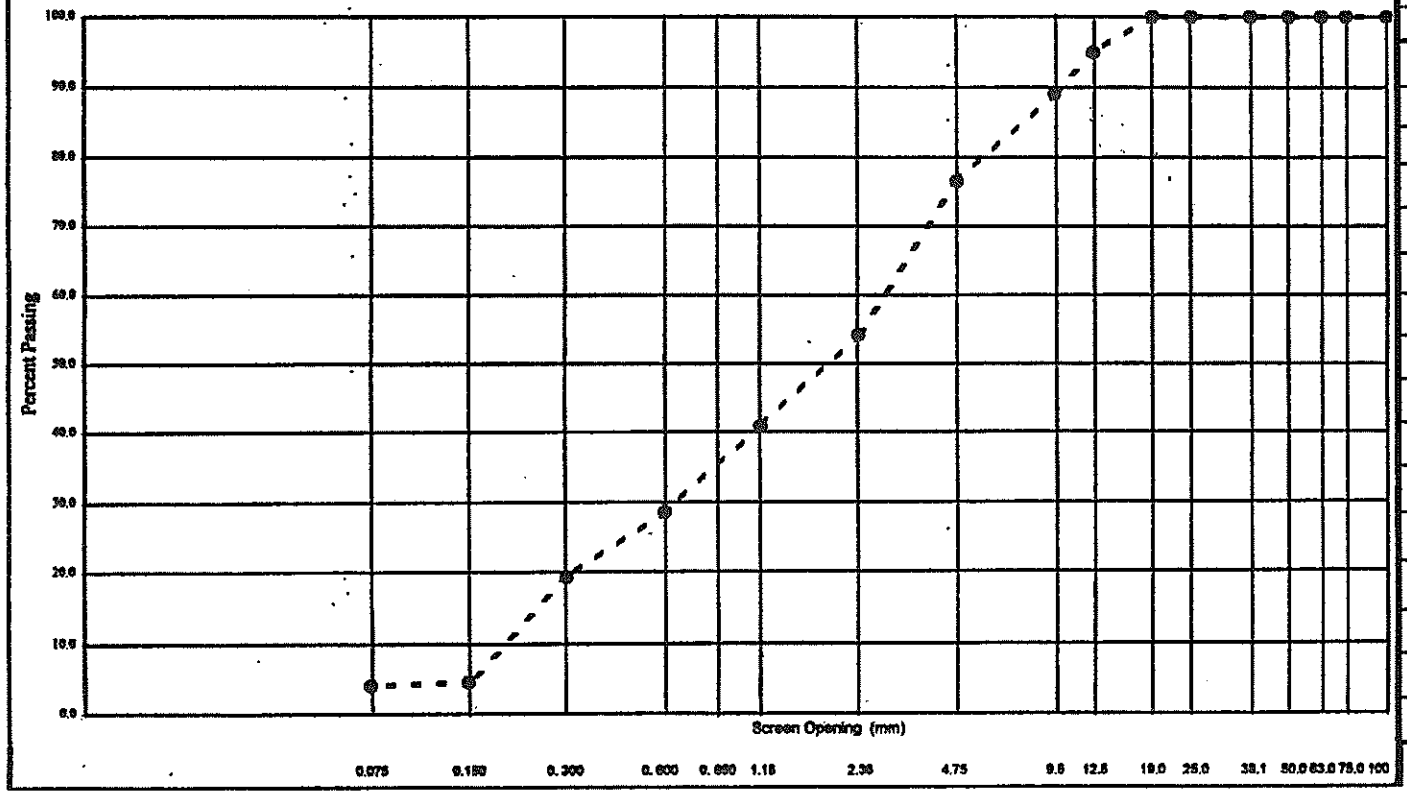
cc:

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-132 @ 4'-5'
Specified Limits:

Sampled by: RW **Date:** 19-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	94.9		
9.50	89.1		
4.75	76.5		
2.36	54.2		
1.180	40.8		
0.600	28.6		
0.300	19.2		
0.150	4.6		
0.075	4.1		

Remarks:

Gravel: 23.5 **Sand:** 72.4 **Fines:** 4.1 Moisture % 4.1

Reviewed by:

BH5-132 @ 4'-5'

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Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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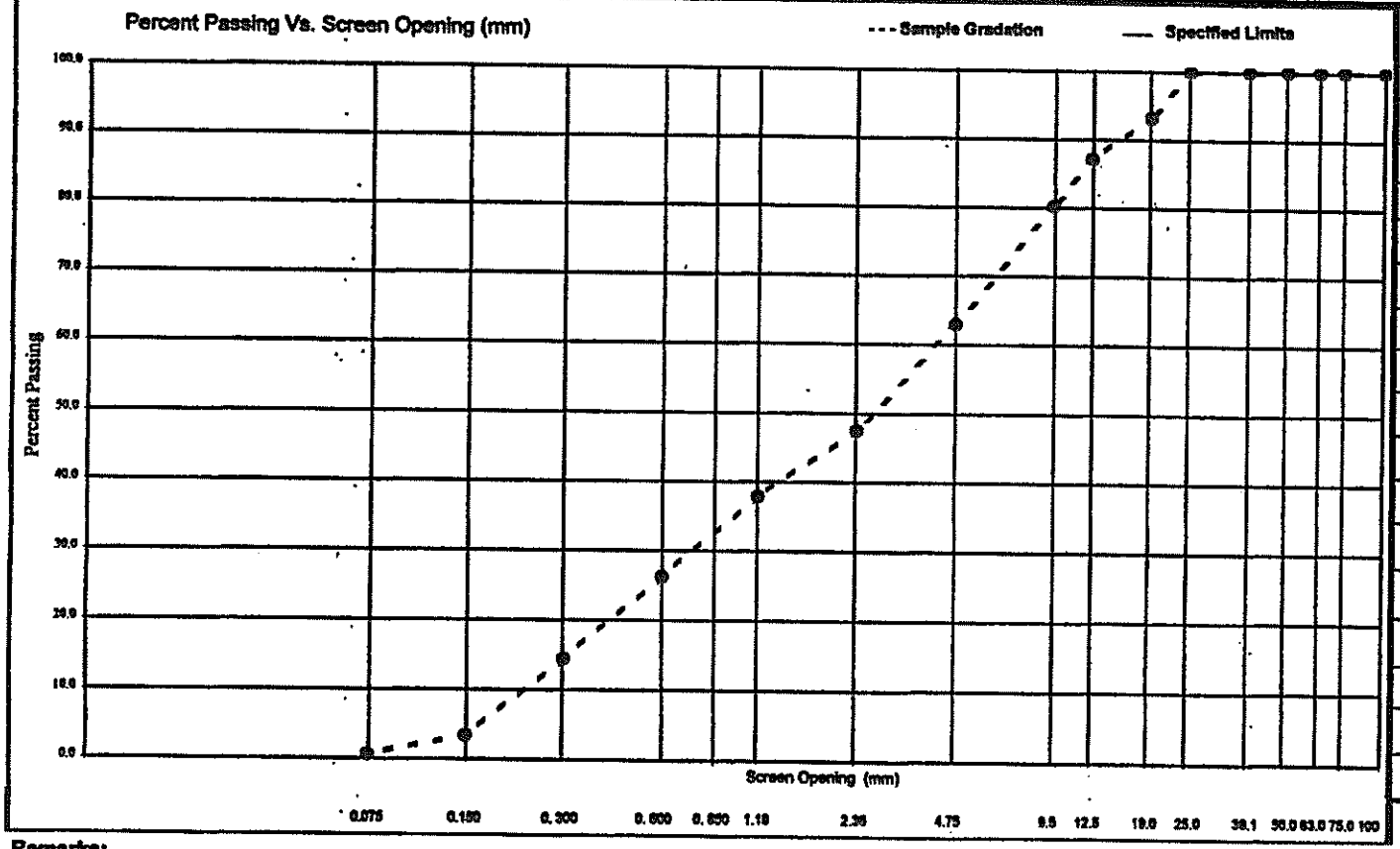
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 26-Jul-99

Type of Sample: Sand and Gravel
Sample No:
Source: BH5-132 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 19-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	93.2		
12.5	87.2		
9.50	80.2		
4.75	62.9		
2.36	47.5		
1.180	37.9		
0.600	26.3		
0.300	14.4		
0.150	3.4		
0.075	0.6		

Remarks:

Gravel: 37.1 **Sand:** 62.3 **Fines:** 0.6 **Moisture %** 3.7

Reviewed by:

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

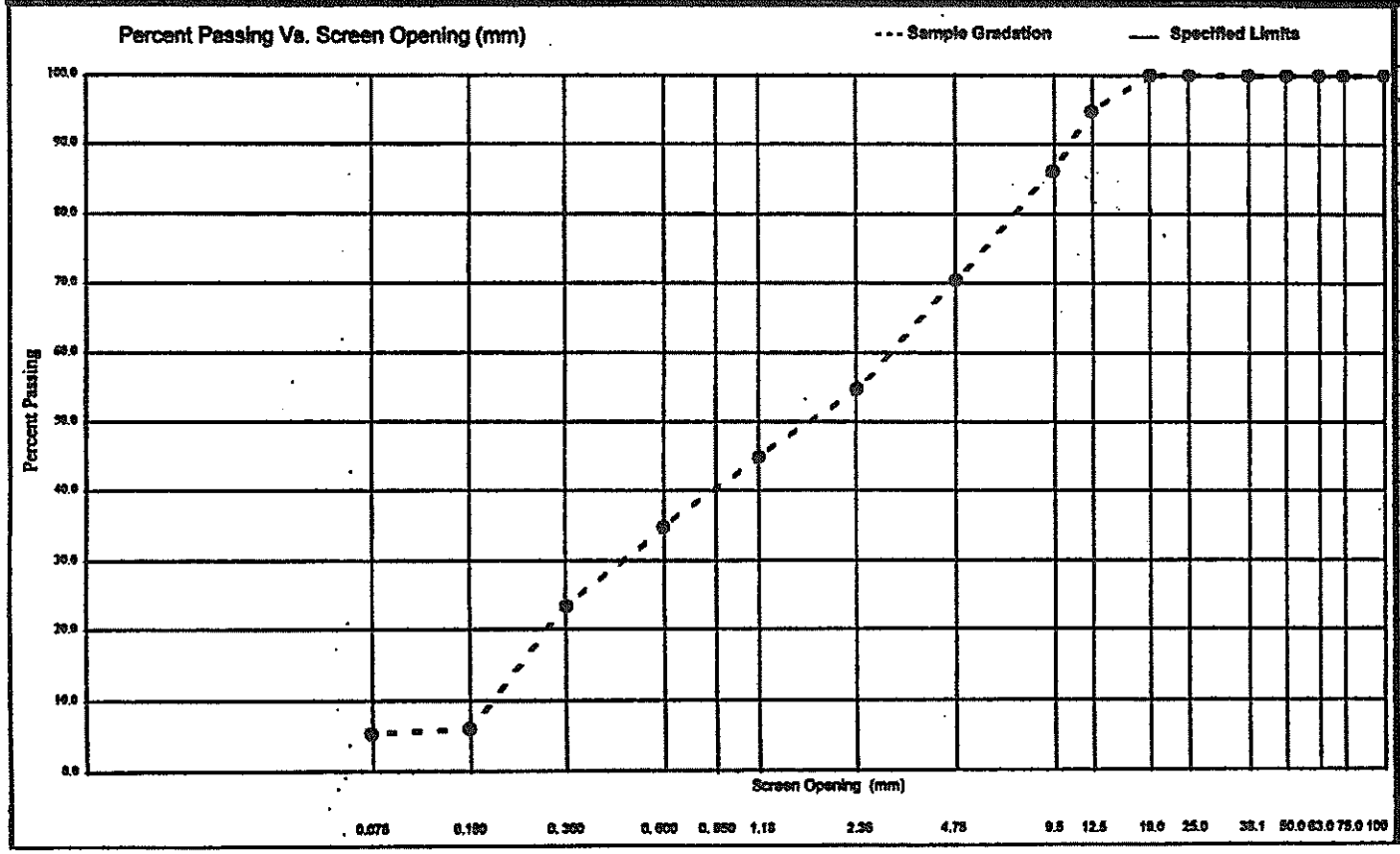
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 26-Jul-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-132 @ 19'-20'
Specified Limits:

Sampled by: RW **Date:** 19-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	94.7		
9.50	86.1		
4.75	70.4		
2.36	54.8		
1.180	44.8		
0.600	34.6		
0.300	23.4		
0.150	6.0		
0.075	5.3		

Remarks:

Gravel: 29.6 **Sand:** 65.1 **Fines:** 5.3 **Moisture %** 3.9

Reviewed by:

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

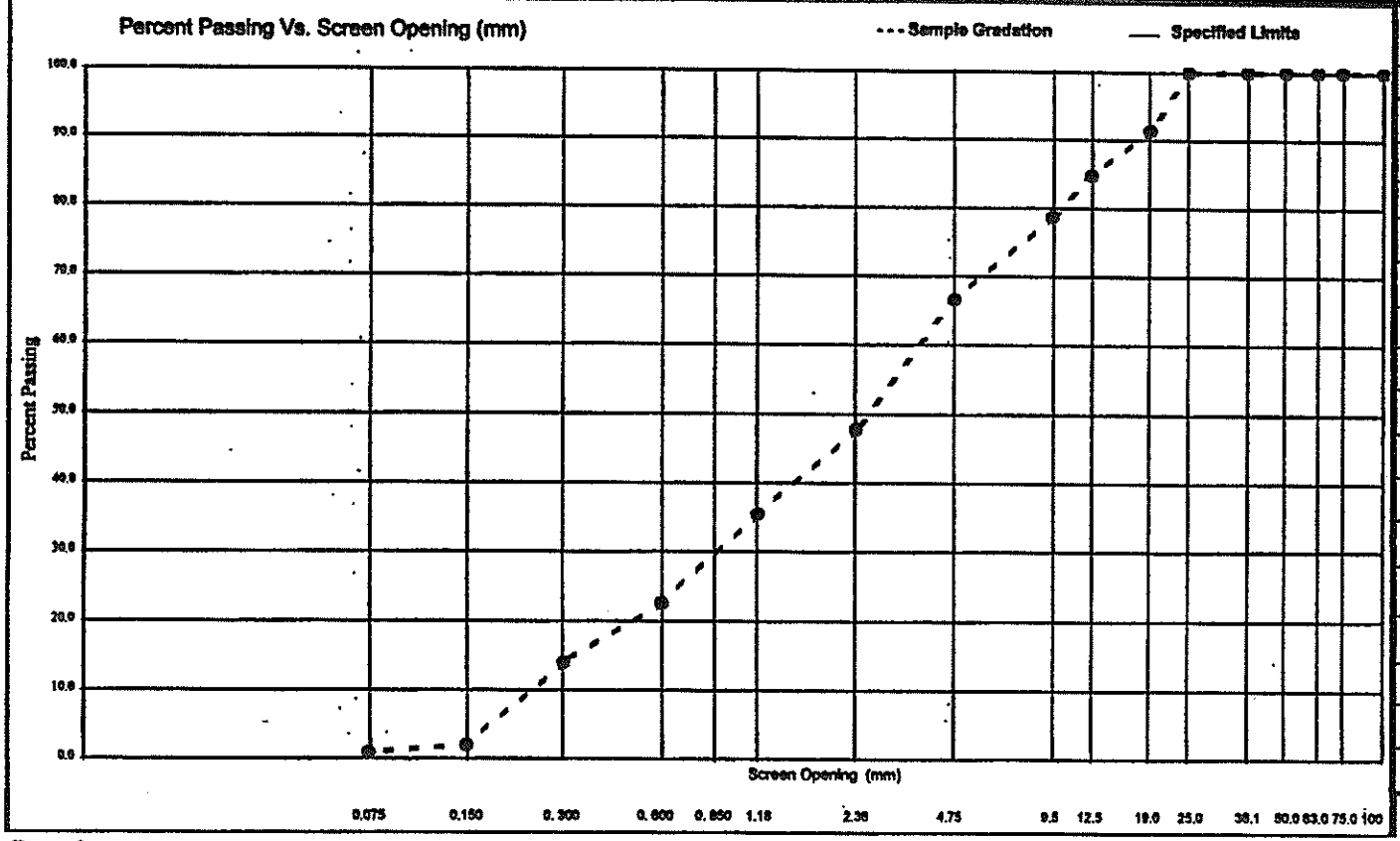
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-133 @ 29'-30'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	91.3		
12.5	84.8		
9.50	78.6		
4.75	66.6		
2.36	47.8		
1.180	35.3		
0.600	22.6		
0.300	13.9		
0.150	1.9		
0.075	0.9		

Remarks:

Gravel: 33.4 **Sand:** 65.7 **Fines:** 0.9 **Moisture %** 4.1

Reviewed by:

BH5-133 @ 29'-30'.xls

Sirra Engineering Ltd
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1080

Report of: Aggregate Sieve Analysis

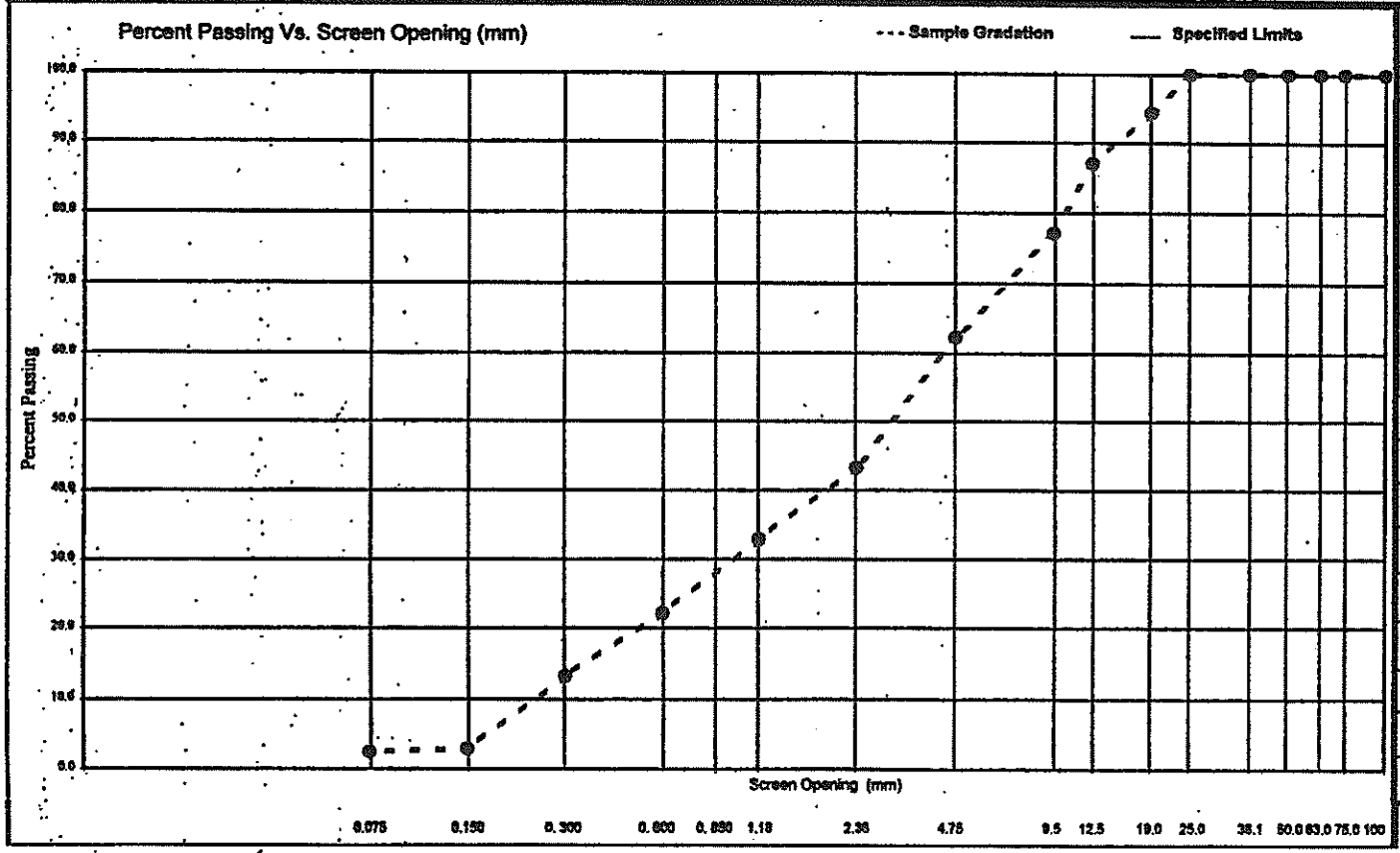
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-134 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 19-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	94.3		
12.5	87.1		
9.50	77.1		
4.75	62.3		
2.36	43.2		
1.180	32.8		
0.600	22.2		
0.300	13.2		
0.150	2.9		
0.075	2.4		

Remarks:

Gravel: 37.7 **Sand:** 59.9 **Fines:** 2.4 **Moisture %** 4.7

Reviewed by:

BH5-134 @ 9'-10'.xls

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

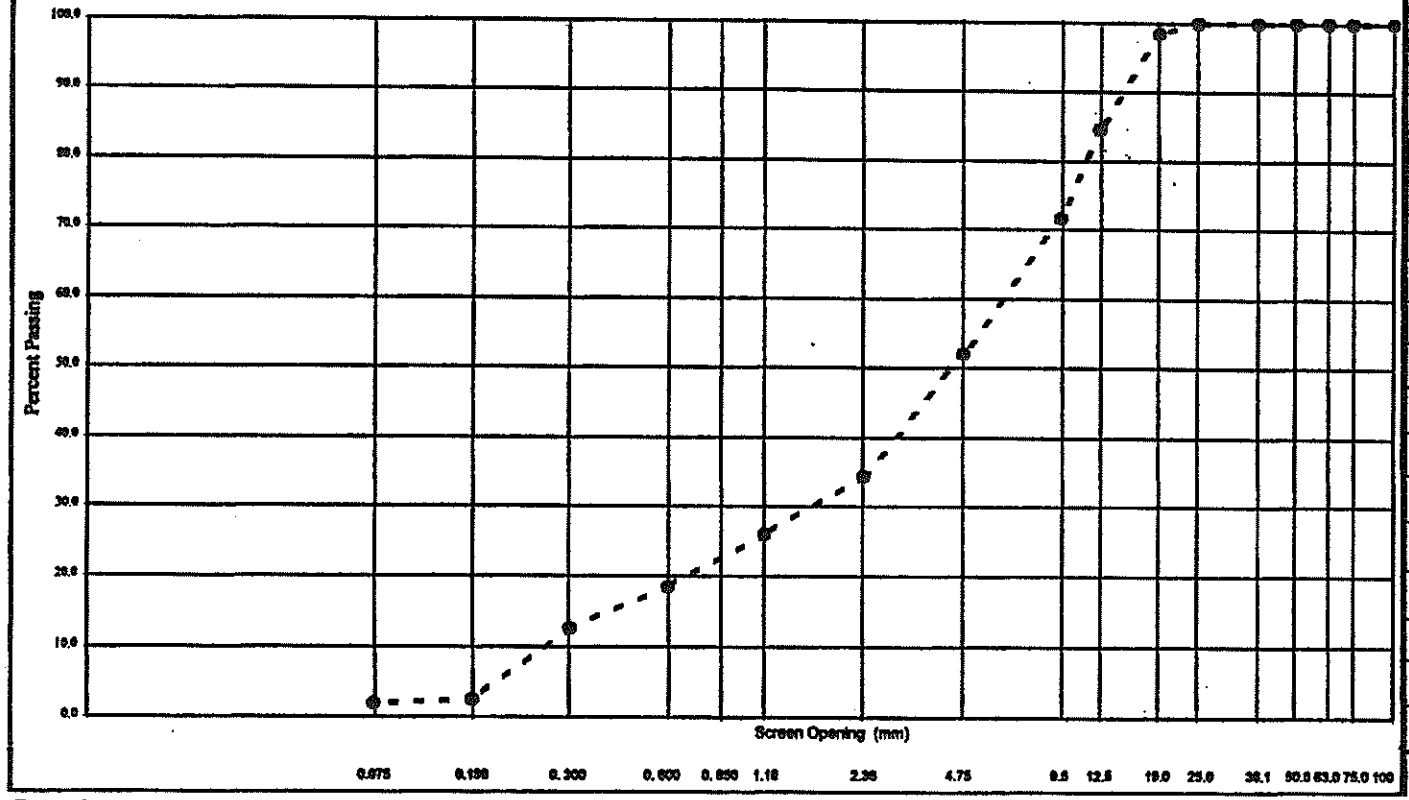
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-134 @ 19'-20'
Specified Limits:

Sampled by: RW **Date:** 19-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	98.5		
12.5	84.5		
9.50	71.6		
4.75	52.0		
2.36	34.4		
1.180	26.1		
0.600	18.5		
0.300	12.6		
0.150	2.4		
0.075	1.9		

Remarks:

Gravel: 46.0 **Sand:** 50.1 **Fines:** 1.9 **Moisture %** 3.5

Reviewed by:

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
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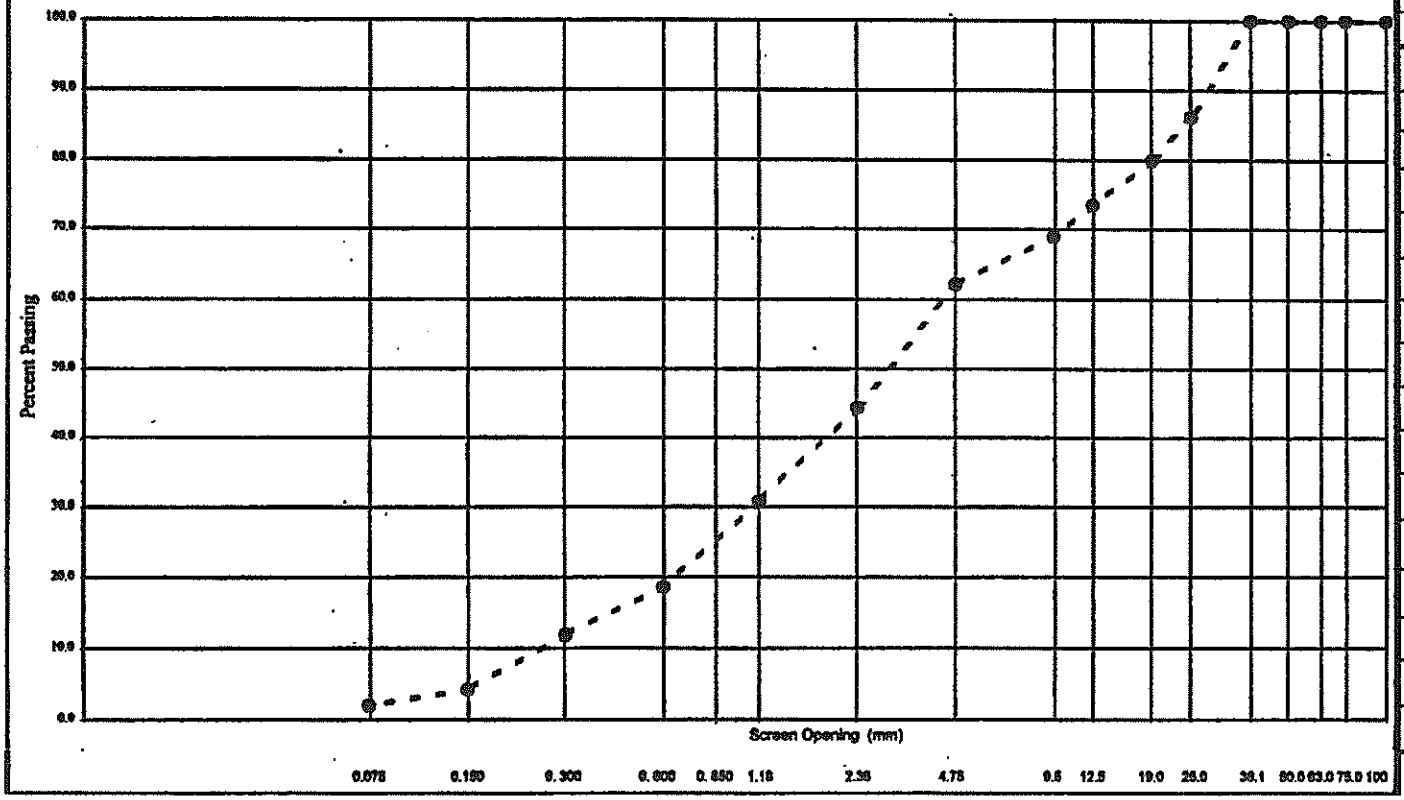
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-135 @ 5'-6.5'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	86.2		
19.0	79.9		
12.5	73.4		
9.50	68.9		
4.75	62.1		
2.36	44.4		
1.180	30.8		
0.600	18.6		
0.300	11.9		
0.150	4.2		
0.075	2.0		

Remarks:

Gravel: 37.9 **Sand:** 60.2 **Fines:** 2.0 **Moisture %** 3.8

Reviewed by:

BH5-135 @ 5'-6.5'

Terra Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

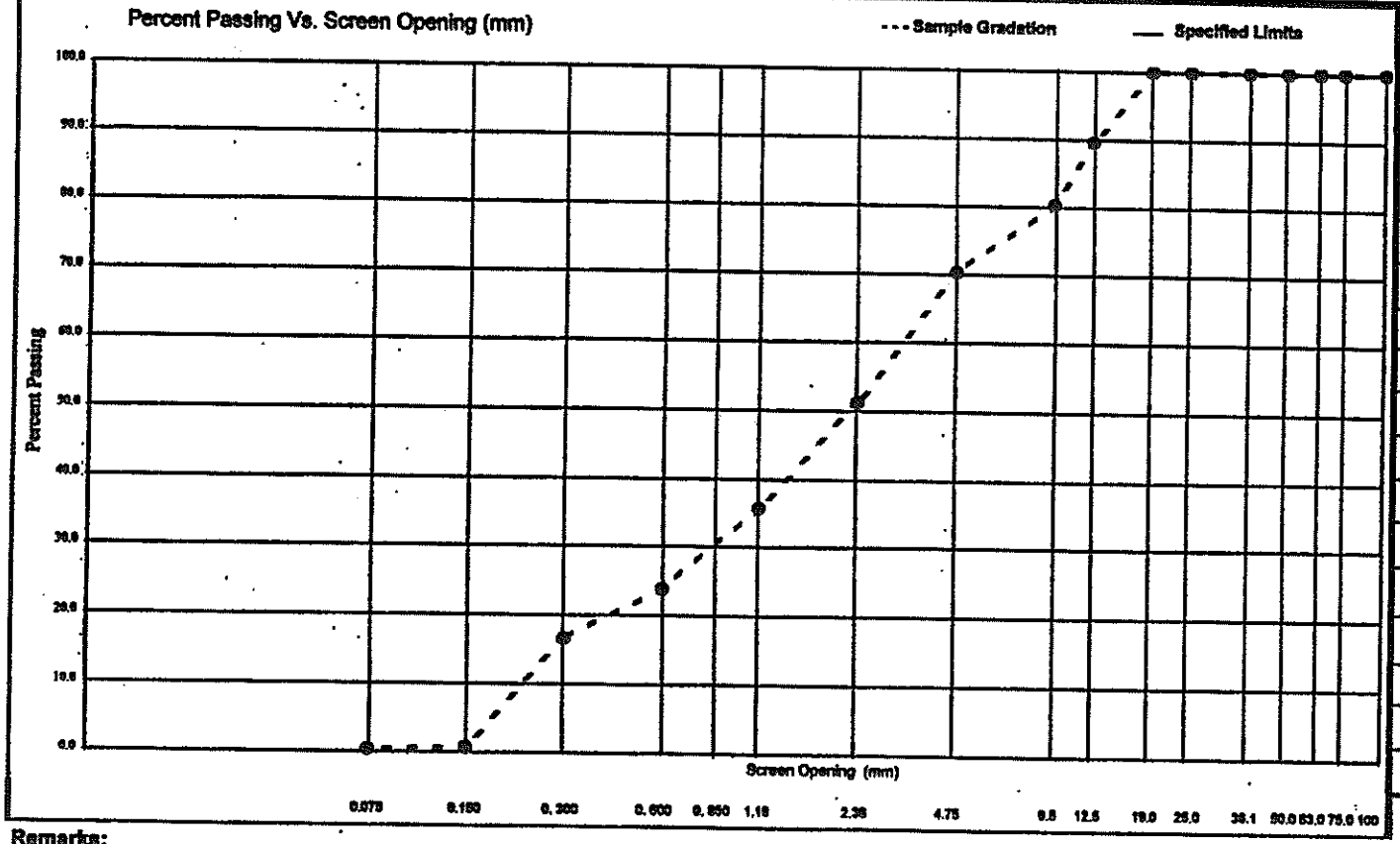
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 26-Jul-99

Type of Sample: Sand - Gravely
Sample No:
Source: BH5-135 @ 10'-11.5'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	89.6		
9.50	80.3		
4.75	70.2		
2.36	51.2		
1.180	35.6		
0.600	23.9		
0.300	16.6		
0.150	0.7		
0.075	0.3		

Remarks:

Gravel: 29.8 **Sand:** 69.9 **Fines:** 0.3 **Moisture %** 13.0

Reviewed by:

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

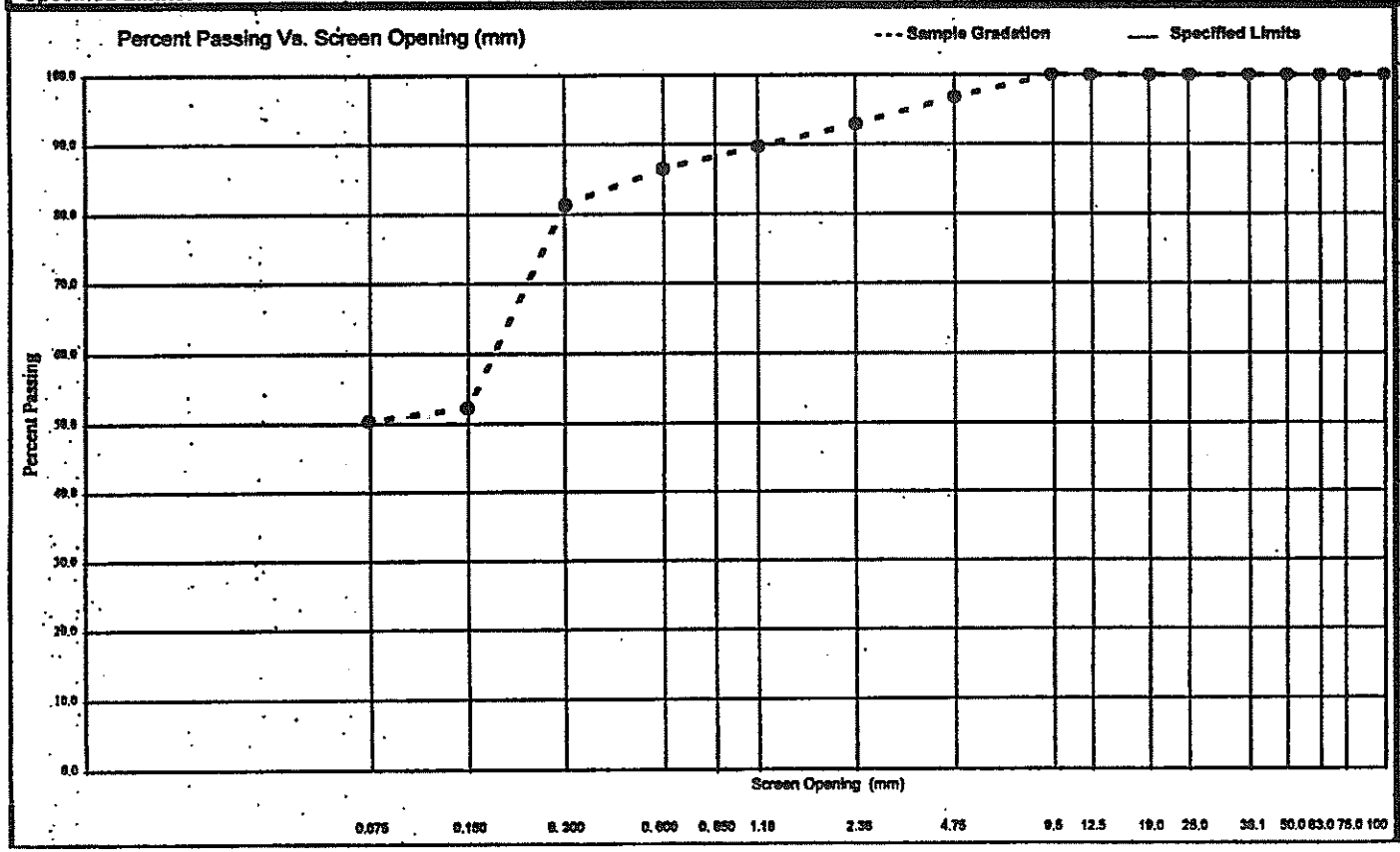
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

Type of Sample: Silt and Sand - trace Gravel, some Clay
Sample No:
Source: BH5-135 @ 20'-21.5'
Specified Limits:

Sampled by: RW **Date:** 19-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	96.8		
2.36	92.9		
1.180	89.7		
0.600	86.5		
0.300	81.3		
0.150	52.3		
0.075	50.3		

Remarks:

Gravel: 3.2 **Sand:** 46.5 **Fines:** 50.3 **Moisture %** 15.3

Reviewed by:

BH5-135 @ 20'-21.5'.xls

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

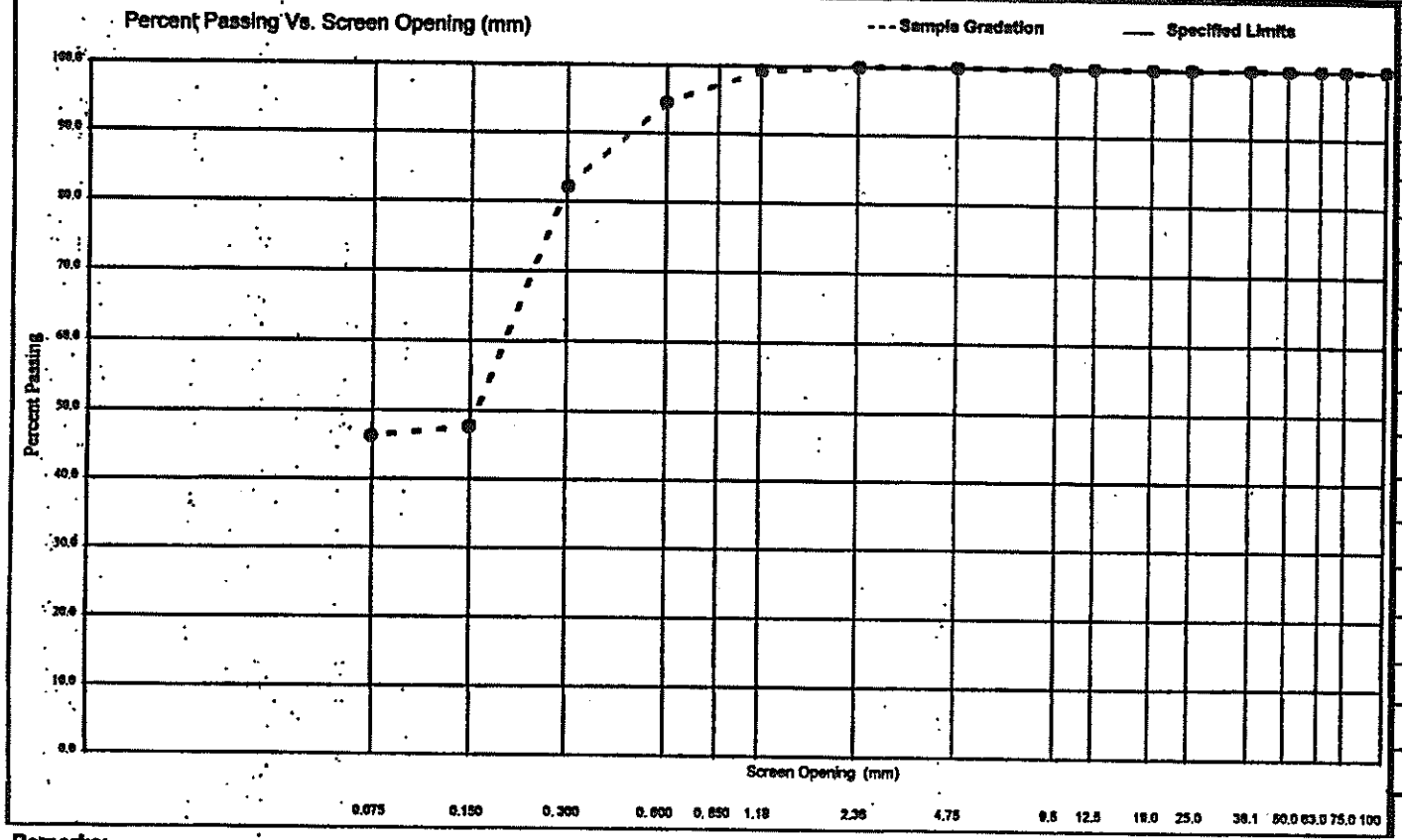
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 26-Jul-99

Type of Sample: Sand and Silt - trace Clay
Sample No:
Source: BH5-135 @ 25'-26.5'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 26-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	100.0		
2.36	100.0		
1.180	99.3		
0.600	94.5		
0.300	82.1		
0.150	47.6		
0.075	46.2		

Remarks:

Gravel: 0.0 **Sand:** 53.8 **Fines:** 46.2 **Moisture %** 16.2

Reviewed by:

BH5-135 @ 25'-26.5'.xls

Port Coquitlam (604) 945-9939 · Williams Lake (250) 398-8788 · Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 31-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
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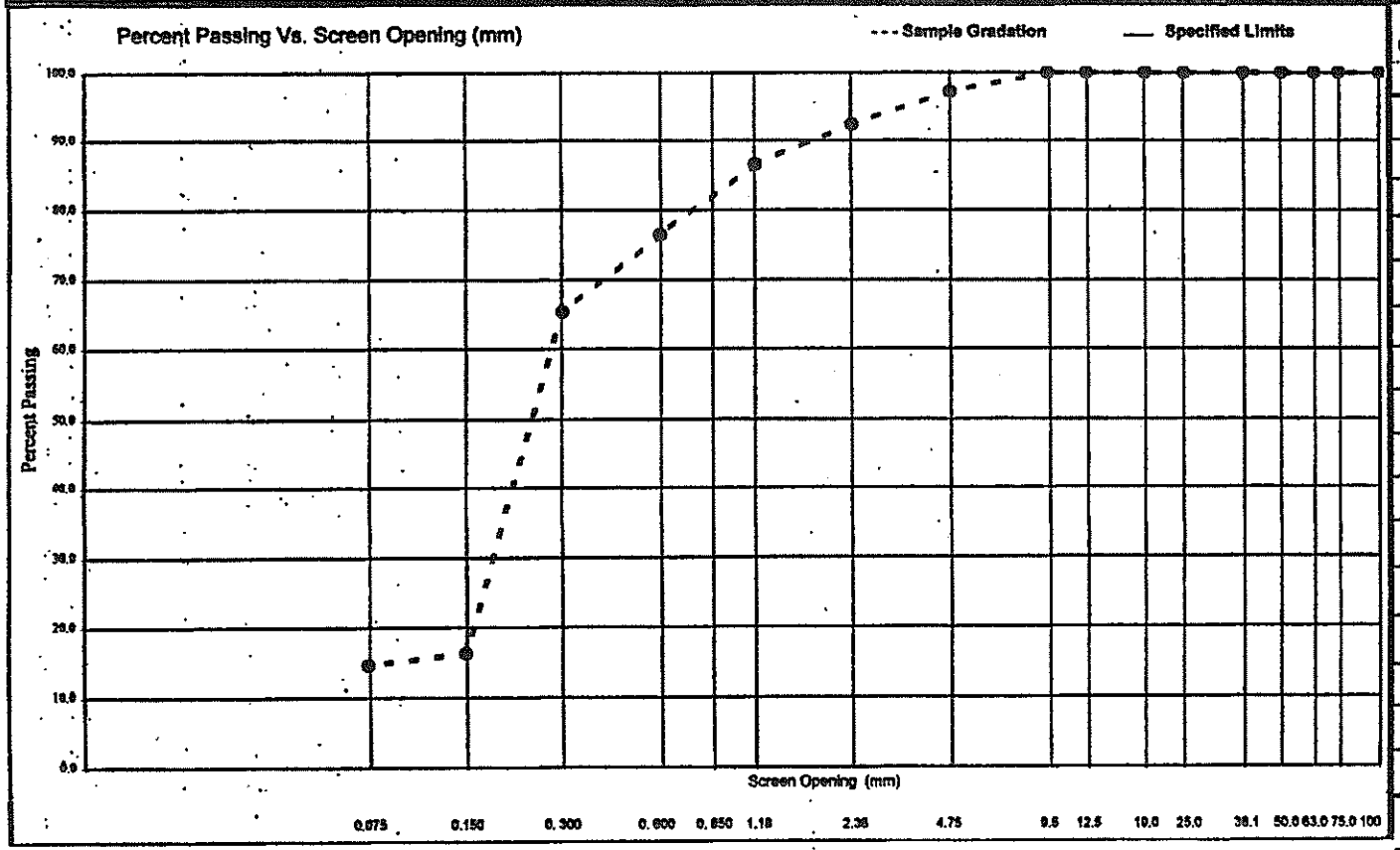
cc:

Type of Sample: Sand - trace Silt, trace clay, trace Gravel
Sample No:
Source: BH5-136 @ 4'-5'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	97.2		
2.36	92.4		
1.180	86.5		
0.600	76.4		
0.300	65.3		
0.150	16.3		
0.075	14.6		

Remarks:

Gravel: 2.8 **Sand:** 82.6 **Fines:** 14.6 **Moisture %** 13.6

Reviewed by:

Engineering Ltd.
Vancouver (604) 45 | Kamloops) 372 | Abbotsford ( )-64
Port Coquitlam (604) 945-9939 | Williams Lake (250) 398-8788 | Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 31-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES

cc:
cc:
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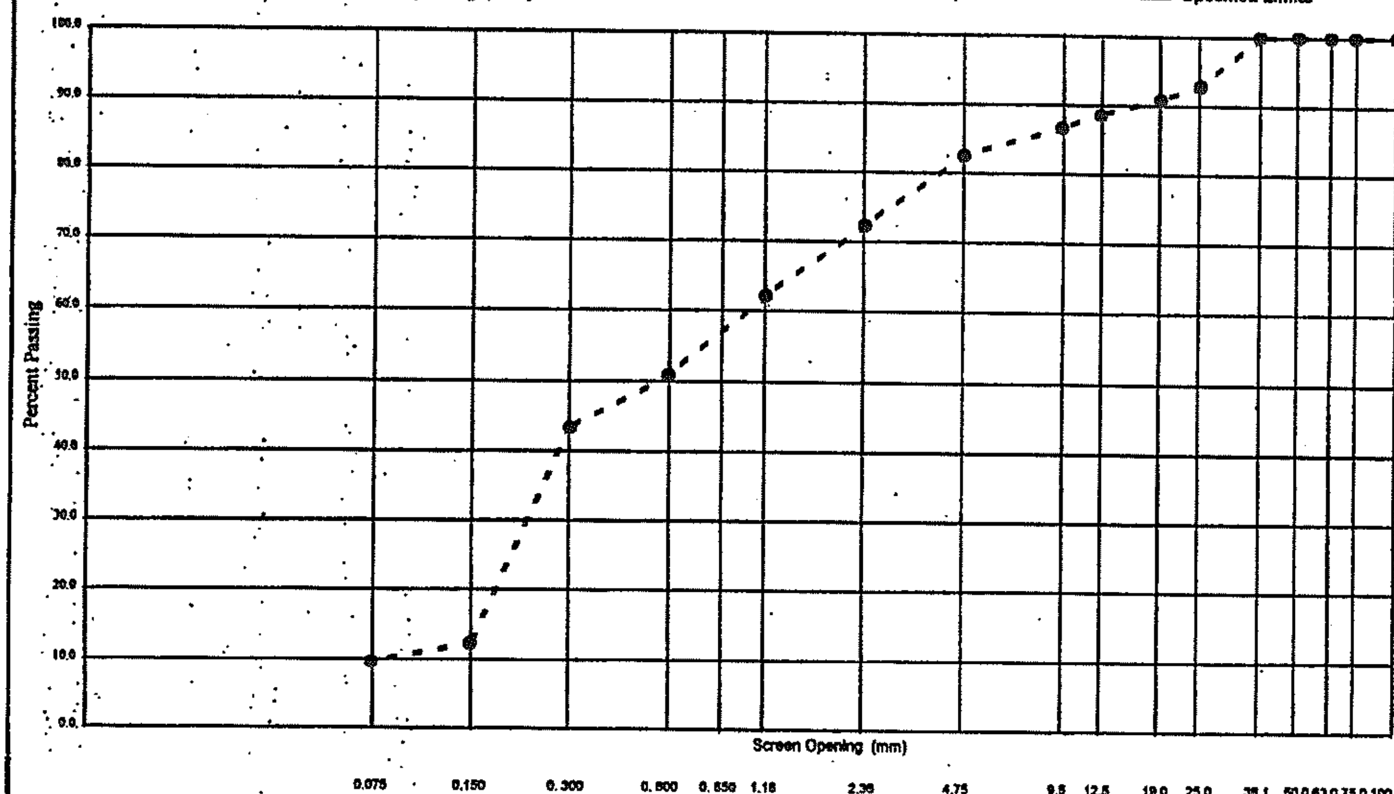
Type of Sample: Sand - some Gravel, trace Clay
Sample No:
Source: BH5-136 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	92.9		
19.0	90.9		
12.5	88.6		
9.50	86.7		
4.75	82.6		
2.36	72.3		
1.180	62.1		
0.600	50.9		
0.300	43.3		
0.150	12.3		
0.075	9.6		

Remarks:

Gravel: 17.4 **Sand:** 72.9 **Fines:** 9.6 Moisture % 15.5

Reviewed by:

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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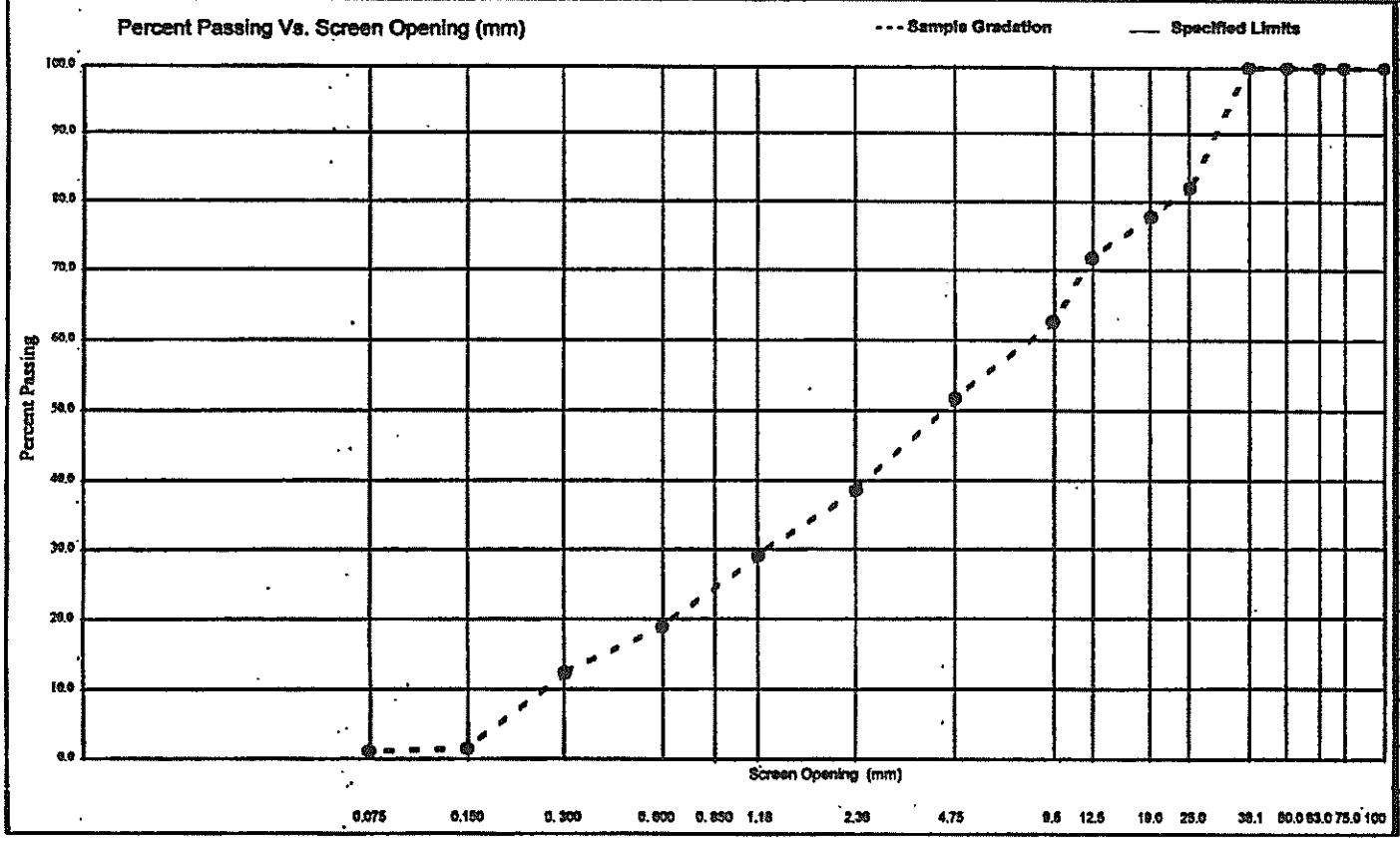
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-136 @ 24'-25'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	82.1		
19.0	77.8		
12.5	71.8		
9.50	62.7		
4.75	51.7		
2.36	38.6		
1.180	29.2		
0.600	18.9		
0.300	12.3		
0.150	1.5		
0.075	1.1		

Remarks:

Gravel: 48.3 **Sand:** 50.6 **Fines:** 1.1 Moisture % 5.3

Reviewed by:

BH5-136 @ 24'-25'

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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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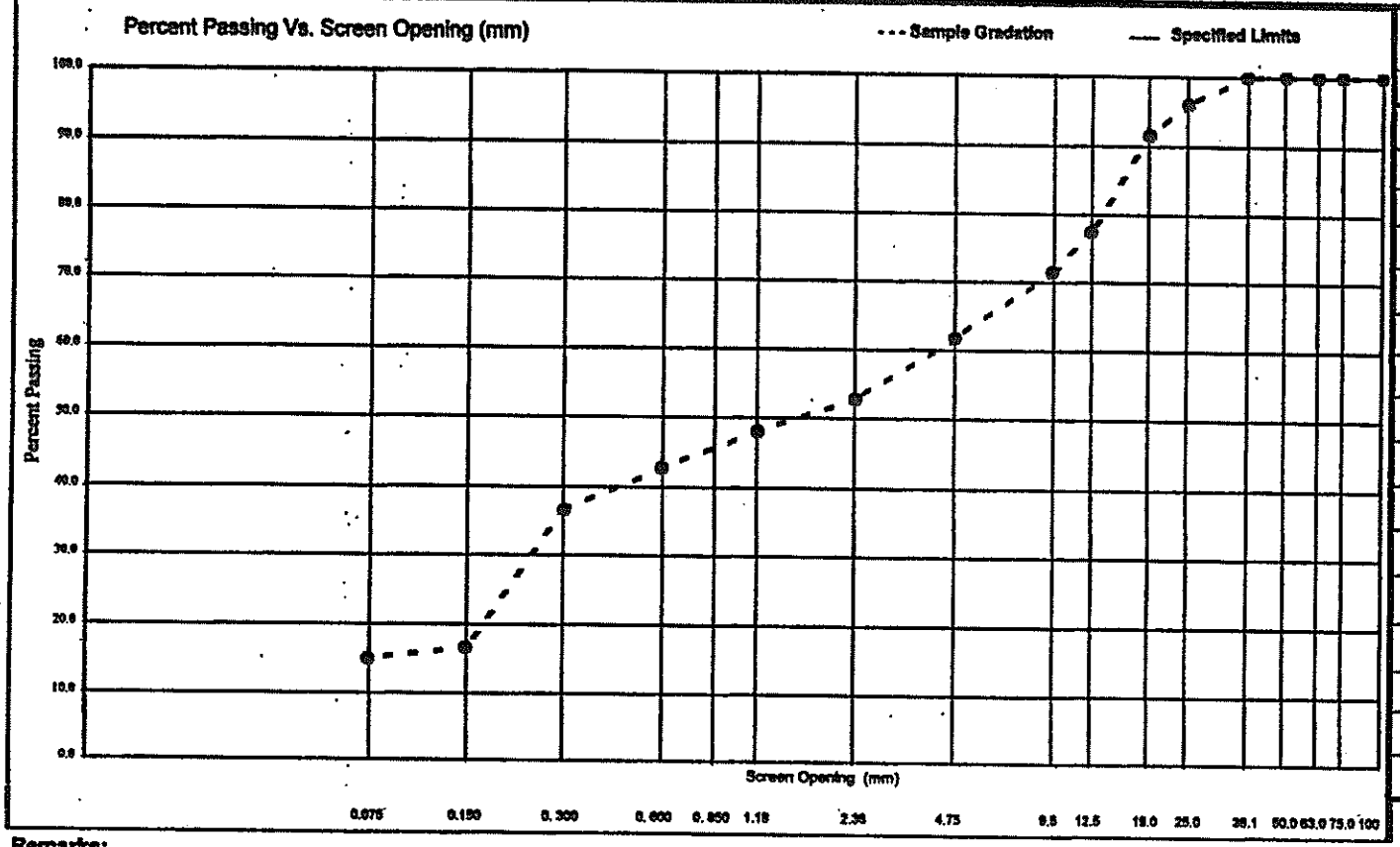
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

Type of Sample: Sand and Gravel - some Silt
Sample No:
Source: BH5-137 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	96.0		
19.0	91.6		
12.5	77.4		
9.50	71.4		
4.75	61.7		
2.36	52.8		
1.180	48.0		
0.600	42.7		
0.300	36.5		
0.150	16.6		
0.075	15.0		

Remarks:

Gravel: 38.3 **Sand:** 46.7 **Fines:** 15.0 **Moisture %** 8.1

Reviewed by:

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
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Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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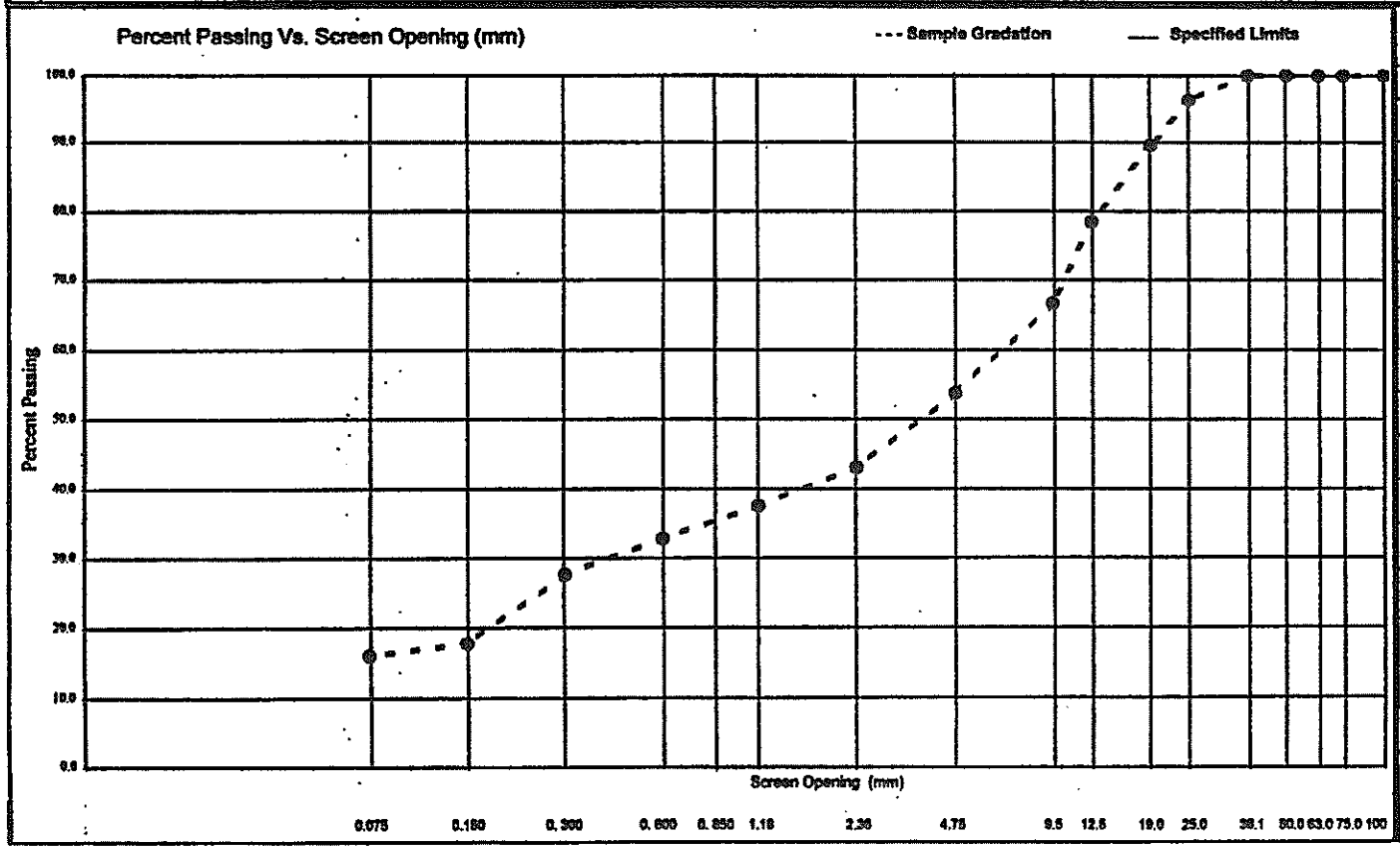
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 31-Jul-99

Type of Sample: Gravel and Sand - some Silt
Sample No:
Source: BH5-137 @ 19'-20'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	96.3		
19.0	89.6		
12.5	78.5		
9.50	66.6		
4.75	53.8		
2.36	43.0		
1.180[1]	37.5		
0.600	32.7		
0.300	27.7		
0.150	17.7		
0.075	16.0		

Remarks:

Gravel: 46.2 **Sand:** 37.8 **Fines:** 16.0 **Moisture %** 6.1

Reviewed by:

Port Coquitlam (604) 945-9939
(250) 398-8788
(250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

Date of Report: 01-Aug-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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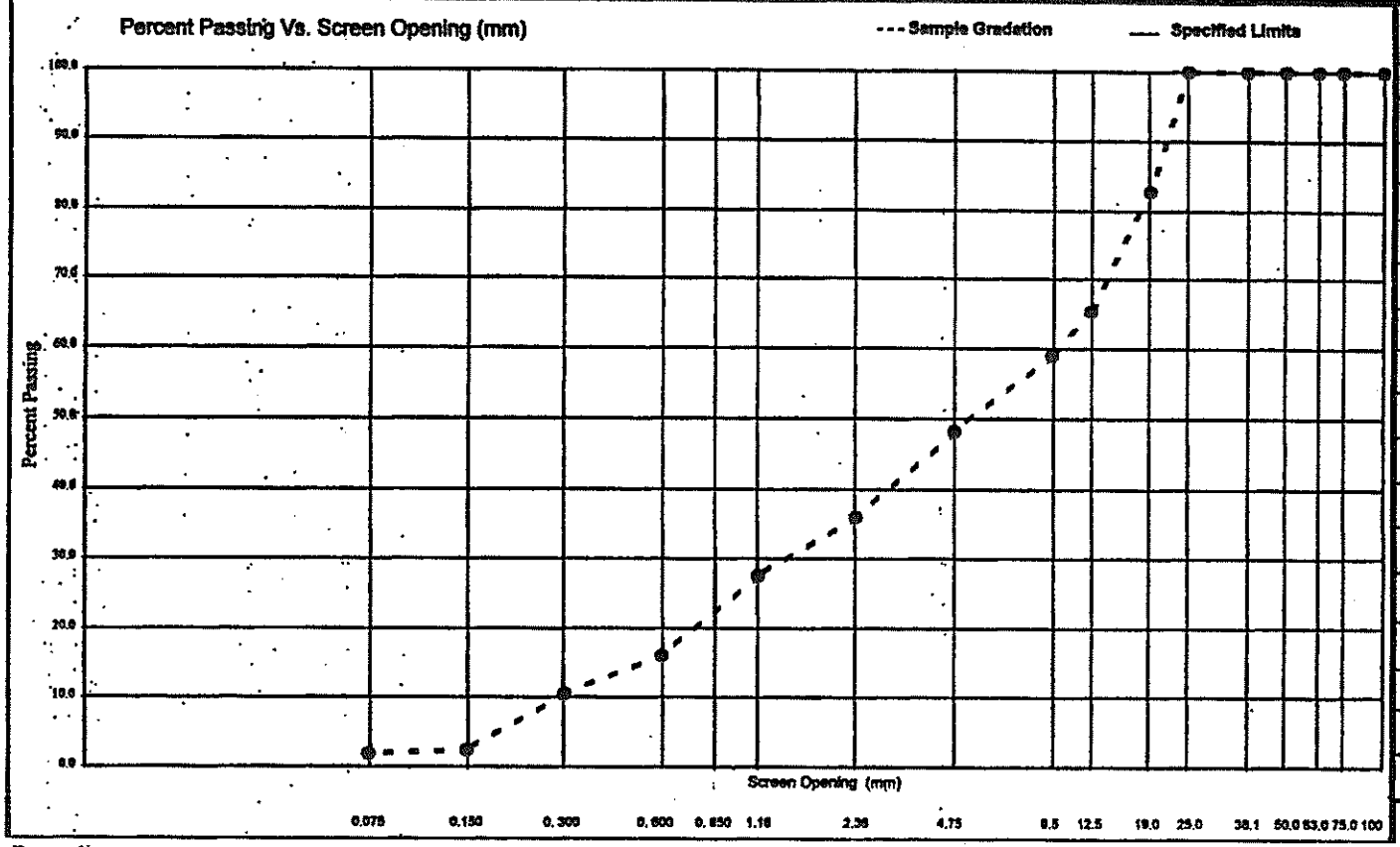
Type of Sample: Gravel and Sand - trace Clay
Sample No:
Source: BH5-138 @ 14'-15'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 1-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	82.7		
12.5	65.3		
9.50	59.0		
4.75	48.2		
2.36	35.9		
1.180	27.5		
0.600	16.1		
0.300	10.4		
0.150	2.4		
0.075	1.9		

Remarks:

Gravel: 51.8 **Sand:** 46.3 **Fines:** 1.9 **Moisture %** 4.7

Reviewed by:

Terra Engineering Ltd
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
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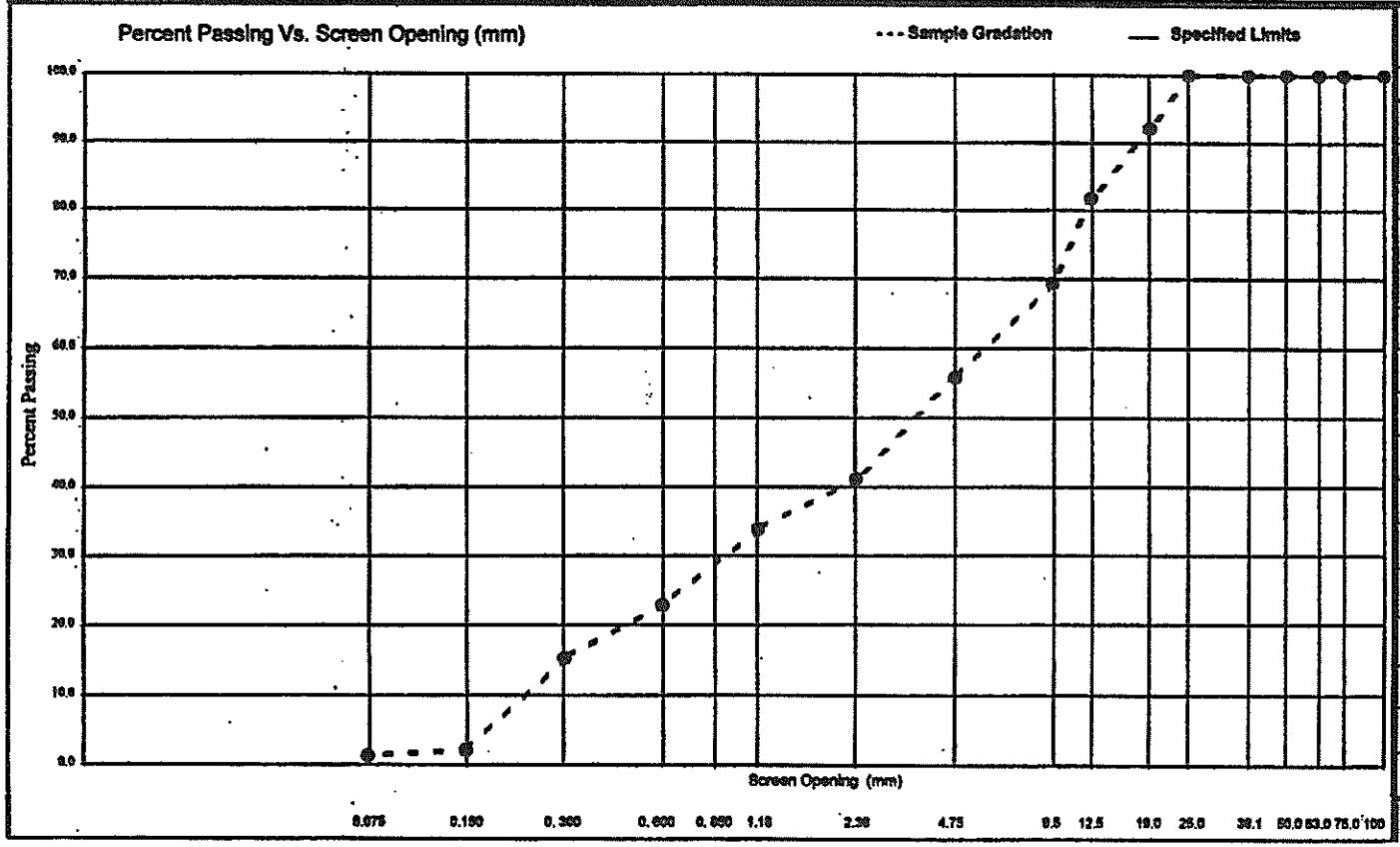
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand and Gravel, trace Silt
Sample No:
Source: BH5-139 @ 19'-20'
Specified Limits:

Sampled by: RW
Tested by: EA

Date: 20-Jul-99
Date: 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	92.1		
12.5	81.7		
9.50	69.3		
4.75	55.8		
2.36	41.1		
1.180[1]	33.8		
0.600	22.8		
0.300	15.2		
0.150	2.0		
0.075	1.3		

Remarks:

Gravel: 44.2 **Sand:** 54.6 **Fines:** 1.3 **Moisture %** 6.6

Reviewed by:

Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
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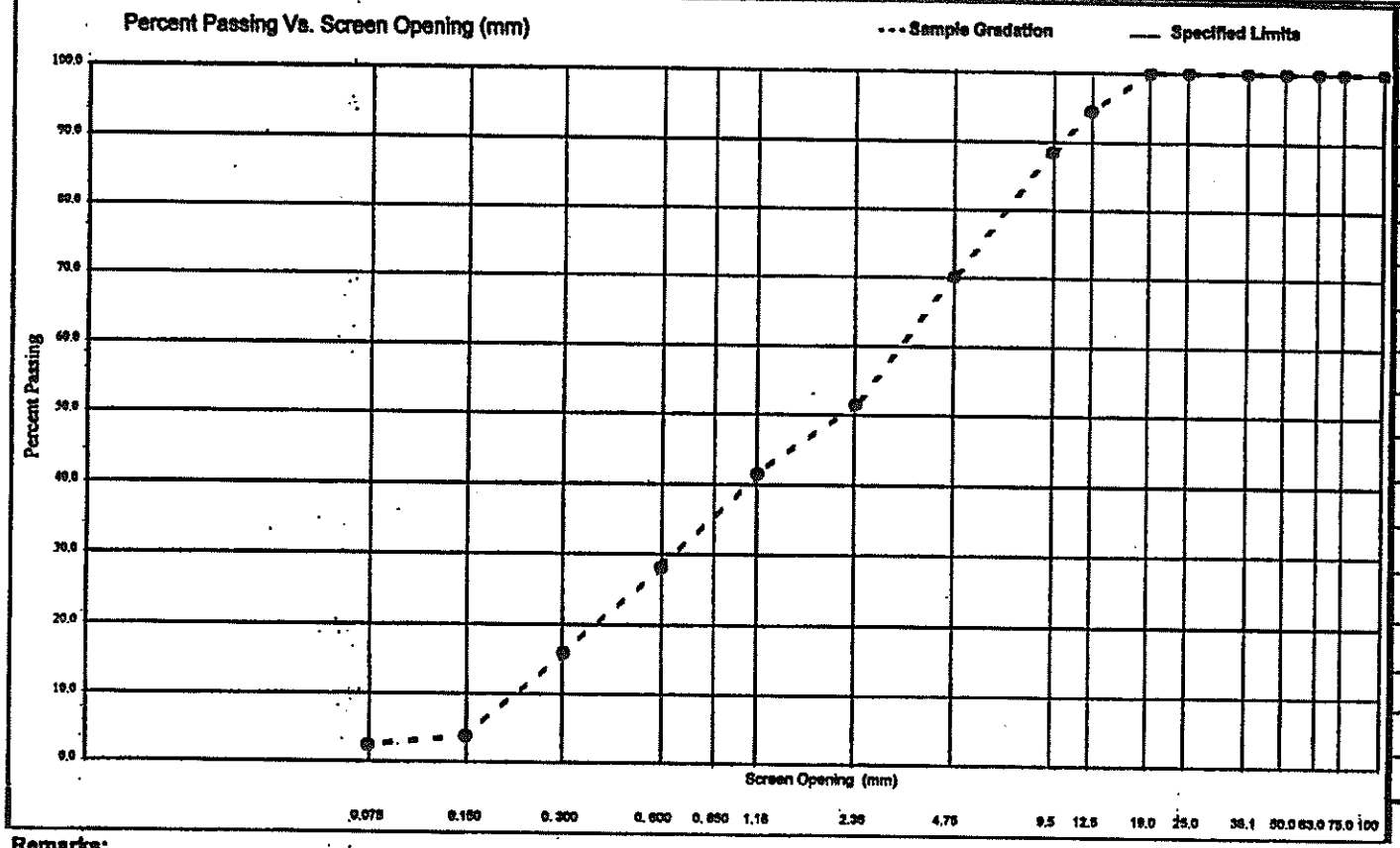
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-140 @ 19'-20'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	94.5		
9.50	88.5		
4.75	70.1		
2.36	51.4		
1.180	41.5		
0.600	28.1		
0.300	16.0		
0.150	3.7		
0.075	2.4		

Remarks:

Gravel: 29.9 **Sand:** 67.7 **Fines:** 2.4 **Moisture %** 4.5

Reviewed by:

Engineering Ltd.
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
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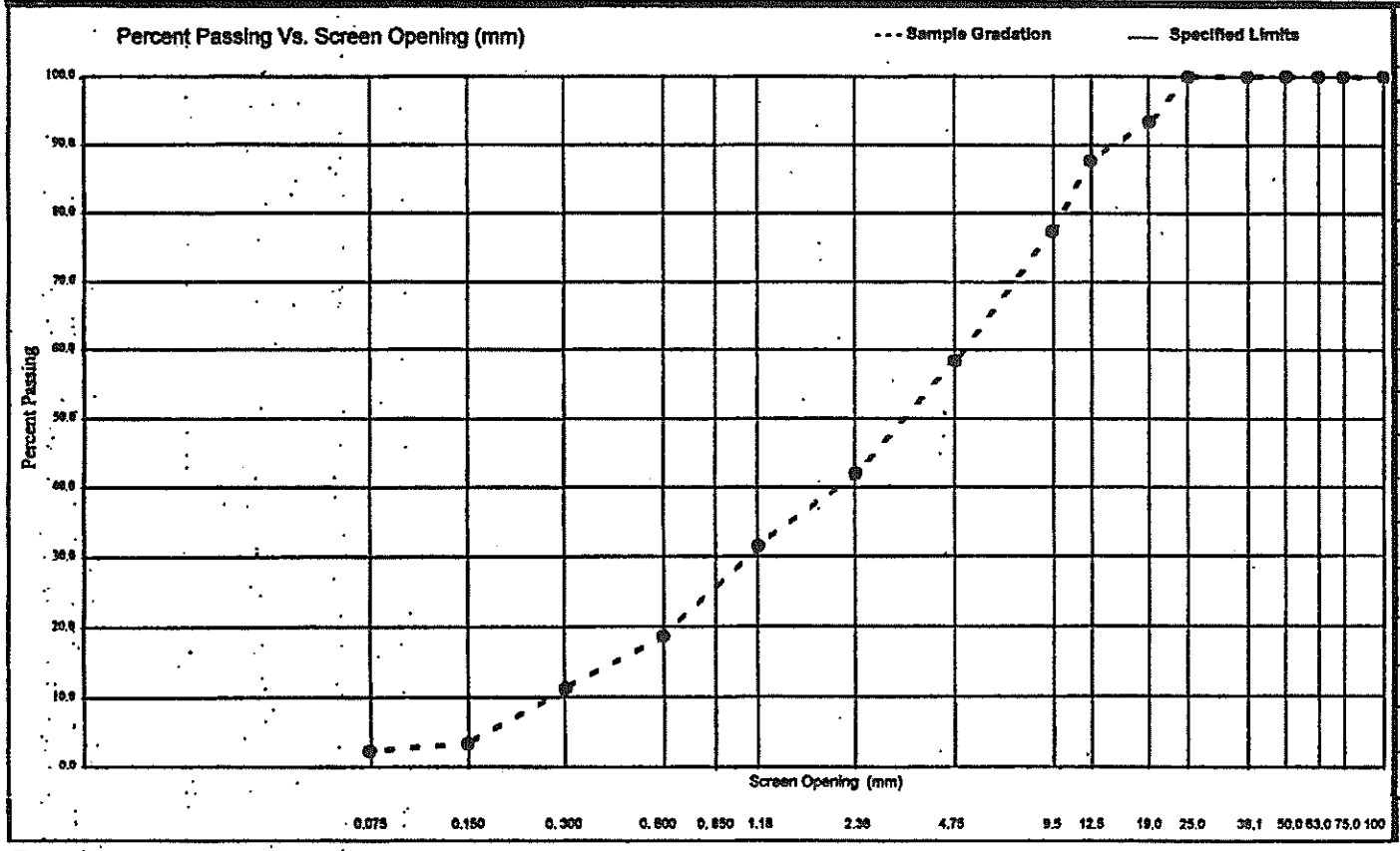
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-141 @ 14'-15'
Specified Limits:

Sampled by: RW **Date:** 20-Jul-99
Tested by: EA **Date:** 1-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	93.5		
12.5	87.7		
9.50	77.4		
4.75	58.3		
2.36	41.9		
1.180	31.4		
0.600	18.6		
0.300	11.2		
0.150	3.4		
0.075	2.2		

Remarks:

Gravel: 41.7 **Sand:** 56.1 **Fines:** 2.2 **Moisture %** 4.5

Reviewed by:

BH5-141 @ 14'-15'.xls

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
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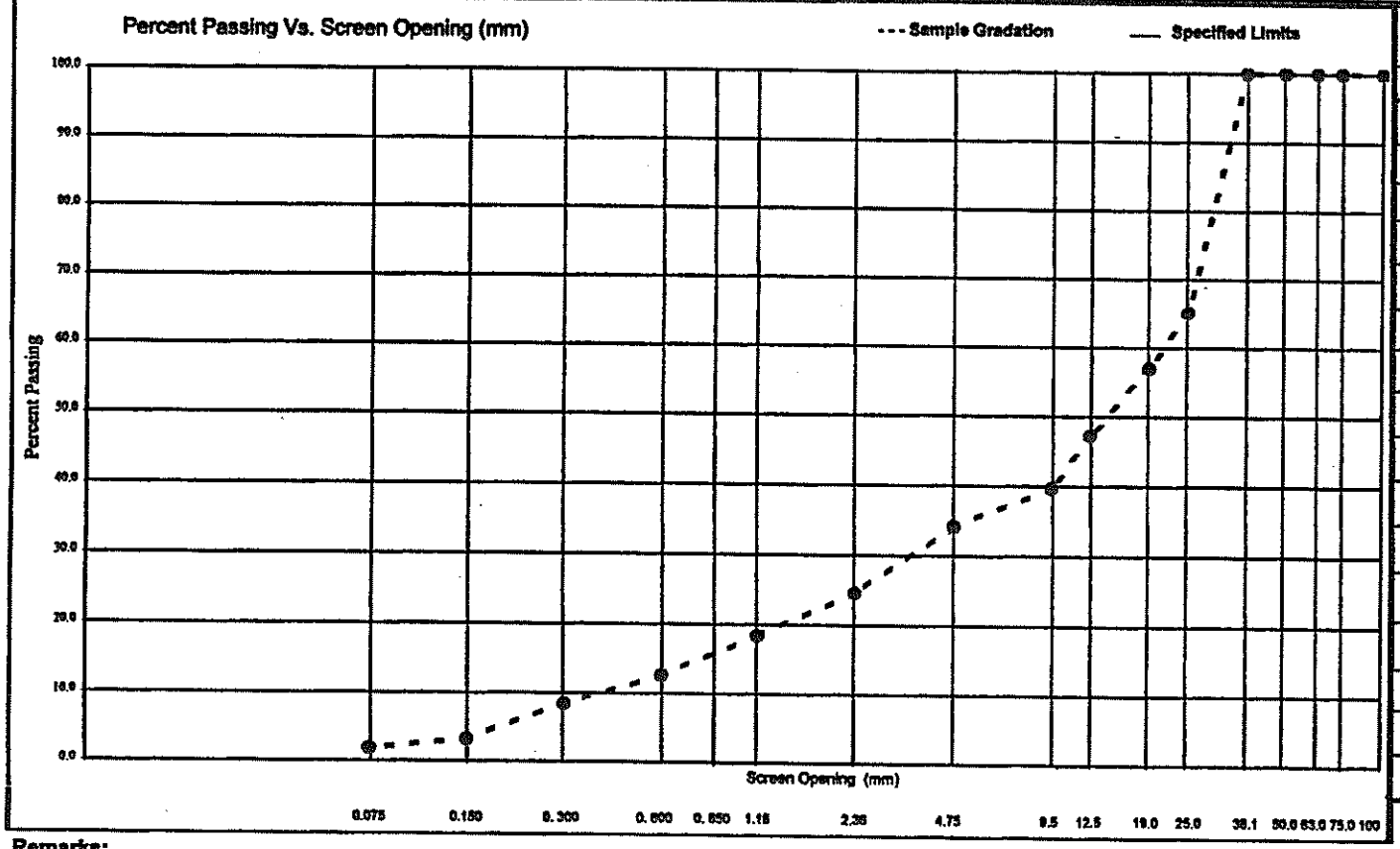
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Gravel - Sandy, trace Silt
Sample No:
Source: BH5-142 @ 13'-14.5'
Specified Limits:

Sampled by: RW **Date:** 21-Jul-99
Tested by: EA **Date:** 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	65.1		
19.0	57.0		
12.5	47.2		
9.50	39.6		
4.75	34.1		
2.36	24.7		
1.180	18.4		
0.600	12.6		
0.300	8.4		
0.150	3.1		
0.075	1.8		

Remarks:

Gravel: 65.9 **Sand:** 32.3 **Fines:** 1.8 **Moisture %** 3.5

Reviewed by:

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
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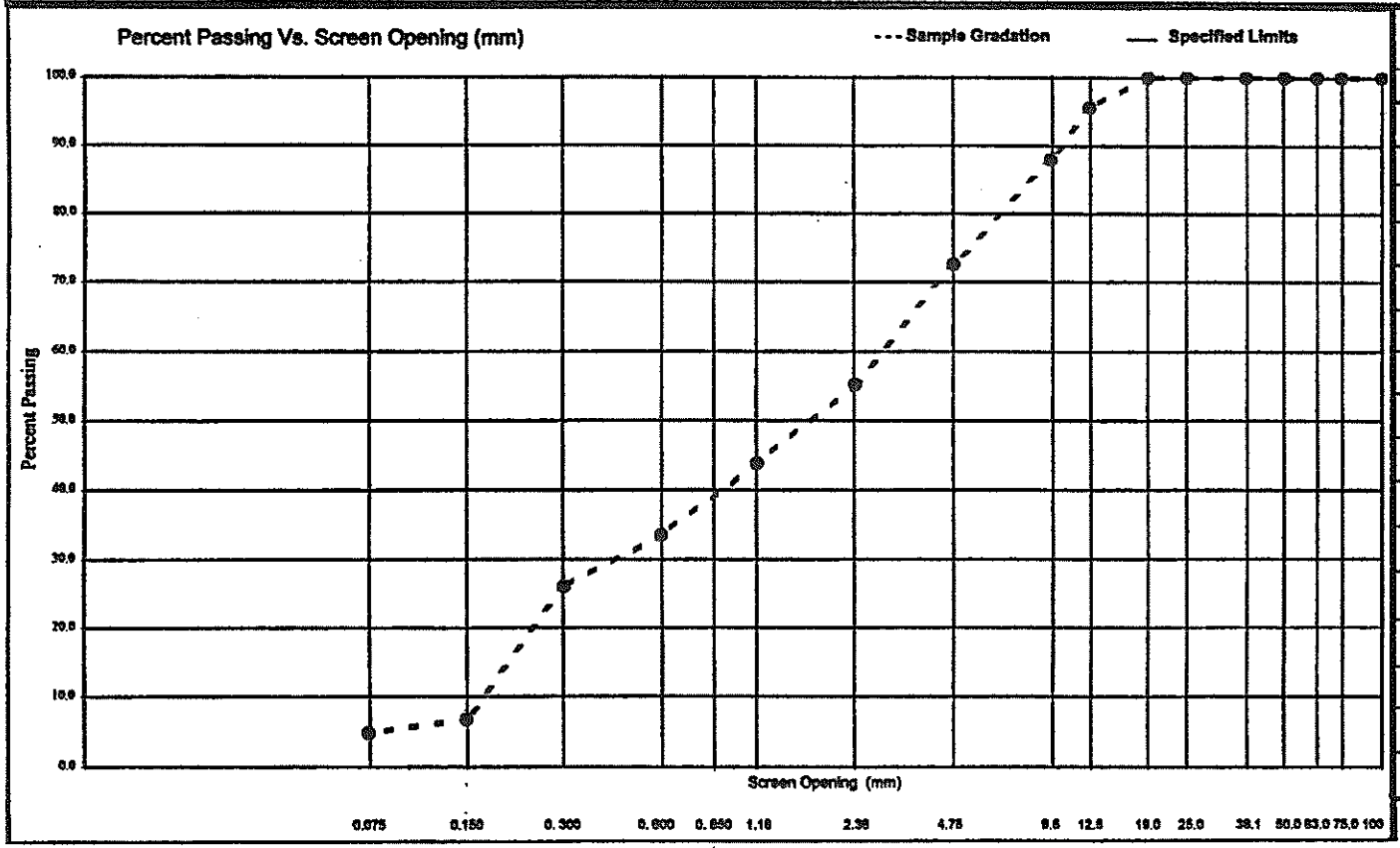
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-143 @ 9'-10'
Specified Limits:

Sampled by: RW
Tested by: EA

Date: 21-Jul-99
Date: 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	95.6		
9.50	87.9		
4.75	72.6		
2.36	55.2		
1.180	43.7		
0.600	33.5		
0.300	26.1		
0.150	6.7		
0.075	4.8		

Remarks:

Gravel: 27.4 **Sand:** 67.8 **Fines:** 4.8 **Moisture %** 3.7

Reviewed by:

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
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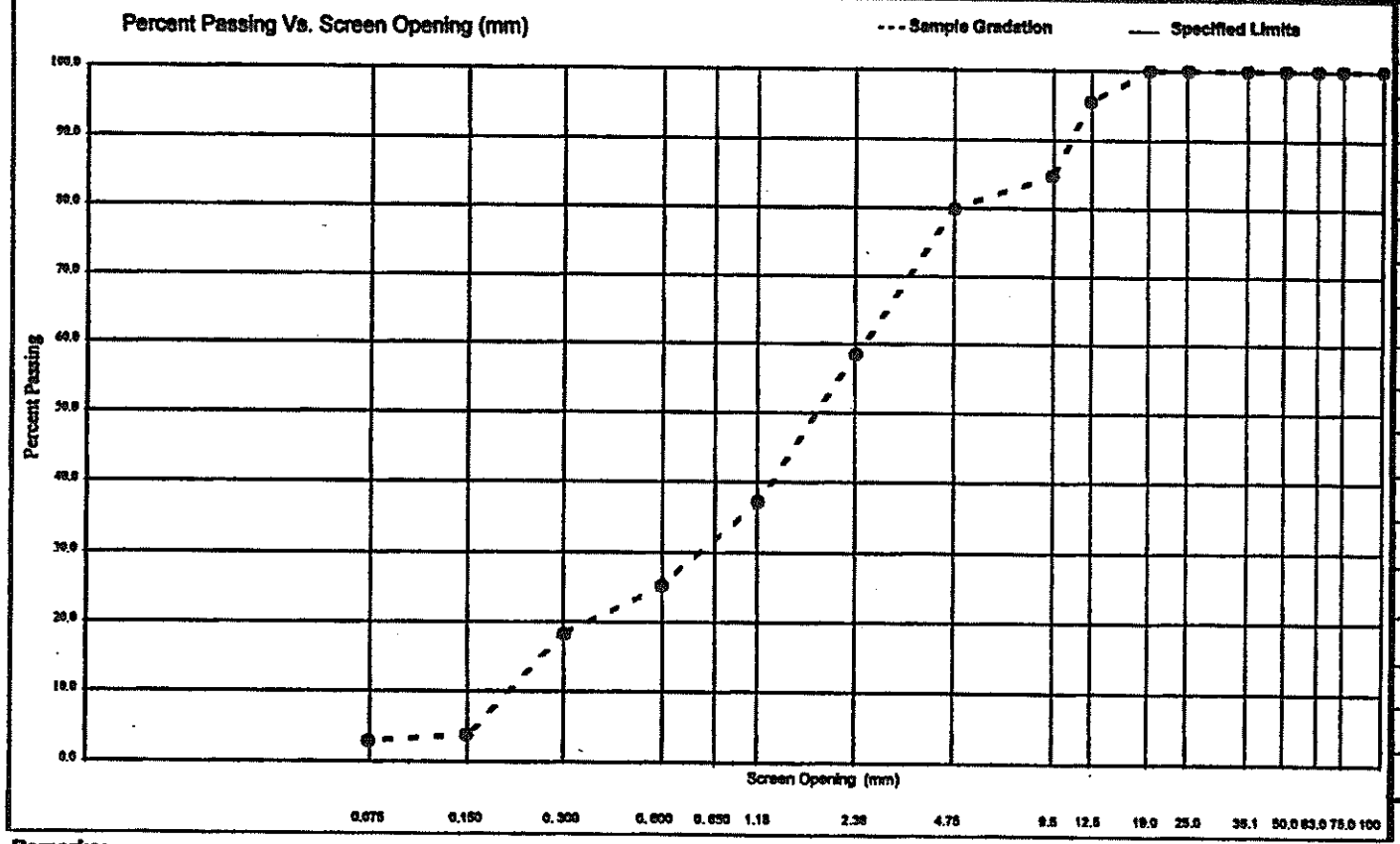
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-146 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 21-Jul-99
Tested by: EA **Date:** 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	95.5		
9.50	84.7		
4.75	79.9		
2.36	58.5		
1.180	37.1		
0.600	25.2		
0.300	18.2		
0.150	3.8		
0.075	2.9		

Remarks:

Gravel: 20.1 **Sand:** 77.0 **Fines:** 2.9 Moisture % 7.4

Reviewed by:

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
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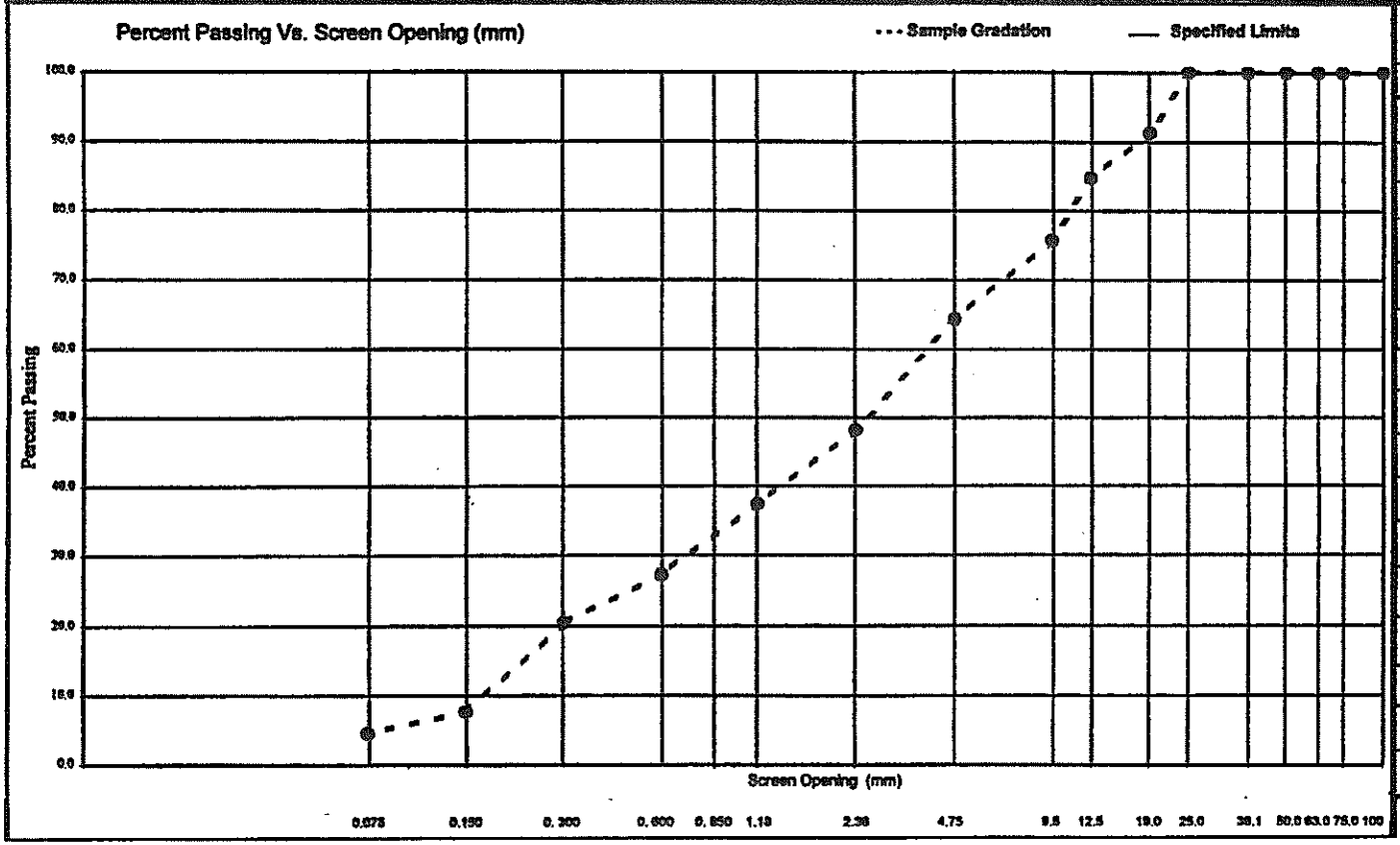
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-147 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	91.4		
12.5	84.8		
9.50	75.7		
4.75	64.4		
2.36	48.2		
1.180	37.4		
0.600	27.2		
0.300	20.4		
0.150	7.6		
0.075	4.5		

Remarks:

Gravel: 35.6 **Sand:** 59.9 **Fines:** 4.5 **Moisture %** 6.6

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Report of: Aggregate Sieve Analysis

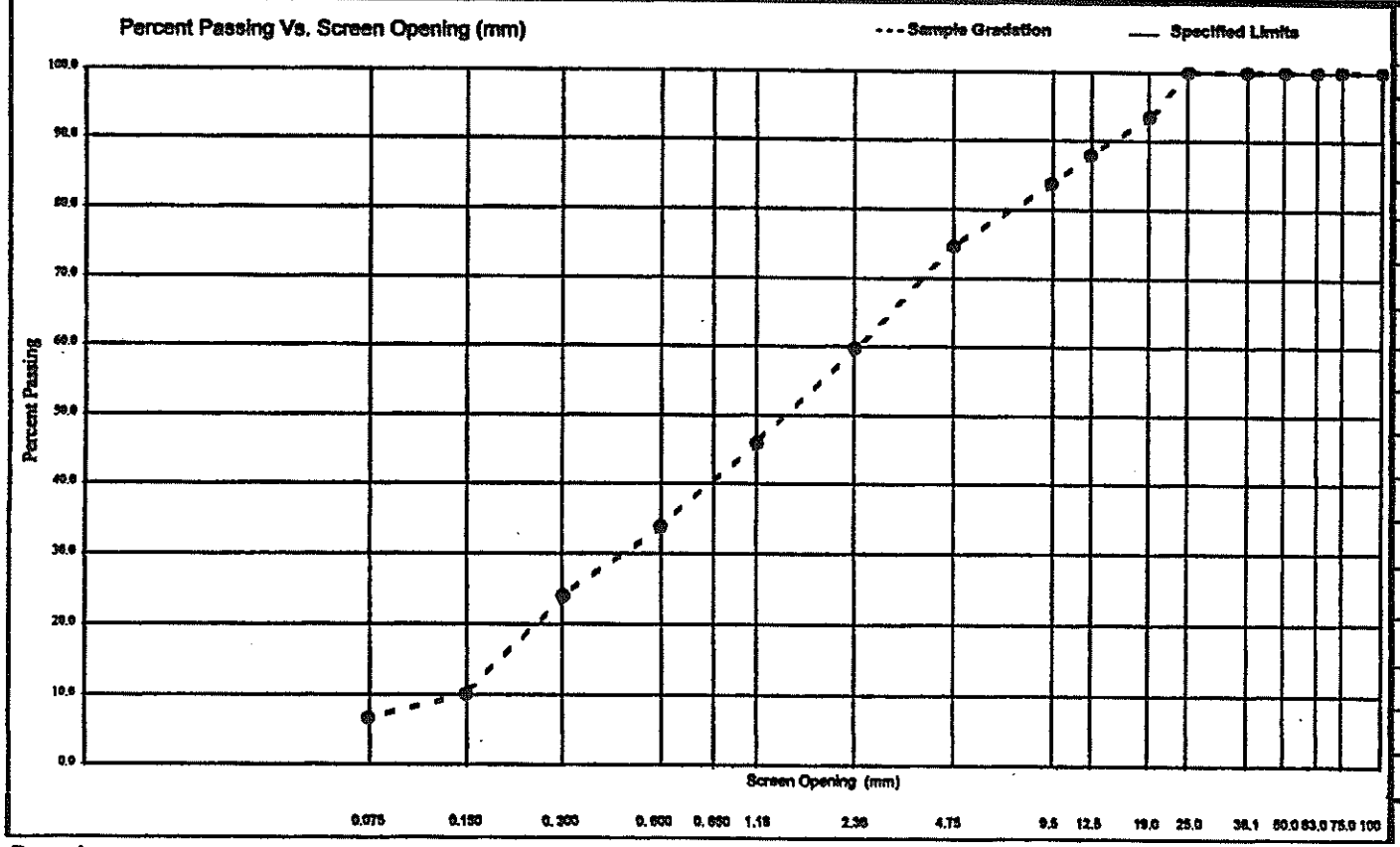
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-148 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	93.4		
12.5	87.8		
9.50	83.7		
4.75	74.7		
2.36	59.7		
1.180	45.8		
0.600	33.7		
0.300	24.0		
0.150	10.1		
0.075	6.6		

Remarks:

Gravel: 25.3 **Sand:** 68.1 **Fines:** 6.6 **Moisture %** 8.9

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Report of: Aggregate Sieve Analysis

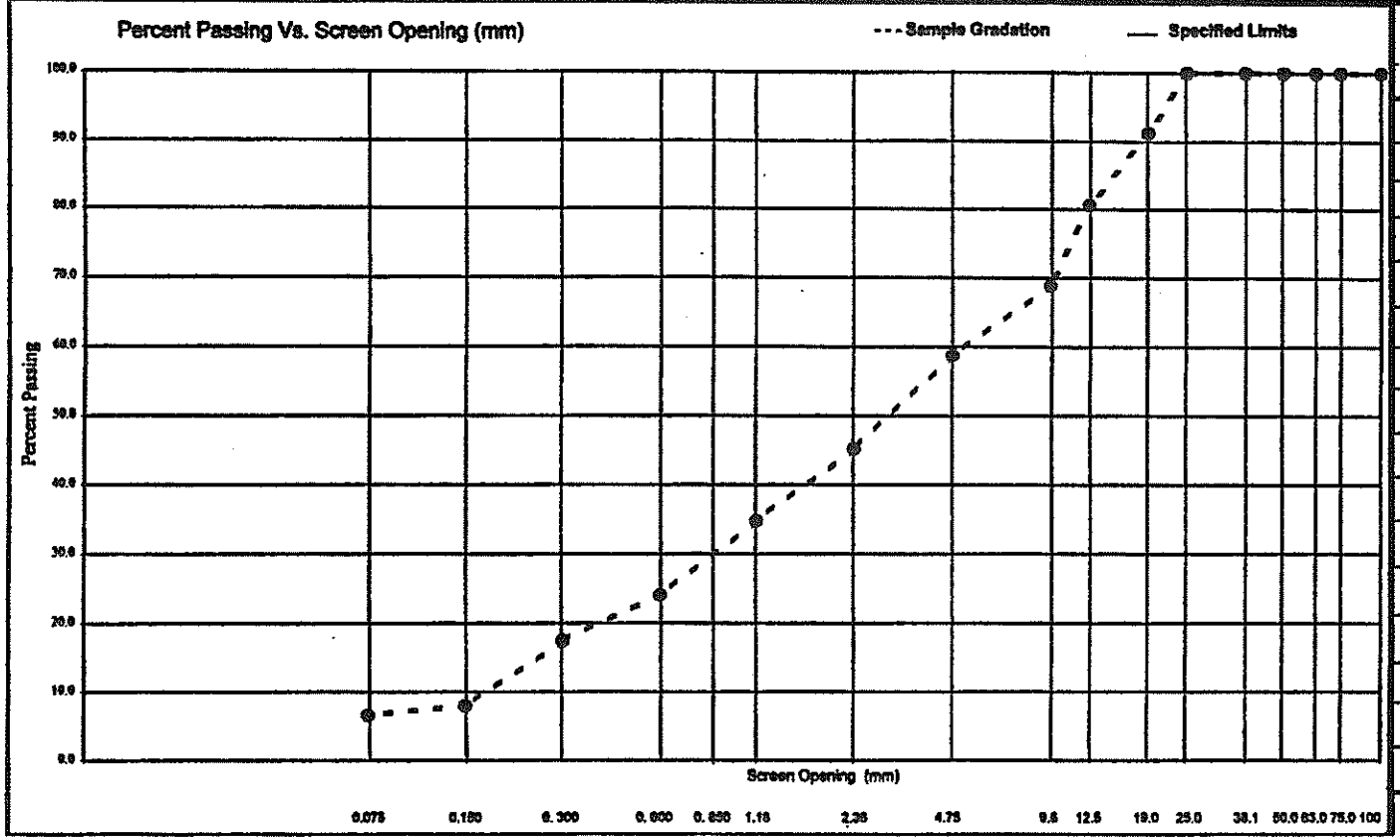
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand and Gravel - trace Silt
Sample No:
Source: BH5-149 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	91.2		
12.5	80.5		
9.50	68.9		
4.75	58.8		
2.36	45.2		
1.180	34.7		
0.600	24.0		
0.300	17.5		
0.150	7.9		
0.075	6.5		

Remarks:

Gravel: 41.2 **Sand:** 52.3 **Fines:** 6.5 **Moisture %** 7.1

Reviewed by:

BH5-149 @ 9'-10'

Report of: Aggregate Sieve Analysis

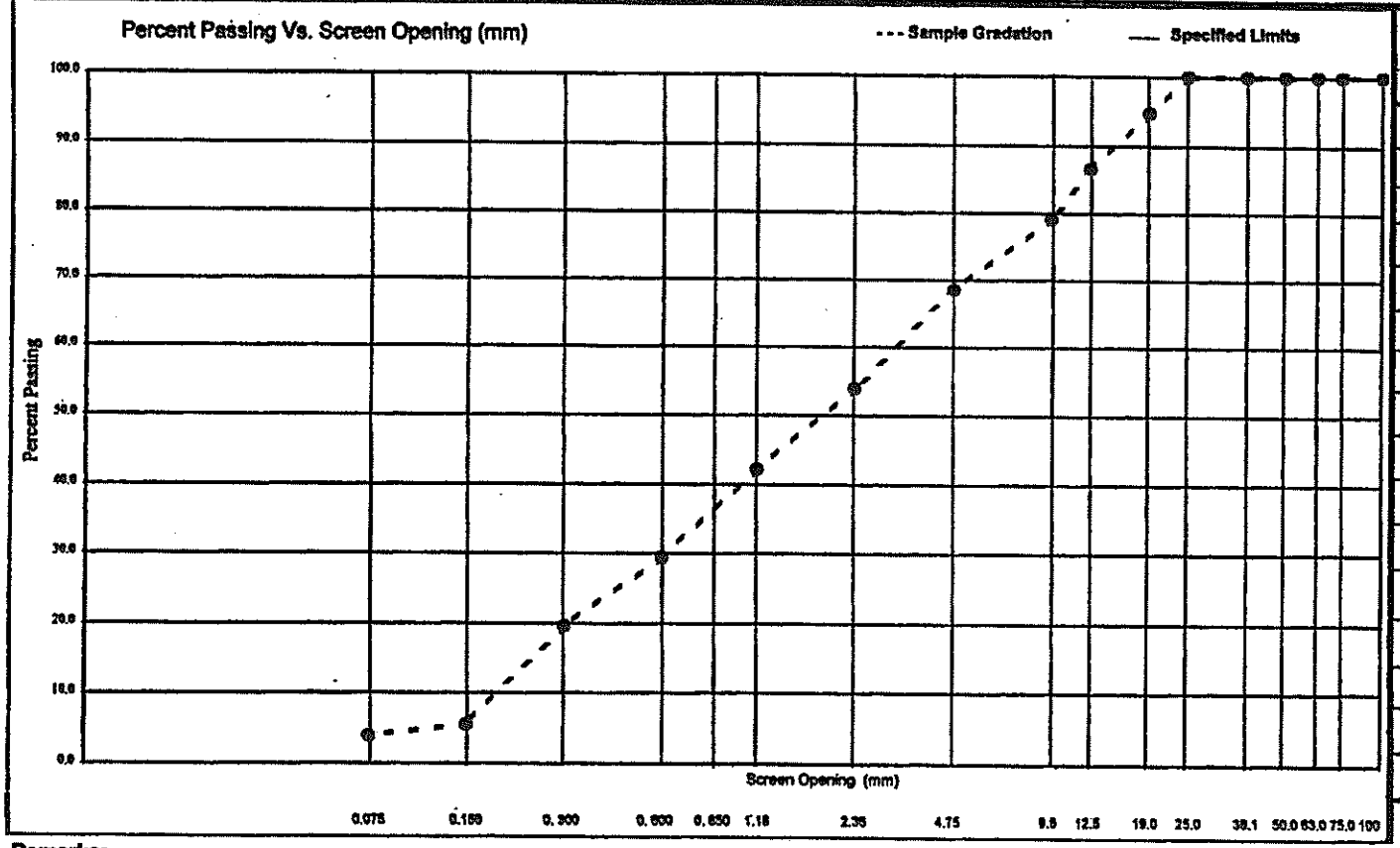
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 01-Aug-99

Type of Sample: Sand - Gravely, trace Silt
Sample No:
Source: BH5-149 @ 19'-20'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 01-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
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75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	94.8		
12.5	86.6		
9.50	79.1		
4.75	68.6		
2.36	53.9		
1.180	42.2		
0.600	29.4		
0.300	19.6		
0.150	5.6		
0.075	3.9		

Remarks:

Gravel: 31.4 **Sand:** 64.7 **Fines:** 3.9 Moisture % 8.4

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BH5-149 @ 19'-20'

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Report of: Aggregate Sieve Analysis

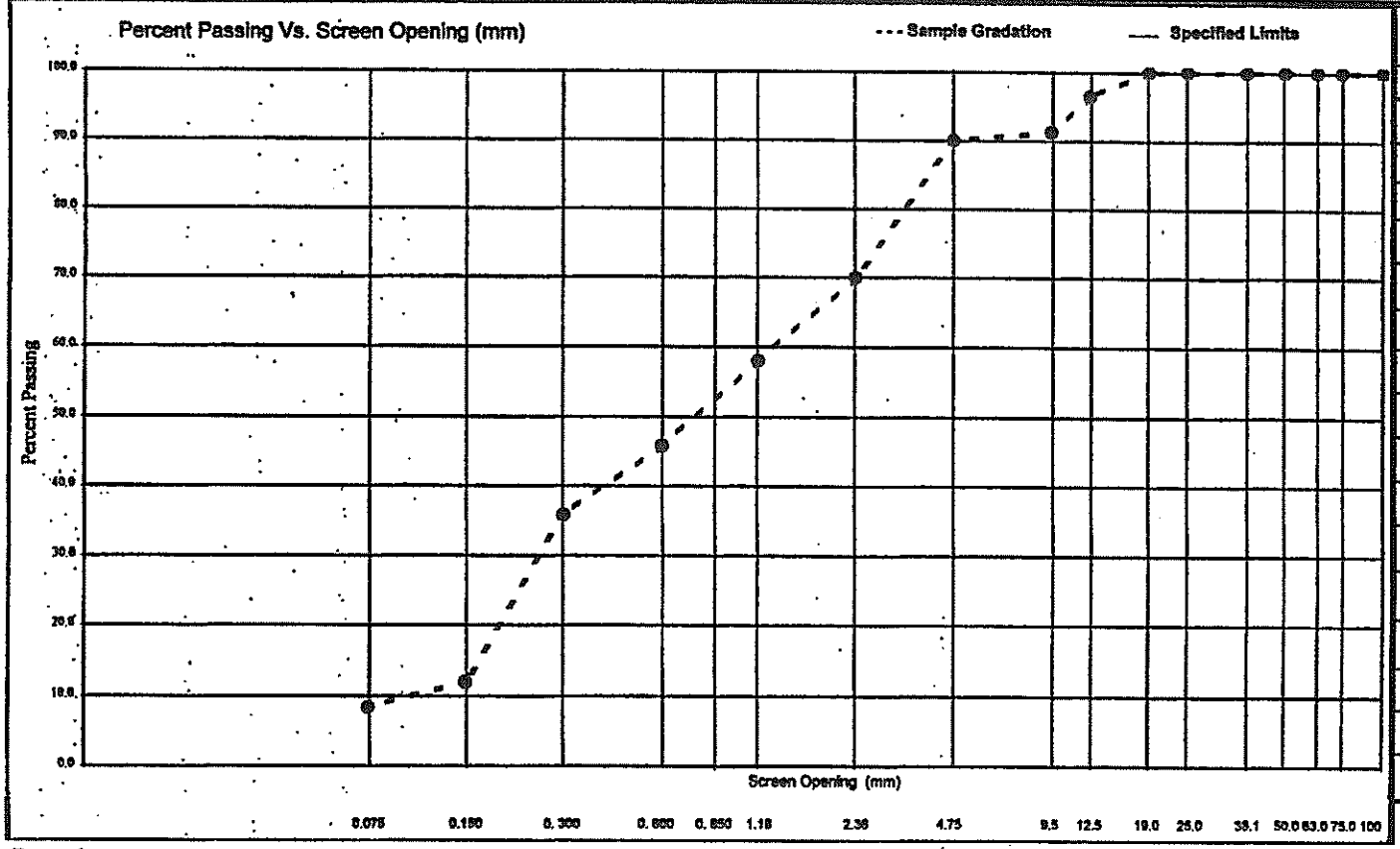
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 02-Aug-99

Type of Sample: Sand - trace to some Gravel, trace Silt
Sample No:
Source: BH5-152 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 2-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	96.5		
9.50	91.3		
4.75	90.0		
2.36	70.0		
1.180	58.1		
0.600	45.8		
0.300	35.8		
0.150	11.9		
0.075	8.4		

Remarks:

Gravel: 10.0 **Sand:** 81.6 **Fines:** 8.4 **Moisture %** 9.9

Reviewed by:

BH5-152 @ 9'-10'.xls

engineering Ltd.
Vanc (604) 45 Port Coquitlam (604) 945-9939
loops 372 Williams Lake (250) 398-8788
A rd Terrace (250) 638-1090

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Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

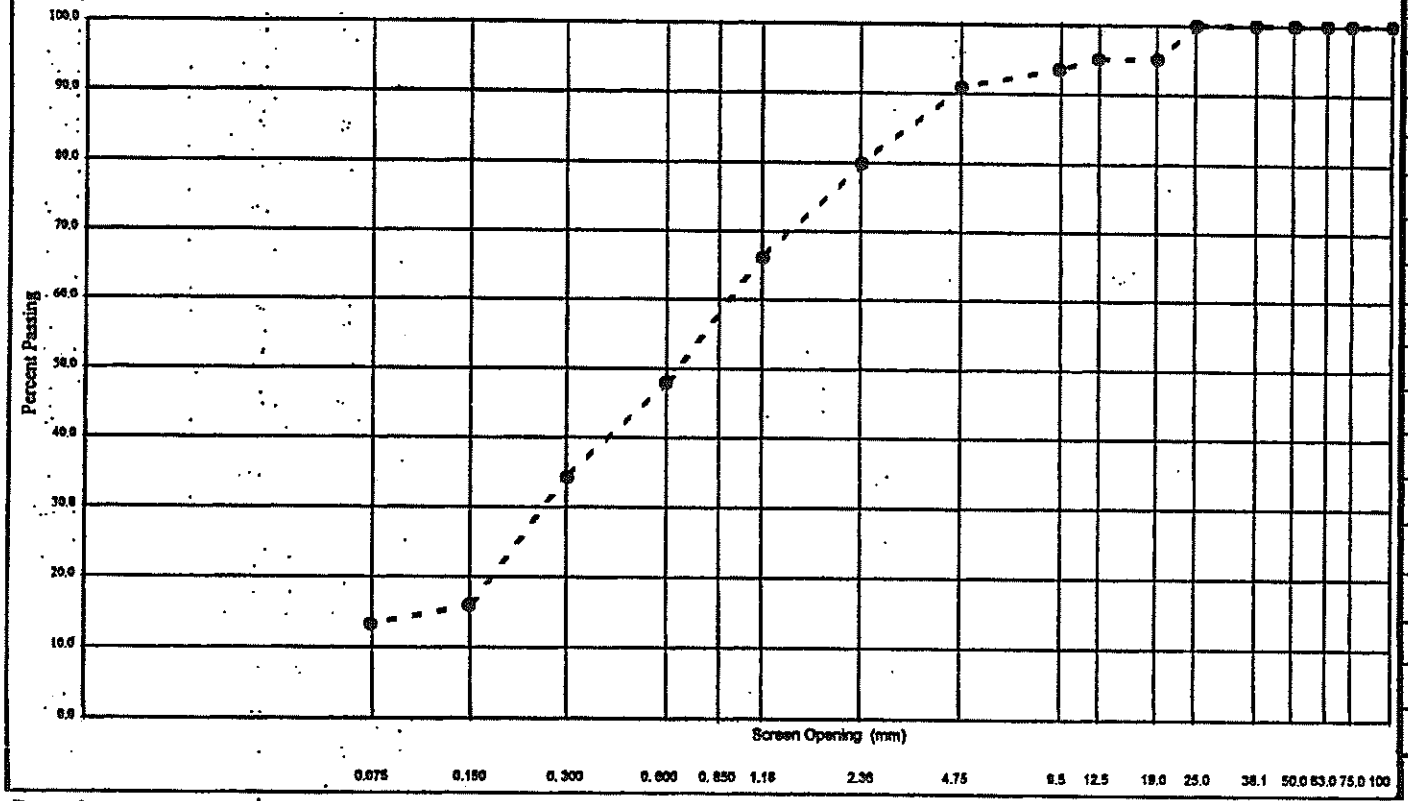
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 02-Aug-99

Type of Sample: Sand - some Clay, trace Gravel
Sample No:
Source: BH5-153 @ 4'-5'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 2-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	95.1		
12.5	95.1		
9.50	93.5		
4.75	90.9		
2.36	79.8		
1.180	66.2		
0.600	47.9		
0.300	34.2		
0.150	16.0		
0.075	13.3		

Remarks:

Gravel: 9.1 **Sand:** 77.6 **Fines:** 13.3 **Moisture %** 16.0

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Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

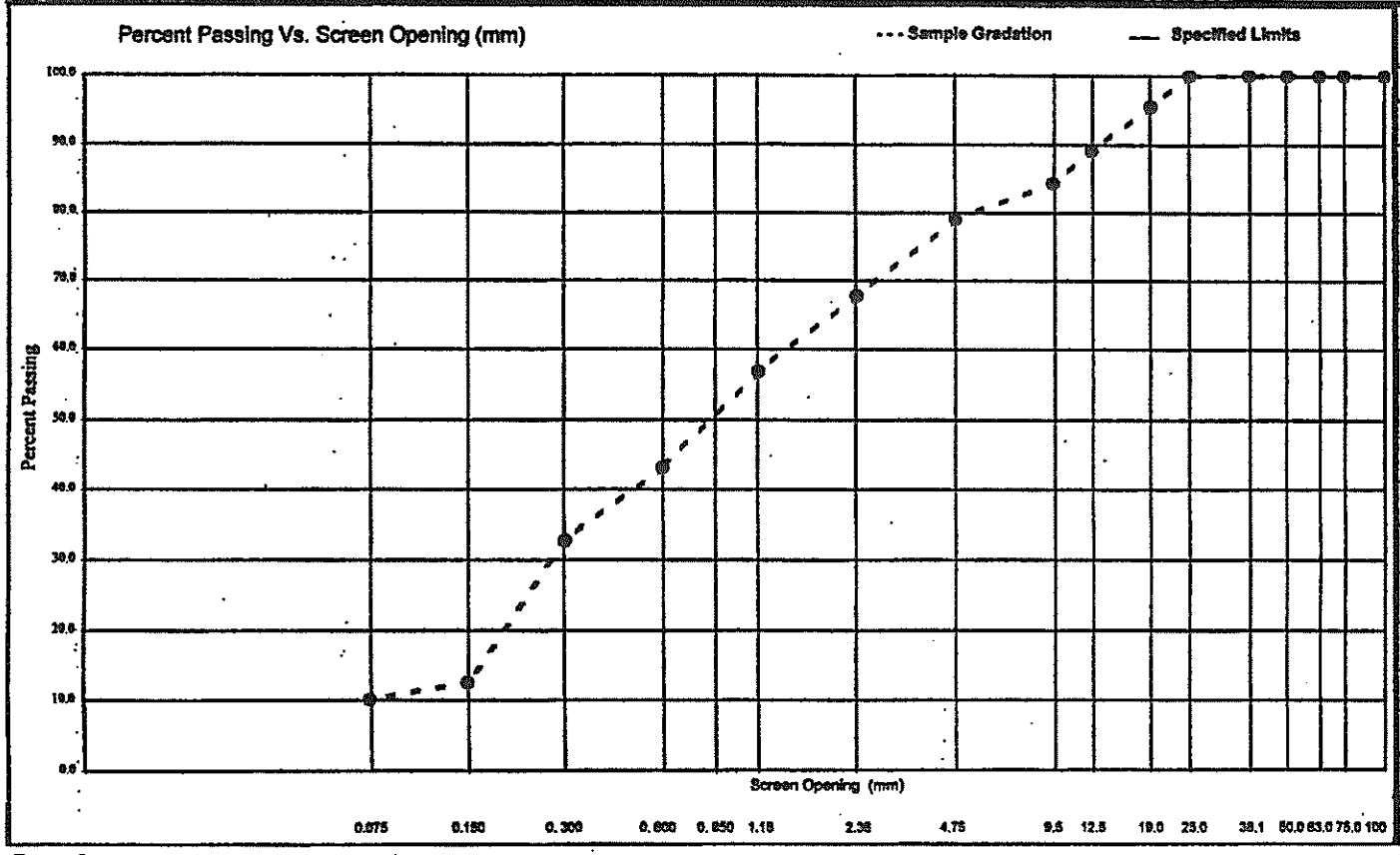
Date of Report: 02-Aug-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Type of Sample: Sand - Gravely, some Silt
Sample No:
Source: BH5-154 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 02-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening	Percent Passing	Specified Limits	
(mm)	Total	Lower	Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	95.6		
12.5	89.1		
9.50	84.3		
4.75	79.0		
2.36	67.7		
1.180	56.9		
0.600	43.1		
0.300	32.7		
0.150	12.5		
0.075	10.1		

Remarks:

Gravel: 21.0 **Sand:** 69.0 **Fines:** 10.1 **Moisture %** 12.1

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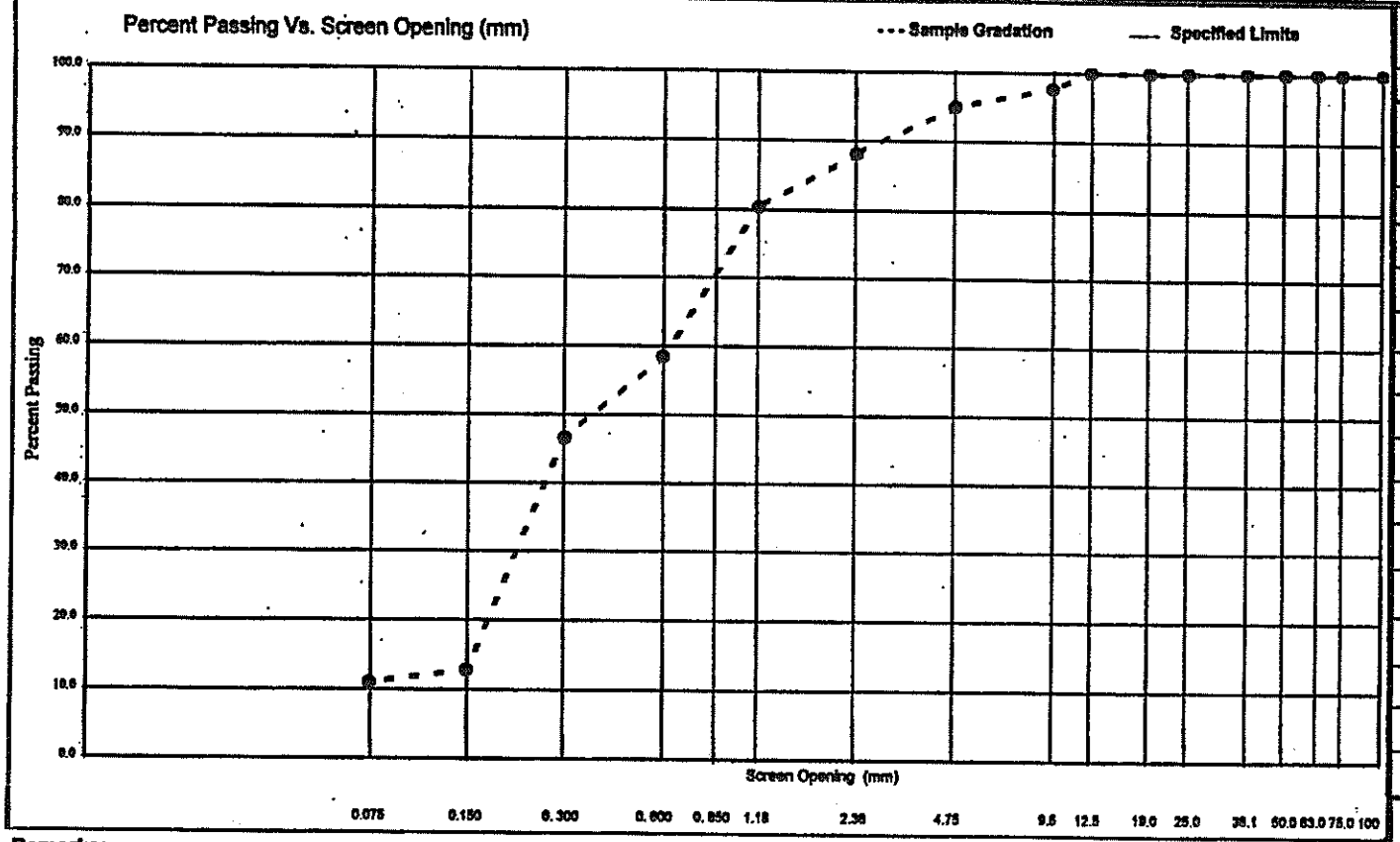
Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 02-Aug-99

Type of Sample: Sand - some Silt, trace Gravel
Sample No:
Source: BH5-156 @ 9'-10'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 02-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	97.7		
4.75	95.0		
2.36	88.1		
1.180	80.4		
0.600	58.4		
0.300	46.6		
0.150	12.8		
0.075	11.0		

Remarks:

Gravel: 5.0 **Sand:** 84.0 **Fines:** 11.0 **Moisture %** 17.4

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Engineering Ltd
Port Coquitlam (604) 945-9939
Williams Lake (250) 398-8788
Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Project: ALASKA HIGHWAY

Project No: 992-1474

Location:

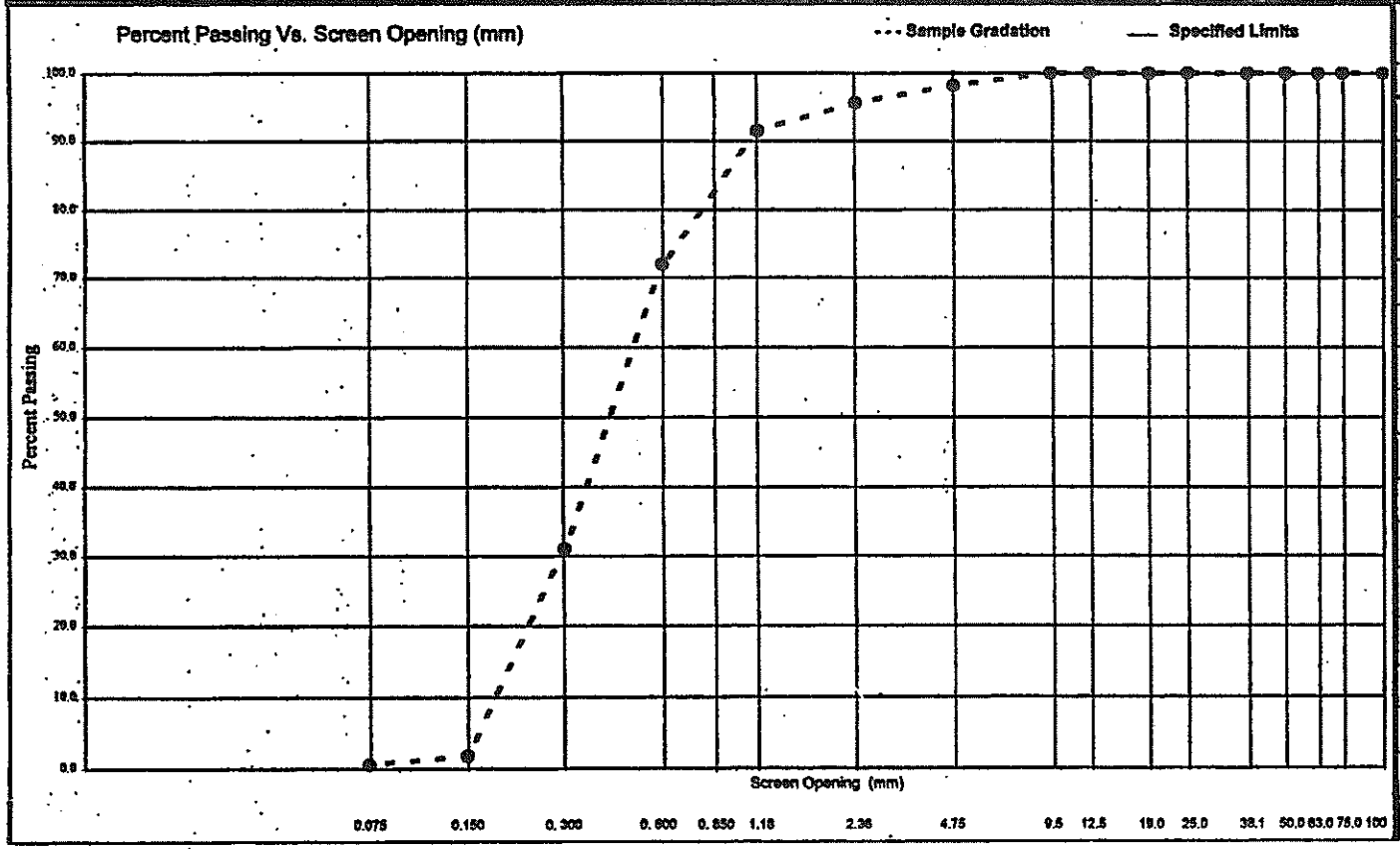
Date of Report: 31-Jul-99

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

Type of Sample: Sand - trace Gravel
Sample No:
Source: BH5-164 @ 0'-1'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 31-Jul-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
100.0	100.0		
75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	98.2		
2.36	95.6		
1.180	91.5		
0.600	72.0		
0.300	31.0		
0.150	1.8		
0.075	0.6		

Remarks:

Gravel: 1.8 **Sand:** 97.6 **Fines:** 0.6 **Moisture %** 4.3

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BH5-164 @ 0'-1'.xls

Terra Engineering Ltd.
Port Coquitlam (604) 945-9939
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Terrace (250) 638-1090

Report of: Aggregate Sieve Analysis

Client: PUBLIC WORKS & GOVERNMENT SER. CANADA
REAL PROPERTY SERVICES
cc:
cc:
cc:

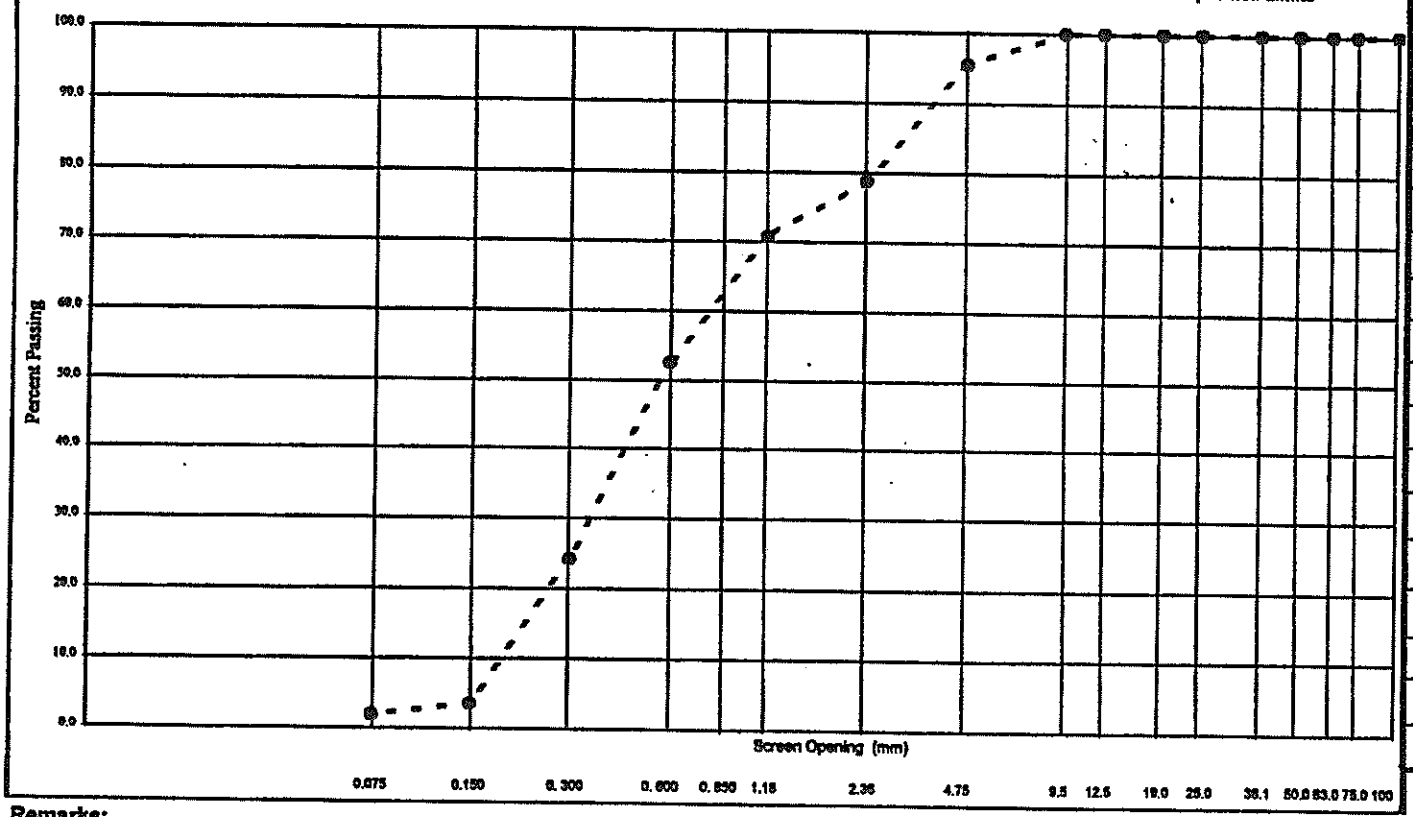
Project: ALASKA HIGHWAY
Project No: 992-1474
Location:
Date of Report: 02-Aug-99

Type of Sample: Sand - trace Gravel, trace Silt
Sample No:
Source: BH5-166 @ 25'-26'
Specified Limits:

Sampled by: RW **Date:** 22-Jul-99
Tested by: EA **Date:** 02-Aug-99
Native Fill
Imported Fill

Washed Analysis X
Dry Analysis

Percent Passing Vs. Screen Opening (mm)



Screen Opening (mm)	Percent Passing Total	Specified Limits Lower	Specified Limits Upper
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75.0	100.0		
63.0	100.0		
50.0	100.0		
38.1	100.0		
25.0	100.0		
19.0	100.0		
12.5	100.0		
9.50	100.0		
4.75	95.5		
2.36	78.8		
1.180	70.8		
0.600	52.6		
0.300	24.2		
0.150	3.6		
0.075	1.9		

Remarks:

Gravel: 4.5 **Sand:** 93.6 **Fines:** 1.9 **Moisture %** 5.5

Reviewed by:

APPENDIX B
THURBER ENGINEERING (2001) REPORT

DESI(

km 737 to km 750
Alaska Highway B.C.
Part 3
Geotechnical

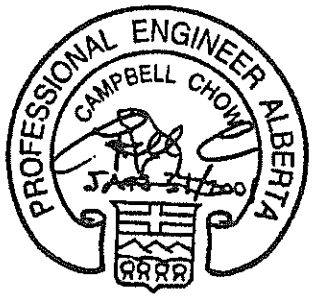
E 000141

PROPOSED CULVERT
ED'S CREEK
KM 748.1, ALASKA HIGHWAY, BRITISH COLUMBIA
GEOTECHNICAL INVESTIGATION

Report

to

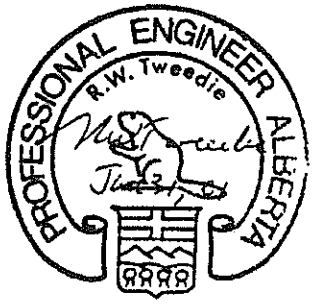
Public Works and Government Services Canada



Thurber Engineering Ltd.
Edmonton, Alberta

C. Chow, P.Eng.
Project Engineer

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
Signature R.W. Tweedie
Date Jan 31, 01
PERMIT NUMBER: P 5186
The Association of Professional Engineers, Geologists and Geophysicists of Alberta



Date: January 31, 2001
File: 16-4-132A

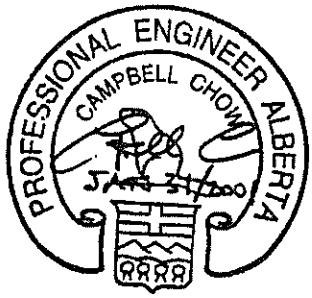
R.W. Tweedie, P.Eng.
Review Principal

PROPOSED CULVERT
ED'S CREEK
KM 748.1, ALASKA HIGHWAY, BRITISH COLUMBIA
GEOTECHNICAL INVESTIGATION

Report

to

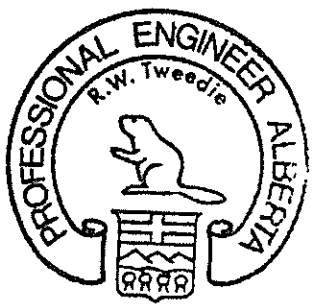
Public Works and Government Services Canada



Thurber Engineering Ltd.
Edmonton, Alberta

C. Chow, P.Eng.
Project Engineer

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
Signature _____
Date _____
PERMIT NUMBER: P 5186
The Association of Professional Engineers, Geologists and Geophysicists of Alberta



Date: January 31, 2001
File: 16-4-132A

R.W. Tweedie, P.Eng.
Review Principal

TABLE OF CONTENTS

1. INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed Super Cor culvert to be constructed over Ed's Creek along the Alaska Highway in northern British Columbia. It is located about 14 km east of the Liard River bridge crossing at km 748.1. Presently the creek flows within a concrete box culvert which passes beneath the existing highway.

The investigation was carried out in general accordance with our proposal letter to Public Works and Government Services Canada (PWGSC) dated October 18, 2000.

Use of this report is subject to the Statement of General Conditions which is included at the end of the text of this report. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of this report.

2. PROPOSED DEVELOPMENT

As the grade and alignment of the highway are to be altered, a culvert structure measuring approximately 35 m long having a span of 16.2 m and a rise of 6.8 m is to be installed slightly south of the existing box culvert. The Super Cor culvert consists of a steel multiplate arch structure. The height of fill over the new structure is to be about 12.3 m. The culvert may be founded on spread footings or piles and the base will consist of either a concrete slab or large rip-rap rock. It is understood that PWGSC will assess the hydraulic protection requirements.

3. METHOD OF INVESTIGATION

3.1 Field Program

Two test holes (TH00-1 and TH00-2) were drilled within the existing gulley - one on each side of the creek near the proposed highway centreline on November 16 and 17, 2000. The locations of the test holes are shown on the site plan, Drawing No. 16-4-132-1A in Appendix A. Test holes TH00-1 and TH00-2 were located on the west and east sides of the existing culvert respectively. Surveying of

the locations and elevations of the test holes were carried out by a representative of PWGSC. The elevations of TH00-1 and TH00-2 were 528.94 and 530.45 metres respectively. The proposed invert grade of the multiplate culvert is to vary from 527.5 m to 526.5 m (inlet to outlet).

The field drilling program was carried out under the supervision of Mr. D. Neitsch, P.Eng. of Thurber Engineering Ltd. (Thurber).

The test holes were drilled using a track-mounted auger drill operated by Midnight Sun Drilling Ltd. of Whitehorse, YT. The test holes were drilled to 16.8 and 24.1 metres below the existing ground surface. Test hole 00-1 met refusal at 16.8 m depth in very dense gravel or possible bedrock.

Disturbed and undisturbed samples were obtained during drilling. Standard Penetration Tests (SPT) were carried out in test hole TH00-1. Undrained shear strength measurements were taken on representative cohesive soil samples using a pocket penetrometer (Cpen value). Water and slough levels were noted during and immediately after the drilling program. On completion, all test holes were backfilled with drill cuttings.

3.2 Laboratory Testing

Laboratory testing included a visual classification and the determination of the natural water content of all soil samples. Also, gradation analyses and water soluble sulphate tests were carried out on selected soil samples to determine engineering properties and cement type.

The results of the drilling and laboratory program are summarized on the test hole logs in Appendix B. An explanation of the symbols and terms used to describe observations in the test hole logs and the Unified Soil Classification are also provided in Appendix B.

4. SITE DESCRIPTION

4.1 Surface Conditions

The site is situated in a ravine located about 14 km South of the Liard River bridge along the Alaska Highway in northern British Columbia.

The ravine is in the order of 20 metres deep. A gravelly soil exposure could be observed on the western slope. The creek flows in a northerly direction through a box culvert beneath the existing highway. A cluster of small diameter poplar trees was present along the proposed alignment centerline and the site was snow covered at the time of the investigation. Site photographs are attached in Appendix C.

4.2 Subsurface Conditions

Both test holes (TH00-1 and TH00-2) contained a considerable thickness of clay beneath surface layers varying from sand and gravel to silt. The clay at depth contained considerable amounts of gravel and possibly cobbles. A brief description of the soil units is provided in the following paragraphs. Detailed soil descriptions are given on the test hole logs in Appendix B.

Surface Layers of Sand, Gravel and Silt

In TH00-1 loose to compact very silty sand was encountered to a depth of 3.8 metres. Moisture contents of the sand varied from approximately 27 to 40 percent. The sand contained up to 45% silt and clay sizes. A layer of organic silt was noted within the sand layer from 0.45 m to 1.9 m.

In TH00-2 gravelly sand was encountered to a depth of 5.8 m, overlying loose sandy silt to 7.3 m. Moisture contents of the sand and gravel varied from roughly 2 to 7 percent with a 17 percent moisture content recorded for the loose sand and silt.

Clay

Clay was encountered in both test holes (TH00-1 and TH00-2) at 3.8 and 7.3 metres below the ground surface, respectively. The clay was very stiff to hard in consistency becoming stiff with depth. At TH00-1 SPT blow counts varied between 11 and 37 blows for 300 mm penetration. The clay was silty, containing gravel and occasional silt, silty sand and sand seams. The clay had moisture contents ranging from 8 to 20 percent. The clay extended to a depth of 14 and 16.2 metres below grade at test hole locations of TH00-1 and TH00-2, respectively.

Clay and Gravel

A clayey gravel soil matrix containing sand and silt was encountered below the clay layer in both test holes.

Moisture contents of this layer varied from 9 to 15 percent and was considered to be in a compact to very dense state.

At TH00-1 location a clayey gravelly till was encountered at a depth of 16.2 metres. The till was very dense and refusal was met at a depth of 16.8 metres to both the solid and hollow stem augers. At this elevation an SPT test was performed and a value of 67 blows for 150 mm penetration was obtained. It is possible that bedrock or dense till (containing cobbles) was encountered at this depth. The clayey gravel had a moisture content of approximately 13 percent.

At TH00-2 location a mixed clay and gravel soil with a variable silt, sand and cobble content continued to a depth of 24.1 metres below the ground surface, at which depth the test hole was terminated.

4.3 Groundwater and Slough

Groundwater seepage was encountered during drilling at 1.7 metres and 4.9 metres below the ground surface in TH00-1 and TH00-2, respectively. The test holes sloughed to roughly 2.0 and 2.3 metres below grade upon drilling completion.

It should be noted that groundwater levels will vary in response to seasonal factors and precipitation, hence the actual groundwater conditions at the time of construction could vary from those recorded during this investigation.

5. GEOTECHNICAL EVALUATIONS AND RECOMMENDATIONS

5.1 Foundations

5.1.1 General

It is understood that the invert of the proposed arch culvert will be founded at about elevation 527.5 m at the inlet and will drop to elevation 526.5 m at the outlet.

Results of the geotechnical investigation indicate that the culvert is expected to be underlain by a sand and silt layer several metres thick overlying very stiff clay approximately 10 m thick, overlying very dense/hard clay and gravel soil. The water table is expected to be at or close to the base of the culvert and hence foundation excavations are expected to extend below the water table.

Based on the results of the geotechnical investigation, the following foundation types are considered feasible for the Super Cor arch culvert:

- spread footings founded in very stiff clay
- driven steel piles founded in the very dense clay till or gravel layer
- cast in place concrete end bearing piles founded in clay or on top of dense clayey gravel layer

Recommendations for these foundation types are provided in the following sections.

It should be noted that due to the significant height of new fill to be placed over the culvert and underlying soil layers, the required size of founding elements are expected to be relatively large. It is recommended that consideration be given to lowering the road profile as much as possible in order to reduce the fill loading on the culvert.

5.1.2 Spread Footings

Spread footings should be founded at a suggested minimum depth of 2 m below invert level. It should be noted that the foundation conditions are expected to be variable based on the two test holes and hence the footings may bear on very stiff clay or on compact sand and silt depending on the footing level. Placing the footings entirely on the clay is recommended for uniformity but this may require footing excavations up to about 4 m deep based on the test hole information (see TH00-2).

Spread footings may be proportioned based on an allowable bearing capacity of 200 kPa for strip footings bearing in compact sand and silt or 300 kPa for footings bearing in the underlying very stiff clay.

The water table is expected to be above the footing level and hence adequate drainage will be required to handle the groundwater seepage into the excavation which is expected to be mainly above the clay level in the saturated sand and silt. This may require installation of sumps and pumps to lower the water table below the excavation level. Further recommendations are provided in Section 5.3.

Any disturbed or softened material should be removed prior to pouring the footings. Since the silt and clay at the site are susceptible to loss of strength due to exposure to water and construction traffic, it is recommended that a lean concrete mud slab be poured over the prepared freshly excavated surface to provide a resistant working surface for preparation of forms and reinforcing steel for the footings.

If the base cannot be maintained in the saturated silt and sand it will be necessary to sub excavate to the very stiff clay level and backfill the excavation with lean concrete, or extend the foundation level deeper.

The base of the footing should be inspected by qualified geotechnical personnel prior to pouring the footing. Water should not be allowed to pond in the excavation and the excavation should not be allowed to freeze as this could result in softening of the foundation soils.

Horizontal forces may be resisted by frictional resistance between the base of the footing and the stiff clay or compact sand and silt using an ultimate base friction factor of 0.40. A factor of safety of 1.5 should be applied on the ultimate base friction to limit lateral movements.

5.1.3 Driven Steel Piles

Foundation loads may be carried on driven steel piles founded in the very dense gravel till encountered below a depth of approximately 17 meters below the design invert grade level.

The piles should be driven to practical refusal using a diesel hammer with a minimum rated energy of 40 kJ. Piles are expected to encounter practical refusal in the gravel at about 17 m depth in TH00-1 but may penetrate to depths of greater than 20 m in the gravel/clay in TH00-2.

Steel piles driven to practical refusal may be designed based on an allowable end bearing capacity of 3000 kPa, and allowable skin friction of 20 kPa.

Steel H-piles should be installed at a minimum pile spacing of three flange widths centre to centre.

The maximum driving energy should not exceed 630 J/cm^2 of steel area (3000 ft-lbs/square inch) to avoid damage to the pile section. The proposed hammer, piling rig and methodology should be approved in advance of construction and the required pile set should be confirmed for the actual hammer and design load.

Pile driving records should be maintained during driving of all piles and should be assessed by driving analyses to confirm the design load capacity of the piles. Selected end bearing piles should be re-driven after a minimum period of 24 hours to confirm set-up capacity.

Heave of adjacent piles is a concern for close pile spacing, and should be monitored throughout the driving. All piles indicating heave should be re-driven. Pile heaving may be reduced by pre-boring, but this may reduce the allowable skin friction.

An out-of-plumb tolerance of 2 percent is typically specified and achieved for driven steel piles. Care will be required in set-up and driving of the piles to meet these objectives.

Driving of deep steel piles may cause void near grade surface due to pile "flutter" during driving. Voids should be grouted to maintain contact between the pile and ground resistance to vertical and lateral loads

5.1.4 Cast-in-Place Concrete End Bearing Piles

Foundation loads may be carried on cast-in-place concrete end piles. The piles may be founded in the very stiff clay at a suggested minimum depth of 6 m below invert level, or alternatively on top of the gravel and clay layer at a depth of about 14 to 17 m below ground present ground level (refer to nearest test hole log).

The piles may be designed based on the following allowable design values:

(a) End bearing piles may be designed based on an allowable end bearing capacity of 400 kPa, for piles founded in the very stiff clay and 600 kPa for piles founded on top of the very dense/hard clay and gravel.

(b) Friction may be included in the pile design based on the following allowable skin friction values.

TABLE 5.1
ALLOWABLE SKIN FRICTION VALUES
CONCRETE CAST-IN-PLACE PILES

DEPTH BELOW GRADE (m)	ALLOWABLE SKIN FRICTION (kPa)
0 - 10 m	25
below 10 m	30

(c) A minimum pile shaft diameter of 400 mm is recommended to prevent voids from forming during pouring of the concrete.

(d) As a minimum and not including structural requirements, a nominal percentage of longitudinal reinforcement of 0.5 percent of the sectional area of the pile shaft should be provided. This is required throughout the length of the pile shaft to resist potential uplift forces on the pile due to frost action and seasonal moisture variations. If piles are designed as tension elements, the pile reinforcing should be designed to resist the anticipated uplift stresses.

(e) Concrete should be poured immediately after drilling of the pile hole to reduce the risk of groundwater seepage and sloughing soil. Seepage will likely be encountered in sand and silt layers found above the clay and also possibly from the gravel layers found at depth below the clay. Casing should be used to control seepage and sloughing conditions during piling where required.

5.2 Base Slab

Based on test hole results, silt, sand and gravel are expected to be encountered at the proposed culvert invert of base slab elevation and the water table is expected to be close to invert level.

A minimum thickness of 600 mm of well graded clean sand and gravel (80 mm minus) is recommended below the base slab of the culvert to act as a drainage layer and to distribute the slab loads to the underlying foundation soils.

Care should be taken to avoid disturbance to the foundation layer. A non-woven geotextile should be provided between the gravel fill and the native silt and clay to provide separation and prevent loss of fines from the pit-run gravel bedding. Alternatively, a mud slab should be poured over the prepared subgrade to prevent deterioration of the clay.

The gravel layer should be compacted to a minimum 95 percent of Standard Proctor Maximum Dry Density (SPMDD).

5.3 Excavation and Dewatering Considerations

Control of creek water flows is required during the construction of the culvert. Ideally, construction should be carried out during the late fall to winter months when creek flows are expected to be at their lowest. This aspect of the scheduling should be reviewed by PWGSC to select the optimum construction period. The water will need to be diverted in a controlled manner past the work area through the use of methods such as cofferdams, diversion channels and existing culverts.

Construction dewatering will also be required within the temporary excavation for the culvert and slab. Groundwater seepage was encountered at approximately 2 to 3 metres above the clay layer and dewatering with sumps and pumps will be necessary.

Assuming adequate dewatering is carried out to maintain the temporary construction slopes and excavation in a drained condition, temporary excavation side slopes in the soft silt to loose to compact sand and gravel should remain stable at 1.5H:1V. Flatter slopes may be required if the excavation is not adequately dewatered. Alternatively, temporary shoring may be required to maintain a steeper excavation slope

5.4 Backfill

A minimum thickness of 2 m of well graded free draining gravel should be placed as backfill immediately against the outer circumference (sides and top) of the Super Cor culvert structure to act as a drainage layer. Greater thickness of gravel may be required by the supplier to meet structural backfill requirements. The gravel should consist of 80 mm minus pit run gravel or as specified by the supplier to provide a uniform cushion zone which can be compacted using a small walk behind compactor to avoid overstressing the culvert.

The gravel should be placed and compacted in horizontal lifts not exceeding 150 mm in thickness to at least 95 percent of Standard Proctor Maximum Dry Density (SPMDD) at Optimum Moisture Content (OMC). The zone outside the gravel layer may be backfilled using general onsite mineral soil (non-organic) or 80 mm minus gravel fill.

Care should be taken to raise the fill uniformly on both sides of the culvert to avoid imbalanced forces on the culvert. It is recommended that the level of fill on one side of the culvert should not exceed the level of fill on the other side by more than 300 mm. Backfill should be placed, spread and compacted with equipment running parallel to the direction of the culvert. A cover layer of at least one metre in thickness should be placed over the crown of the culvert before self propelled equipment is allowed to operate over the culvert.

Embankment side slopes should be sloped at 3H:1V when using clay backfill or 2H:1V using granular fill. Mechanically Stabilized Earth (MSE) walls may be used to reduce the required length of the culverts.

5.5 Design Earth Pressures

Assuming that the backfill is placed in accordance with Section 5.5, the preliminary design of the culvert may be based on the following equations and soil parameters in Table 5.1:

Lateral earth pressure:

$$P_h = k_o * \gamma * H$$

where: P_h = unfactored lateral earth pressure, kPa
k_o = At rest earth pressure coefficient
γ = Unit weight of soil, kN/m^3
H = Depth below top of design road grade, m

Vertical earth pressure:

$$P_v = \gamma * H$$

P_v = unfactored vertical earth pressure, kPa

TABLE 5.1
UNFACTORED SOIL PARAMETERS FOR EARTH PRESSURE DESIGN

Backfill Type Outside Drainage Layer Zone	K_o	γ (kN/m^3)
General Soil Fill	0.57	20
Pit-Run Gravel*	0.43	21

*Pit-run gravel should meet 80 mm specifications

5.6 Culvert End Treatment

The end treatment of the culvert should be assessed based on the potential for scouring, erosion and hydraulic requirements, etc. It is assumed that this aspect of the work will be designed by PWGSC. A clay plug at least 3 m long is recommended at each end of the granular backfill to reduce infiltration of water and associated potential for fines migration from the structural fill.

5.7 Cement Type

Two water soluble sulphate tests were carried out on selected soil samples - one from a depth of 4.0 metres in TH00-1 and another from a depth of 8.5 metres in TH00-2. Both tests indicated negligible sulphates results in these clay soils. Therefore, Type 10 Normal Portland Cement may be used for all concrete work in contact with the native soil at both sides.

6. CONSTRUCTION MONITORING

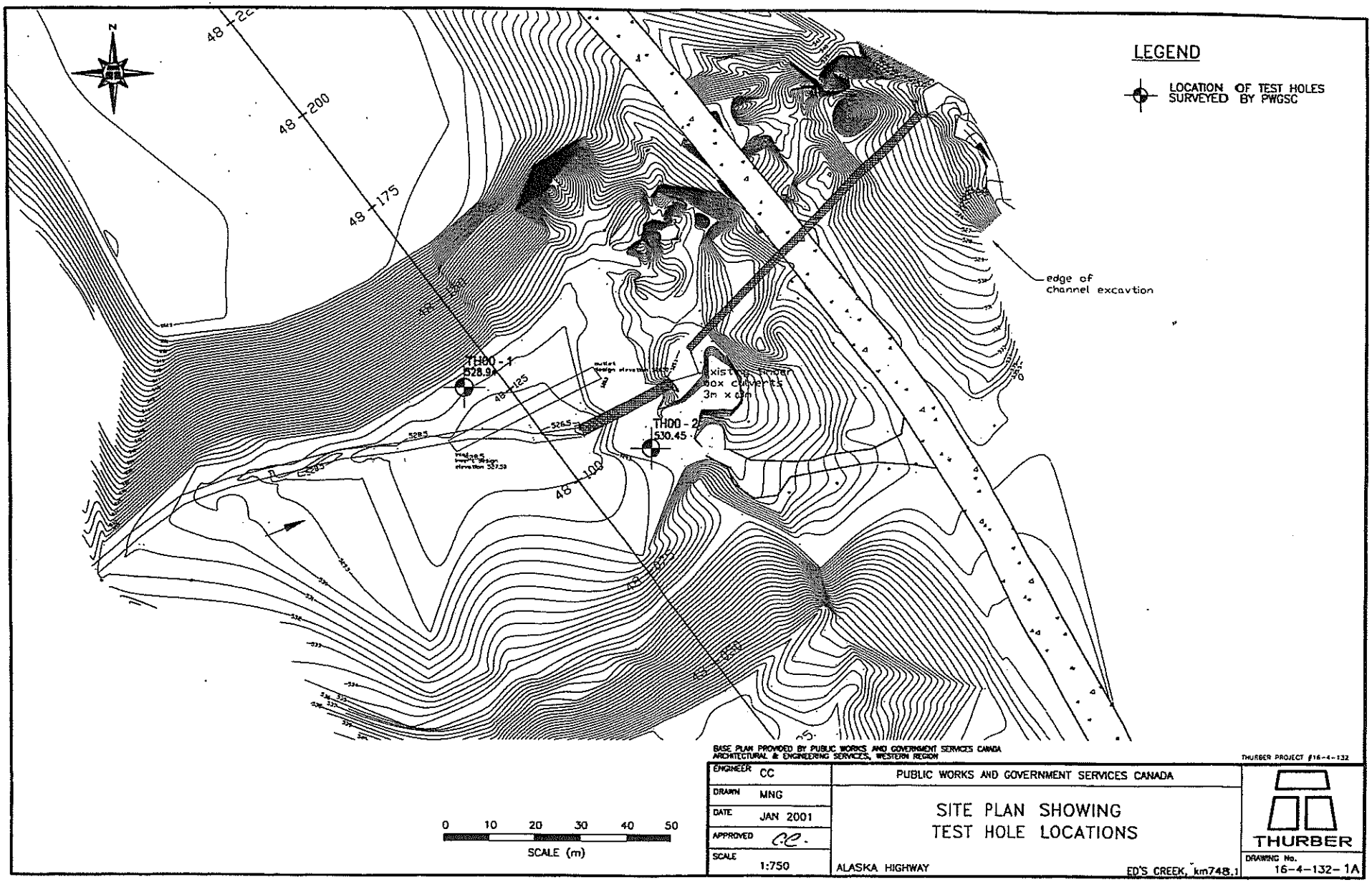
During construction, the stability of the temporary excavation side slopes should be visually checked and monitored. Visual inspection of all foundation elements for the culvert and associated wing walls is also recommended.

Inspection and compaction testing should also be carried out on all fill materials placed as part of the work.

APPENDIX A

APPENDIX A

Drawings



BASE PLAN PROVIDED BY PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
ARCHITECTURAL & ENGINEERING SERVICES, WESTERN REGION

THURBER PROJECT #16-4-132

ENGINEER	CC
DRAWN	MNG
DATE	JAN 2001
APPROVED	CC.
SCALE	1:750

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

SITE PLAN SHOWING TEST HOLE LOCATIONS

ALASKA HIGHWAY — ED'S CREEK, km748.1

THURBER

DRAWING No. 16-4-132-1A

APPENDIX B

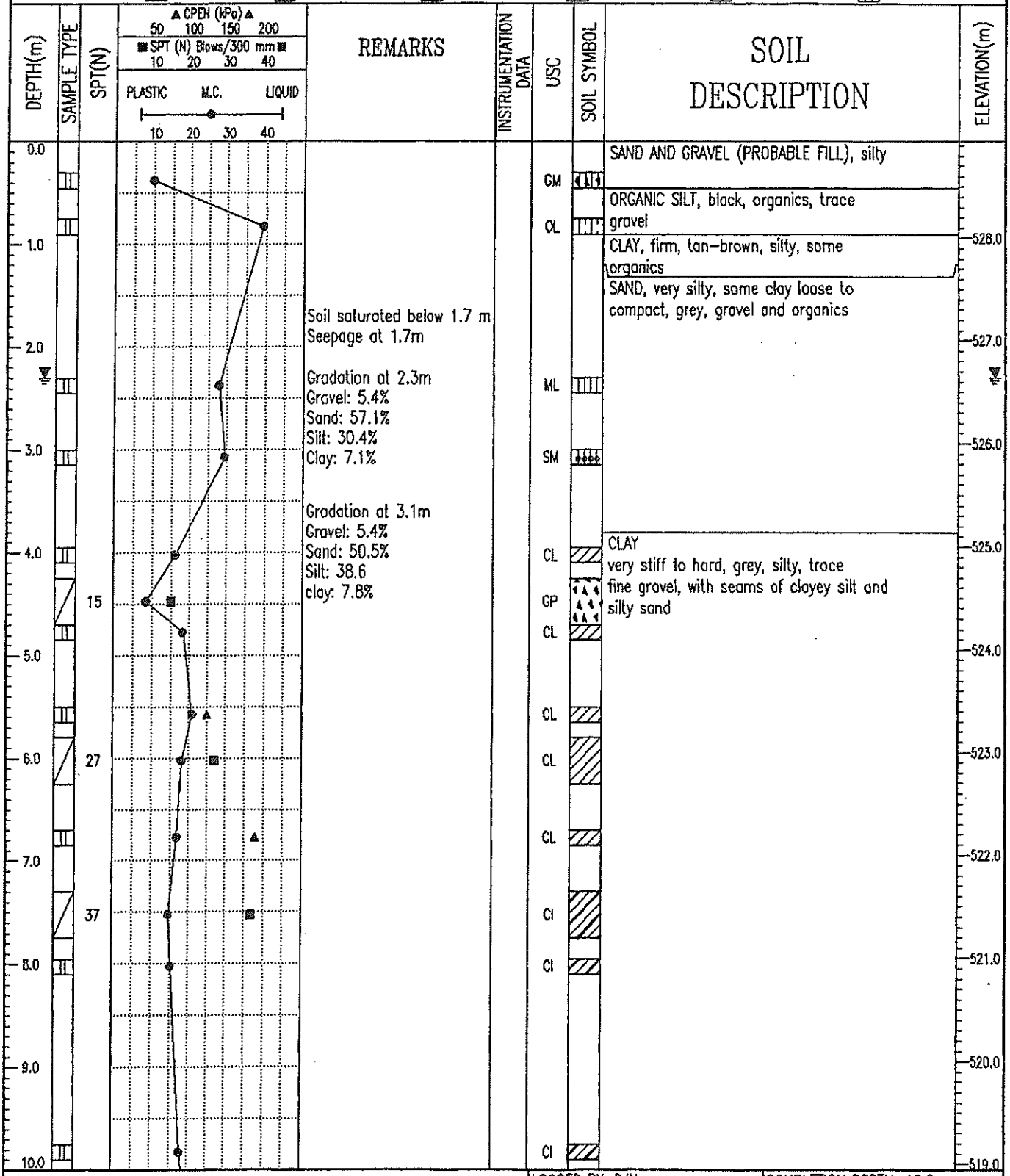
APPENDIX B

Test Hole Logs

CLIENT: PWGSC	ALASKA HIGHWAY – ED'S CREEK, km 748.1	HOLE NO: TH00–1
DRILL CO: MIDNIGHT SUN DRILLING CO. LTD.	DATE DRILLED: NOVEMBER 16, 2000	PROJECT NO: 16-4-132
RIG/METHOD: NODWELL CME 75/SOLID, HOLLOW	LOCATION: SEE DWG. NO. 16-4-132-1A	ELEVATION: 528.94 (m)

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



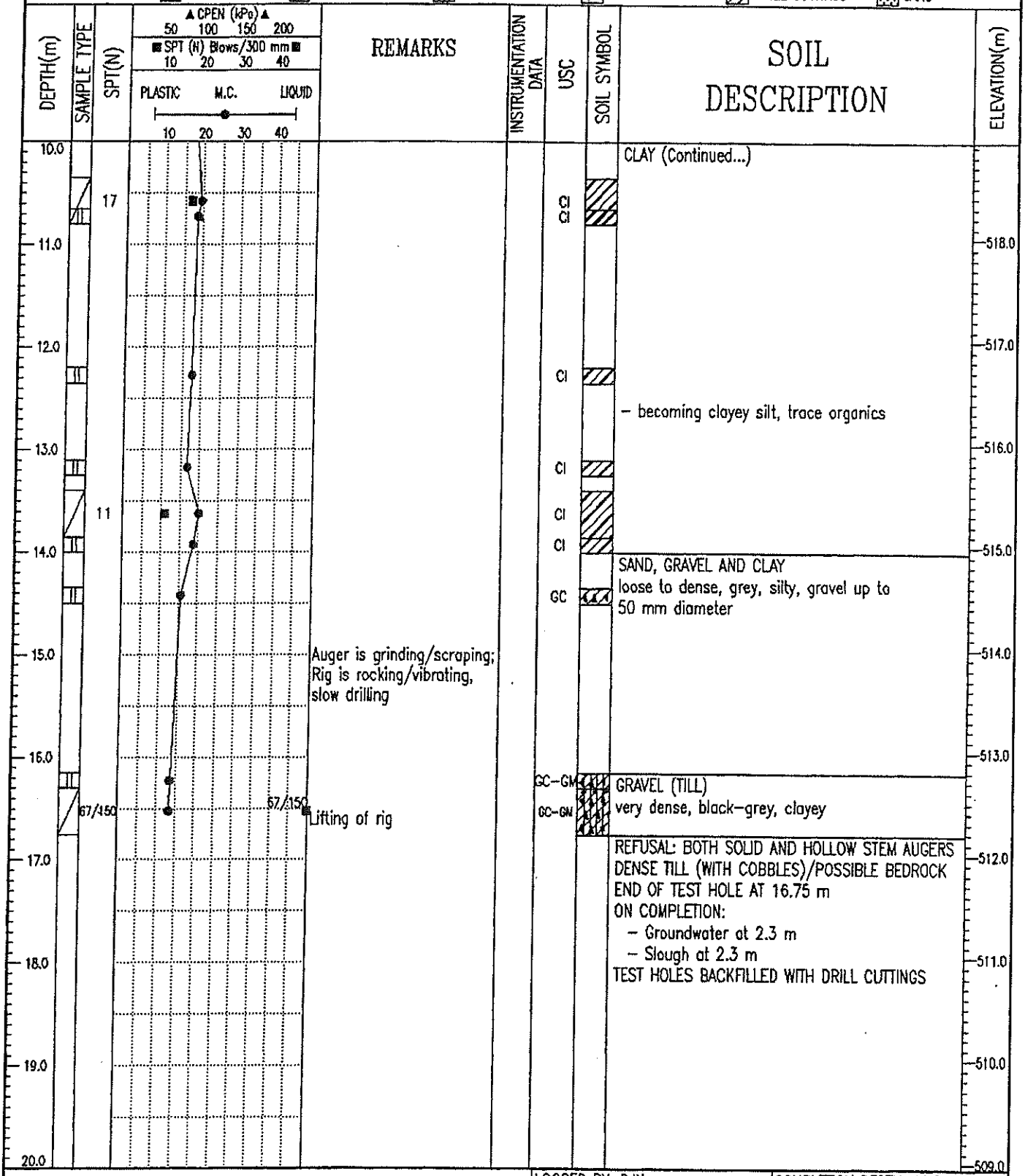
Thurber Engineering Ltd.	LOGGED BY: DJN
Edmonton, Alberta.	REVIEWED BY: CC
	Fig. No:
	COMPLETION DEPTH: 16.8 m
	COMPLETE:
	Page 1 of 2

01/01/31 09:05AM (THURPEZ)

CLIENT: PWGSC	ALASKA HIGHWAY – ED'S CREEK, km 748.1	HOLE NO: TH00–1
DRILL CO: MIDNIGHT SUN DRILLING CO. LTD.	DATE DRILLED: NOVEMBER 16, 2000	PROJECT NO: 16–4–132
RIG/METHOD: NODWELL CME 75/SOLID, HOLLOW	LOCATION: SEE DWG. NO. 16–4–132–1A	ELEVATION: 528.94 (m)

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



Thurber Engineering Ltd.
Edmonton, Alberta.

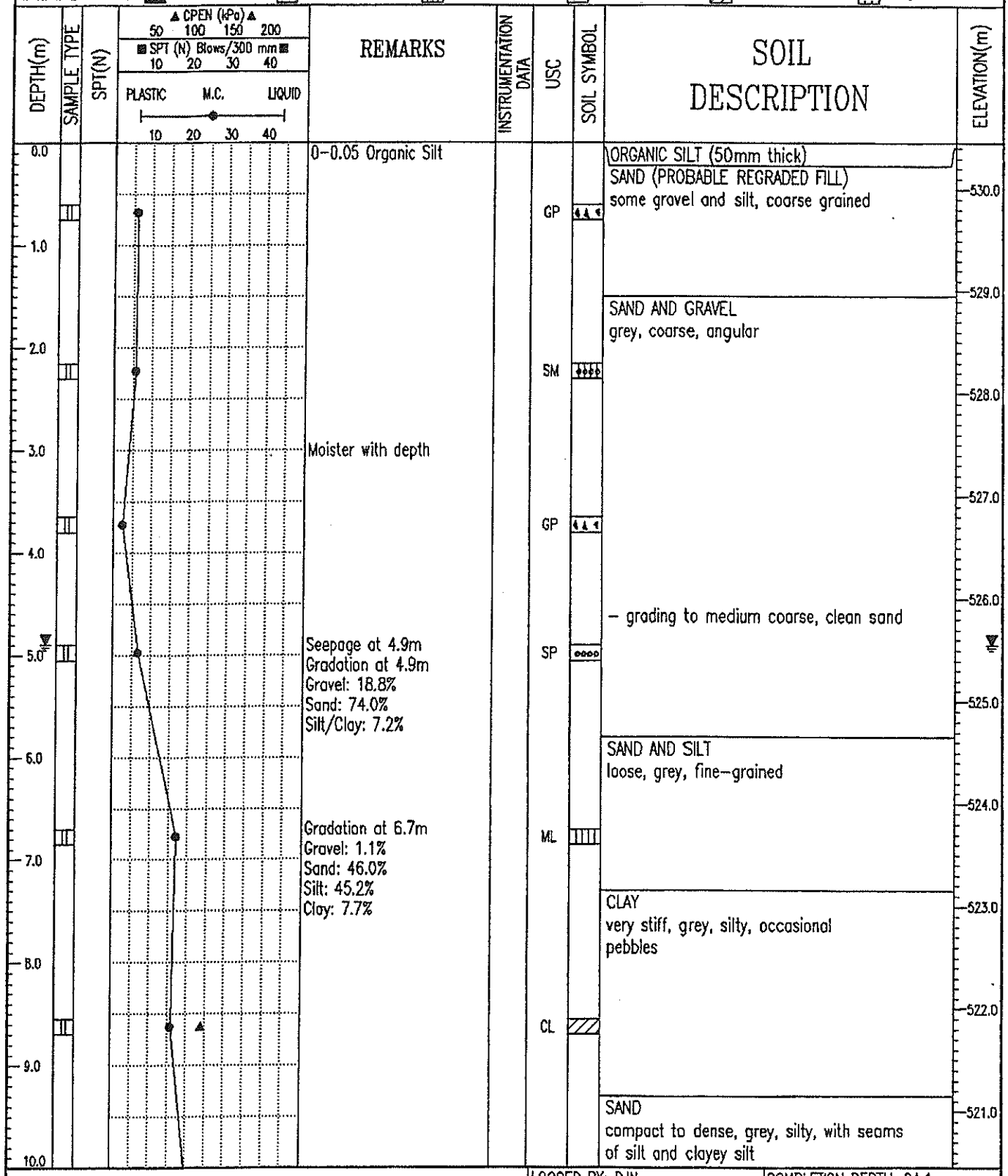
LOGGED BY: DJN	COMPLETION DEPTH: 16.8 m
REVIEWED BY: CC	COMPLETE:
Fig. No:	Page 2 of 2

01/01/31 09:05AM (THURPEZ)

CLIENT: PWGSC	ALASKA HIGHWAY – ED'S CREEK, km 748.1	HOLE NO: TH00–2
DRILL CO: MIDNIGHT SUN DRILLING CO. LTD.	DATE DRILLED: NOVEMBER 17, 2000	PROJECT NO: 16–4–132
RIG/METHOD: NODWELL CME 75/SOLID STEM	LOCATION: SEE DWG. NO. 16–4–132–1A	ELEVATION: 530.45 (m)

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



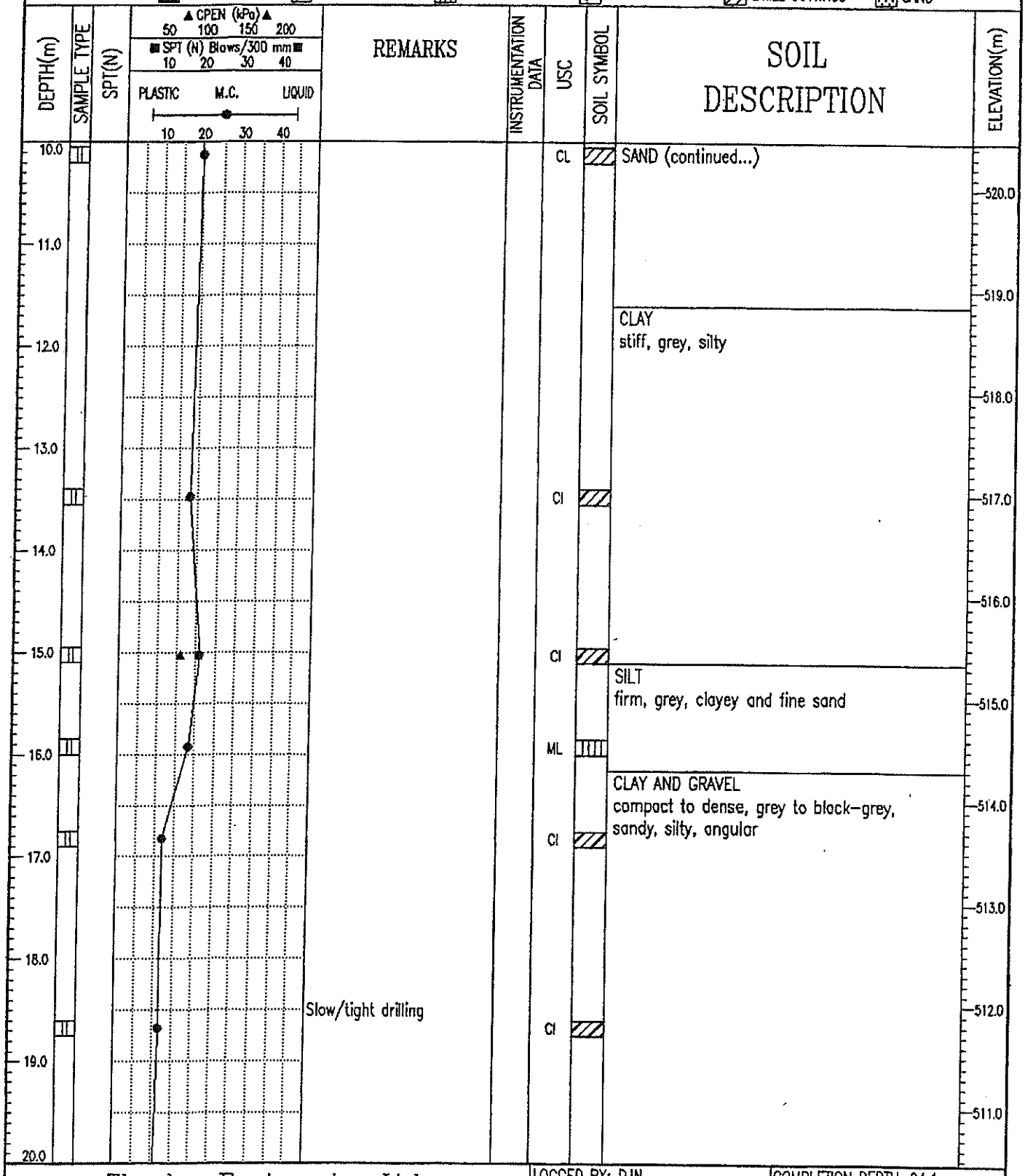
Thurber Engineering Ltd. Edmonton, Alberta.	LOGGED BY: DJN
	REVIEWED BY: CC
	Fig. No:
	COMPLETION DEPTH: 24.1 m
	COMPLETE:
	Page 1 of 3

01/01/31 09:38AM (THURPEZ)

CLIENT: PWGSC	ALASKA HIGHWAY – ED'S CREEK, km 748.1	HOLE NO: TH00–2
DRILL CO: MIDNIGHT SUN DRILLING CO. LTD.	DATE DRILLED: NOVEMBER 17, 2000	PROJECT NO: 16–4–132
RIG/METHOD: NODWELL CME 75/SOLID STEM	LOCATION: SEE DWG. NO. 16–4–132–1A	ELEVATION: 530.45 (m)

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



Thurber Engineering Ltd.
Edmonton, Alberta.

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REVIEWED BY: CC	COMPLETE:
Fig. No:	Page 2 of 3

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CLIENT: PWGSC	ALASKA HIGHWAY – ED'S CREEK, km 748.1	HOLE NO: TH00–2
DRILL CO: MIDNIGHT SUN DRILLING CO. LTD.	DATE DRILLED: NOVEMBER 17, 2000	PROJECT NO: 16–4–132
RIG/METHOD: NODWELL CME 75/SOLID STEM	LOCATION: SEE DWG. NO. 16–4–132–1A	ELEVATION: 530.45 (m)

SAMPLE TYPE: SHELBY TUBE | SPT | NO RECOVERY | A-CASING | GRAB SAMPLE | CORE SAMPLE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

DEPTH(m)	SAMPLE TYPE	SPT(N)	▲CPEN (kPa)▲ 50 100 150 200 / ■SPT (N) Blows/300 mm■ 10 20 30 40 / PLASTIC M.C. LIQUID 10 20 30 40	REMARKS	INSTRUMENTATION DATA	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION(m)
20.0								CLAY AND GRAVEL (continued...)	510.0
21.0						GP			509.0
22.0									508.0
23.0				Auger grinding/rig shaking		GP		– some cobbles at depth	507.0
24.0						GP		END OF TEST HOLE AT 24.1 m – Seepage during drilling at 4.9 m – On completion hole sloughed to 2.0 m TEST HOLE BACKFILLED WITH DRILL CUTTINGS	506.0
25.0									505.0
26.0									504.0
27.0									503.0
28.0									502.0
29.0									501.0
30.0									

Thurber Engineering Ltd.
Edmonton, Alberta.

LOGGED BY: DJN	COMPLETION DEPTH: 24.1 m
REVIEWED BY: CC	COMPLETE:
Fig. No:	Page 3 of 3

01/01/31 00:00AM (THURPEZ)

APPENDIX C

APPENDIX C

Gradation Analyses

THURBER ENGINEERING LTD.
#200,9636 51Avenue, Edmonton, T6E 6A5
Telephone: (780) 438 - 1460 Facsimile (780) 437- 7125

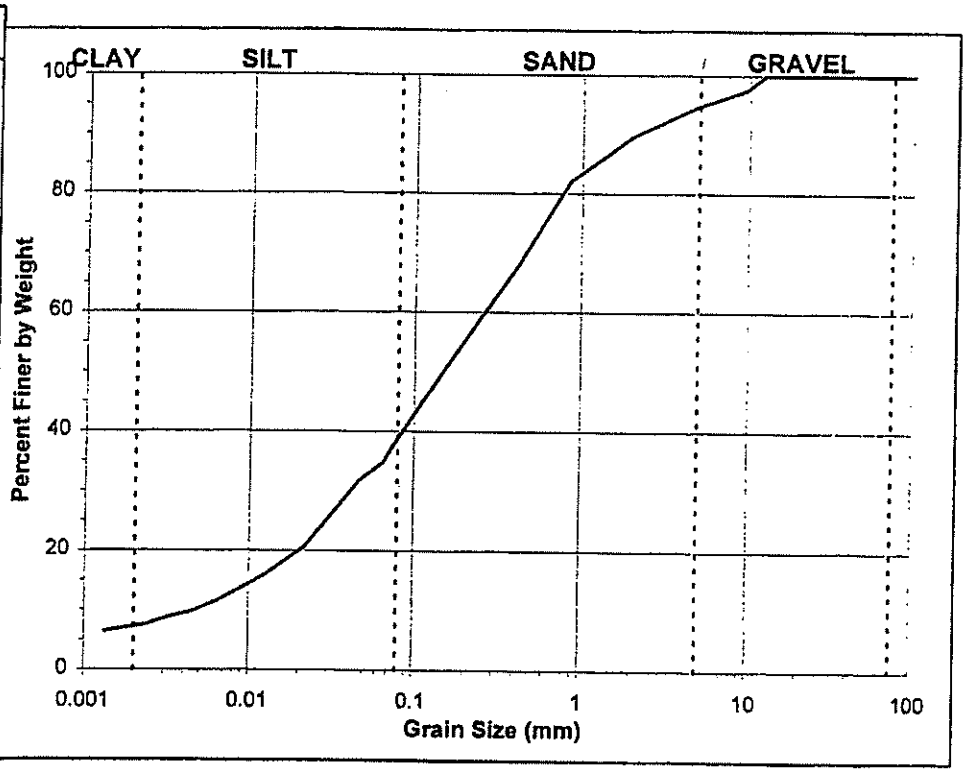
Soil Gradation Analysis Report

Hydrometer 152 H

Client: Public Works & Government Services Canada
Project: Alaska Highway
Job Number: 16-4-132
Test Hole: TH00-1
Sample No. S3
Depth: 2.3m (7.5')

Test Dates: Jan 23/01 to Jan. 25/01

Particle Size mm	Percent Passing
100.0	100.0
75.0	100.0
62.5	100.0
50.0	100.0
37.5	100.0
25.0	100.0
19.0	100.0
12.5	100.0
9.5	97.5
4.75	94.6
2.00	89.6
0.850	82.0
0.425	68.2
0.250	59.1
0.150	50.2
0.075	37.5
0.065	34.7
0.047	31.8
0.034	26.9
0.022	20.5
0.013	16.0
0.009	13.6
0.007	11.5
0.005	9.7
0.003	8.7
0.002	7.5
0.001	6.3



Gravel	5.4%
Sand	57.1%
Silt	30.4%
Clay	7.1%

Comments:

Report Checked: Tested By: KD

Tested in Accordance with ASTM D422, C136 and C117 unless otherwise indicated

THURBER ENGINEERING LTD.
#200,9636 51Avenue, Edmonton, T6E 6A5
Telephone: (780) 438 - 1460 Facsimile (780) 437- 7125

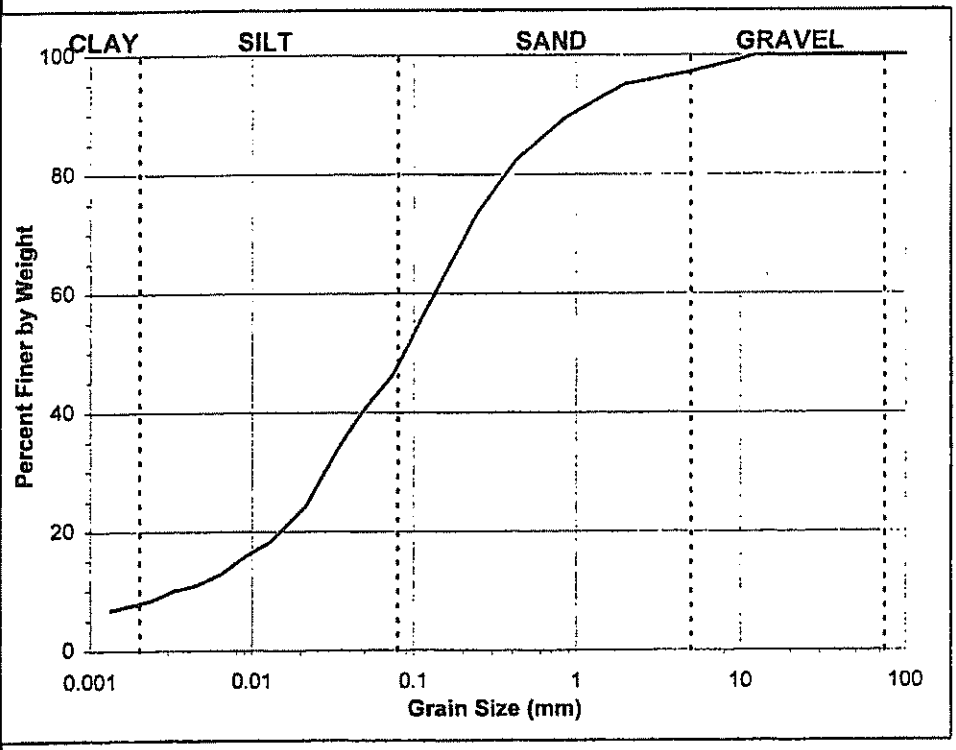
Soil Gradation Analysis Report

Hydrometer 152 H

Client: Public Works & Government Services Canada
Project: Alaska Highway
Job Number: 16-4-132
Test Hole: TH00-1
Sample No. S4
Depth: 3.1m (10')

Test Dates: Jan 23/01 to Jan. 25/01

Particle Size mm	Percent Passing
100.0	100.0
75.0	100.0
62.5	100.0
50.0	100.0
37.5	100.0
25.0	100.0
19.0	100.0
12.5	100.0
9.5	99.0
4.75	97.0
2.00	95.1
0.850	89.4
0.425	82.4
0.250	73.9
0.150	62.5
0.075	46.4
0.064	44.1
0.046	39.3
0.033	33.4
0.022	24.3
0.013	18.1
0.009	15.8
0.006	12.9
0.005	10.9
0.003	9.9
0.002	8.4
0.001	6.8



Gravel	3.0%
Sand	50.5%
Silt	38.6%
Clay	7.8%

Comments:

Report Checked: Tested By: KD

Tested in Accordance with ASTM D422, C136 and C117 unless otherwise indicated

THURBER ENGINEERING
EDMONTON ALBERTA

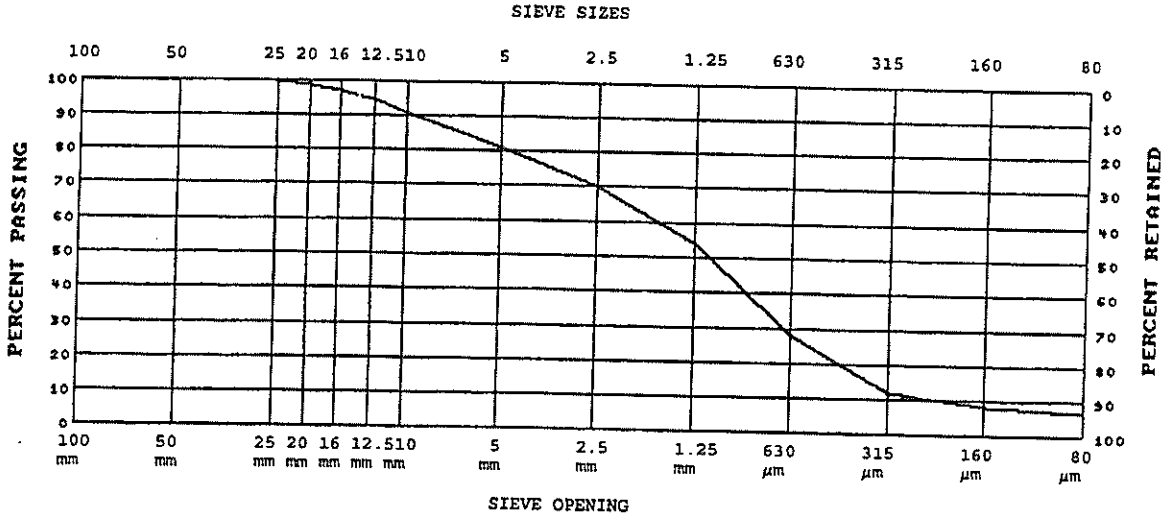
SIEVE ANALYSIS REPORT
SI SERIES

Public Works and Government Services

PROJECT NO: 1600004-132
DATE: 01.Jan.26
CLIENT P.O.:
Public Works and Government
CC:

PROJECT:
Alaska Highway
Km 748, Km 762, Km 775

TEST NUMBER: 31 DATE SAMPLED: 01.Jan.03 SAMPLED BY: MM
SPECIFICATION: No Specifications DATE TESTED: 01.Jan.26
SAMPLE SOURCE: TH 00-2, S4 @ 4.9m (16.0') TEST METHOD: WASHED
SAMPLE TYPE: Gravel



GRAVEL SIZES	PERCENT PASSING	GRADATION LIMITS
100 mm		
50 mm		
25 mm	100.0	
20 mm	98.5	
16 mm	97.3	
12.5 mm	94.6	
10 mm	90.7	

SAND SIZES AND FINES	PERCENT PASSING	GRADATION LIMITS
5 mm	81.2	
2.5 mm	70.4	
1.25 mm	53.9	
630 µm	28.0	
315 µm	12.0	
160 µm	8.5	
80 µm	7.2	

COMMENTS: File #16-4-132AB
Seiries #1096

THURBER ENGINEERING - PER: AS

THURBER ENGINEERING LTD.
#200,9636 51Avenue, Edmonton, T6E 6A5
Telephone: (780) 438 - 1460 Facsimile (780) 437- 7125

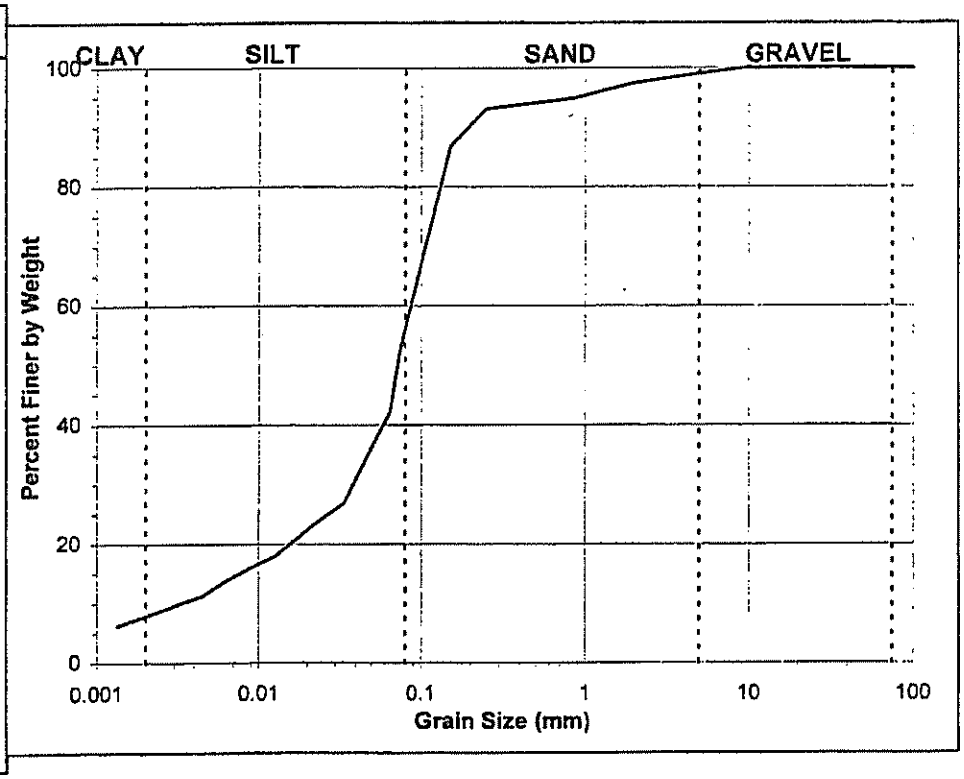
Soil Gradation Analysis Report

Hydrometer 152 H

Client: Public Works & Government Services Canada
Project: Alaska Highway
Job Number: 16-4-132
Test Hole: TH00-2
Sample No. S5
Depth: 6.7m (22')

Test Dates: Jan 23/01 to Jan. 25/01

Particle Size mm	Percent Passing
100.0	100.0
75.0	100.0
62.5	100.0
50.0	100.0
37.5	100.0
25.0	100.0
19.0	100.0
12.5	100.0
9.5	100.0
4.75	98.9
2.00	97.4
0.850	94.9
0.425	93.9
0.250	93.1
0.150	86.8
0.075	52.9
0.064	42.0
0.047	34.6
0.034	26.8
0.022	23.1
0.013	18.0
0.009	16.0
0.006	13.9
0.005	11.2
0.003	10.0
0.002	8.6
0.001	6.2



Gravel	1.1%
Sand	46.0%
Silt	45.2%
Clay	7.7%

Comments:

Report Checked: Tested By: KD

Tested in Accordance with ASTM D422, C136 and C117 unless otherwise indicated

APPENDIX C
UMA ENGINEERING (2002) REPORT

ALASKA HIGHWAY, BC

DESIGN SERVICES – KM 733 TO KM 737
PROJECT 405665
FINAL GEOTECHNICAL REPORT

Prepared for

Public Works and Government Services Canada

Prepared by

UMA Engineering Ltd.
17007 – 107 Avenue
Edmonton, Alberta T5S 1G3

Telephone: 780-486-7000
Fax: 780-486-7070

UMA Job No. 2977 257 00 12

September 2002

Alaska Highway, BC
Design Services – km 733 to km 737
Project 405665
Final Geotechnical Report
September 2002

Table of Contents

Page No.

List of Appendices

UMA Engineering Ltd. - Third Party Disclaimer

1.0 Introduction

This report presents the results of the geotechnical investigations conducted for the design of the reconstruction of km 733 to km 737 of the Alaska Highway, Muncho Lake Park, British Columbia. The geotechnical program was conducted under the Contract for design services awarded to UMA in October 2001.

This report provides the following:

- results of the geotechnical field investigation and laboratory testing programs;
- a summary of the soil and groundwater conditions along the route;
- test results and recommendations regarding potential sources of granular material for embankment and pavement construction;
- recommendations for pavement subdrains to mitigate the potential for frost heave;
- recommendations for cuts in slopes that are currently or potentially unstable; and
- recommendations for design and construction of gabion retaining walls.

2.0 Field Program

2.1 Field Work

A phased approach to the geotechnical investigation program was taken. The preliminary program involved test pits excavated along the right-of-way to obtain geotechnical data for preliminary design. The fieldwork for the preliminary phase was completed in November 2001. The second phase of the program was conducted in May 2002. Supplemental information was obtained from test holes drilled where deep cuts and gabion retaining walls are proposed, where slope instabilities were identified, and at the site of a potential source of granular material. Pat Eckel, CET, of UMA supervised both programs, logged the conditions encountered in the holes and collected the soil samples. The locations of the test holes and pits are shown on the plans in Appendix A.

The preliminary field program was conducted between November 10 and 18, 2001 during which a total of 94 test pits were excavated with a backhoe operated by Doug Gordon Contracting from Fort Nelson. The test pits were located within the existing right-of-way, were typically excavated near the toe of the existing road embankment, and were spaced 50 m to 75 m apart. The test pits ranged in depth from 1.5 m to 4.9 m. Piezometers, constructed from 25 mm diameter PVC pipe, were installed in 12 of the test pits.

The second phase of fieldwork was completed between May 24 and 30, 2002 and involved drilling 39 test holes. Geotech Drilling Ltd. from Prince George, B.C. was hired to drill the test holes. Solid stem augers were used to drill through cohesive soils and some of the granular soils. An air hammer rock drill was used to advance holes drilled deep into granular deposits or where cobbles or boulders prevented drilling with augers. Table 1 summarizes the test holes drilled during the Phase 2 Field Program.

Table 1 – Phase 2 Field Program Test Hole Summary

Station	Test Hole Numbers	Rational
732+900 to 733+250	TH-02-01 to – 04	Drilled in road grade at cut location to investigate subgrade conditions.
733+600 to 734+720	TH-02-05 to – 13	Drilled in road grade at cut location to investigate subgrade conditions.
735+100 to 735+160	TH-02-14	Drilled in road grade at cut location to investigate subgrade conditions.
735+400 to 735+780	TH-02-05 to 18	Drilled in road grade at cut location to investigate subgrade conditions.
736+880 to 737+820	TH-02-19 to 28	Drilled in road grade at cut location to investigate subgrade conditions.
733+000 to 733+220	TH-02-29	Drilled west of road to investigate back slope cut into unstable slope.
734+500 to 734+780	TH-02-30, 31, 32	Drilled west of road to investigate back slope cut into unstable slope.
736+280 to 736+540	TH-02-33	Drilled west of road to investigate back slope cut into unstable slope.
735+700	TH-02-34	Drilled east of road to investigate failed riverbank.
735+850	TH-02-35	Drilled east of road to investigate foundation conditions for proposed steep rock fill
Km 746	TH-02-36, 37, 38	Drilled on top of proposed cut area to investigate potential source of granular material.

2.2 LABORATORY TESTING

Tests on soil samples included determination of natural moisture contents, Atterberg Limits, and grain size analysis. The moisture contents and Atterberg Limits are plotted on the test hole logs in Appendix B and the grain size analyses are reported in Appendix C.

3.0 Site Conditions

3.1 GENERAL TERRAIN

The existing road is aligned along the west side of the Trout River between the bridges over the Trout River and Prochniak Creek. Most of the route is along the alluvial plain at the bottom of the Trout River Valley. In some locations it rises up onto the lower valley slopes which are formed by thick deposits of clay and silt. Within the project area drainage is generally from the mountain range to the west and to the Trout River to the east.

3.2 SLOPE INSTABILITIES

Most of the natural and cut slopes, west of the road within the project area, exhibit signs of instability. The slides are occurring in the weak clay and silt that form these slopes. Seepage and high groundwater levels are also present at these slides. The slumping is apparent on the aerial photographs and from the ground. Tension cracks and tilting trees are evidence of recent and ongoing slope movements along most of these slopes.

It appears that the existing alignment was established to avoid high cuts into these unstable back slopes. The cuts that were made into these back slopes have aggravated the instabilities. Most of these failed slopes are standing at gradients of 3H:1V (horizontal to vertical) or slightly flatter.

The slides are confined to the back slopes and do not extend beneath the road. The slides typically exit slightly above the invert of the ditches and there are no reports that these instabilities have affected the road embankments. However, at some locations slide debris accumulates in the ditches. The debris is periodically removed to keep the ditches draining. Seepage from the slopes collects in the ditch on the west side of the road, often resulting in icing of the ditches in the winter.

4.0 Soil and Groundwater Conditions

4.1 Soil Deposits and Properties

Descriptions of the soils encountered are summarized on the test hole and test pit logs in Appendix B. The results of grain size distribution analysis are included in Appendix C.

The high back slopes are generally cut into deposits of clay and silt. The clay is low to medium plastic with plastic limits and liquid limits near 17 and 30 percent respectively. Silt, and occasionally fine sand, occur in layers or laminations in the clay. The clay is stiff to hard with natural moisture contents near or below the plastic limit. Where the clay is disturbed and softened, as slide debris, it is soft and wet with moisture contents as high as 7 percent above the plastic limit. The silt and clay is frost susceptible.

Granular deposits predominate in the lowered areas, beneath the existing roadbed where the highway crosses the alluvial plain along the valley bottom. The deposits generally consist of sand, gravel and cobbles, with 3 to 39 percent silt and clay. These granular materials were probably used to construct the upper metre of the existing roadbed at most locations.

Terraces, comprised of granular soils, are present along the valley walls north of the project area (i.e. the proposed cut at km 746.6). At km 746.6, the sand and gravel extended to the maximum depth drilled of 41.0 m. Coarse material of cobbles and boulders are visible on the face of the deposit. The properties of the material from this source are described in Section 5.1.1 of this report. Terraces similar to those near km 746 were not identified within the project area between km 733 and km 737.

Alluvial fans occur along the river; some of these may be potential sources of large diameter rock for riprap or crushing.

There are no exposures of bedrock within the right-of-way; bedrock was not encountered in any of the test holes or test pits. Our understanding of the site conditions is that the bedrock generally lies at depth beneath the overburden deposits. A former bedrock quarry is present along the right-of-way several kilometres north of the project.

4.2 GROUNDWATER

Water levels in the piezometers were collected on February 2, June 2 and 3, and July 25, 2002. This data is summarized in Appendix D. At the time of the field program and site visits in the fall of 2001 and spring of 2002, wet conditions persisted at many locations in the west ditch as a result of seepage from the natural back slopes and road cuts west of the road. Generally, seepage areas are coincident with areas of instabilities.

Most of the piezometers were installed in the wet back slopes and proposed cut locations where groundwater conditions are most likely to be an important factor in design. The groundwater conditions at each back slope cut and retaining wall location are discussed in the following section as they pertain to the recommendations at each location. Generally, high groundwater levels were measured in the west ditch below the wet back slopes. Many of the piezometers had water levels near or within a metre or less from the ground surface. Groundwater elevations rise further up the back slope and typically range from 2 to 5 m below ground surface. In some of the piezometers located higher on the back slopes the water level rose significantly between June 3 and July 25, 2002. It will be necessary to obtain further water level readings to determine the stabilized levels. The silt and fine sand laminations in the clay produced small amounts of free water during drilling, and groundwater flow is likely to be controlled by these more permeable layers.

Groundwater was not encountered in the test holes drilled at the proposed cut and borrow site at km 746.6.

5.0 Design Recommendations

5.1 CONSTRUCTION MATERIALS

5.1.1 Granular Materials

There are three potential sources of granular material for construction: salvaged granular material from the existing roadbed; natural sand and gravel deposits within the right-of-way along the valley bottom; and the cut at km 746.6. The results of the gradation analysis of samples collected from these potential sources are included in Appendix C and are summarized on Tables C-1, C-2 and C-3.

Salvaged Road Bed Granular: The existing road has a pavement structure consisting of about one metre of granular material. Most of the samples of granular material recovered from the road pavement did not meet the PWGSC specification for select subgrade or subbase. The samples were somewhat finer than the specification for subbase. The percentage of material finer than 0.075 mm averaged 12.2%, which is more than the specified maximum for both materials (maximum of 10% for sub-base and 8% for select sub-grade). However, these samples were obtained by air hammer drilling methods, which may have produced samples somewhat finer than representative. Given that the existing road is performing well and frost heave has not been a wide spread problem, it would be acceptable to use salvaged granular material for select subgrade for the reconstructed road in areas where the road will be raised and well drained. In wet cut areas where there is a potential for frost heave, a free draining material that meets the PWGSC select subgrade specification should be used.

Natural Sand and Gravel Within Right-of-Way: The samples obtained from the test pits adjacent to the road are on average coarser than the granular material encountered beneath the road. However, the difference in gradation may be primarily the result of the sampling method (bulk samples from the test pits versus blown cuttings from the air hammer drill). Much of the granular material used for the road likely came from ditch cuts and other borrow areas adjacent to the road. There is considerable variable in gradation. More than half of the samples had fines exceeding the maximum of 8% and 10% finer than 0.075 mm specified for subbase and select subgrade respectively. The quantity of material obtained from this source for the project will be limited as these deposits are mostly in the low areas where significant cuts are not planned. Where available it can be used for select subgrade. As noted above, material used where there is a potential for frost heave should meet the select subgrade specification.

Cut at km 746.6: The proposed cut and borrow pit at km 746.6 is in one of the large terraces of sand and gravel that are present along the lower slopes of the Trout River valley north of the project area. The grain size analysis on the samples from the three test holes shows the material to be finer than it actually is in situ, because the air drill breaks cobbles and boulders to facilitate drilling. The grain size analysis shows the deposit to be predominantly sand and fine gravel, generally 100% finer than 19 mm, and 10% to 20% finer than 0.075 mm. However, cobbles and boulders are visible on the exposed face of the deposit and were encountered during drilling. They are concentrated in layers or pockets and not evenly disturbed throughout the deposit. A 4.0 m thick clay layer was encountered in one of the test holes. Groundwater was not encountered in the test holes.

The material does not meet the gradation specifications for select subgrade, as it contains more than 10% finer than 0.075 mm. It meets the select subgrade gradation specifications set by some provincial highway authorities and would be suitable as a select subgrade for highway reconstruction. A material that meets the select subgrade specification should be used in areas where there is a potential for frost heave.

The material can be processed to meet the gradation specifications for crushed base and subbase gravel. It will need to be blended with crushed rock in the appropriate proportions to meet the specified gradation and crushed content for crushed base gravel The oversize rock within the deposit can be crushed; however, it will likely be necessary to develop a supplementary source of rock, such as a bedrock quarry, to furnish the quantities of crush material needed for crushed base gravel.

Other Aggregate Sources Between km 737 and km 746.6: Test results from previous geotechnical investigations prepared by Terra Engineering Ltd. for PWGSC have indicated that there are potential aggregate sources at km 737.8, km 740.8, km 741.7, and km 744.8. (Note that these stations are 0.4 km greater than used in this report, i.e. km 737.8 in the Terra report equates to UMA's station of km 738.2 in this report).

5.1.2 Common Fill

The majority of cuts will be in the large back slopes, which are primarily silt and clay. These soils are weak, poorly drained, and potentially frost susceptible. These soils should only be used as common fill near the base of the higher fills. Granular materials, such as that salvaged from the roadbed and some of the ditch excavations, should be used higher in the embankment and for select subgrade.

5.2 PAVEMENT SUB-DRAINS

Wet frost susceptible soils are present along many portions of the route, particularly where the road cuts into the valley slopes. At some of these locations, it is proposed to lower the road and potentially cut into the clay and silt subgrade. Where possible, the ditch inverts should be set well below the base of the select subgrade to ensure that the entire pavement structure drains. Subdrains will be required to prevent saturation of the subgrade and the pavement where the underside of the select subgrade is below the ditch inverts.

5.3 GABION RETAINING WALLS

Gabion retaining walls are proposed in some of the back slopes to limit the extent of the cuts. Most of these back slopes are in poorly drained clay and silt and are unstable. Since measures to fully stabilize the back slopes are not being implemented, there is a risk that ongoing slope movements could cause the retaining walls to shift and tilt. Gabion walls will be located along the lower portions of these unstable slopes and wall construction will entail removal of the disturbed softer soils along the lower portions of the slopes only. Since the disturbed unstable soils on the upper portions of the slopes will not be completely removed, some of the risks associated with the larger instabilities will remain.

Gabion retaining walls have been selected over other retaining wall systems for a number reasons. Gabion retaining walls are a flexible system that will tolerate some foundation settlements and movements associated with back slope instabilities. At some locations, gabion walls will improve back slope stability as they will be used to attain more stable back slope cut angles and will lower groundwater levels near the toe of the slopes. Gabion walls are considered to be cost effective for heights of up to six metres, approximately the maximum height of retaining walls for this project.

The following are general recommendations for gabion wall design. Specific recommendations for incorporating the retaining walls into each back slope cut are provided in Section 5.4. The gabion supplier must design the retaining walls for global and basal stability.

The gabion walls should be founded on undisturbed soil. At most locations this will involve excavating through the soft disturbed clay and silt into stiff to very stiff clay and silt. A layer of compacted free draining granular material should be placed on the exposed subgrade prior to construction of the gabions. Subdrains should be installed to collect and remove water from the granular material below and behind the walls. The retaining walls should be backfilled with free draining compacted granular material. This material should form a 1H:1V (horizontal to vertical) wedge extending from the heel of the retaining wall to final grade behind the wall. Back slopes above the retaining walls should be no steeper than 3H:1V and benched as recommended for the back slope cuts.

Experienced geotechnical personal familiar with the site conditions and design should be onsite during construction to ensure that all design requirements of the gabion retaining walls (foundation preparation, backfilling and sub-drain installation) are met.

5.4 BACK SLOPE CUTS

It is unlikely that the high cost of stabilizing the back slopes would be justifiable. Provided the instabilities do not affect the road or develop into conditions that are costly to maintain, some ongoing back slope movements can be tolerated. The following guidelines for each of the cut locations are not intended to eliminate instabilities but to improve upon the existing conditions, mitigate risks to the road, and minimize ongoing maintenance costs associated with the instabilities.

733+040 to 733+220: This cut will approach 10 m in height. Soil conditions in the cut are gravel over clay. Groundwater discharge into the ditch is evident and groundwater levels near ditch level were measured in TP-01-32. The groundwater level in TH-02-29, 30 m west of existing centreline appeared to have stabilized at about 4.6 m below ground surface during the summer of 2002.

The existing instabilities are primarily due to the existing overly steep cut, which has a gradient of about 2H:1V. The slope should be cut to 3H:1V, with a 5 m wide bench for each 5 m rise in elevation. A subdrain should be installed in the ditch at the toe of the slope to collect seepage and control ditch icing.

734+480 to 734+780: This will be a 15 m high cut in silt and clay and will extend up to 75 m west of the existing centreline. Test pits in the west ditch encountered wet silt and clay. The water levels in the piezometers in TP-01-32 and 38, in the west ditch, were near ground surface in the summer of 2002. Groundwater levels in TH-02-30, located on the back slope, were about 5 m below ground surface or about 2 m higher in elevation than in TP-01-32 and 38. The existing slope is between 2H:1V and 3H:1V and existing failures are due to an overly steep cut and high groundwater levels.

The slope should be cut to 3H:1V, with a 5 m wide bench for each 5 m rise in elevation. A subdrain should be installed in the ditch at the toe of the slope to collect seepage and control ditch icing. An interceptor ditch at the top of the cut is recommended to divert surface runoff away from the slope.

The gabion walls between 734+660 and 734+780 are required to limit the amount of back slope cut. Most of the slide debris at the toe of the slope will be removed to construct the retaining wall and then make the 3H:1V cut immediately above the wall. Drainage at the toe of the slope will also be improved. As a result of these measures, the lower slope and retaining wall are expected to perform well. However, there will be little improvement in the stability of the upper slope, above the 3H:1V cut, which will remain at gradients steeper than 3H:1V.

735+540 to 735+720: The existing back slope is in excess of 20 m high and cuts will approach 10 m in height. The existing slope gradients are generally flatter than 3H:1V. Sand and gravel were encountered below about 2 m of silt and clay in the test pits excavated at the toe of this slope. The slope appears to be well drained and the 4.5 m deep piezometers installed in the test pits were dry in the summer of 2002. Evidence of recent instability is not apparent along the slope.

This slope should be cut at 3H:1V, with a 5 m wide bench for each 5 m rise in elevation. A subdrain should be installed in the ditch at the toe of the slope to collect seepage and control ditch icing. An interceptor ditch should be excavated at the crest of the slope to divert runoff and minimize erosion and infiltration.

735+720 to 735+780: The existing back slope is in excess of 20 m high, is unstable and exhibits evidence of ongoing movements. The back slope is clay and silt and groundwater levels are high. Groundwater discharge collects in the ditch and the piezometers located slightly above the west ditch (TP-01-67 and 67) had water levels within 0.7 m of the ground surface. On June 3, the water level in the piezometer in TH-02-32, installed approximately 70 m west of centreline and about 10 m above the road, was about 14.0 m below ground surface. By July 25, the water level had risen to 5.5 m below ground surface.

This back slope coincides with instabilities of the grade slope discussed below (Section 5.5). Instabilities on both sides of the highway limit re-alignment options. The proposed alignment was determined to avoid the instabilities on both sides of the road as much as possible. Nevertheless, the back slope cut will approach a height of 20 m in the vicinity of 735+740, and about 60 m of retaining wall up to 4.5 m in height will be required to limit the amount of back slope cut. It will not be possible to flatten the entire upper slope because 3H:1V cuts would extend 150 m or more from the road. Although the improved drainage behind the gabions is expected to lower groundwater levels and improve slope stability, instabilities originating on the upper slopes, some of which will remain steeper than 3H:1V, could damage the retaining wall. Subdrains or French drains extending upslope may further improve slope drainage if they can be installed deep enough to intercept the water table in the slope. Additional water level readings in the back slope piezometers should be obtained to determine if this is a viable option.

A subdrain should be installed in the ditch at the toe of the slope to collect seepage and control ditch icing. An interceptor ditch at the slope crest to divert runoff will not be feasible.

736+280 to 736+520: Clay and silt were encountered in the test pits excavated on the back slope. The existing natural back slopes along this section show signs of instability and the proposed 2H:1V cuts will likely aggravate the existing movements. The movements will likely be confined to back slopes and will not threaten the new road. Slope debris may accumulate in the back slope ditch and require periodic removal. Gabion walls installed to minimize cuts, maintain existing slope geometry, and improve back slope drainage will likely perform better than cuts.

A subdrain should be installed in the ditch at the base of the back slopes and retaining walls along this entire section.

737+600 to 737+680: This back slope is comprised of granular soils (Terra Engineering Ltd. BH5-1) and appears to be well drained. The existing slope gradient is between 2H:1V and 3H:1V and is not exhibiting signs of instability. The slope can be cut to 3H:1V with 5 m wide benches to accommodate the new alignment. A cut would produce some granular fill material for the project.

5.5 GRADE SLOPE FAILURE 735+700

A relatively large riverbank failure is present between the existing road and Trout River at about 735+700. The riverbank is about 30 m high at this location. The instability is occurring because the river is cutting into the base of the slope and eroding the toe of the failure. Based on the results of TH-02-34, drilled behind the crest of the slide, the slope is formed by sand over clay and silt. Water was encountered in the test hole and the groundwater level in TH-02-34 rose to 6.3 m below ground surface in July 2002. Although the crest of this failure is 30 m or more from the road, it will retrogress and eventually could undermine the road. Eventually, protective riprap armouring will be required along the edge of the river to control this failure. Fisheries regulations will need to be addressed when this armouring is designed and placed. Redirecting the discharge from the culvert at km 735.7 away from the failure may also help to reduce the rate of slope movements.

5.6 ROCK FILL 735+800 TO 735+920

A rock fill with a side slope of 1.5H:1V and a height of up to 12 m is proposed to avoid encroaching on the river along this section. The foundation conditions for this fill were investigated with TH-02-35. The foundation for the embankment is 4 m of gravel over very stiff low plastic clay. This foundation will have an adequate bearing capacity for the fill.

Respectfully submitted,

UMA ENGINEERING LTD.

Jeff Tallin, P.Eng.
Senior Geotechnical Engineer

Appendix A
Drawings

EXISTING ACCESS TRAIL

TH-02-37

TH-02-38

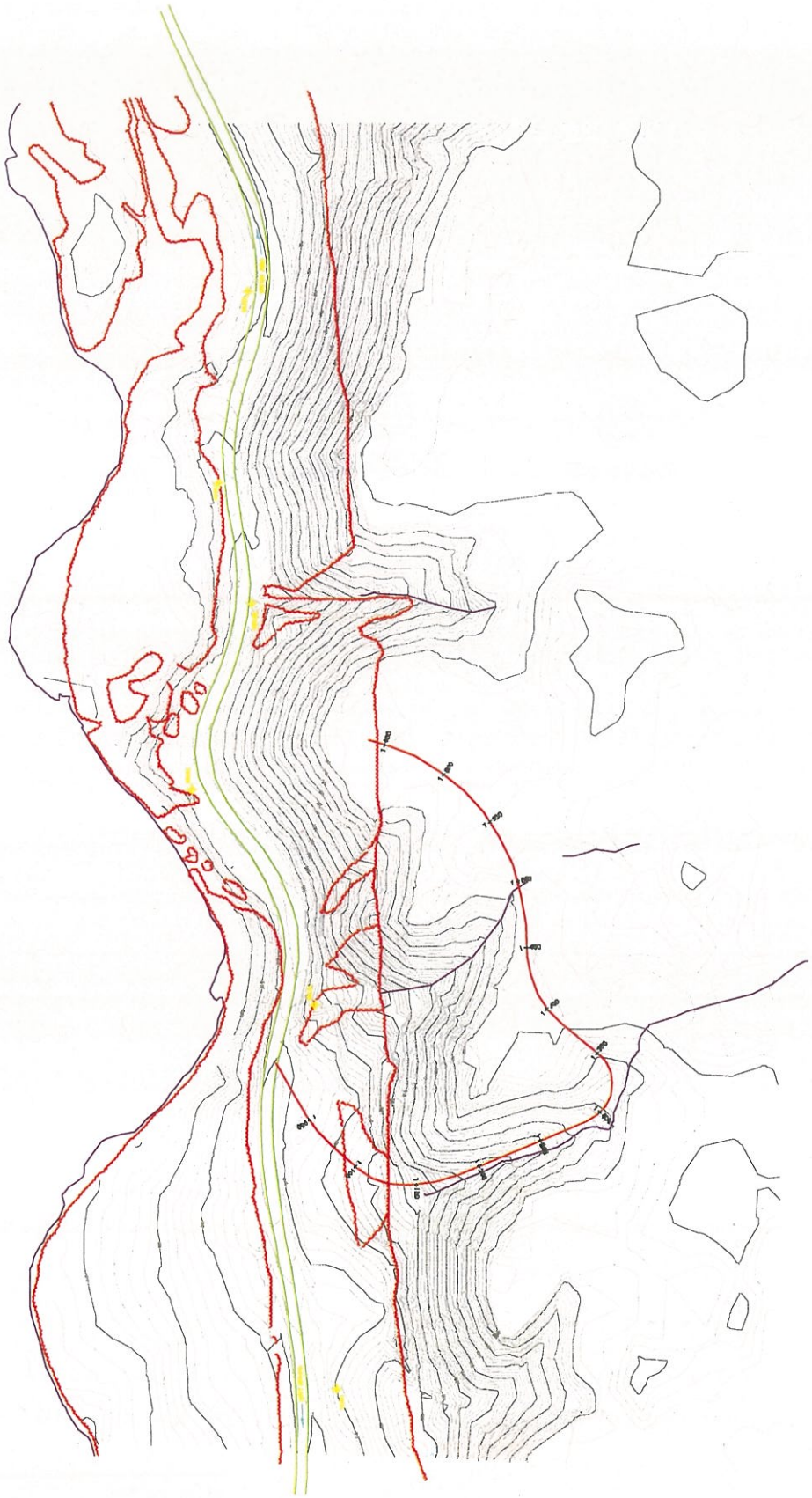
TH-02-36

N:\Dept09\PWGC2977257\Phase03_Detail Design\Ref files\images\km 746 THs.jpg

TEST HOLE LOCATIONS

Km 746.6
AGGREGATE SOURCE

ALASKA HIGHWAY



Appendix B
Test Hole Logs

PROJECT: Alaska Highway Realignment	CLIENT: PWCGS	TESTHOLE NO.: 36
LOCATION: At km 746.6		PROJECT NO.: 2799-257-00-12
CONTRACTOR: Geotech Drilling Ltd.	METHOD: Air Hammer	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ▯ CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0	OR		ORGANIC: rootlets, moss (75mm)		1		1
1			GRAVEL: sandy, silty, cobbbles and boulders, very moist, grey				2
2					2		3
3							4
4							5
5					3		6
6							7
7							8
8					4		9
9							10
10							11
11					5		12
12							13
13							14
14					6		15
15							16
16							17
17					7		18
18							19
19							20
20	GR		- dense				21
21							22
22					8		23
23							24
24							25
25					9		26
26							27
27							28
28							29
29					10		30
30			- increasing boulders and cobbles below 30.0m				31
31							32
32							33
33							34
34					11		35
35							36
36							37
37							38
38							39
39					12		40
40							41
41			END OF HOLE AT 41.0m - DRILL REFUSAL				42
42			NO FREE WATER OR SLOUGH UPON COMPLETION				43
43			HOLE BACKFILLED WITH DRILL CUTTINGS AND SEALED WITH BENTONITE				
44							

uma	LOGGED BY: Pat Eckel	COMPLETION DEPTH: 41.00 m
	REVIEWED BY: Jeff Tallin	COMPLETION DATE: 1/6/02
	PROJECT ENGINEER: Jeff Tallin	Page 1 of 1

LOG OF TESTHOLE ALCAN-AUG8-02.GPJ UMA.GDT 5/3/03

PROJECT: Alaska Highway Realignment	CLIENT: PWCGS	TESTHOLE NO.: 37
LOCATION: At km 746.6		PROJECT NO.: 2799-257-00-12
CONTRACTOR: Geotech Drilling Ltd.	METHOD: Air Hammer	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ▮ CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0	OR		ORGANIC: rootlets, fibrous, moss (100mm)				0
1			GRAVEL: sandy, silty, cobbles and boulders, moist, grey		1		1
2							2
3					2		3
4							4
5							5
6					3		6
7							7
8							8
9							9
10					4		10
11							11
12							12
13							13
14					5		14
15					6		15
16							16
17							17
18							18
19							19
20	GR				7		20
21			- dense, slow drilling				21
22							22
23							23
24							24
25					8		25
26							26
27							27
28							28
29							29
30					9		30
31							31
32							32
33							33
34							34
35					10		35
36							36
37							37
38							38
39							39
40					11		40
41			END OF HOLE AT 41.0m - HOLE VERY TIGHT				41
42			NO FREE WATER OR SLOUGH UPON COMPLETION				42
43			HOLE BACKFILLED WITH DRILL CUTTINGS AND SEALED WITH BENTONITE				43
44							

LOGGED BY: Pat Eckel	COMPLETION DEPTH: 41.00 m
REVIEWED BY: Jeff Tallin	COMPLETION DATE: 1/6/02
PROJECT ENGINEER: Jeff Tallin	Page 1 of 1

LOG OF TESTHOLE ALCAN-AUG8-02.GPJ UMA.GDT 5/3/03

PROJECT: Alaska Highway Realignment	CLIENT: PWCGS	TESTHOLE NO.: 38
LOCATION: At km 746.6		PROJECT NO.: 2799-257-00-12
CONTRACTOR: Geotech Drilling Ltd.	METHOD: Air Hammer	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0	OR		ORGANIC: rootlets, fibrous, mossy, moist (150mm)				0
1			GRAVEL: sandy, silty, cobbles and boulders, moist, grey		1		1
2							2
3			- decreasing silt content below 2.5m		2		3
4							4
5							5
6							6
7							7
8					3		8
9							9
10					4		10
11							11
12							12
13							13
14					5		14
15					6		15
16							16
17							17
18							18
19	GR						19
20					7		20
21							21
22							22
23							23
24							24
25					8		25
26							26
27							27
28							28
29							29
30					9		30
31							31
32							32
33							33
34							34
35					10		35
36							36
37							37
38			END OF HOLE AT 38.1m		11		38
39			(BROKE DRILL HEAD)				39
40			NO FREE WATER OR SLOUGH UPON COMPLETION				40
41			HOLE BACKFILLED WITH DRILL CUTTINGS AND SEALED WITH BENTONITE				

LOGGED BY: Pat Eckel	COMPLETION DEPTH: 38.10 m
REVIEWED BY: Jeff Tallin	COMPLETION DATE: 1/6/02
PROJECT ENGINEER: Jeff Tallin	Page 1 of 1

LOG OF TESTHOLE ALCAN-AUG8-02.GPJ UMA.GDT 5/3/03

Appendix C
Grain Size Analysis

J.R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 36 Depth: 0.75m
Location:

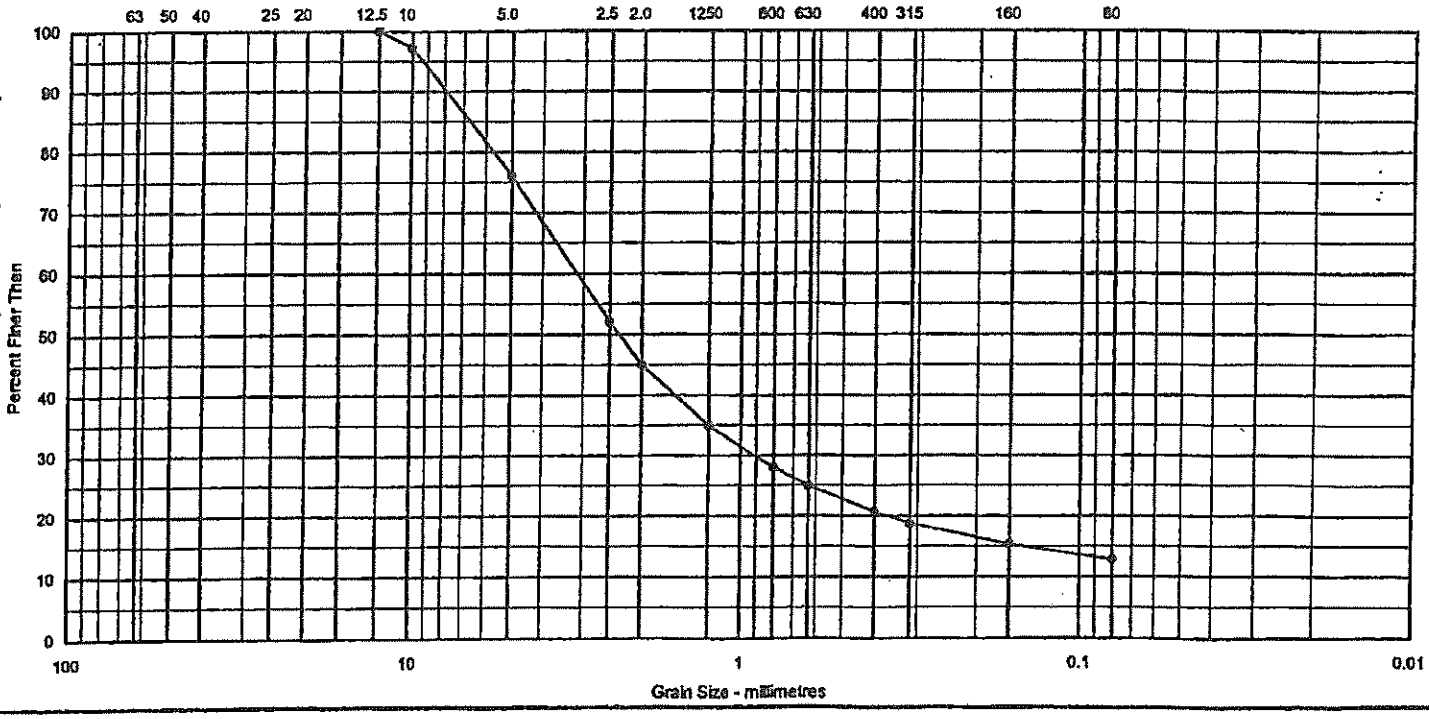
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM
Ck'd By:
File: 1066-248
Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				97.2
5,000	5.0				76.0
2,500	2.5				52.1
2,000	2.0				45.0
1,250	1.25				34.9
800	0.800				28.0
630	0.630				24.9
400	0.400				20.7
315	0.315				18.7
160	0.160				15.3
80	0.080				12.8

Description of Sample:

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: _____ %
2 Face Crush Count = _____ %
Remarks:

Time of Sieving: 15 minutes



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CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 36 Depth: 12.2m
Location:

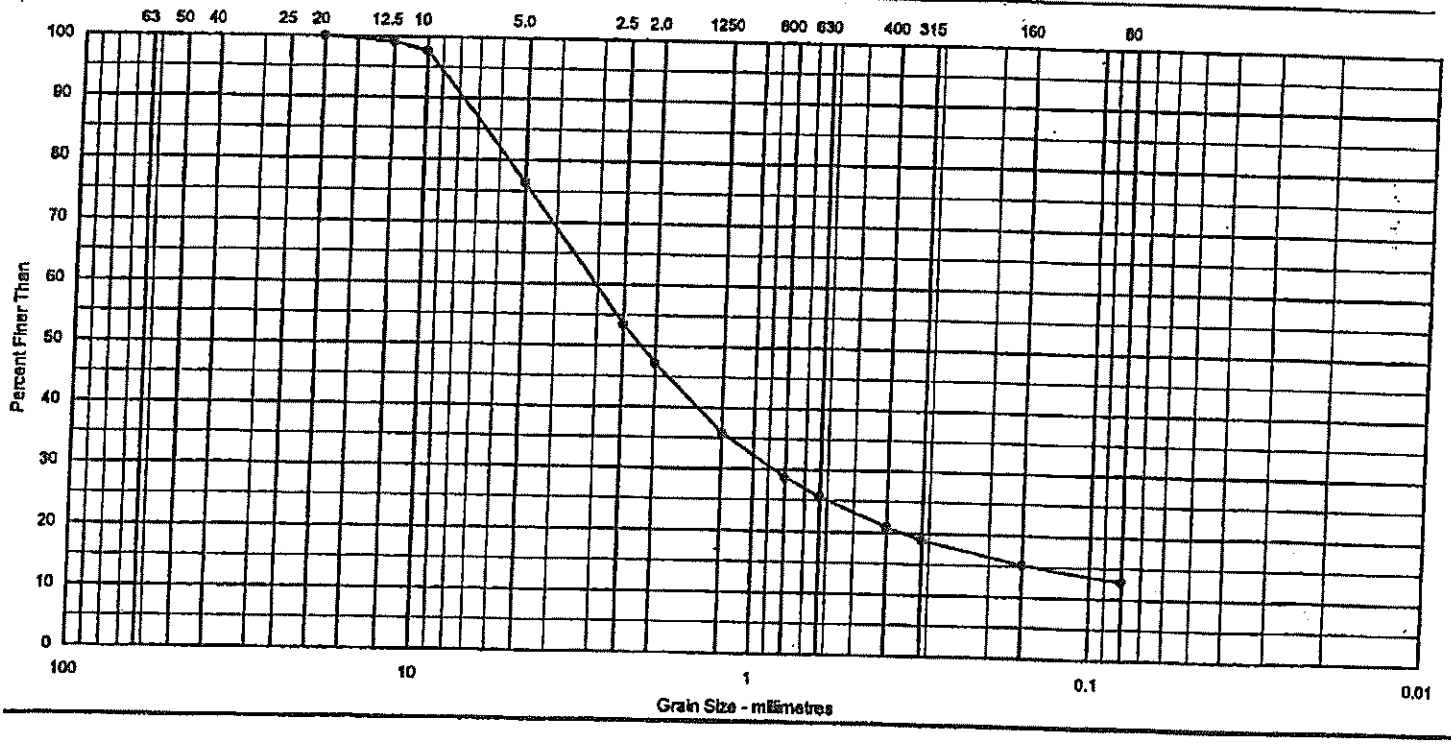
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM
Ck'd By:
File: 1066-248
Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				99.1
5,000	5.0				97.7
2,500	2.5				76.4
2,000	2.0				53.5
1,250	1.25				47.2
800	0.800				35.9
630	0.630				28.7
400	0.400				25.6
315	0.315				20.9
160	0.160				18.9
80	0.080				15.2
					12.8

Description of Sample:

Time of Sieving: 15 minutes

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: ____ %
2 Face Crush Count = ____ %
Remarks:



J.R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 36 Depth: 26.0m
Location:

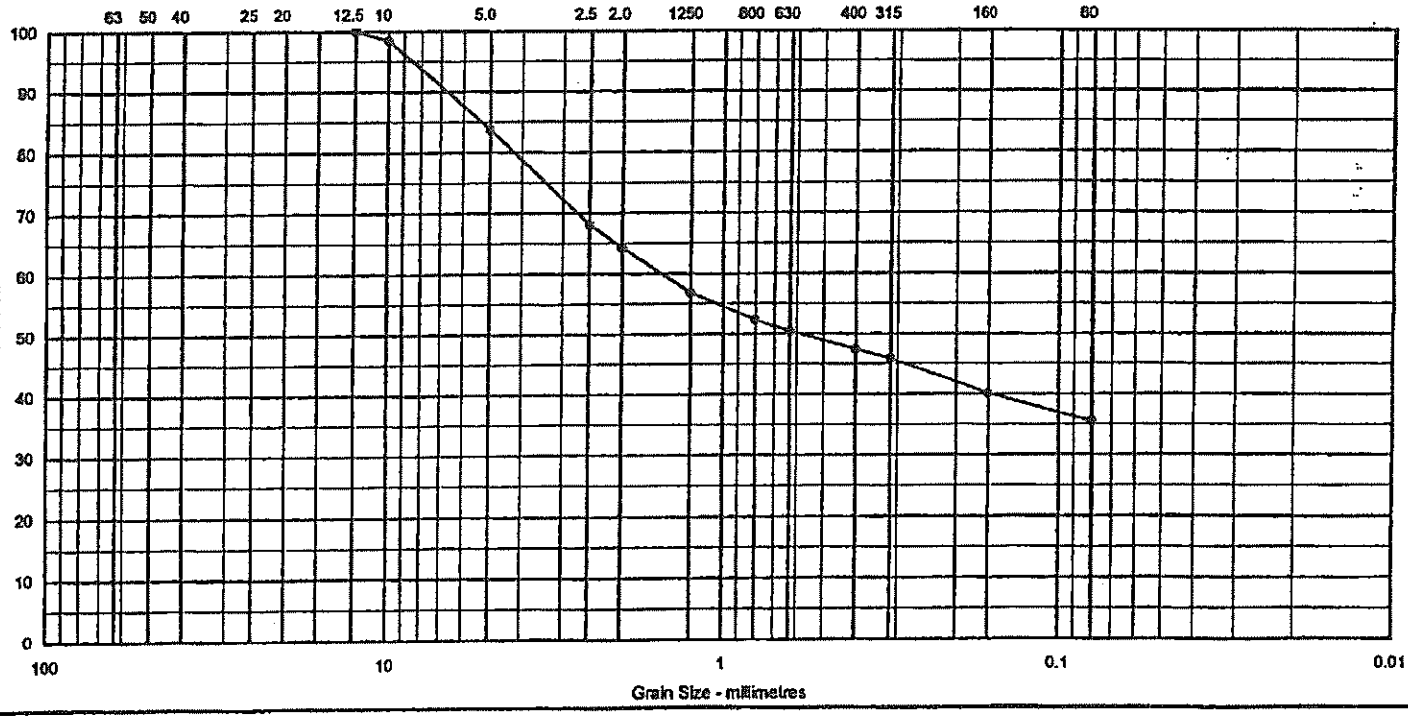
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM File: 1066-248
Ck'd By: Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				98.4
5,000	5.0				83.7
2,500	2.5				68.1
2,000	2.0				64.2
1,250	1.25				56.8
800	0.800				52.3
630	0.630				50.4
400	0.400				47.5
315	0.315				45.9
160	0.160				40.1
80	0.080				35.5

Description of Sample:

Time of Sieving: 15 minutes

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: ____ %
2 Face Crush Count = ____ %
Remarks:



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CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 37 Depth: 6.05m
Location:

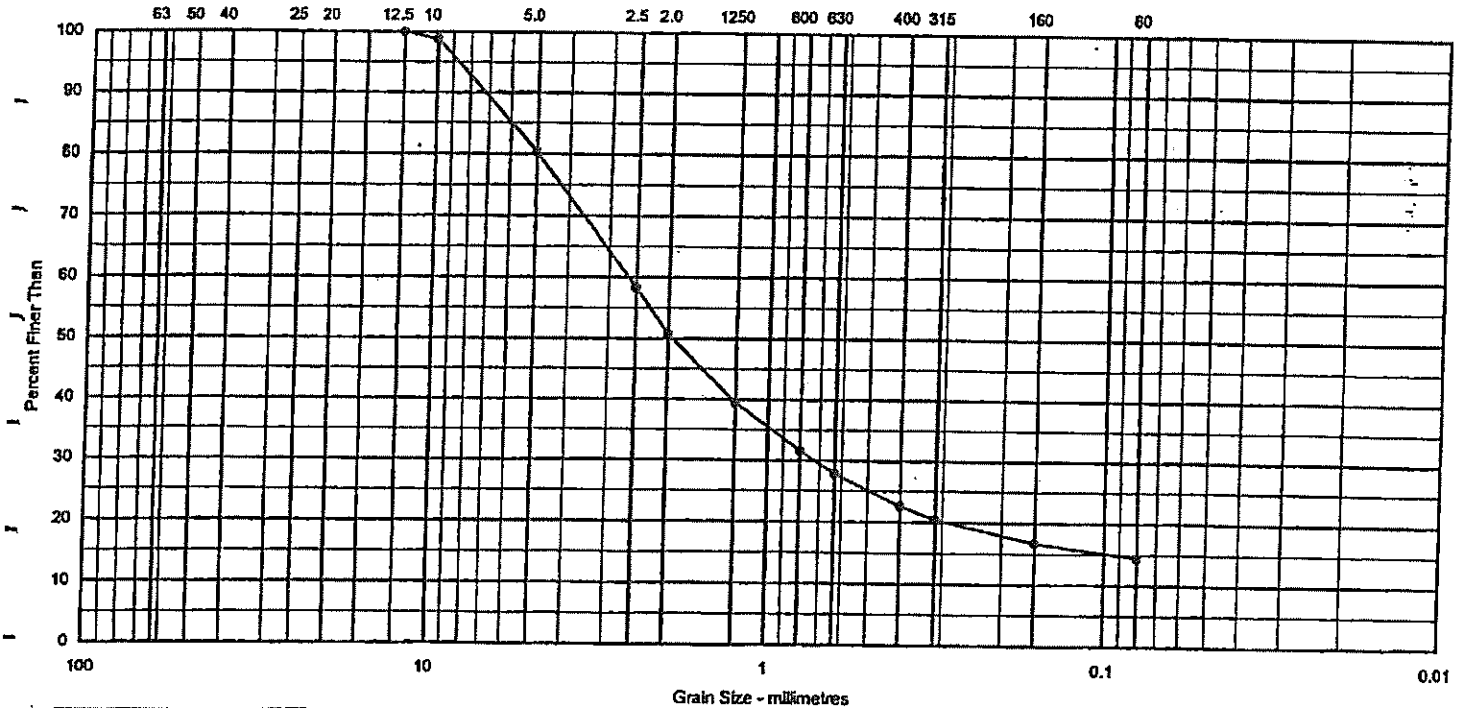
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM
Ck'd By:
File: 1066-248
Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				98.8
5,000	5.0				80.3
2,500	2.5				58.3
2,000	2.0				50.7
1,250	1.25				39.5
800	0.800				31.6
630	0.630				27.8
400	0.400				22.6
315	0.315				20.4
160	0.160				16.7
80	0.080				14.4

Description of Sample:

Time of Sieving: 15 minutes

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: ____ %
2 Face Crush Count = ____ %
Remarks:



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CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 37 Depth: 15.0m
Location:

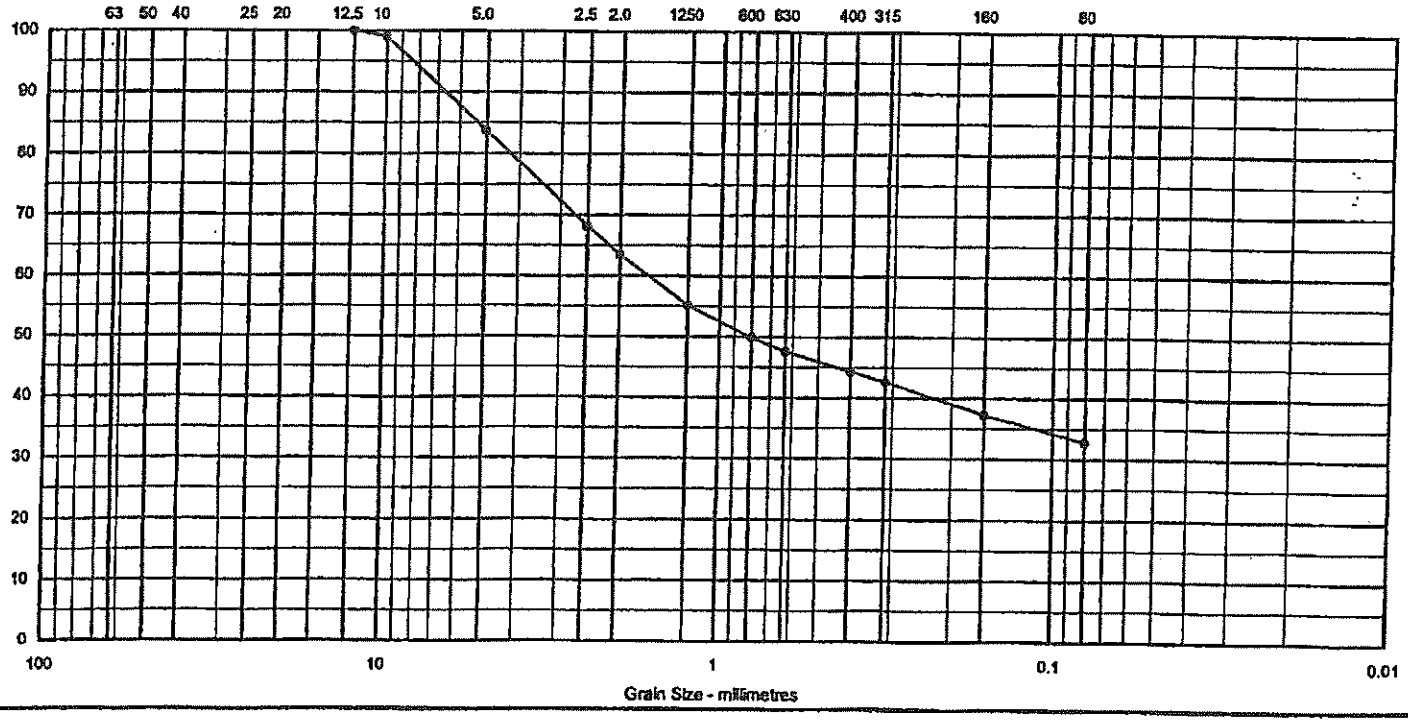
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM
Ck'd By:
File: 1066-248
Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				99.0
5,000	5.0				83.7
2,500	2.5				68.1
2,000	2.0				63.4
1,250	1.25				55.1
800	0.800				49.9
630	0.630				47.6
400	0.400				44.3
315	0.315				42.6
160	0.160				37.3
80	0.080				32.8

Description of Sample:

Time of Sieving: 15 minutes

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: ____ %
2 Face Crush Count = ____ %
Remarks:



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CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 37 Depth: 35.0m

Location:

Client: UMA Engineering Ltd.

Project: Alaska Highway Realignment, 2977-257-00-12

Made By: AM

Ck'd By:

File: 1066-248

Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				98.5
5,000	5.0				80.3
2,500	2.5				58.4
2,000	2.0				52.3
1,250	1.25				40.2
800	0.800				32.2
630	0.630				28.7
400	0.400				23.5
315	0.315				21.3
160	0.160				17.3
80	0.080				14.7

Description of Sample:

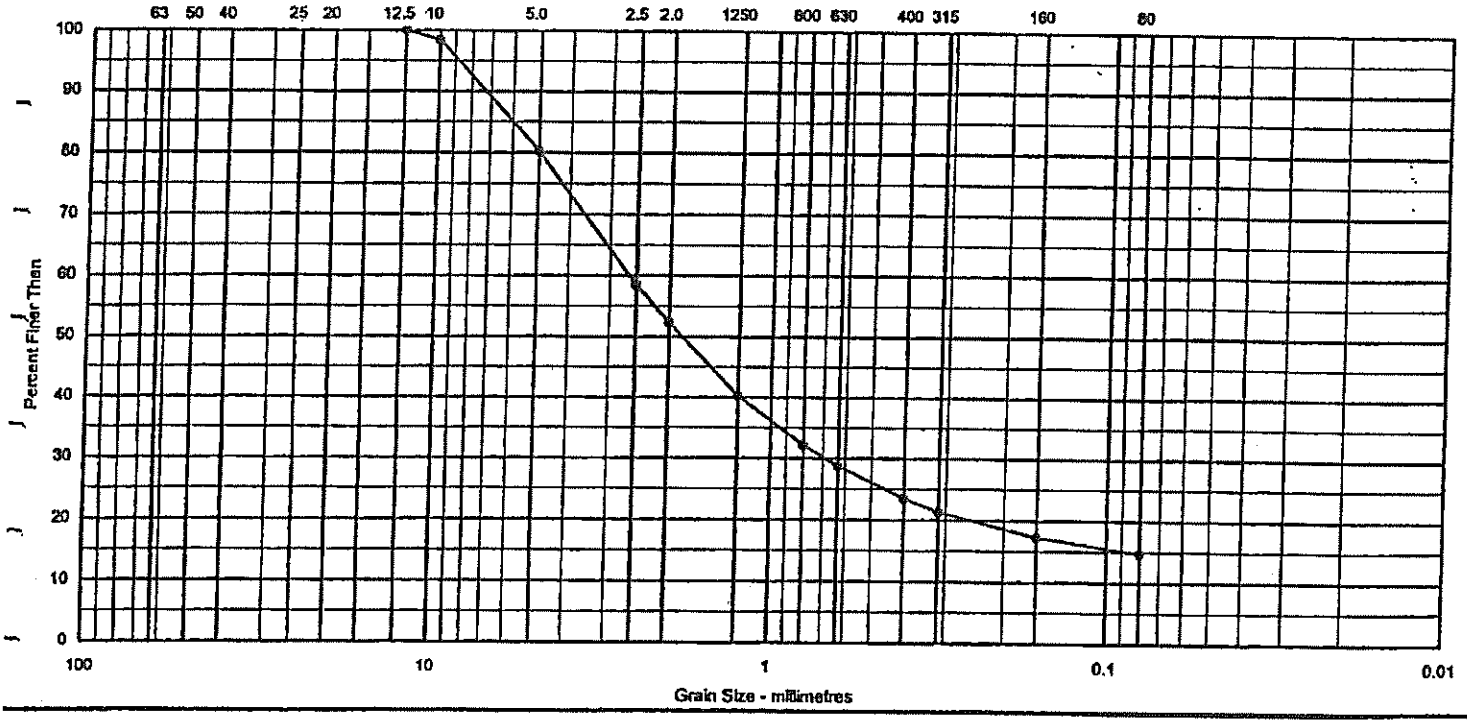
Method of Preparation: Dry ☐ Washed ☑

Moisture Content: ____ %

2 Face Crush Count = ____ %

Remarks:

Time of Sieving: 15 minutes



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CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 38 Depth: 1.0m
Location:

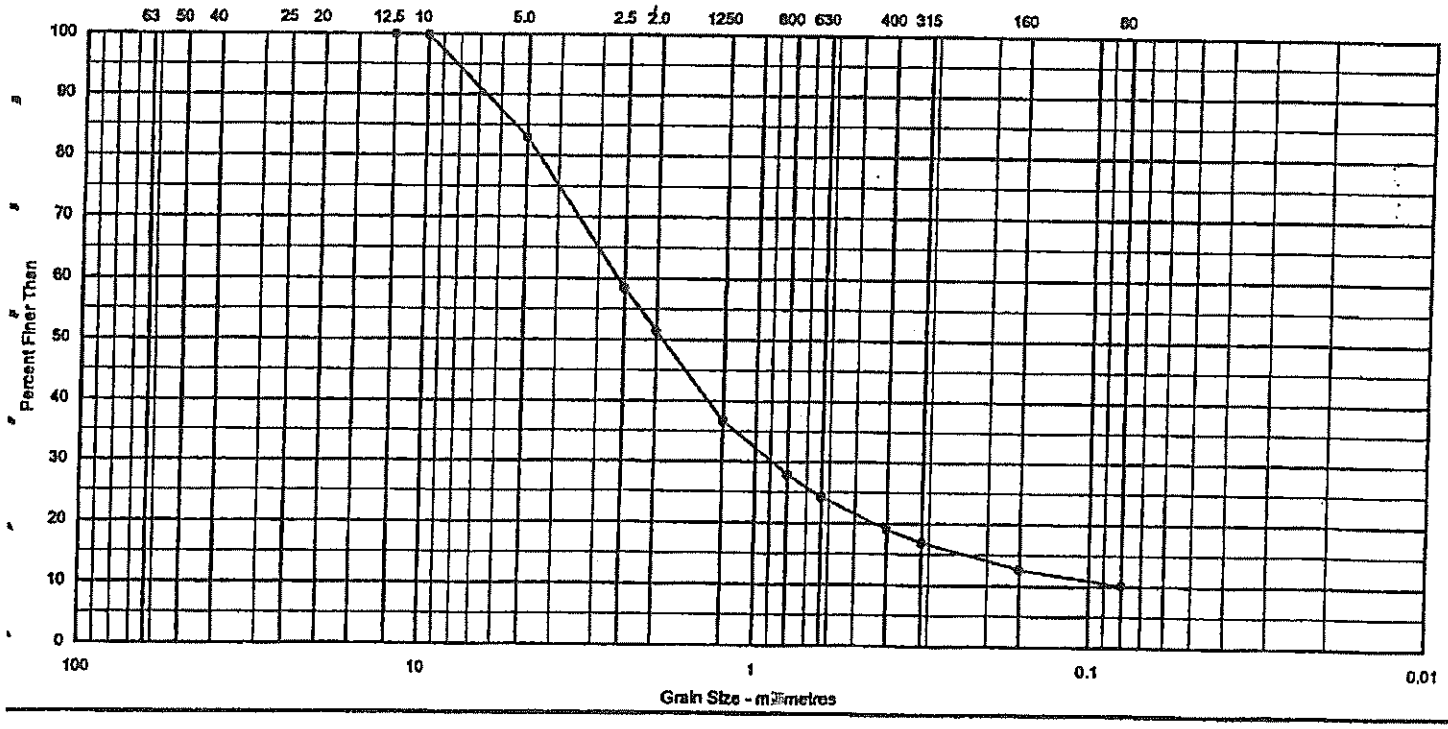
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM
Ck'd By:
File: 1066-248
Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				99.9
5,000	5.0				83.0
2,500	2.5				58.4
2,000	2.0				51.4
1,250	1.25				36.7
800	0.800				27.9
630	0.630				24.2
400	0.400				19.0
315	0.315				16.9
160	0.160				12.6
80	0.080				10.1

Description of Sample:

Time of Sieving: 15 minutes

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: ____ %
2 Face Crush Count = ____ %
Remarks:



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CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 38 Depth: 10.0m
Location:

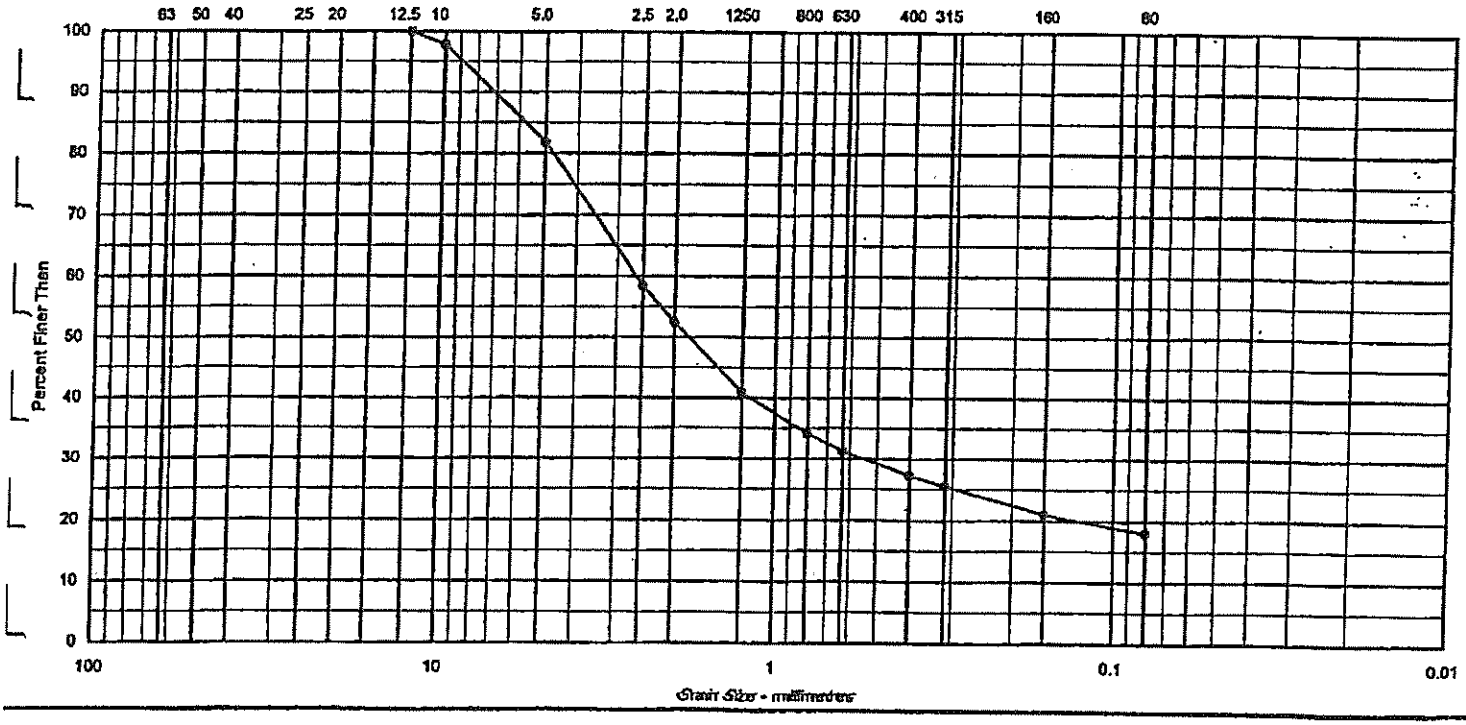
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM
Ck'd By:
File: 1066-248
Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications Minimum	Specifications Maximum	Percent Finer Than	Percent Finer Than Basis Original Sample
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				97.8
5,000	5.0				81.8
2,500	2.5				58.4
2,000	2.0				52.4
1,250	1.25				40.9
800	0.800				34.1
630	0.630				31.3
400	0.400				27.3
315	0.315				25.5
160	0.160				21.0
80	0.080				18.0

Description of Sample:

Time of Sieving: 15 minutes

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: ____ %
2 Face Crush Count = ____ %
Remarks:



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CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 38 Depth: 25.0m
Location:

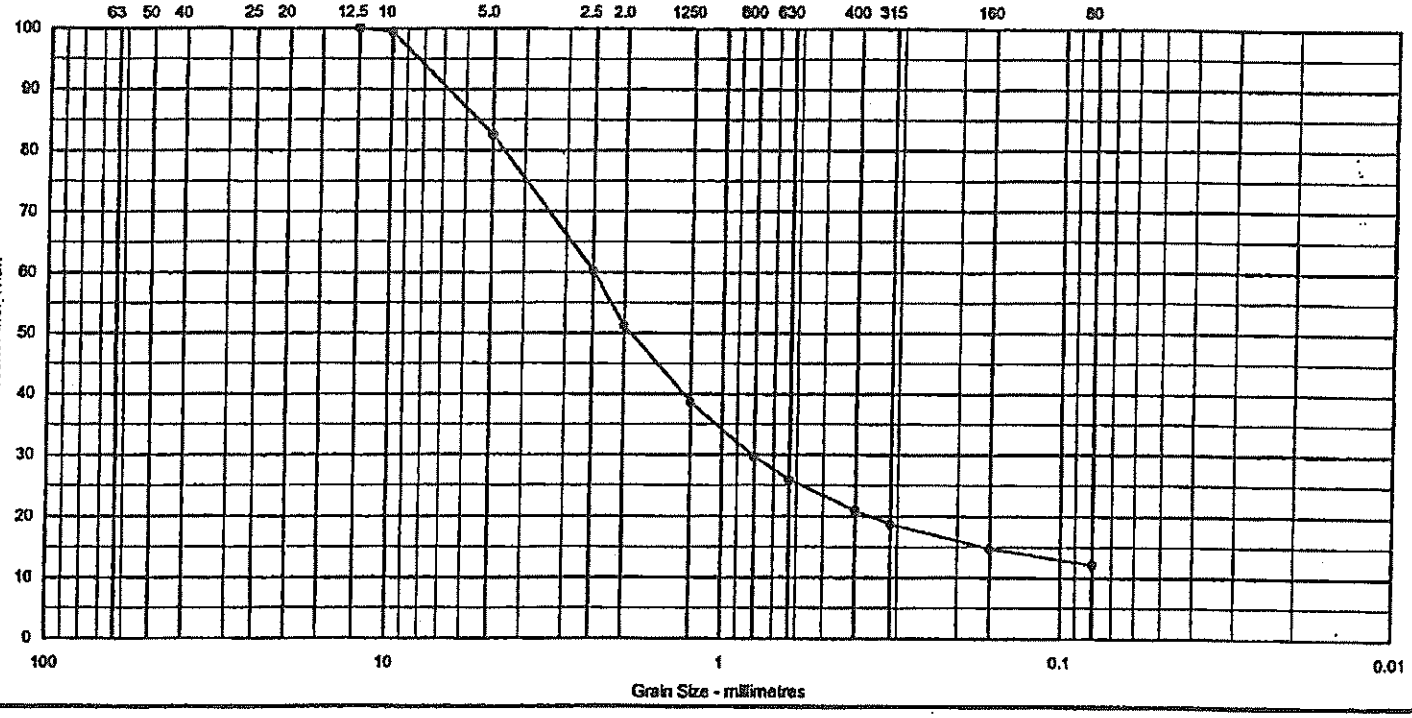
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM
Ck'd By:
File: 1066-248
Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				
12,500	12.5				100.0
10,000	10.0				99.4
5,000	5.0				82.6
2,500	2.5				60.3
2,000	2.0				51.2
1,250	1.25				38.7
800	0.800				29.7
630	0.630				25.9
400	0.400				20.9
315	0.315				18.7
160	0.160				14.7
80	0.080				12.1

Description of Sample:

Time of Sieving: 15 minutes

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: _____ %
2 Face Crush Count = _____ %
Remarks:



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CONSULTING AND TESTING ENGINEERS
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

SCREEN ANALYSIS

Sample: TH 38 Depth: 38.1m
Location:

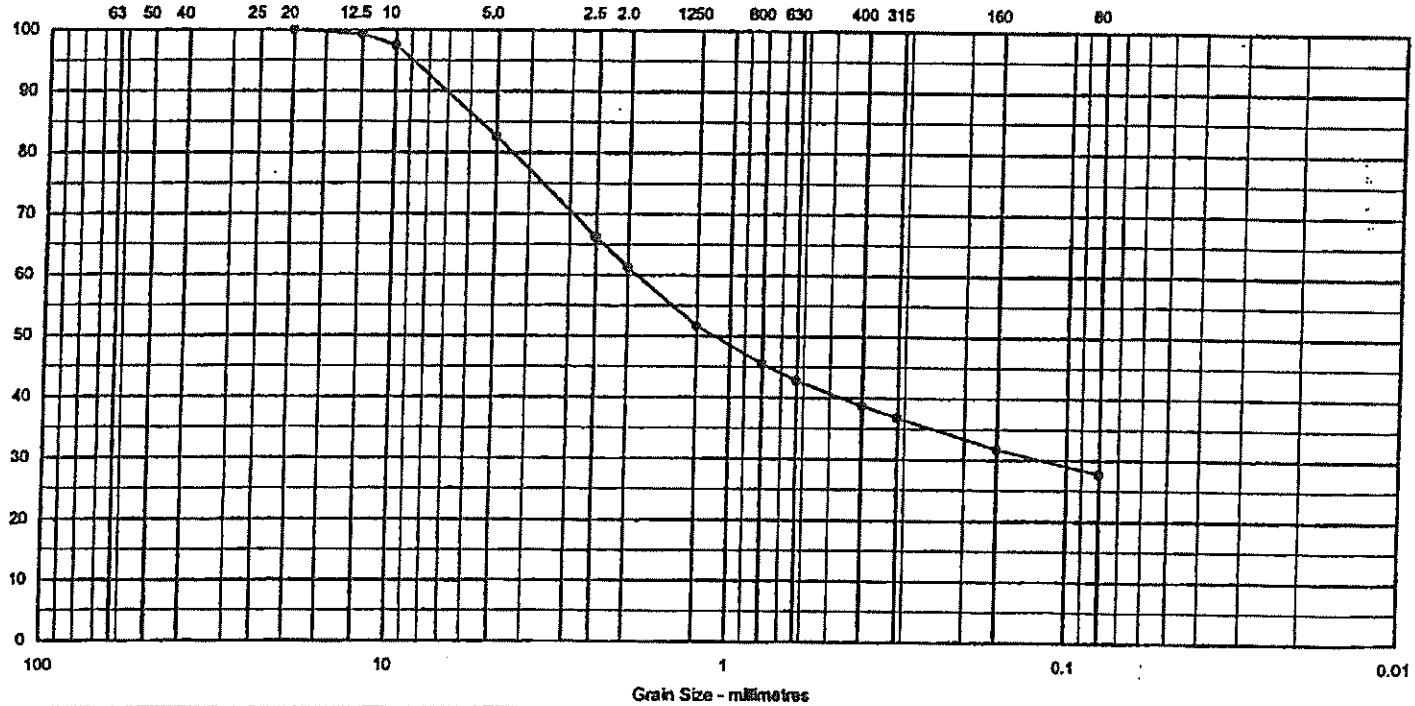
Client: UMA Engineering Ltd.
Project: Alaska Highway Realignment, 2977-257-00-12
Made By: AM
Ck'd By:
File: 1066-248
Date: July 16/02

Sieve No.	Size of Opening millimetres	Specifications		Percent Finer Than	Percent Finer Than Basis Original Sample
		Minimum	Maximum		
63,000	63.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				100.0
12,500	12.5				99.2
10,000	10.0				97.5
5,000	5.0				82.6
2,500	2.5				66.2
2,000	2.0				61.2
1,250	1.25				51.7
800	0.800				45.5
630	0.630				42.6
400	0.400				38.7
315	0.315				36.8
160	0.160				31.7
80	0.080				27.7

Description of Sample:

Time of Sieving: 15 minutes

Method of Preparation: Dry ☐ Washed ☑
Moisture Content: ____ %
2 Face Crush Count = ____ %
Remarks:



APPENDIX D

TETRA TECH EBA 2013 & 2014 LABORATORY TESTING RESULTS

ATTERBERG LIMITS - LABORATORY RESULTS SUMMARY

ASTM D4318

Project: Alaska Highway km 738 to 750
Project No.: V33103085-01.001.02
Client: PWGSC
Attention:

Test Hole No.:
Submitted By: Jason Pellett
Date Sampled:
Date Tested: November 19, 2013

Sampled By:
Tested By: BG
Laboratory: Nanaimo

Test Hole Number	Sample ID	Depth (m)	Moisture Content (%)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	USCS	Soil Description Type, constituants/composition, structure, moisture, consistency, plasticity, colour, odour, inclusions.
737+150	SA -1	0.5	15.5	22	16	6	CL-ML	CLAY, silty, trace sand, trace gravel

Remarks:

Reviewed By: _____ ASc.T.

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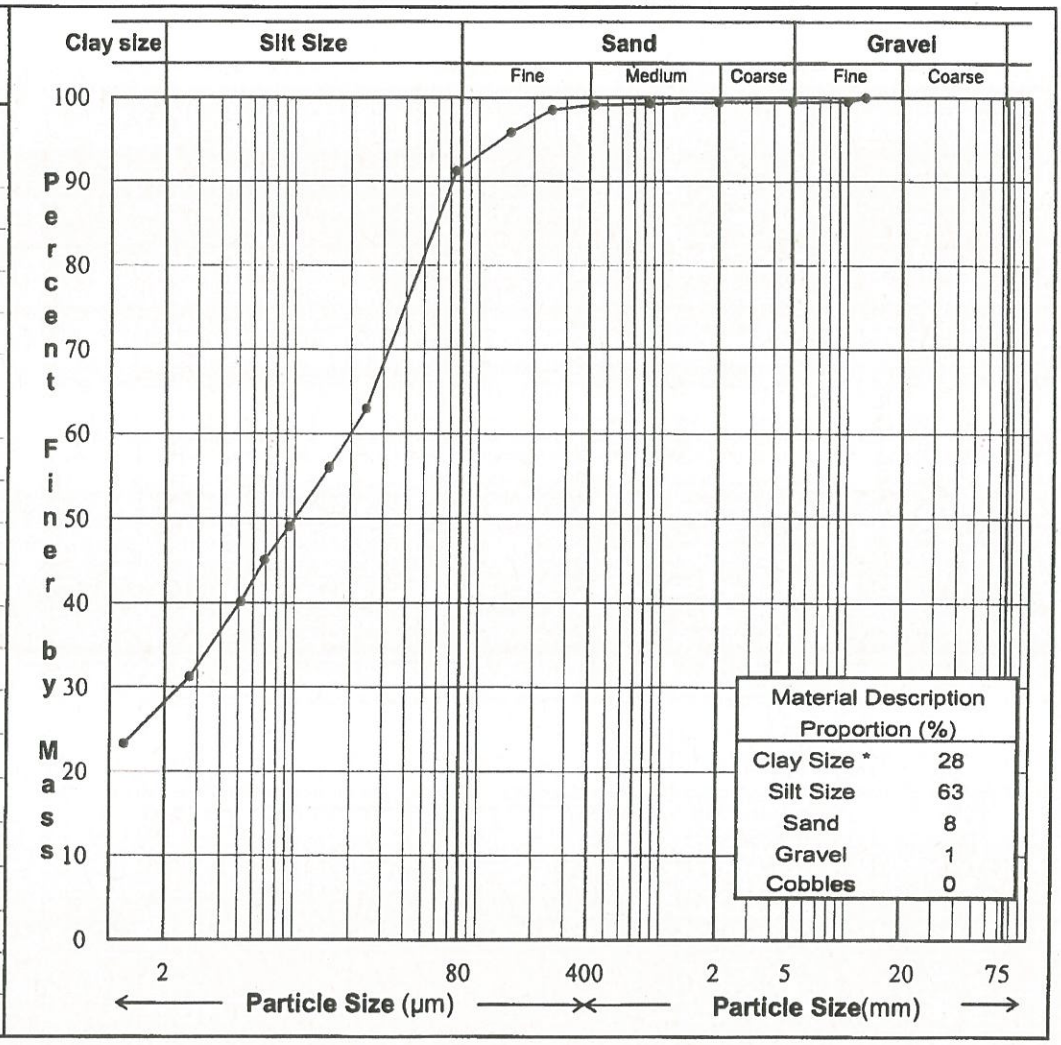
PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Alaska Highway km 738-750	Sample No.:	SA-01
Client:	PWGSC	Borehole/ TP:	
Project No.:	V33103085-01.001.02	Depth:	0.5 m
Location:	737+150	Date Tested	November 18, 2013
Description **:	CLAY (CL- ML), silty, trace sand, trace gravel	Tested By:	BG

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	100
10 mm	100
5 mm	99
2 mm	99
850 µm	99
425 µm	99
250 µm	99
150 µm	96
75 µm	91
24 µm	63
15 µm	56
9 µm	49
7 µm	45
5 µm	40
3 µm	31
1 µm	23



Remarks: * The upper clay size of 2 µm is as per the Canadian Foundation Manual.

** The description is behaviour based & subject to EBA description protocols.

Moisture content= 15.5%

Reviewed By: _____ ASc.T.

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PARTICLE SIZE ANALYSIS REPORT

ASTM C136 & C117

Project: Alaska Highway km 738-750

Project Number: V33103085-01.001.02

Date Tested: November 18, 2013

Borehole Number: 744+780 (SA-02)

Depth: 0.5 m

Soil Description: GRAVEL (GW), sandy, trace silt

Cu: 27.8

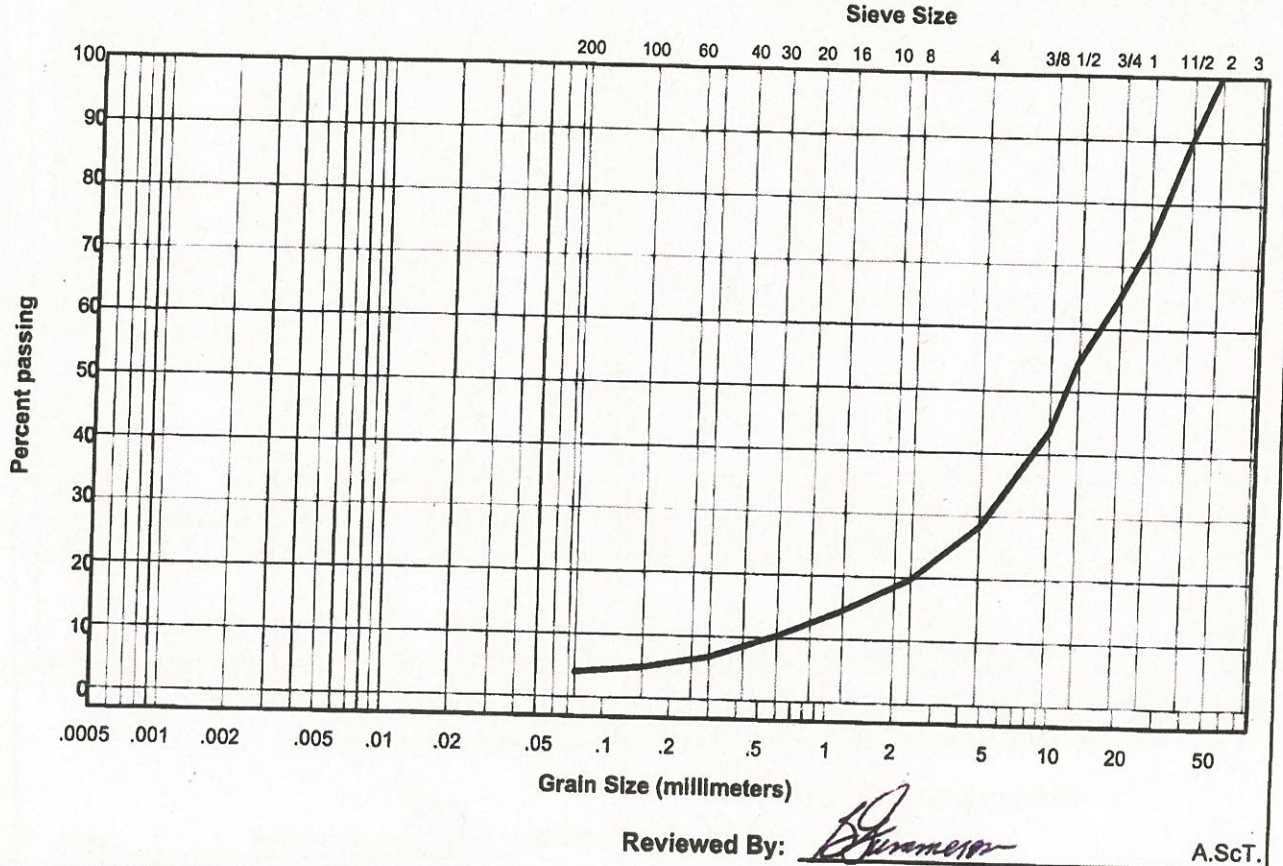
Cc: 3.0

Natural Moisture Content: 2.2%

Remarks: Gravel (72%) Sand (24%) Fines (4%)

Sieve Size (mm)	Percent Passing
50.000	100
37.500	90
25.000	73
19.000	65
12.500	54
9.500	44
4.750	28
2.360	20
1.180	15
0.600	10
0.300	7
0.150	5
0.075	4.0

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



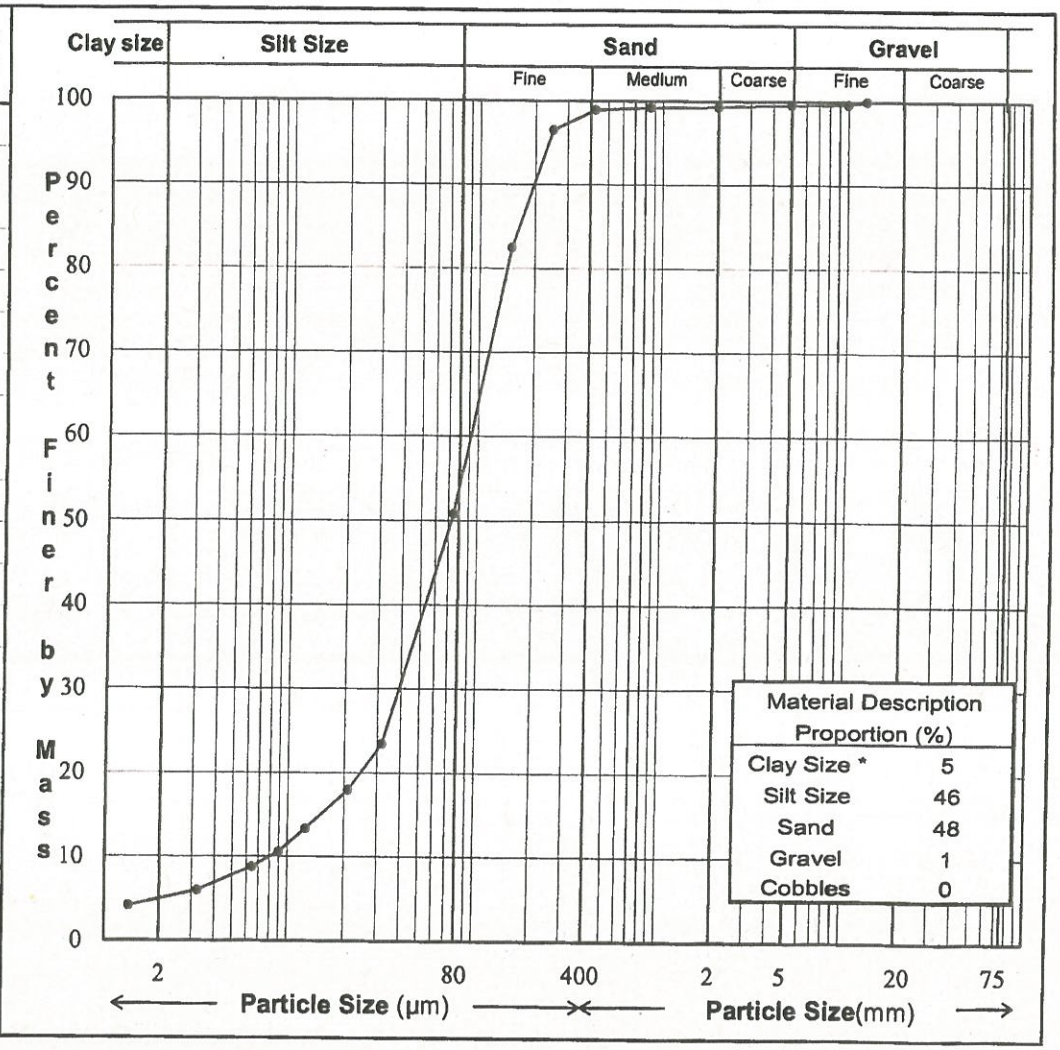
Reviewed By: _____ A.ScT.

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Alaska Highway km 738-750	Sample No.:	SA-04
Client:	PWGSC	Borehole/ TP:	
Project No.:	V33103085-01.001.02	Depth:	0.5 m
Location:	743+660	Date Tested	November 18, 2013
Description **:	SAND and SILT (SM), trace clay, trace gravel	Tested By:	BG

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	100
10 mm	100
5 mm	100
2 mm	99
850 µm	99
425 µm	99
250 µm	97
150 µm	82
75 µm	51
32 µm	23
21 µm	18
13 µm	13
9 µm	11
6 µm	9
3 µm	6
1 µm	4



Remarks: * The upper clay size of 2 µm is as per the Canadian Foundation Manual.

** The description is behaviour based & subject to EBA description protocols.

Moisture content= 22.3%

Reviewed By: _____ ASc.T.

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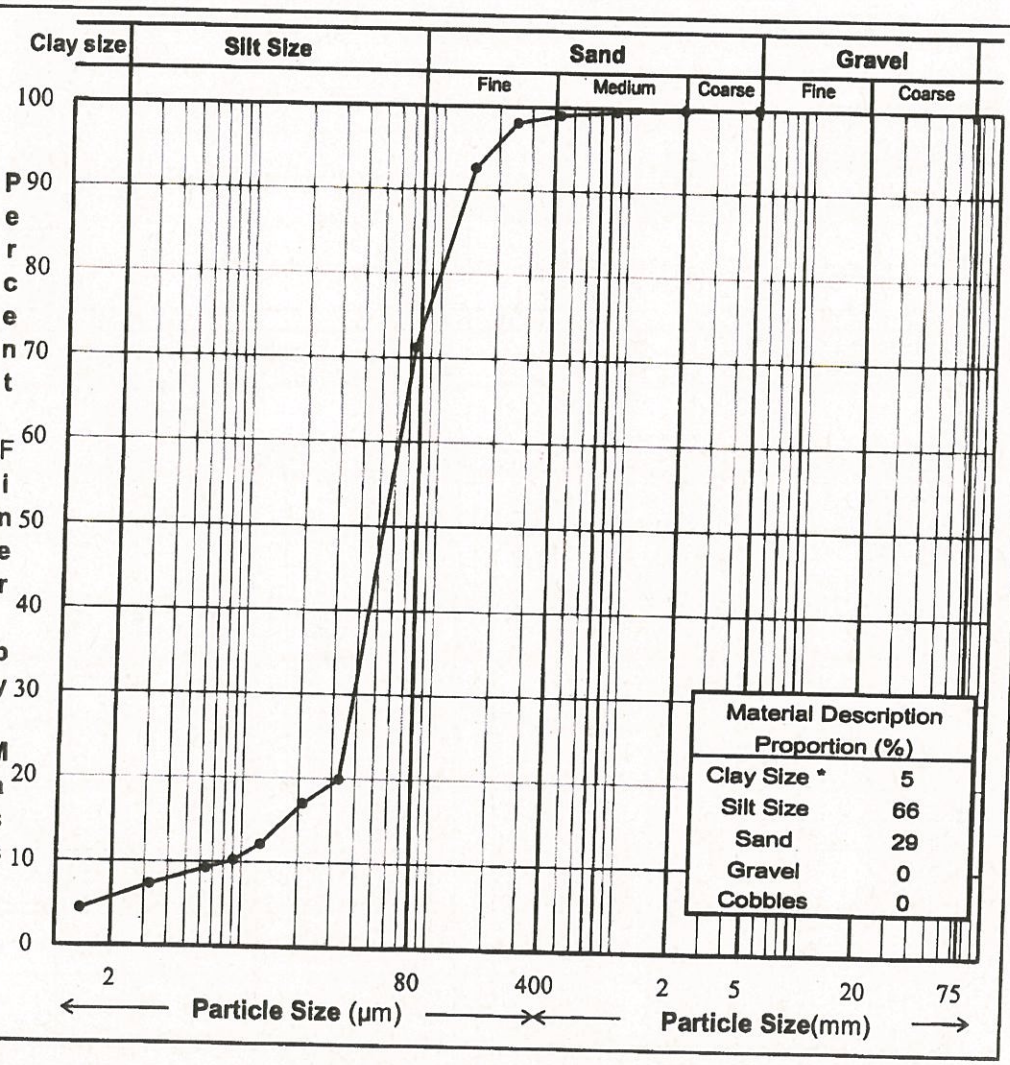
PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project:	Alaska Highway km 738-750	Sample No.:	SA-05
Client:	PWGSC	Borehole/ TP:	
Project No.:	V33103085-01.001.02	Depth:	0.5 m
Location:	746+280	Date Tested	November 18, 2013
Description **:	SILT(ML), sandy, trace clay	Tested By:	BG

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	100
2 mm	100
850 µm	100
425 µm	99
250 µm	98
150 µm	93
75 µm	71
33 µm	20
21 µm	17
13 µm	12
9 µm	10
6 µm	9
3 µm	7
1 µm	4



Remarks: * The upper clay size of 2 µm is as per the Canadian Foundation Manual.

** The description is behaviour based & subject to EBA description protocols.

Moisture content= 7.8%

Reviewed By: _____ ASc.T.

PARTICLE SIZE ANALYSIS REPORT

ASTM C136 & C117

Project: Alaska Highway km 738-750

Project Number: V33103085-01.001.02

Date Tested: November 13, 2013

Borehole Number: 746+360 (SA-06)

Depth: 0.15 m

Soil Description: GRAVEL and SAND (GW), trace silt

Cu: 29.3

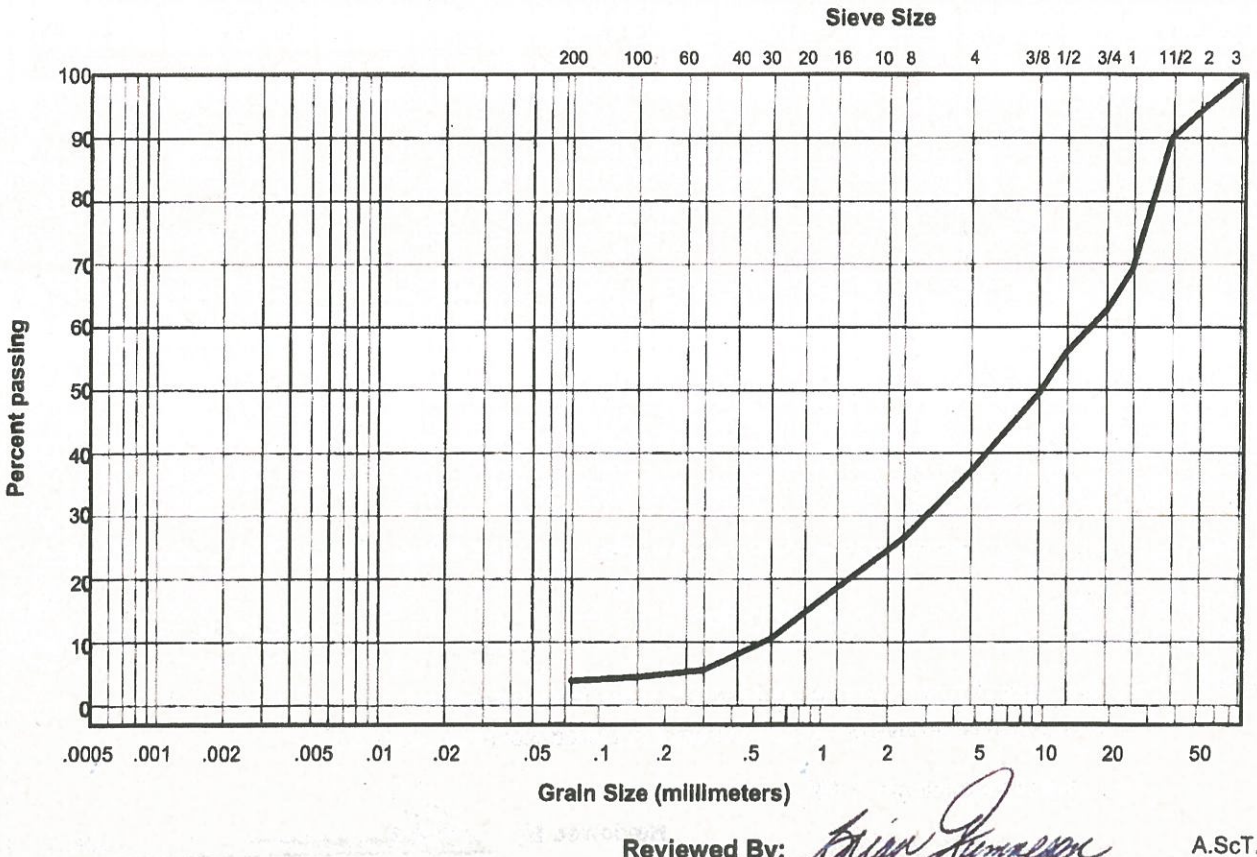
Cc: 1.0

Natural Moisture Content: 3.8%

Remarks: Gravel (63%) Sand (33%) Fines (4%)

Sieve Size (mm)	Percent Passing
50.000	94
37.500	90
25.000	69
19.000	63
12.500	56
9.500	49
4.750	37
2.360	27
1.180	19
0.600	11
0.300	6
0.150	4
0.075	3.9

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By: Brian Stevenson A.ScT.

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PARTICLE SIZE ANALYSIS REPORT

ASTM C136 & C117

Project: Alaska Highway km 738-750

Project Number: V33103085-01.001.02

Date Tested: November 18, 2013

Borehole Number: 746+620 (SA-07)

Depth: 0.5 m

Soil Description: GRAVEL and SAND (GW), trace silt

Cu: 10.7

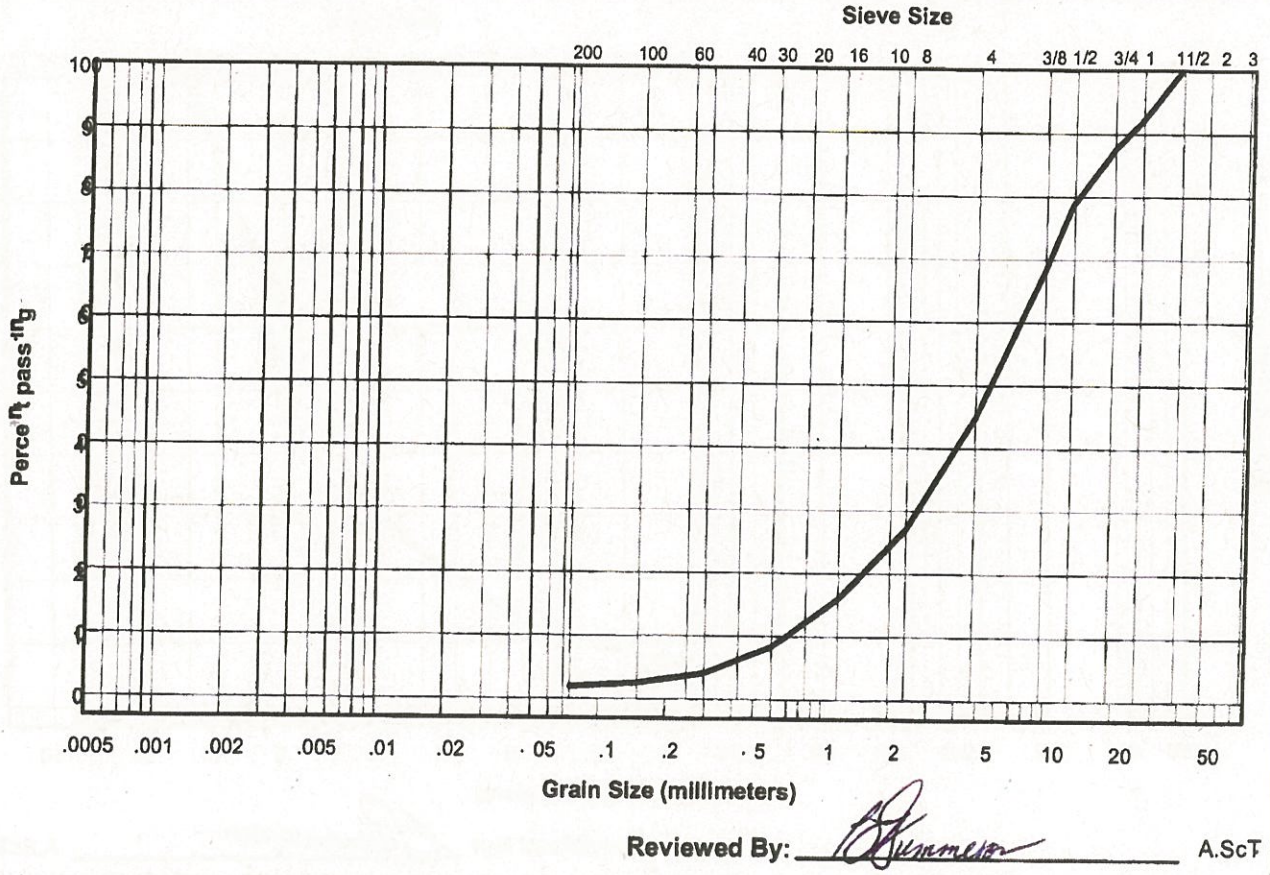
Cc: 1.4

Natural Moisture Content: 2.1%

Remarks: Gravel (55% Sand (43% Fines (2%)

Sieve Size (mm)	Percent Passing
50.000	#N/A
37.500	100
25.000	92
19.000	88
12.500	79
9.500	68
4.750	45
2.360	27
1.180	16
0.600	8
0.300	4
0.150	3
0.075	2.0

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By: _____ A.Sc.T

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A TETRA TECH COMPANY

PARTICLE SIZE ANALYSIS REPORT

ASTM C136 & C117

Project: Alaska Highway Km 738 to Km 750

Project Number: V33103085-01.001.002

Date Tested: October 2, 2014

Borehole Number: Km 750 Pit

Depth: Sample 1

Soil Description: SAND and GRAVEL (SW/GW), trace silt, damp, brown

Cu: 22.8

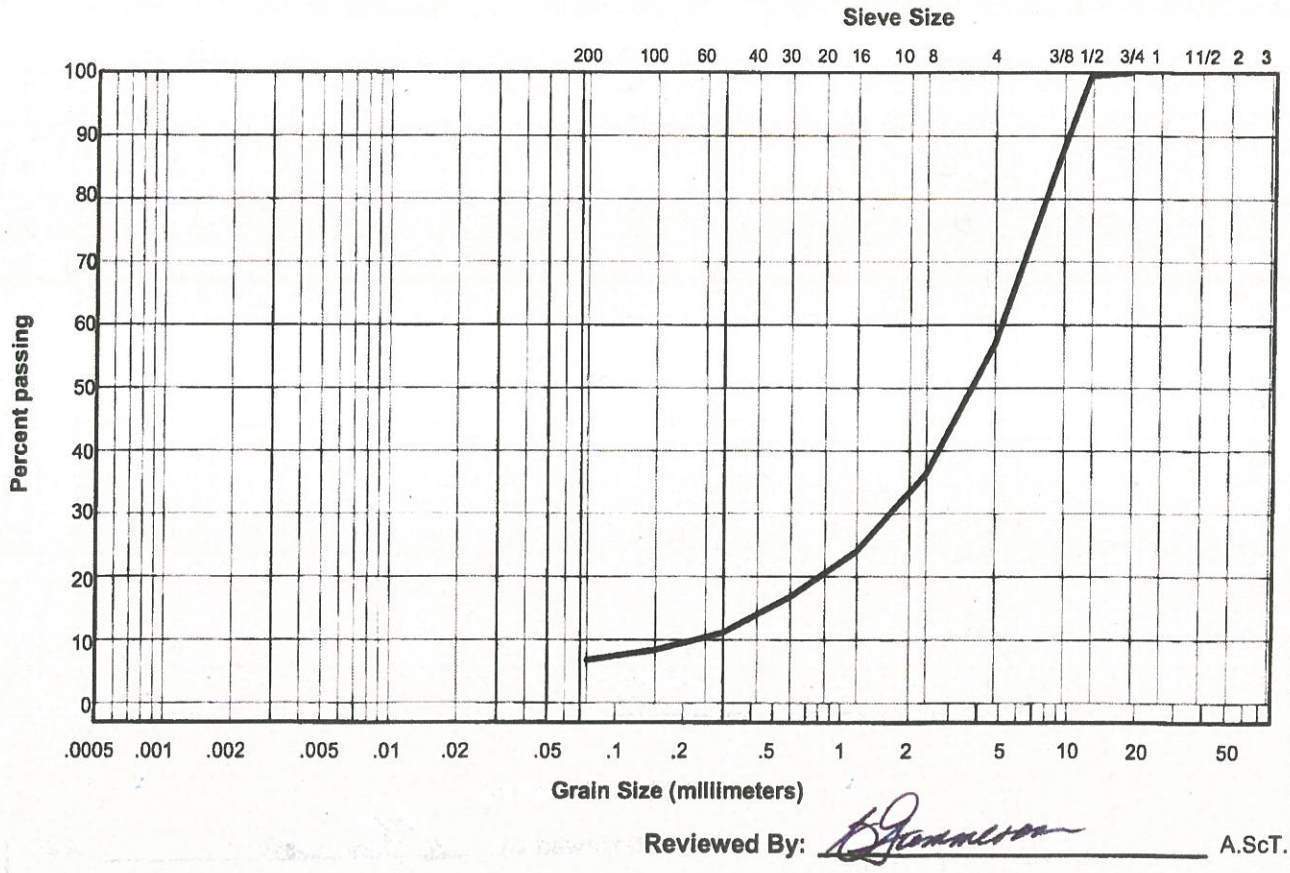
Cc: 2.4

Natural Moisture Content: 2.4%

Remarks:

Sieve Size (mm)	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	100
12.500	99
9.500	88
4.750	57
2.360	36
1.180	24
0.600	17
0.300	11
0.150	8
0.075	6.8

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By: _____ A.ScT.

TETRA TECH

Relative Density and Absorption of Aggregate

Project:	Alaska Highway Km 738 to 750	**Sample No.:**	274, 277
Project No:	V33103085-01.001.002	**Date Sampled:**	September 23, 2014
Client:	PWGSC	**Date Tested:**	October 6, 2014
		Tested By:	BG
		Lab Location :	Nanaimo

Source: Km 750 Pit Sample 1

Description: GRAVEL and SAND, trace silt

Fine Aggregate

ASTM C128

Description	AVG.
Bulk Relative Density (OD)	2.64
Bulk Relative Density (SSD)	2.69
Apparent Relative Density	2.76
Absorption (%)	1.6

Coarse Aggregate

ASTM C127

Description	AVG.
Bulk Relative Density (OD)	2.69
Bulk Relative Density (SSD)	2.71
Apparent Relative Density	2.76
Absorption (%)	1.0

Remarks:

Reviewed By: _____ ASc.T.

PARTICLE SIZE ANALYSIS REPORT

ASTM C136 & C117

Project: Alaska Highway Km 738 to Km 750

Project Number: V33103085-01.001.002

Date Tested: October 2, 2014

Borehole Number: Km 750 Pit

Depth: Sample 2

Soil Description: GRAVEL and SAND (GW/SW), trace silt, damp, brown

Cu: 34.7

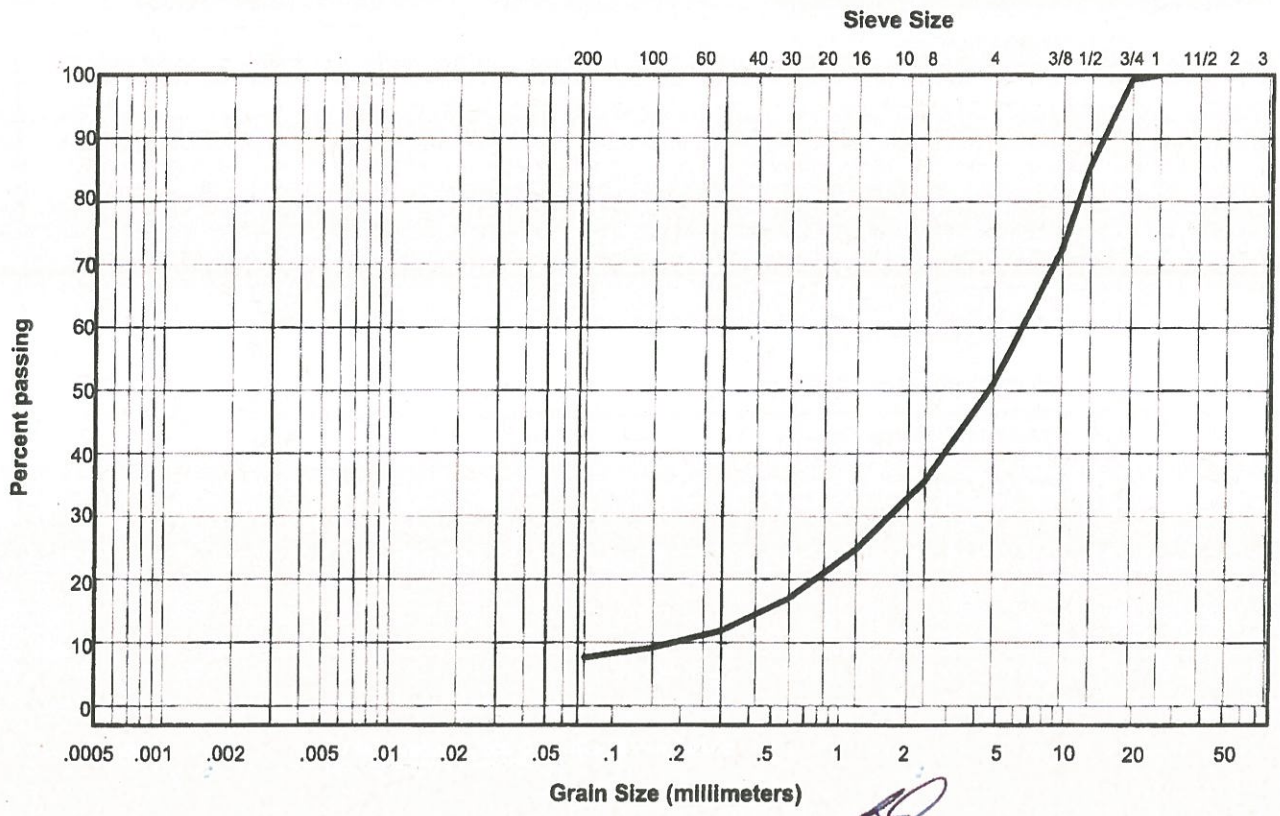
Cc: 2.3

Natural Moisture Content: 2.8%

Remarks:

Sieve Size (mm)	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	100
19.000	99
12.500	85
9.500	72
4.750	51
2.360	36
1.180	25
0.600	17
0.300	12
0.150	9
0.075	7.7

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By: _____ A.ScT.

TETRA TECH

Relative Density and Absorption of Aggregate

Project:	Alaska Highway Km 738 to 750	**Sample No.:**	275, 278
Project No:	V33103085-01.001.002	**Date Sampled:**	September 23, 2014
Client:	PWGSC	**Date Tested:**	October 7, 2014
		Tested By:	BG
		Lab Location :	Nanaimo

Source: Km 750 Pit Sample 2

Description: GRAVEL and SAND, trace silt

Fine Aggregate

ASTM C128

Description	AVG.
Bulk Relative Density (OD)	2.65
Bulk Relative Density (SSD)	2.69
Apparent Relative Density	2.75
Absorption (%)	1.3

Coarse Aggregate

ASTM C127

Description	AVG.
Bulk Relative Density (OD)	2.68
Bulk Relative Density (SSD)	2.70
Apparent Relative Density	2.75
Absorption (%)	0.9

Remarks:

Reviewed By: _____ ASc.T.

PARTICLE SIZE ANALYSIS REPORT

ASTM C136 & C117

Project: Alaska Highway Km 738 to Km 750

Project Number: V33103085-01.001.002

Date Tested: October 2, 2014

Borehole Number: Km 750 Pit

Depth: Sample 3

Soil Description: GRAVEL and SAND (GW/SW), trace silt, damp, brown

Cu: 21.1

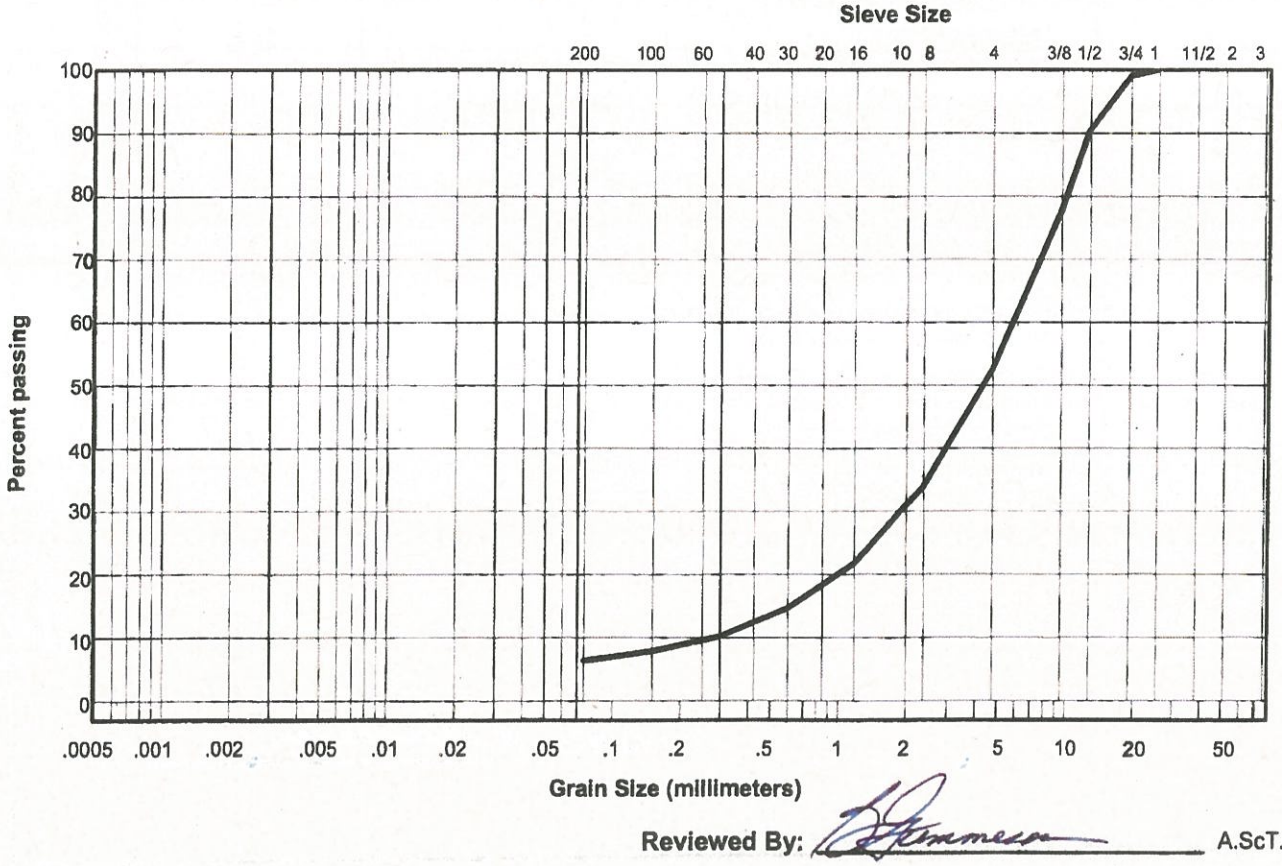
Cc: 2.2

Natural Moisture Content: 2.2%

Remarks:

Sieve Size (mm)	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	100
19.000	99
12.500	90
9.500	78
4.750	53
2.360	34
1.180	22
0.600	15
0.300	10
0.150	8
0.075	6.4

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By: _____ A.ScT.

TETRA TECH

Relative Density and Absorption of Aggregate

Project: Alaska Highway Km 738 to 750
Project No: V33103085-01.001.002
Client: PWGSC

Sample No.: 276, 279
Date Sampled: September 23, 2014
Date Tested: October 7, 2014
Tested By: BG
Lab Location : Nanaimo

Source: Km 750 Pit Sample 3
Description: GRAVEL and SAND, trace silt

Fine Aggregate

ASTM C128

Description	AVG.
Bulk Relative Density (OD)	2.65
Bulk Relative Density (SSD)	2.69
Apparent Relative Density	2.76
Absorption (%)	1.4

Coarse Aggregate

ASTM C127

Description	AVG.
Bulk Relative Density (OD)	2.69
Bulk Relative Density (SSD)	2.71
Apparent Relative Density	2.76
Absorption (%)	1.0

Remarks:

Reviewed By: _____ ASc.T.

Thurber Engineering Ltd.

100, 4396 West Saanich Road
Victoria, BC V8Z 3E9
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Fax: (250) 727-3710

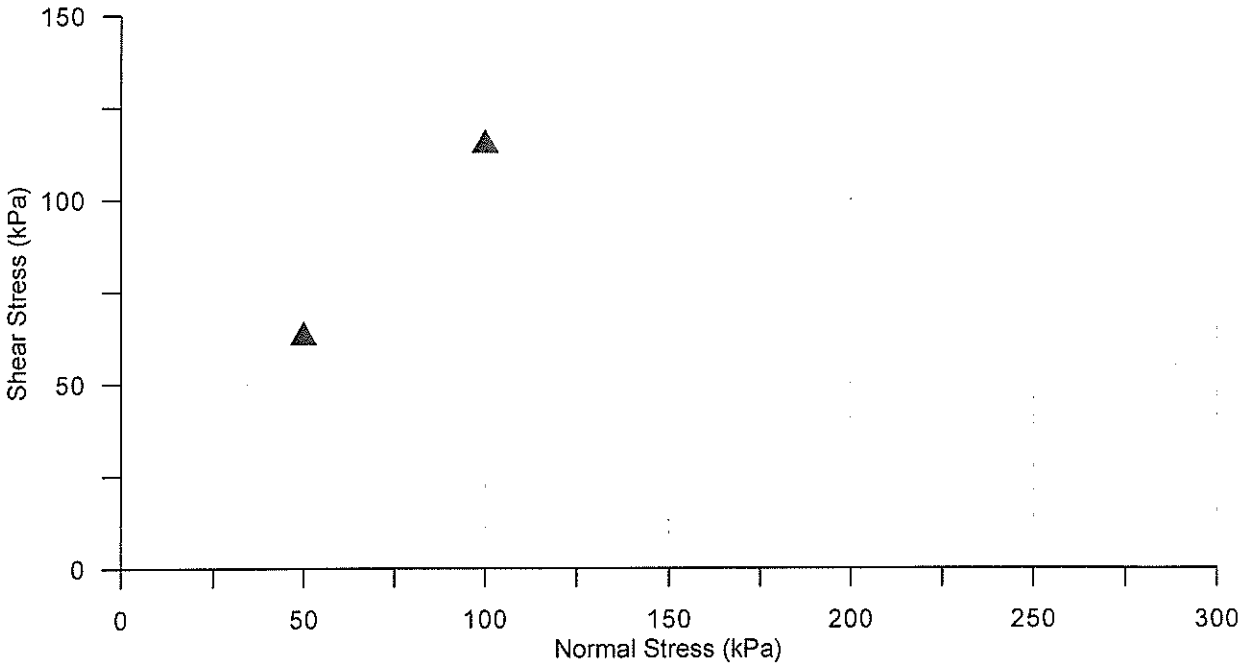
Direct Shear Test Results

Client: EBA - A TETRA TECH COMPANY
Project: Alaska Highway km 738 - 750
Job No.: 19-6486-4

Sample: SA-03, Sta 744+820
Date: Dec. 10, 2013

fine Sand

50 kPa specimen: Dry Density = 1,713 kg/m^3 at 15 % moisture content.
100 kPa specimen: Dry Density = 1,700 kg/m^3 at 15 % moisture content.



Remarks: Brown, SILT and FINE SAND (SM), trace of clay.
Moisture conditoned to 15% and compacted
to a target dry density of 1,700 kg/m^3 as directed by client.

THURBER ENGINEERING LTD.

DIRECT SHEAR TEST REPORT DS 13-1
Sa. 03, 744+820
50 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 10, 2013
File Number: 19-6486-4

SAMPLE DESCRIPTION

Brown, SILT and FINE SAND (SM), trace of clay

	Start of Test	After Consolidation
Wet Density (kg/cu.m.):	1,970	---
Dry Density (kg/cu.m.):	1,713	1,720
Moisture Content:	15.0%	---
Void Ratio:	0.606	0.598
Saturation:	68.3%	---
Specific Gravity (assumed):	2.75	

AFTER TEST NOTES

Normal Stress = 50 kPa Peak Shear Stress = 64 kPa

Moisture content taken within 1 mm of shear surfaces = 13.9 %.
Moisture content taken from the rest of the specimen = 13.9%.

The top cap was level and there was no misalignment of the shearbox halves.
There was a very small amount of extruded silty sand between the shearbox halves.

The lower shear surface was rough, undulating and slightly dome shaped. The upper shear surface mirrored the lower shear surface. The material on the shear surfaces was very dense with some faint striations parallel with the direction of travel.

THURBER

DIRECT SHEAR TEST REPORT DS 13-1
Sa. 03, 744+820
50 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 10, 2013
File Number: 19-6486-4

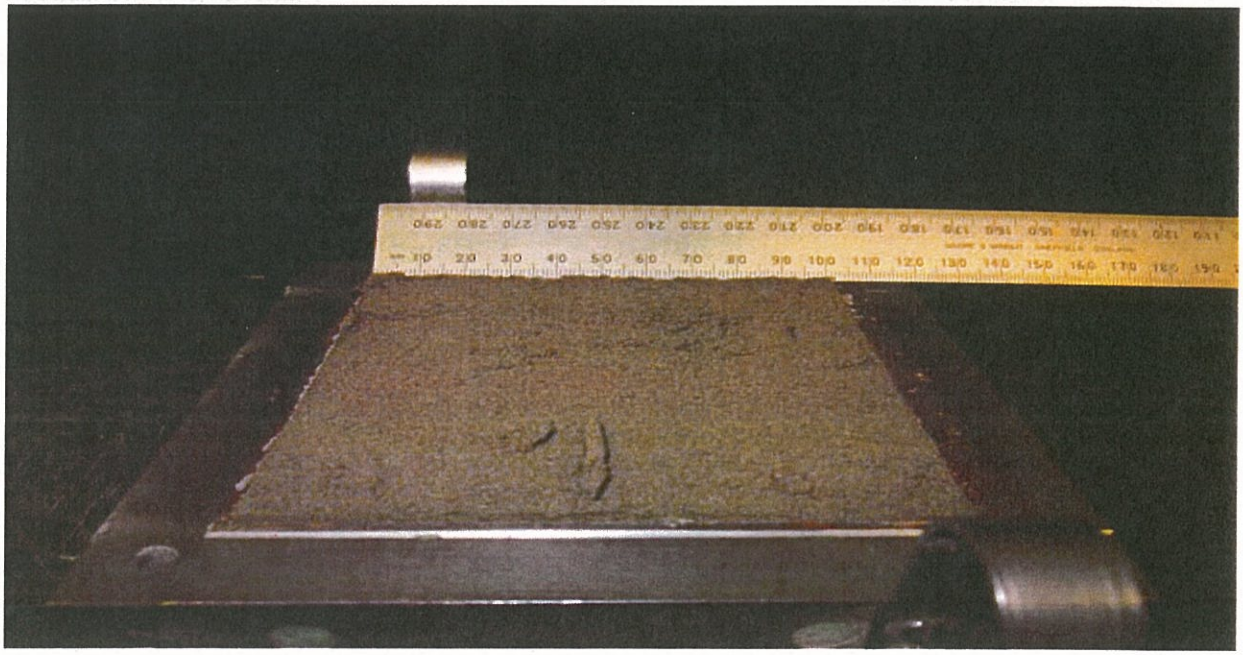


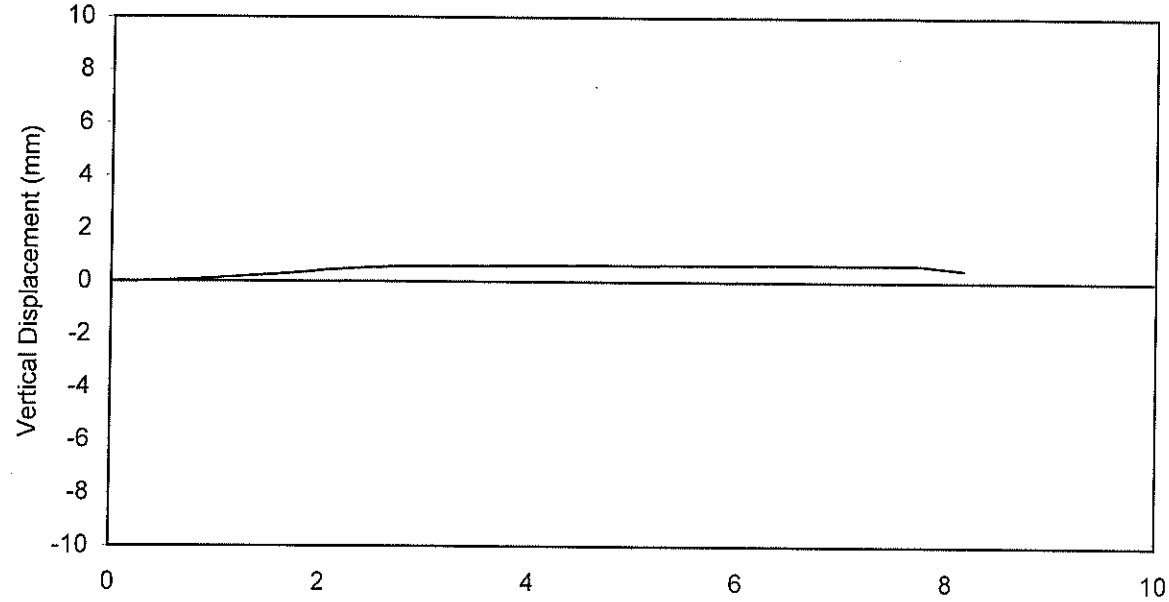
PHOTO OF SHEAR PLANE AFTER TEST

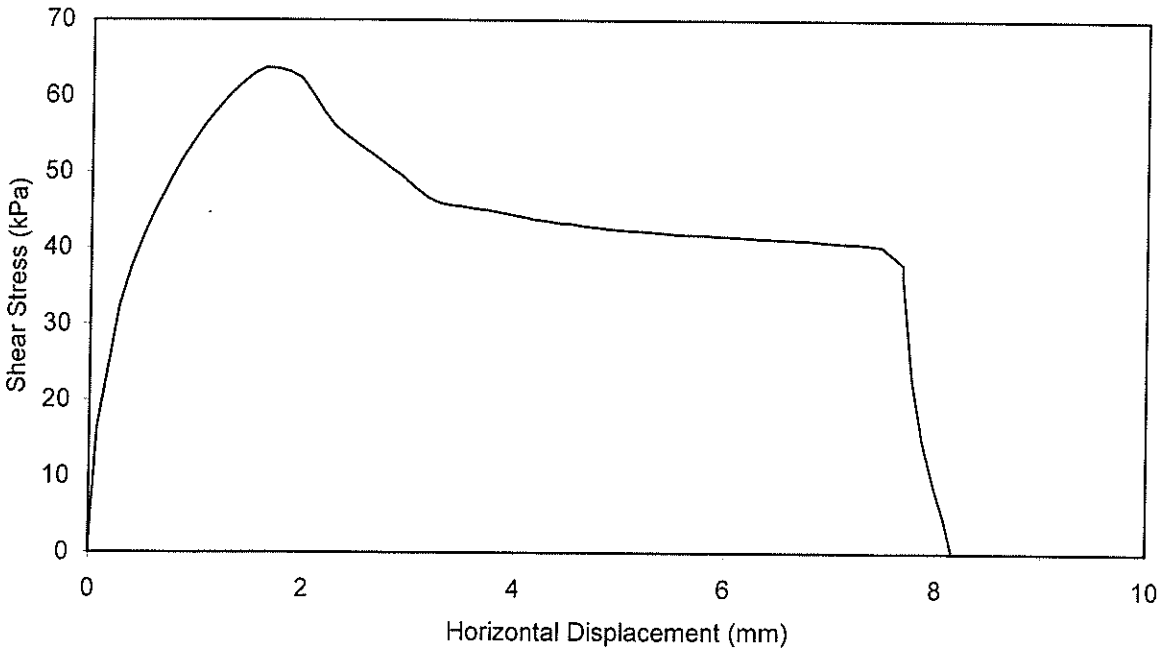
TEST EQUIPMENT - Wykeham Farrance direct test apparatus with a 100 mm square shear box. Vertical and horizontal strains were measured by electronic displacement transducer. The normal force was applied by dead weights on a 10:1 lever loading yoke. The shear stress was measured with an electronic load cell.

TEST PROCEDURE - This test was conducted in accordance with ASTM D 3080 - 90 Direct Shear Test of Soils Under Consolidated Drained Conditions. The test sample was received at a moisture content of 10.7 %. The sample was moisture conditioned to 15 % with a target dry density of 1700 kg/m^3. The test specimen was compacted in the shear box in 3 equal layers of 10 mm. The test was run under dry conditions, i.e. the shear box was not flooded with water. The specimen was consolidated to the required normal stress of 50 kPa in one stage. A rate of displacement was selected to complete the test overnight. Moisture content samples were taken from the shear plane and the rest of the specimen.

THURBER

DIRECT SHEAR TEST REPORT DS 13-1





EBA - A Tetra Tech Company
Alaska Highway - Km 738-750
File Number: 19-6486-4

Normal Stress = 50 kPa
Sample: Sa. 03, 744+820
Test Dates: Dec. 3 - 4, 2013

THURBER ENGINEERING LTD.

DIRECT SHEAR TEST REPORT DS 13-2
Sa. 03, 744+820
100 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 10, 2013
File Number: 19-6486-4

SAMPLE DESCRIPTION

Brown, SILT and FINE SAND (SM), trace of clay

	Start of Test	After Consolidation
Wet Density (kg/cu.m.):	1,960	---
Dry Density (kg/cu.m.):	1,704	1,716
Moisture Content:	15.0%	---
Void Ratio:	0.614	0.603
Saturation:	67.3%	---
Specific Gravity (assumed):	2.75	

AFTER TEST NOTES

Normal Stress = 100 kPa Peak Shear Stress = 116 kPa

Moisture content taken within 1 mm of shear surfaces = 14.1 %.
Moisture content taken from the rest of the specimen = 14.2%.

The top cap was level and there was a slight misalignment of the shearbox halves.
There was a very small amount of extruded silty sand between the shearbox halves.

The specimen did not separate cleanly along the shear surface, only a portion of the shear surface was exposed. Where exposed the surface was rough and very dense.

THURBER

DIRECT SHEAR TEST REPORT DS 13-2
Sa. 03, 744+820
100 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 10, 2013
File Number: 19-6486-4

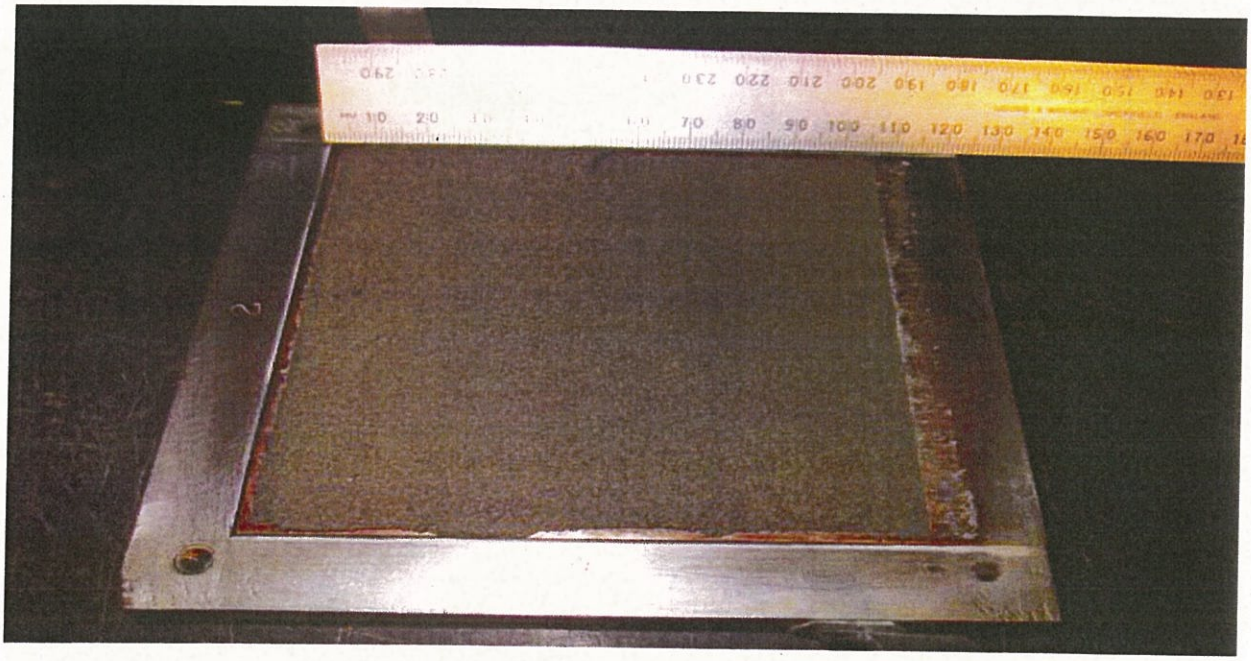


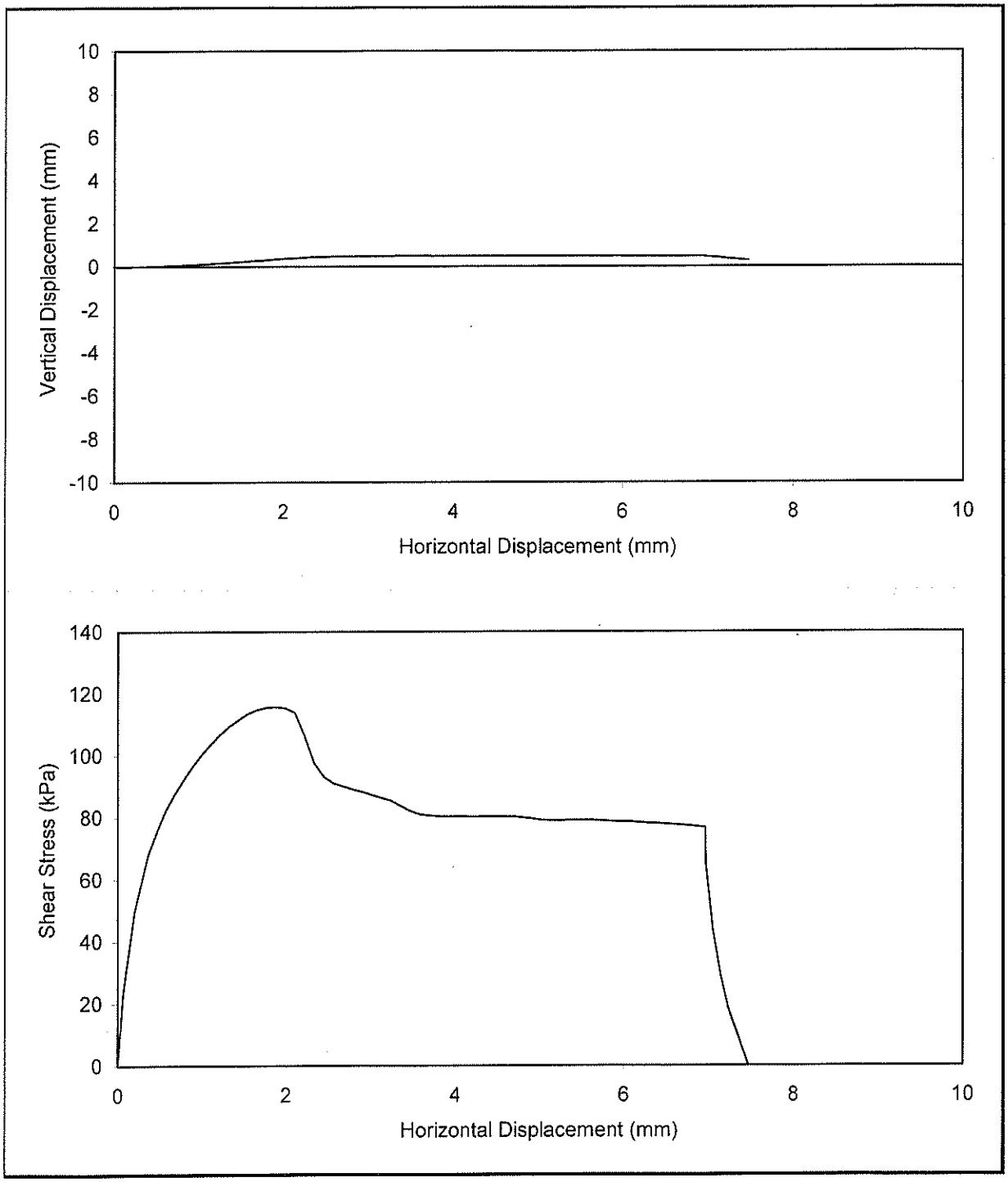
PHOTO OF SHEAR PLANE AFTER TEST

TEST EQUIPMENT - Wykeham Farrance direct test apparatus with a 100 mm square shear box. Vertical and horizontal strains were measured by electronic displacement transducer. The normal force was applied by dead weights on a 10:1 lever loading yoke. The shear stress was measured with an electronic load cell.

TEST PROCEDURE - This test was conducted in accordance with ASTM D 3080 - 90 Direct Shear Test of Soils Under Consolidated Drained Conditions. The test sample was received at a moisture content of 10.7 %. The sample was moisture conditioned to 15 % with a target dry density of 1700 kg/m3. The test specimen was compacted in the shear box in 3 equal layers of 10 mm. The test was run under dry conditions, i.e. the shear box was not flooded with water. The specimen was consolidated to the required normal stress of 100 kPa in one stage. A rate of displacement was selected to complete the test overnight. Moisture content samples were taken from the shear plane and the rest of the specimen.

THURBER

DIRECT SHEAR TEST REPORT DS 13-2



EBA - A Tetra Tech Company
Alaska Highway - Km 738-750
File Number: 19-6486-4

Normal Stress = 100 kPa
Sample: Sa. 03, 744+820
Test Dates: Dec. 3 - 4, 2013

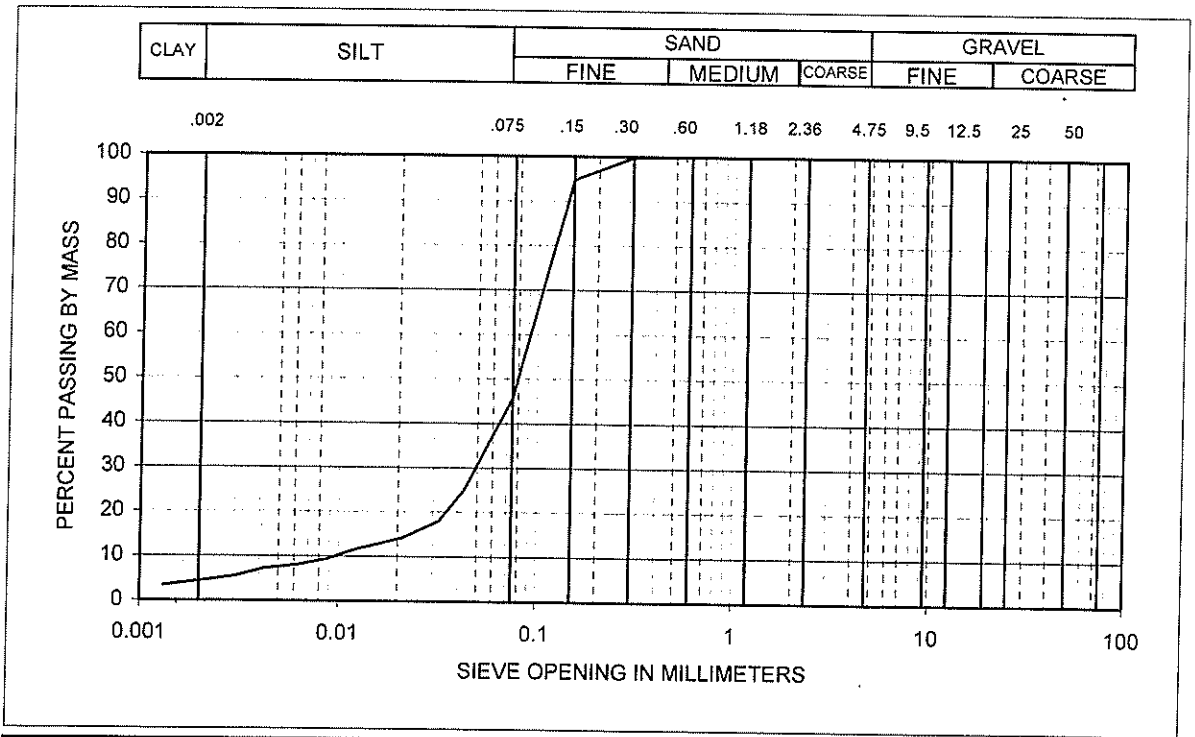
THURBER

PARTICLE-SIZE ANALYSIS REPORT

CLIENT :	EBA, A Tetra Tech Company	FILE NUMBER :	19-6486-4
PROJECT :	Alaska Hwy - Km 738-750	REPORT DATE :	10-Dec-13
SAMPLE:	Sa. 03, 744+820	DATE SAMPLED:	08-Oct-13
SOURCE:	Grab sample	DATE RECEIVED:	29-Nov-13
TEST METHOD:	ASTM D-422	DATE TESTED:	03-Dec-13
LIQUID LIMIT:	---	GRAVEL:	0.0%
PLASTIC LIMIT:	---	SAND:	54.4%
PLASTICITY INDEX:	---	SILT:	41.2%
SPECIFIC GRAVITY:	2.75 (assumed)	CLAY:	4.4%

DESCRIPTION: SILT and SAND, trace of clay

UNIFIED SOIL CLASSIFICATION: SM



Gravel		Sand		Hydrometer		Hydrometer	
mm	% Passing	mm	% Passing	mm	% Passing	mm	% Passing
75	100	4.75	100.0	0.0429	24.8	0.0031	5.5
50	100	2.36	100.0	0.0321	17.9	0.0023	4.7
37.5	100	1.18	100.0	0.0209	14.1	0.0013	3.4
25	100	0.6	100.0	0.0123	11.5		
19	100	0.3	99.8	0.0088	9.4		
12.5	100	0.15	94.8	0.0063	8.1		
9.5	100	0.075	45.6	0.0043	7.3		

Thurber Engineering Ltd.

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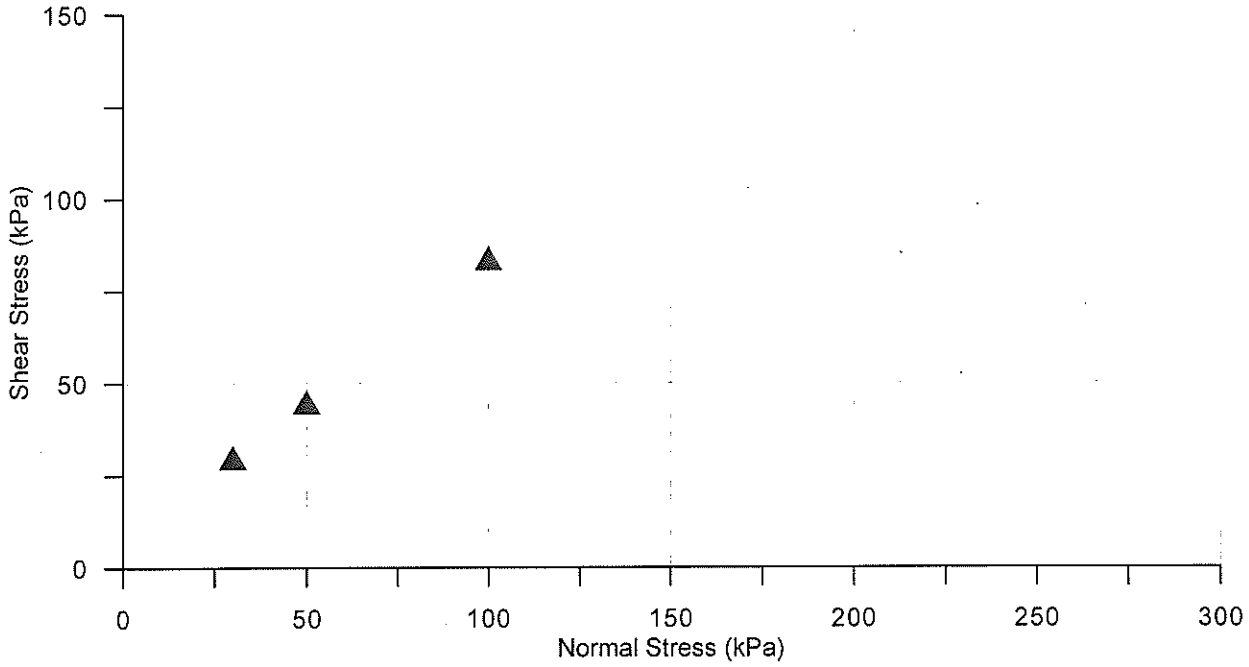
Direct Shear Test Results

Client: EBA - A TETRA TECH COMPANY
Project: Alaska Highway km 738 - 750
Job No.: 19-6486-4

Sample: SA-08, Sta 746+550
Date: Dec. 13, 2013

Sand portion of as received gravelly Sand

30 kPa specimen: Dry Density = 1,906 kg/m^3 at 5.7 % moisture content.
50 kPa specimen: Dry Density = 1,911 kg/m^3 at 5.7 % moisture content.
100 kPa specimen: Dry Density = 1,915 kg/m^3 at 5.7 % moisture content.



Remarks: Removed material greater than 4.75 mm.
Brown, SAND (SP-SM), trace to some fines.
Moisture conditoned to 5.7% and compacted
to a target dry density of 1,900 kg/m^3 as directed by client.

THURBER ENGINEERING LTD.

DIRECT SHEAR TEST REPORT DS 13-3
Sa. 08, 746+550
30 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 13, 2013
File Number: 19-6486-4

SAMPLE DESCRIPTION

Brown SAND (SP-SM), trace to some silt

	Start of Test	After Consolidation
Wet Density (kg/cu.m.):	2,015	---
Dry Density (kg/cu.m.):	1,906	1,907
Moisture Content:	5.7%	---
Void Ratio:	0.443	0.442
Saturation:	35.6%	---
Specific Gravity (assumed):	2.75	

AFTER TEST NOTES

Normal Stress = 30 kPa Peak Shear Stress = 30 kPa

Moisture content taken within 5 mm of shear surfaces = 5.3 %.
Moisture content taken from the rest of the specimen = 5.4%.

The top cap was slightly tilted and there was no misalignment of the shearbox halves.
There was a very small amount of extruded silty sand between the shearbox halves.

The specimen did not separate along the shear surfaces.

THURBER

DIRECT SHEAR TEST REPORT DS 13-3
Sa. 08, 746+550
30 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 13, 2013
File Number: 19-6486-4

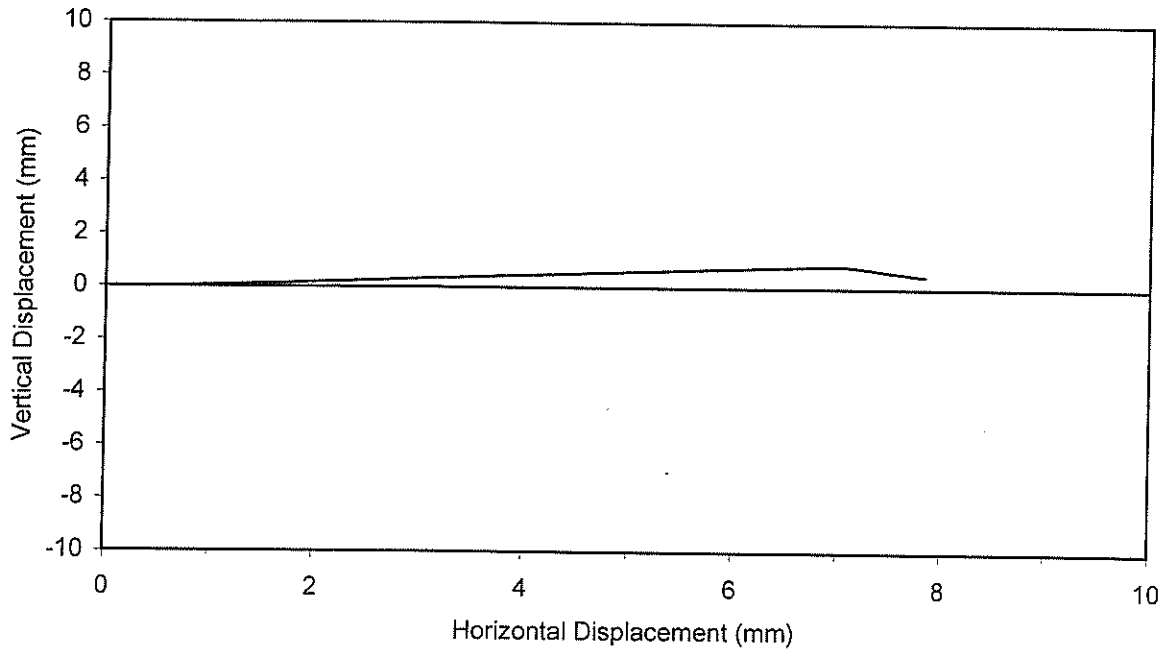
PHOTO OF SHEAR PLANE AFTER TEST

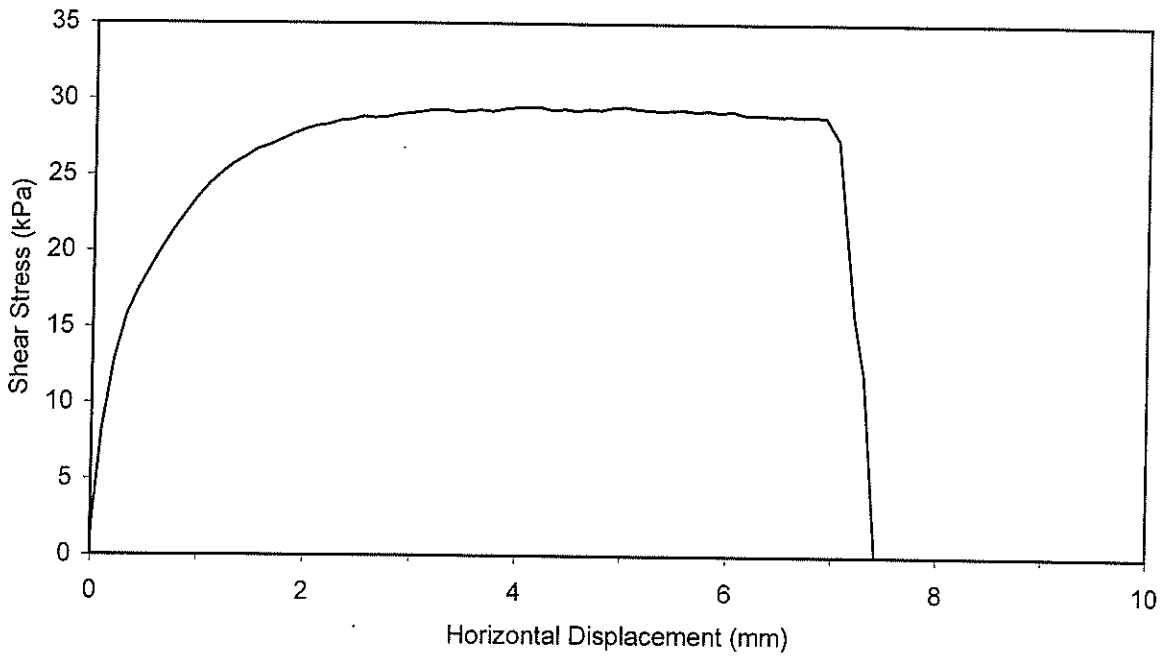
TEST EQUIPMENT - Wykeham Farrance direct test apparatus with a 100 mm square shear box. Vertical and horizontal strains were measured by electronic displacement transducer. The normal force was applied by dead weights on a 10:1 lever loading yoke. The shear stress was measured with an electronic load cell.

TEST PROCEDURE - This test was conducted in accordance with ASTM D 3080 - 90 Direct Shear Test of Soils Under Consolidated Drained Conditions. The test sample as received included gravel particles up to 25 mm in size. The moisture content of the test sample as received was 2.8 %. The sample was screened over a 4.75 mm sieve and the minus 4.75 mm material was used for the direct shear tests. A target dry density of 1,900 kg/m^3 was selected. De-ionized water was added to the material until it appeared to be close to optimum moisture content. This moisture content was 5.7%. The test specimen was compacted in the shear box in 3 equal layers of 10 mm. The test was run under dry conditions, i.e. the shear box was not flooded with water. The specimen was consolidated to the required normal stress of 30 kPa in one stage. A rate of displacement was selected to complete the test overnight. Moisture content samples were taken from the shear plane and the rest of the specimen.

THURBER

DIRECT SHEAR TEST REPORT DS 13-3





EBA - A Tetra Tech Company
Alaska Highway - Km 738-750
File Number: 19-6486-4

Normal Stress = 30 kPa
Sample: Sa. 08, 746+550
Test Dates: Dec. 3 - 4, 2013

THURBER ENGINEERING LTD.

DIRECT SHEAR TEST REPORT DS 13-4
Sa. 08, 746+550
50 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 13, 2013
File Number: 19-6486-4

SAMPLE DESCRIPTION

Brown SAND (SP-SM), trace to some silt

	Start of Test	After Consolidation
Wet Density (kg/cu.m.):	2,021	---
Dry Density (kg/cu.m.):	1,911	1,926
Moisture Content:	5.7%	---
Void Ratio:	0.439	0.428
Saturation:	35.9%	---
Specific Gravity (assumed):	2.75	

AFTER TEST NOTES

Normal Stress = 50 kPa Peak Shear Stress = 45 kPa

Moisture content taken within 5 mm of shear surfaces = 5.3 %.
Moisture content taken from the rest of the specimen = 5.2%.

The top cap was slightly tilted and there was no misalignment of the shearbox halves.
There was a very small amount of extruded silty sand between the shearbox halves.

The specimen did not separate along the shear surfaces.

THURBER

DIRECT SHEAR TEST REPORT DS 13-4
Sa. 08, 746+550
50 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 13, 2013
File Number: 19-6486-4

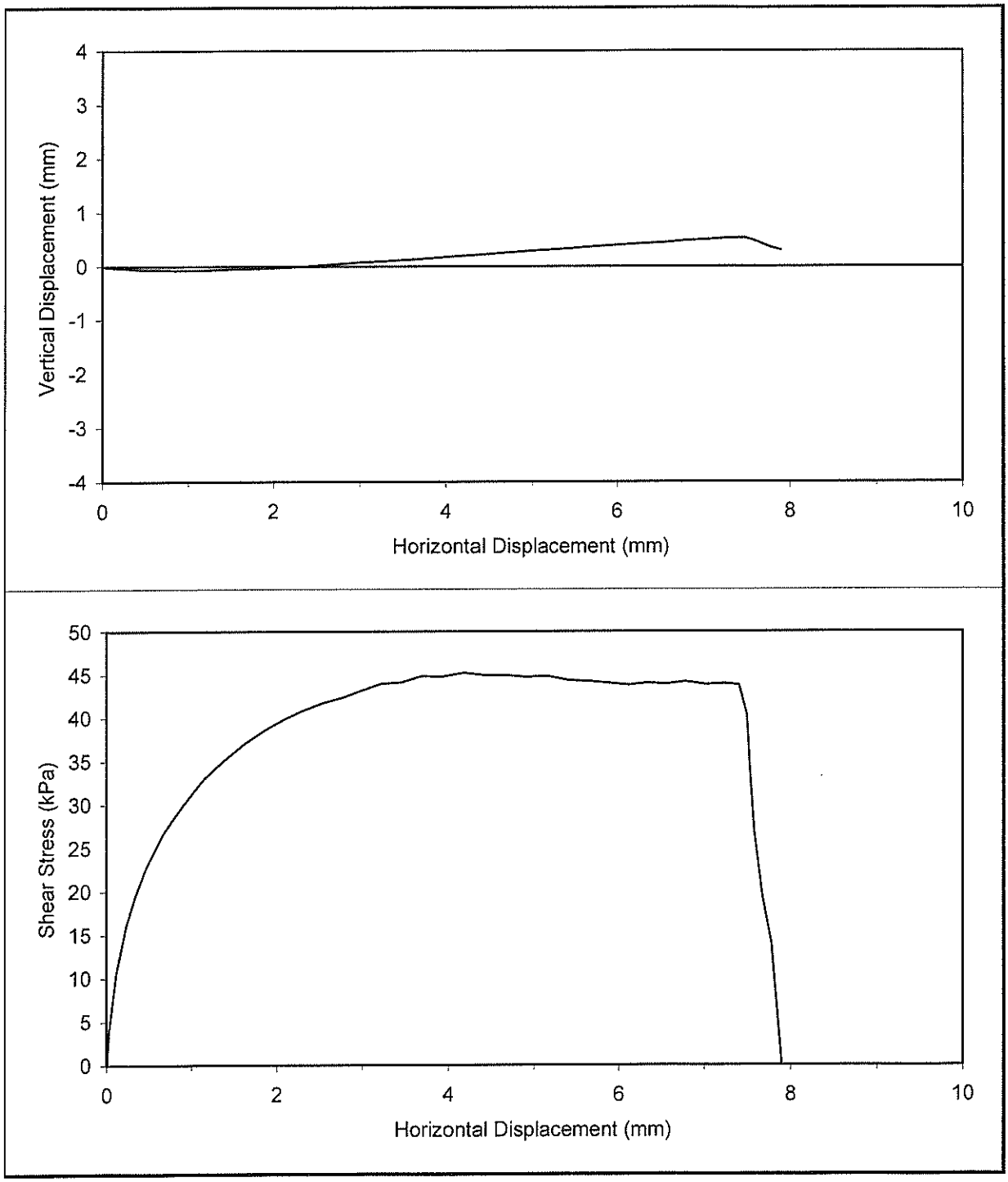
PHOTO OF SHEAR PLANE AFTER TEST

TEST EQUIPMENT - Wykeham Farrance direct test apparatus with a 100 mm square shear box. Vertical and horizontal strains were measured by electronic displacement transducer. The normal force was applied by dead weights on a 10:1 lever loading yoke. The shear stress was measured with an electronic load cell.

TEST PROCEDURE - This test was conducted in accordance with ASTM D 3080 - 90 Direct Shear Test of Soils Under Consolidated Drained Conditions. The test sample as received included gravel particles up to 25 mm in size. The moisture content of the test sample as received was 2.8 %. The sample was screened over a 4.75 mm sieve and the minus 4.75 mm material was used for the direct shear tests. A target dry density of 1,900 kg/m3 was selected. De-ionized water was added to the material until it appeared to be close to optimum moisture content. This moisture content was 5.7%. The test specimen was compacted in the shear box in 3 equal layers of 10 mm. The test was run under dry conditions, i.e. the shear box was not flooded with water. The specimen was consolidated to the required normal stress of 50 kPa in one stage. A rate of displacement was selected to complete the test overnight. Moisture content samples were taken from the shear plane and the rest of the specimen.

THURBER

DIRECT SHEAR TEST REPORT DS 13-4



EBA - A Tetra Tech Company
Alaska Highway - Km 738-750
File Number: 19-6486-4

Normal Stress = 50 kPa
Sample: Sa. 08, 746+550
Test Dates: Dec. 5 - 6, 2013

THURBER ENGINEERING LTD.

DIRECT SHEAR TEST REPORT DS 13-5
Sa. 08, 746+550
100 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec. 13, 2013
File Number: 19-6486-4

SAMPLE DESCRIPTION

Brown SAND (SP-SM), trace to some silt

	Start of Test	After Consolidation
Wet Density (kg/cu.m.):	2,025	---
Dry Density (kg/cu.m.):	1,915	1,932
Moisture Content:	5.7%	---
Void Ratio:	0.436	0.423
Saturation:	36.1%	---
Specific Gravity (assumed):	2.75	

AFTER TEST NOTES

Normal Stress = 100 kPa Peak Shear Stress = 84 kPa

Moisture content taken within 5 mm of shear surfaces = 5.6 %.
Moisture content taken from the rest of the specimen = 5.3%.

The top cap was slightly tilted and there was no misalignment of the shearbox halves.
There was a very small amount of extruded silty sand between the shearbox halves.

The specimen did not separate along the shear surfaces.

THURBER

DIRECT SHEAR TEST REPORT DS 13-5
Sa. 08, 746+550
100 kPa

EBA - A Tetra Tech Company
Alaska Highway - Km 738-750

Report Date: Dec 13, 2013
File Number: 19-6486-4

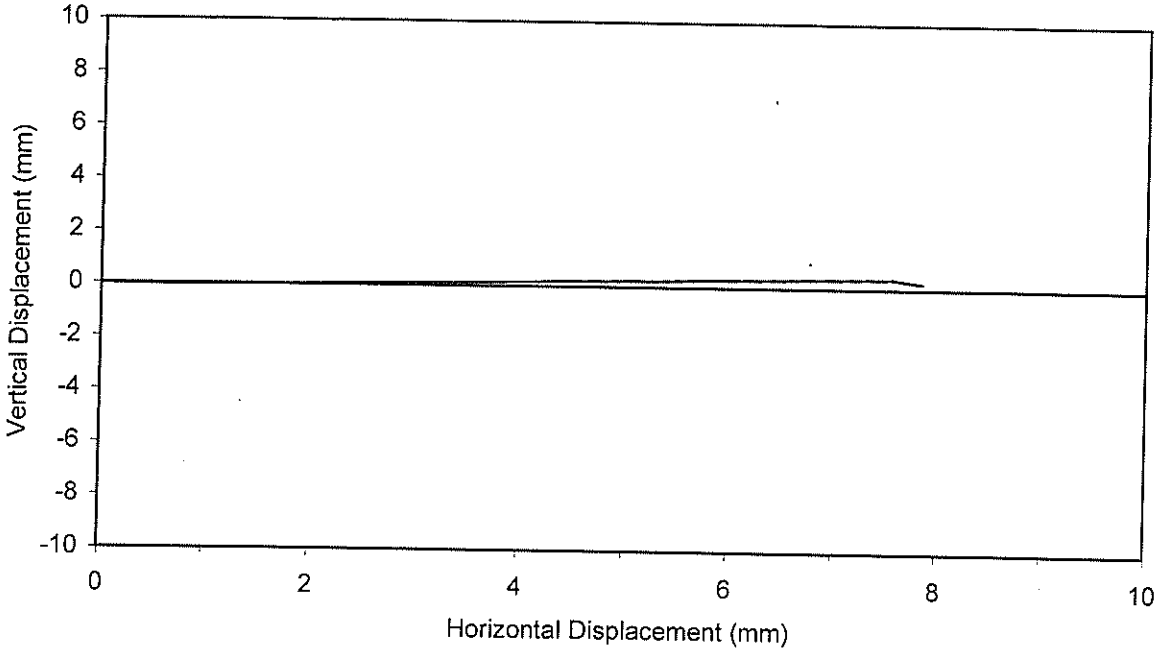
PHOTO OF SHEAR PLANE AFTER TEST

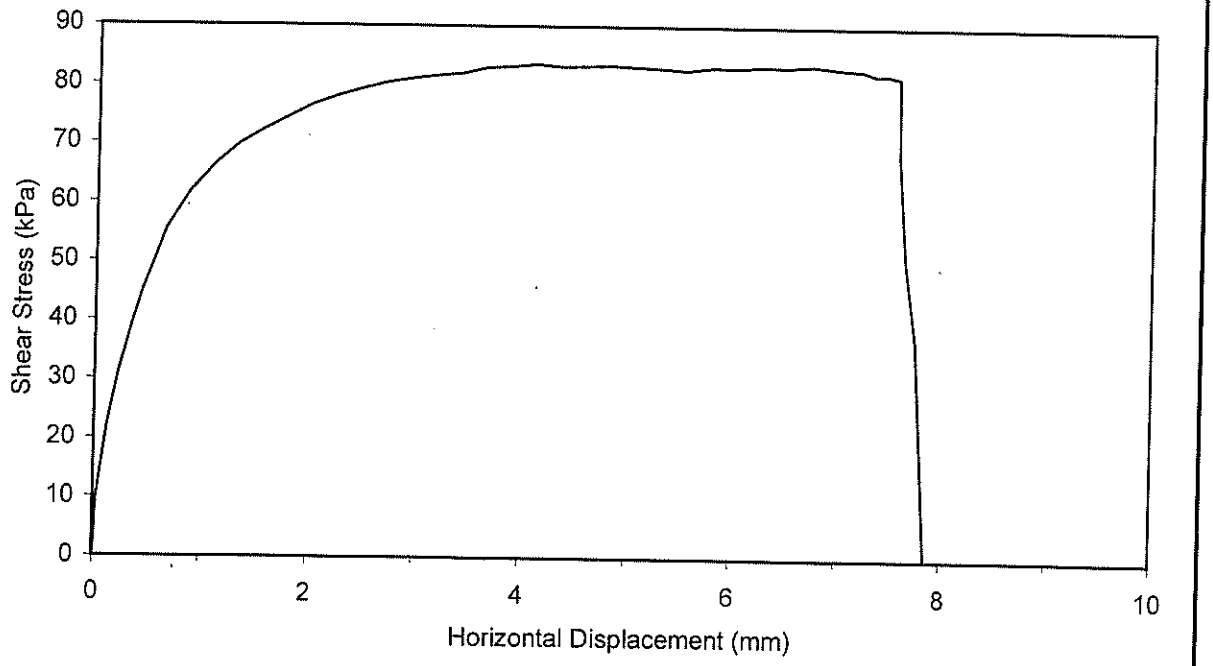
TEST EQUIPMENT - Wykeham Farrance direct test apparatus with a 100 mm square shear box. Vertical and horizontal strains were measured by electronic displacement transducer. The normal force was applied by dead weights on a 10:1 lever loading yoke. The shear stress was measured with an electronic load cell.

TEST PROCEDURE - This test was conducted in accordance with ASTM D 3080 - 90 Direct Shear Test of Soils Under Consolidated Drained Conditions. The test sample as received included gravel particles up to 25 mm in size. The moisture content of the test sample as received was 2.8 %. The sample was screened over a 4.75 mm sieve and the minus 4.75 mm material was used for the direct shear tests. A target dry density of 1,900 kg/m3 was selected. De-ionized water was added to the material until it appeared to be close to optimum moisture content. This moisture content was 5.7%. The test specimen was compacted in the shear box in 3 equal layers of 10 mm. The test was run under dry conditions, i.e. the shear box was not flooded with water. The specimen was consolidated to the required normal stress of 100 kPa in one stage. A rate of displacement was selected to complete the test overnight. Moisture content samples were taken from the shear plane and the rest of the specimen.

THURBER

DIRECT SHEAR TEST REPORT DS 13-5





EBA - A Tetra Tech Company
Alaska Highway - Km 738-750
File Number: 19-6486-4

Normal Stress = 100 kPa
Sample: Sa. 08, 746+550
Test Dates: Dec. 5 - 6, 2013

THURBER

SIEVE ANALYSIS REPORT
ALASKA HIGHWAY - KM 738-750
SA-08, 746+550

Attn: Mr. Jason Pellett

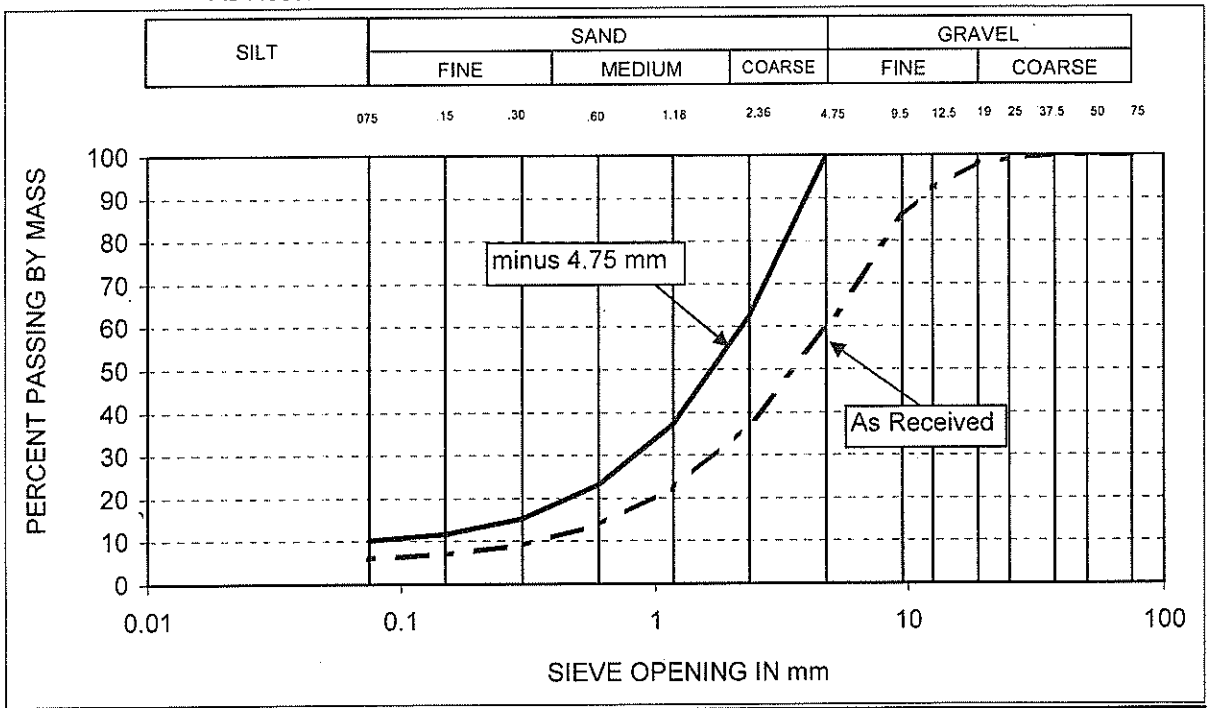
File Number: 19-6486-4

EBA, A Tetra Tech Company
Oceanic Plaza, 9th Floor, 1066 West Hastings St.
Vancouver, BC
V6E 3X2

Sampled: 09-Oct-13 By: Client
Received: 29-Nov-13 By: BRE
Tested: 05-Dec-13 By: AGW

Sample Source: Site
Description: Gravelly SAND (SW-SM), trace to some fines
Test Method: ASTM C 136 & C 117

Remarks: As Received: Gravel = 40.5 % Sand = 53.4 % Fines = 6.1 %
Minus 4.75 mm: Sand = 89.8 % Fines = 10.2 %
As Received Moisture Content = 2.8 %



Gravel Size		Percent Passing	Percent Passing	Sand Size		Percent Passing	Percent Passing
Inches	mm	As Received	minus 4.75 mm	Inches	mm	As Received	minus 4.75 mm
3	75	100	100	#4	4.75	59	100
2	50	100	100	#8	2.36	37	62.5
1.5	37.5	100	100	#16	1.18	22	37.2
1	25	99	100	#30	0.6	14	23.2
.75	19	98	100	#50	0.3	9	15.2
.5	12.5	92	100	#100	0.15	7	11.7
.375	9.5	86	100	#200	0.075	6.1	10.2

Vancouver Petrographics Ltd.
8080 GLOVER ROAD, LANGLEY, B.C. V1M 3S3
PHONE: 604-888-1323 • FAX: 604-888-3642
email: vanpetro@vanpetro.com
Website: www.vanpetro.com

Report for: Jason Pellett, P.Eng.
EBA, A Tetra Tech Company
Oceanic Plaza, 9th Floor
1066 West Hastings Street
Vancouver, BC V6E 3X2

Sent to: Jason Pellett, P.Eng.
jpellett@eba.ca

Report 130850

December 4, 2013

Petrographic Examination of Sample SA-6

Fabrizio Colombo, Ph.D., P.Geo.

Table of Contents

1. Introduction

Mr. Jason Pellett of EBA submitted 1 aggregate sample (SA-6) to Vancouver Petrographics for petrographic examination according to the Standard C295/C295M-12. Mr. Pellett indicated that the sample was collected from the km 746+360 of the Alaska Highway in British Columbia, and that the aggregate is being assessed for potential use as crushed aggregate for road fill and paved road surfacing.

The sample was dry sieved in accordance with Method C136. The results of the sieve analysis were provided to me and are listed in Table 1. The sieve fractions were analysed separately.

Some of the fragments, in particular from the fraction retained on the 50 mm to 37.5 mm sieve, were cut and then analysed under a stereomicroscope. All of the fragments in the fraction retained on the 50 mm to 9.5 mm sieve were identified and counted under the stereomicroscope. Each of the 50 mm to 9.5 mm fractions (see Table 2) consisted of fewer than 150 fragments each. The fractions retained on the 4.5 mm to 0.075 mm sieve consisted of more than 500 particles each; in this case, each fraction was reduced to a sample of 500 particles, as recommended in the ASTM C295 / C295 - 12 and references therein. The retained fraction from 2.36 mm to 0.075 mm was reduced, impregnated in epoxy resin and prepared as polished thin sections that were analysed petrographically under transmitted and reflected polarised light.

The rock types (Table 3) are classified according to Gillespie and Styles (1999) and Robertson (1999).

2. Results

The particles were examined, identified and counted in each size fraction (see Table 1).

The Standard Guide for Petrographic Examination of Aggregate for Concrete suggests that at least 150 particles of each sieve fraction should be identified and counted in order to obtain reliable results. This condition was met only for the size fractions 4.75 mm to 0.075 mm, therefore the results reported in Table 2 are statistically sound and consistent only in the fine-grained fraction of the sample.

Table 1: Sieved Sample Size.

Size Fraction Larger Than (mm)	Mass (g)
50	253
37.5	173
25.4	850
19	276
12.7	290
9.5	272
4.75	510
2.36	441
1.18	331
0.600	338
0.300	218
0.150	57
0.075	34
Total weight	**4043**

The particles were subdivided into 3 physical condition types. Condition **1** refers to particles that are hard to firm and relatively free of fractures, equant and with a shape varying from rounded to angular.

Condition **2** applies to particles that exhibit one or two of the following qualities: (i) firm to friable, (ii) moderately fractured, (iii) capillary absorption small to moderate, (iv) surface relatively smooth and impermeable, (v) shape elongate to platy. Condition **3** particles exhibit one or more of the following qualities: (i) friable to soft or pulverulent, (ii) slaking when wetted and dried, (iii) highly fractured, (iv) high capillary absorption, (v) includes a significant amount of potentially deleterious constituents.

Innocuous material is defined as any mineral, mineral aggregate or rock type that does not contain a significant amount of deleterious material. **Deleterious material** is any mineral, mineral aggregate or rock type with a high alkali-silica reactivity, namely chalcedony, chalcedonic silica, cristobalite, crushed greywacke, opal, opaline silica, tridymite, strained quartz, iron oxides, sulphides, and clay.

The results of the petrographic examination are summarized in Table 2.

Gravel analysis

Petrographic analysis, under stereomicroscope, of the retained fraction from 2.36 mm to fragments larger than 50 mm allowed me to distinguish:

- A **carbonate-rich sedimentary suite**, including dolomite and calcite-rich fine- to very fine-grained rock.
- A **silicate-rich sedimentary suite** and rare fragments of granitoid.

- A third suite of very fine-grained and dark rock, which is probably the product of alteration/weathering of an **andesitic rock** or a **mudstone**.

Calcite-rich **coatings** were observed in some of the fragments (see Table 4). The coatings were in most cases discontinuous and would probably be removed during crushing.

Petrographic examination of the gravel indicates the particles are in relatively good condition (see Table 2).

As mentioned in the previous section, the results of the gravel analysis suffer from the low number of particles in the coarser size fraction, therefore they cannot be considered reliable, despite providing results consistent with the sand analysis.

Sand analysis

The retained size fractions from 1.18 mm to 0.075 mm were analysed using a petrographic microscope under transmitted and reflected polarised light. This type of analysis allowed me to distinguish:

- A **carbonate-rich sedimentary suite**, including dolomite-calcite limestone, carbonate-clay-quartz-iron oxides sandstone and mudstone, iron oxides-bearing limestone, and carbonate-quartz-iron oxides sandstone/mudstone.
- A **silicate-rich sedimentary suite**, including fine- to medium-grained quartzite, clay-iron oxides sandstone/mudstone, quartz-carbonate-iron oxides sandstone, quartz-iron oxides-albite sandstone, and strained fragments of quartz.
- A third suite consists of very fine-grained **clay±quartz±iron oxides±carbonate alterite**.

Under the petrographic microscope, **strained quartz fragments** were distinguished within the silicate-rich sedimentary suite. Strained quartz is a highly reactive constituent, as discussed in Wong (2006) and references therein.

All the size fractions from 1.18 mm to 0.075 mm consisted of more than 500 particles, therefore the recommendation concerning the number of particles to be counted was met, and the sand analysis is to be considered statistically sound and consistent. The petrographic analysis also allowed me to determine with higher precision and reliability the composition of the particles. Point counting was carried out according to the recommendation in ASTM C295 / C295 – 12. The results of the petrographic analysis are listed in Table 3. The main compositional features, including the potential content of deleterious constituents are summarised in Table 3.

The result of the petrographic examination indicates the aggregate is suitable for its use as aggregate material for road fill and paved road surfacing.

Table 2: Composition and Condition of the Aggregate Sample SA-6.

	Size Fractions (mm)															
	>50	**37.5**	**25.4**	**19**	**12.7**	**9.5**	**4.75**	**2.36**	**1.18**	**0.6**	**0.3**	**0.15**	**0.075**			
Condition 1: rounded to angular, equant, fresh, dense.	1	2	16	10	28	85	473	458	458	441	429	445	393			
Condition 2: elongate to platy, moderately weathered.			1		12	15	27	42	29	42	49	48	105			
Condition 3: friable to soft, highly fractured, severely weathered, includes a significan amount of potentially deleterious constituents.				1		2			13	17	22	7	2			
Total Particles*	1	2	17	11	40	102	500	500	500	500	500	500	500			
Percentage of sample retained o	6.3	4.3	21.0	6.8	7.2	6.7	12.6	10.9	8.2	8.4	5.4	1.4	0.8			
Weighted Average Condition 1	6.3	4.3	19.8	6.2	5.0	5.6	11.9	10.0	7.5	7.4	4.6	1.3	0.7	**90.5**		
Weighted Average Condition 2			1.2	0.0	2.2	1.0	0.7	0.9	0.5	0.7	0.5	0.1	0.2		**8.0**	
Weighted Average Condition 3			0.0	0.6	0.0	0.1	0.0	0.0	0.2	0.3	0.2	0.0	0.0			**1.5**

*The recommendation concerning the number of particles to be counted was met only for the size fractions 4.75 mm to 0.075 mm.

Table 3: Petrographic Analysis of the Aggregate Sample SA-6.

Rock Type	Grain-size	Main constituents	Accessory constituents	Remarks
Dolomite-calcite limestone	fine- to very fine-grained	dolomite, calcite		Some particles are brecciated and filled in by calcite veins, wrapped by patchy calcite coating. Rare oxidised, and porous particles.
Quartzite	fine- to medium-grained	quartz	iron oxides, white mica, clay	In some cases it is layered, very rare particles are porous because of dissolved crystals.
Clay-iron oxides sandstone/mudstone	fine-grained	clay, iron oxides	carbonate, quartz	
Clay-quartz-iron oxides-carbonate alterite	very fine-grained	clay, quartz, iron oxides	carbonate	Dark particles, some of them coated by discontinuous calcite, clay weathered and oxidized, slightly fractured, in rare cases fine-grained phenocrystals(?) are visible.
Quartz-carbonate-iron oxides sandstone	fine-grained	quartz, dolomite, calcite	iron oxides	Some particles are coated by calcite.
Carbonate-clay-quartz-iron oxides sandstone and mudstone	fine- to very fine-grained	dolomite, calcite, quartz	iron oxides	Rare fragments are porous and oxidised, and discontinuously coated by calcite.
Iron oxides-bearing limestone	fine- to very fine-grained	dolomite, calcite	iron oxides	
Carbonate-quartz-iron oxides sandstone	fine-grained	dolomite, calcite, quartz	iron oxides	
Quartz-iron oxides-albite sandstone	fine-grained	quartz, iron oxides, albite	dolomite, calcite, white mica, clay	
Strained quartz fragments	fine- to medium-grained	quartz	iron oxides	Strained quartz.
Quartz-iron oxides fragments	very fine-grained	quartz, iron oxides		
Granitoid	fine-grained	quartz, feldspar, chlorite	clay iron oxides, sulphides (pyrite?)	Rare calcite coatings.

3. Discussion and Recommendations

Standard C295 / C295 - 12 is a guide to examining aggregates for concrete. The submitted aggregate is intended to be used as crushed aggregate for road fill and paved road surfacing.

A standard for the petrographic examination of aggregates for bituminous mixtures is not available, therefore ASTM C295 / C295 - 12 is used here. The undesirable constituents in the aggregates for bituminous aggregates are mineral fragments and rock types with high alkali-silica reactivity, low durability, and susceptibility to freezing-thawing cycles.

Despite the low number of particles in the coarser size fractions, and the consequent low reliability of the results, the relatively good condition of the coarser fragments suggests that the quality of the aggregate could be improved by crushing the coarser fraction.

To overcome the statistical problem arising from the fractions coarser than 9.5 mm, a bigger sample is recommended (see Table 1 in ASTM C295 / C295M - 12).

A detailed petrographic analysis of a statistically significant population of the coarser fraction would confirm that the particles contain an insignificant amount of deleterious constituents, and that the quality of the aggregate would improve after the coarser fraction was crushed. Further analysis should determine the type and amount of clay in the carbonate-rich sedimentary suite, as the presence of clay associated with carbonate is one of the deleterious materials causing alkali reactivity.

Petrographic analysis is recommended for the clay±quartz±iron oxides±carbonate alterite. This rock type is relatively abundant, and understanding its composition is important to better identify possible deleterious constituents. Because of the dark colour of these particles, short-wave infra-red spectroscopy (SWIR) is not a viable analytical solution for this problem. Petrographic analysis of a limited number of fragments (3-4) would indicate the presence of clay and/or chlorite.

4. Bibliography

ASTM International, 2012. *ASTM C295 / C295M – 12: Standard Guide for Petrographic Examination of Aggregates for Concrete*. West Conshohocken, PA. DOI: 10.1520/C0295_C0295M-12, 9 pp.

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Robertson, S., 1999, *British Geological Survey Rock Classification Scheme. Volume 2: Classification of Metamorphic Rocks.* British Geological Survey Research Report, RR/92–02, 24 p.

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Signed by
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Web: www.petrographically.com

APPENDIX E
TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Tetra Tech EBA's Client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA's Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. Tetra Tech EBA's instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, Tetra Tech EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. Tetra Tech EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. Tetra Tech EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

Tetra Tech EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

R.017173.801
Appendix B

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 PWGSC Environmental Management Plan (EMP) or the Environmental Assessment (EA) as supporting documents in the completion of the site Environmental Protection Plan (EPP).

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 PWGSC'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, re-fuelling 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.017173.801
Appendix C

Responsibility Checklist For Authorizations/Approvals/Notifications/Permitting

Project Title	
Project Description	
Project Type	
Comments	

Issued By	Document Type	Yes	No	N/A
PWGSC 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 (eg. 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	Section 5(1) Formal Approval for			

http://laws.justice.gc.ca/en/N-22/text.html	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 gryones) or "waters" that are not large enough for vessel traffic (ie. 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 PWGSC CEAA Checklist, and will be the mechanism by which project information is submitted to PWGSC 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, PWGSC project managers1			

[1] Project Manager refers to anyone who leads, manages or delivers a project

	will ensure that their projects are systematically evaluated for compliance with environmental 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 Front Counter BC 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 - MOE http://www.qp.gov.bc.ca/statreg/stat/W/96483	Section 9 – 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 ect.			
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 9 when applying for approval.			
Ministry of Forests, Lands and Natural Resources Operations 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 and Natural Resources Operations*** 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 and Natural Resources Operations 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.017173.801
Appendix D

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.017173.801
Appendix E

Public Works and Government Services Canada | Travaux publics et Services gouvernementaux Canada

PRELIMINARY HAZARD ASSESSMENT FORM

Project Number:	R.017173.801
Location:	Alaska Highway Km 737 to Km 750.3
Date:	June – October 2015
Name of Departmental Representative:	Alex Taheri
Name of Client:	Real Property Services – Western Services
Name of Client Project Co-ordinator	Alex Taheri PH: (604)-666-9374

Site Specific Orientation Provided at Project Location Yes ☐ No ☒

Notice of Project Required Yes ☒ No ☐

NOTE:
PWGSC 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 PWGSC 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. PWGSC 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.	PWGSC, 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)	Yes		Yes		
Slip Hazards or Unsound Footing	Yes		Yes		
Working at Heights	Yes		Yes		
Working Over or Around Water	Yes		Yes		
Heavy overhead lifting operations, mobile cranes etc.	Yes		Yes		
Marine and/or Vehicular Traffic (site vehicles, public vehicles, etc.	Yes		Yes		
Fire and Explosion Hazards	Yes		Yes		
High Noise Levels	Yes		Yes		

Canada

Excavations	Yes		Yes		
Blasting		No		No	No blasting anticipated
Construction Equipment	Yes		Yes		
Pedestrian Traffic (site personnel, tenants, visitors, public)	Yes		Yes		
Multiple Employer Worksite	Yes		Yes		Example: Contractor working in an occupied Federal Employee space.

Electrical Hazards					**Comments**
Contact With Overhead Wires		No		No	Excludes electrical wires mobilized from site by the contractor
Live Electrical Systems or Equipment		No		No	Excludes electrical wires mobilized from site by the contractor
Other:					
Physical Hazards					
Equipment Slippage Due To Slopes/Ground Conditions	Yes		Yes		
Earthquake	Yes		Yes		
Tsunami		No		No	
Avalanche	Yes		Yes		
Forest Fires	Yes		Yes		
Fire and Explosion Hazards	Yes		Yes		
Working in Isolation	Yes		Yes		
Working Alone	Yes		Yes		
Violence in the Workplace	Yes		Yes		
High Noise Levels	Yes		Yes		
Inclement weather	Yes		Yes		
High Pressure Systems		No		No	Excludes electrical wires mobilized from site by the contractor
Other:					
Hazardous Work Environments					
Confined Spaces / Restricted Spaces					Review and provide confined space assessment(s) from PWGSC or client confined space inventories. Refer to PWGSC Standard on Entry into Confined Spaces. Contact the Regional Construction Safety Coordinator.
Suspended / Mobile Work Platforms	Yes		Yes		
Other:					
Biological Hazards					
Mould Proliferations		No		No	
Accumulation of Bird or Bat Guano	Yes		Yes		
Bacteria / Legionella in Cooling Towers / Process Water		No		No	
Rodent / Insect Infestation	Yes		Yes		
Poisonous Plants	Yes		Yes		
Sharp or Potentially Infectious Objects in Wastes	Yes		Yes		
Wildlife	Yes		Yes		

Chemical Hazards					
Asbestos Materials on Site		No		No	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		No		No	If "yes" a pre-project designated substance survey report is required.
Chemicals Used in work	Yes		Yes		
Lead in paint		No		No	If "yes" a pre-project lead survey report is required.
Mercury in Thermostats or Switches		No		No	If "yes" a pre-project mercury survey report is required.
Application of Chemicals or Pesticides		No		No	
PCB Liquids in Electrical Equipment		No		No	
Radioactive Materials in Equipment		No		No	
Other:					
Contaminated Sites Hazards					
Hazardous Waste	Yes		Yes		Creosote treated timber
Hydrocarbons		No		No	
Metals	Yes		Yes		Corrugated Steel Pipe
Other:					

Security Hazards					Comments
Risk of Assault		No		No	
Other:					
Other Hazards					

Other Compliance and Permit Requirements[1]	YES	NO	Notes / Comments[2]
Is a Building Permit required?		No	
Is an Electrical permit required?		No	
Is a Plumbing Permit required?		No	
Is a Sewage Permit required?	Yes		TBD (Utilities at Construction Camp)
Is a Dumping Permit required?	Yes		TBD (Materials to be disposed at and offsite disposal facility)
Is a Hot Work Permit required?		No	
Is a Permit to Work required?		No	
Is a Confined Space Entry Permit required?	Yes		TBD
Is a Confined Space Entry Log required	Yes		TBD
Discharge Approval for treated water required	Yes		TBD (Utilities at Construction Camp)

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 PWGSC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING			

R.017173.801
Appendix F

Public Works and Government Services Canada
Pacific Region

Travaux publics et Services gouvernementaux Canada
région du Pacifique

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

ALASKA HIGHWAY
BRITISH COLUMBIA

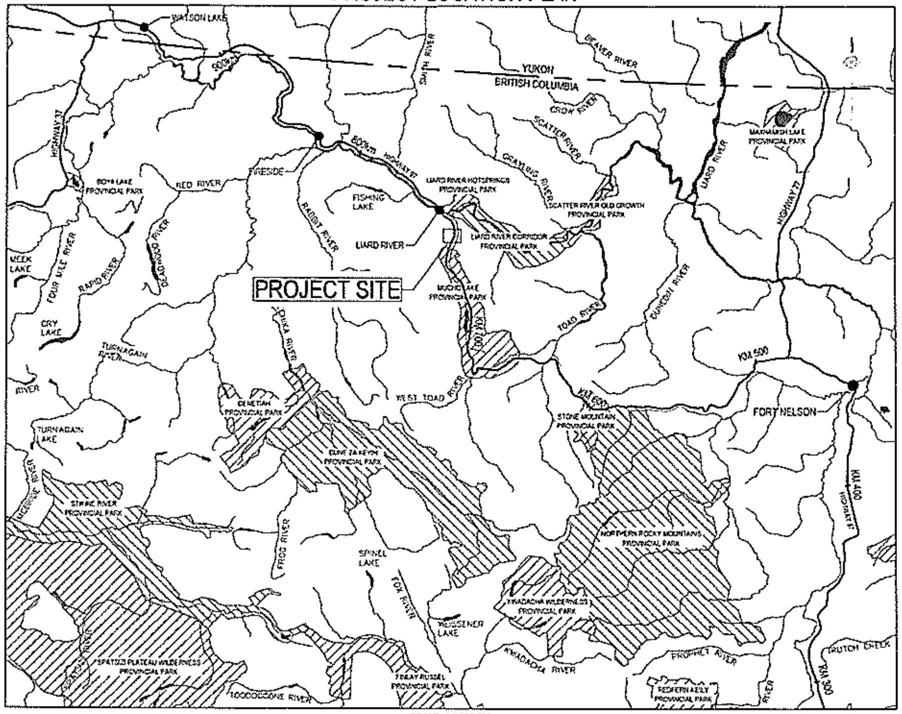
TETRA TECH EBA

TENDER SUBMISSION
REV. 0 - MARCH 27, 2015

PROJECT No. R.017173.701

A1 - 841 x 594

PROJECT LOCATION PLAN



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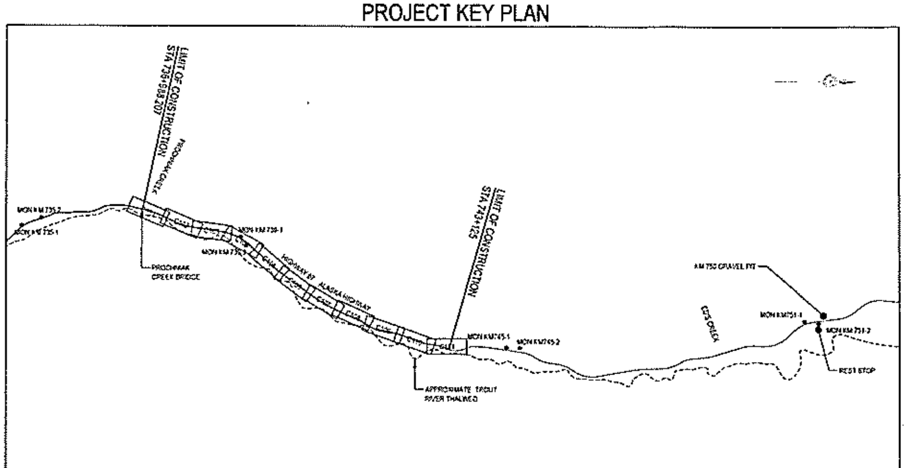
PROJECT KEY PLAN



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DRAWING INDEX

DRAWING	DESCRIPTION
C000	COVER PAGE
C001	PROJECT LOCATION PLAN, PROJECT KEY PLAN, DRAWING INDEX, SURVEY CONTROL MONUMENTS, AND LEGEND
C101 TO C111	PLAN / PROFILE
C201 TO C206	DRAINAGE AND ASSOCIATED ROAD DETAILS
C301 TO C305	TYPICAL SECTIONS
XS01 TO XS24	CROSS SECTIONS
XXXX TO XXXX	SUGGESTED TRAFFIC DETOUR AND CONSTRUCTION STAGING PLANS
XXXX	MASS HAUL DIAGRAM

SURVEY CONTROL MONUMENTS

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
MON KM735-1	6568602.579	330267.344	658.712	CONTROL MONUMENT
MON KM735-2	6568945.927	330124.426	646.882	CONTROL MONUMENT
MON KM739-1	6572519.717	330402.262	611.799	CONTROL MONUMENT
MON KM739-2	6572413.969	330615.531	608.394	CONTROL MONUMENT
MON KM745-1	6577273.411	332448.780	563.582	CONTROL MONUMENT
MON KM745-2	6577508.475	332455.897	563.608	CONTROL MONUMENT
MON KM751-1	6582812.285	331979.540	563.350	CONTROL MONUMENT
MON KM751-2	6582862.531	332014.145	563.051	CONTROL MONUMENT

VERIFY MONUMENT COORDINATES PRIOR TO CONSTRUCTION

NOTES:
1. ELEVATIONS ARE GEODETIC AND DERIVED FROM DUAL FREQUENCY CARRIER PHASE GPS OBSERVATIONS PROCESSED USING PWGSC CONTROL MONUMENTS
2. COORDINATE SYSTEM: UTM NAD 83 ZONE 10
3. SURVEYING PROVIDED BY APEX SURVEYING, OCTOBER 2013 AND JULY 2014
4. ADDITIONAL TOPOGRAPHIC DATA (USED IN LIMITED AREAS BEYOND TREELINE) PREPARED BY NORTHWESTEL / YUKON ENGINEERING SERVICES - APRIL 2009
5. ORTHOPHOTOS TAKEN JUNE 12, 2001

LEGEND

LINETYPE (EXISTING)	LINETYPE (PROPOSED)
CULVERTS	CULVERTS
TOP OF BANK	HIGHWAY CONTROL LINE
HIGHWAY CONTROL LINE	LIMIT OF GRADING / LIMIT OF CUT
CONCRETE BARRIER	CLEARING & GRUBBING
1.0 m CONTOUR	EDGE OF BST
5.0 m CONTOUR	SIGN
EDGE OF WATER	DECOMMISSIONED HIGHWAY (PULVERIZE AND HYDROSEED)
EDGE OF BST	CUT SLOPE STABILIZATION MATERIAL
EDGE OF GRAVEL	SPECIALTY EMBANKMENT MATERIAL
EDGE OF SHOULDER	
FIBER OPTIC	
TREE LINE	
BUSH LINE	
ROAD SIGN	
UTILITY POLE	
GUY WIRE	
BOREHOLE	

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

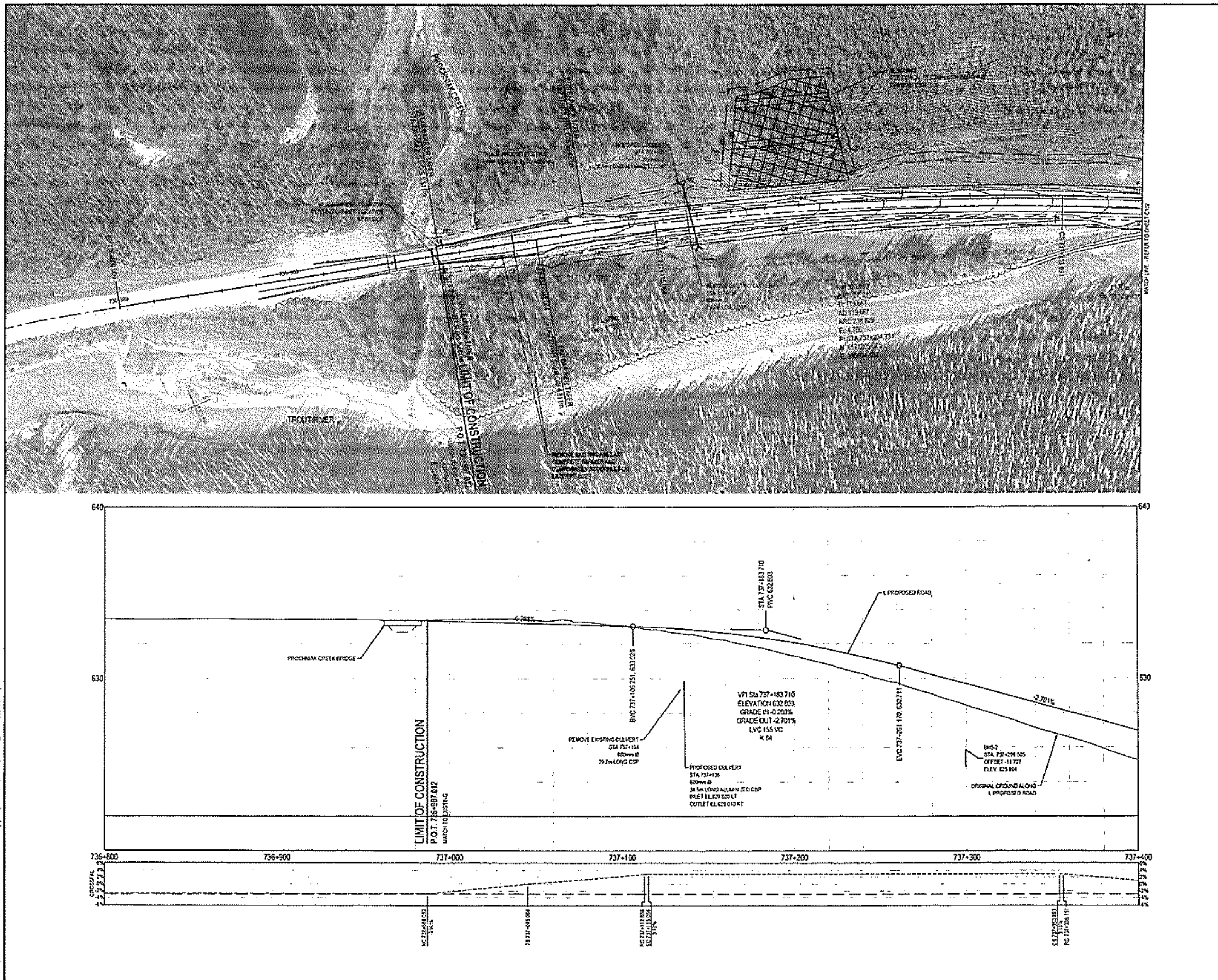
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G.WILANS
A.HORWOOD / S.MATSUDA
A.DRIPWELL
A.TAHERI
PUBLIC WORKS GOVERNMENT SERVICES CANADA

PROJECT LOCATION PLAN, PROJECT KEY PLAN, DRAWING INDEX, SURVEY MONUMENTS AND LEGEND

R.017173.701 | C001 | 0



Government of Canada / Gouvernement du Canada

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

GENERAL NOTES
1. DIMENSIONS, COORDINATES, ELEVATIONS ARE SHOWN IN METRES UNLESS NOTED
2. PROFILE DRAWN AT 10× VERTICAL EXAGGERATION
3. LOCATION OF FIBRE OPTIC CABLE SUPPLIED BY NORTHWESTEL AS OF OCT 2013 AND IS APPROXIMATE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING EXACT LOCATION PRIOR TO CONSTRUCTION
4. UNLESS NOTED OTHERWISE, ALL EXISTING SIGNS AND POSTS WITHIN THE LIMITS OF WORK SHALL BE REMOVED AND STOCKPILED IN A LOCATION DIRECTED BY THE DEPARTMENTAL REPRESENTATIVE
5. SEE TABLE DRAWING C212 FOR CULVERT LAYOUT DETAILS
6. REFER TO GEOTECHNICAL DATA REPORT FOR BOREHOLE DETAILS
7. EXTENTS OF CUT SLOPE STABILIZATION MATERIAL AND SPECIALTY EMBANKMENT TO BE VERIFIED BY DEPARTMENTAL REPRESENTATIVE DURING CONSTRUCTION

PROFILE
TOP OF EX. BST
TOP OF PROP. BST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

0 10 1:1000 50m

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

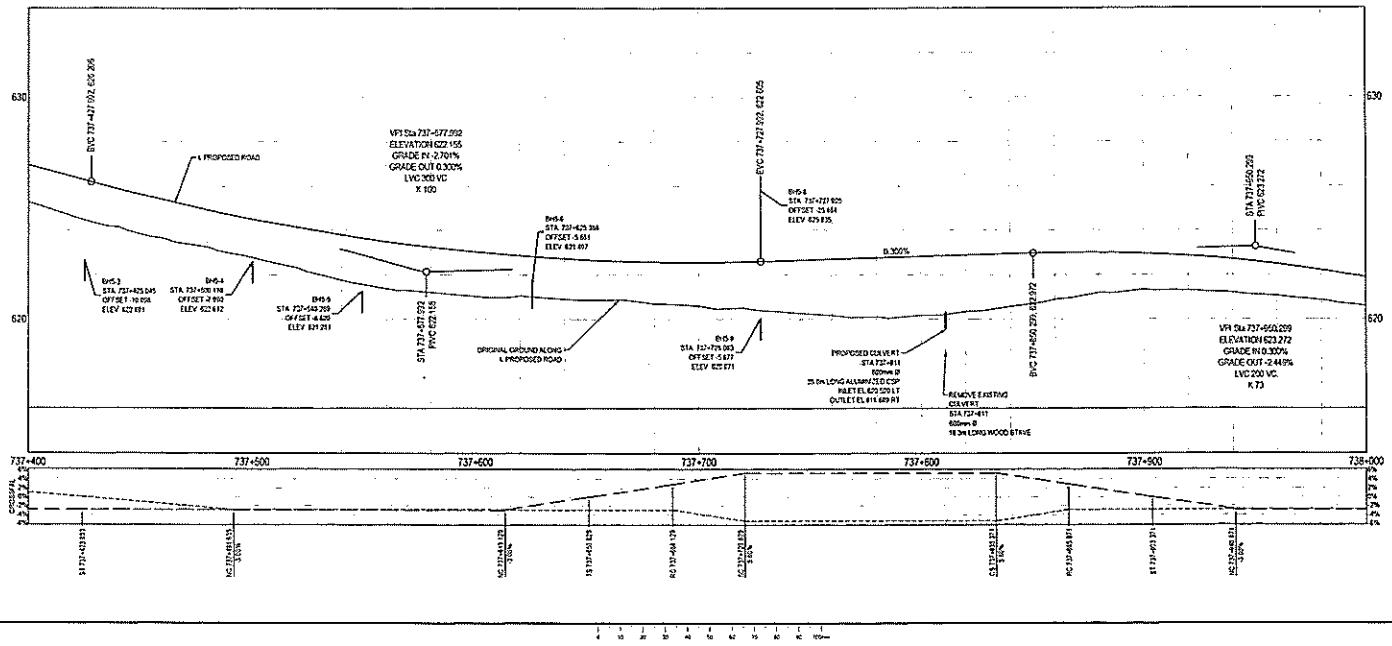
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G.WILKINS
A.HOPWOOD / S. MATSUDA
A.DEEPWELL
K. TANEJI
PUBLIC WORKS GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 737+000 TO 737+400

R.017173.701	C101	0



REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

GENERAL NOTES:
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PROFILE
TOP OF F.R. BST
TOP OF FRSP BST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

No.		
0	ISSUED FOR TENDER	15/05/01

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

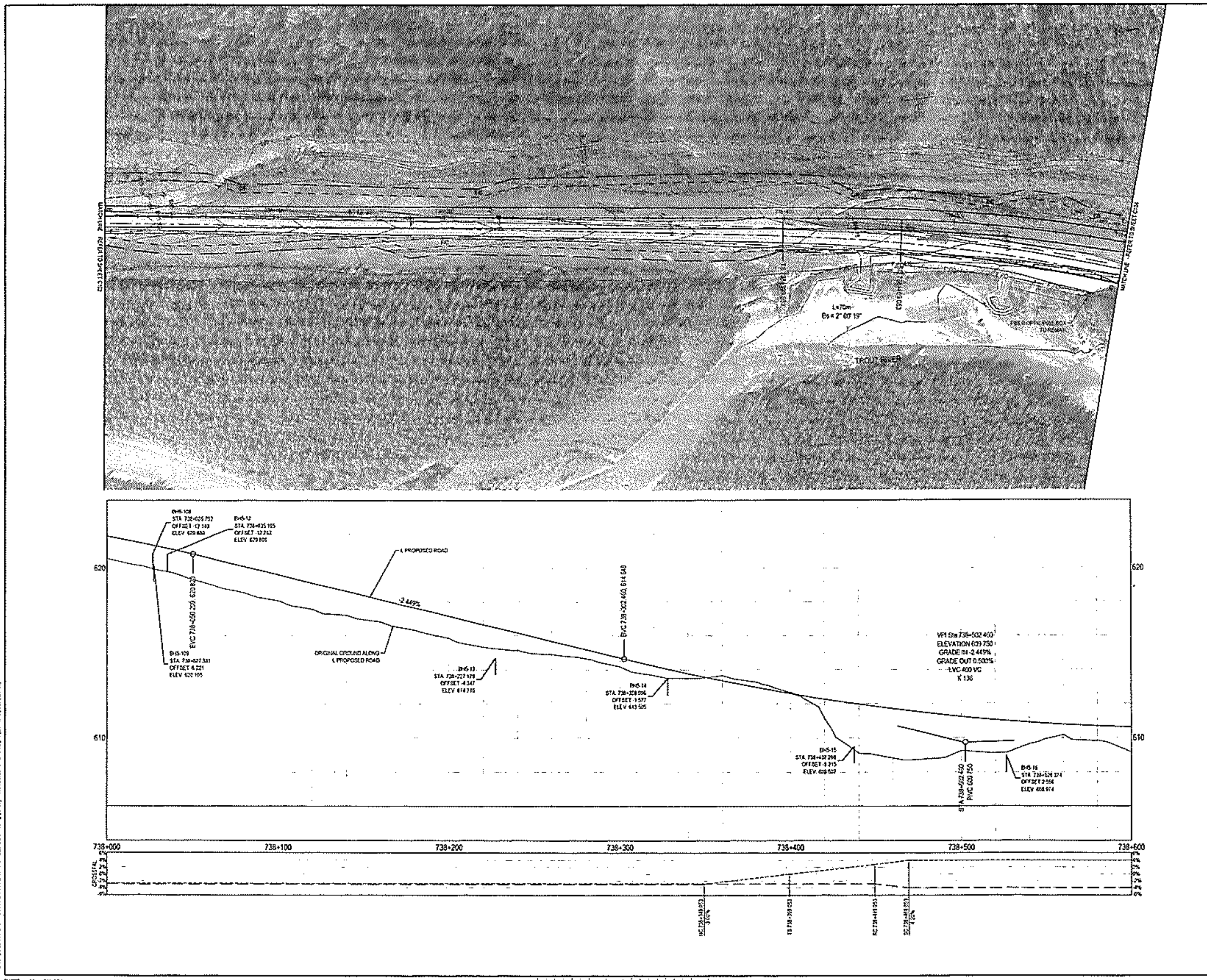
TETRA TECH EBA

KM 737 - 743.1 HIGHWAY REALIGNMENT ALASKA HIGHWAY, BC

G. RIKUNS
A.HOPWOOD / S. MATSUDA
A. DEEPWELL
A. TAMEN
PUBLIC WORKS GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 737+400 TO 738+000

R.617173.701	C102	0



REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

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PROFILE
TOP OF EX. BST
TOP OF PROP. BST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

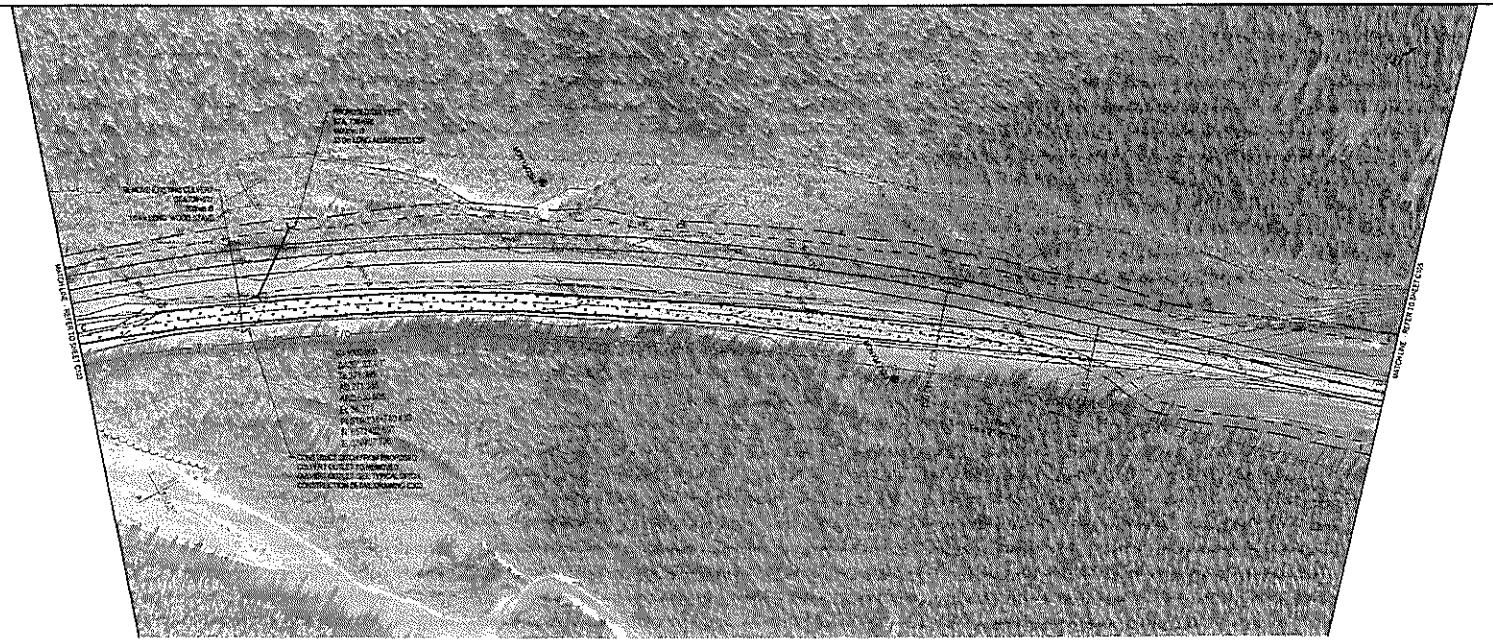
TETRA TECH EBA

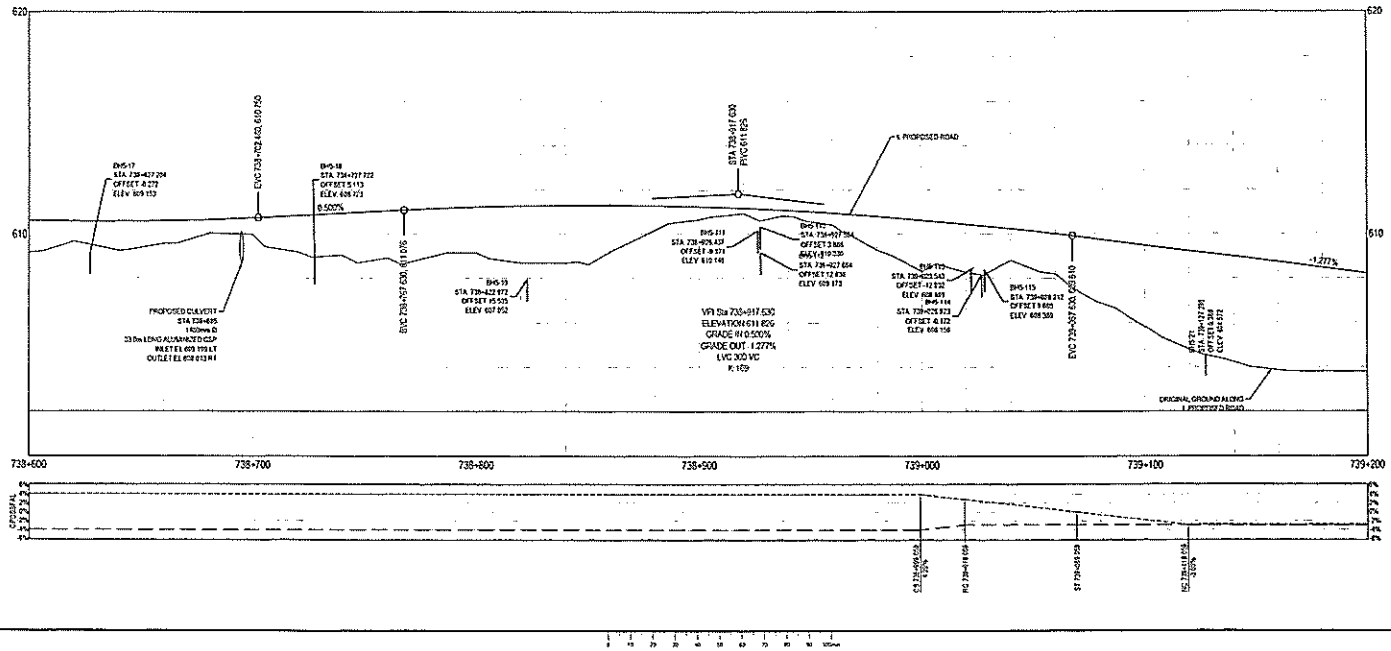
KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

PUBLIC WORKS GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 738+000 TO 738+600

R.017173.701	C103	0





REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Region de l'Ouest

ISSUED FOR TENDER

GENERAL NOTES
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PROFILE
TOP OF EX. BST
TOP OF PROP. BST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

0 10 1:1000 50m

#		
A	ORIGINAL TENDER SUBMISSION	11/10/27

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

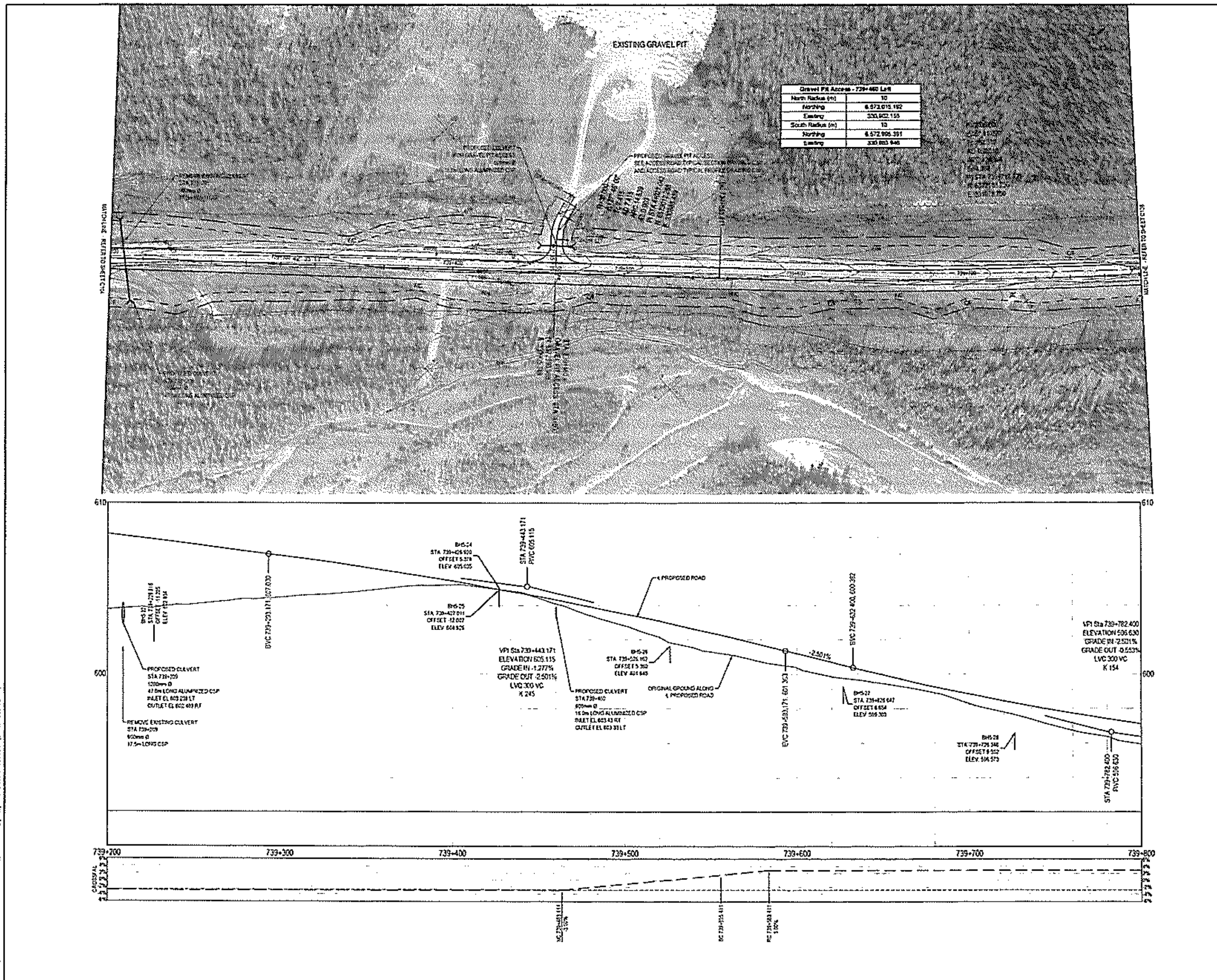
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G. WILKINS
A. HOPWOOD / S. MATSUDA
A. DEEPWELL
A. TAMEN
PUBLIC WORKS GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 738+600 TO 739+200

R.017173.701	C104	0



ISSUED FOR TENDER

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'Ouest

GENERAL NOTES
1. DIMENSIONS, COORDINATES, ELEVATIONS ARE SHOWN IN METRES UNLESS NOTED
2. PROFILE DRAWN AT 10x VERTICAL EXAGGERATION
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5. SEE TABLE DRAWING C212 FOR CULVERT LAYOUT DETAILS.
6. REFER TO GEOTECHNICAL DATA REPORT FOR BOREHOLE DETAILS.
7. EXTENTS OF CUT SLOPE STABILIZATION MATERIAL AND SPECIALTY EMBANKMENT TO BE VERIFIED BY DEPARTMENTAL REPRESENTATIVE DURING CONSTRUCTION

PROFILE
TOP OF EX BST
TOP OF PROP BST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

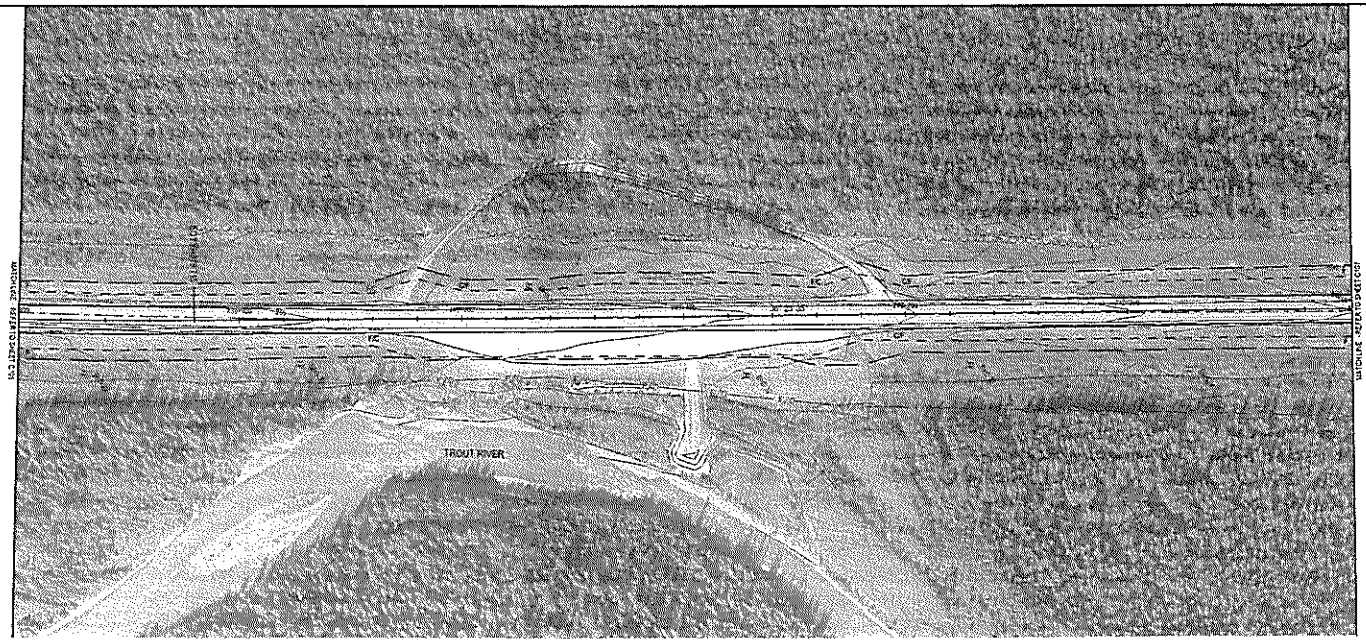
TETRA TECH EBA

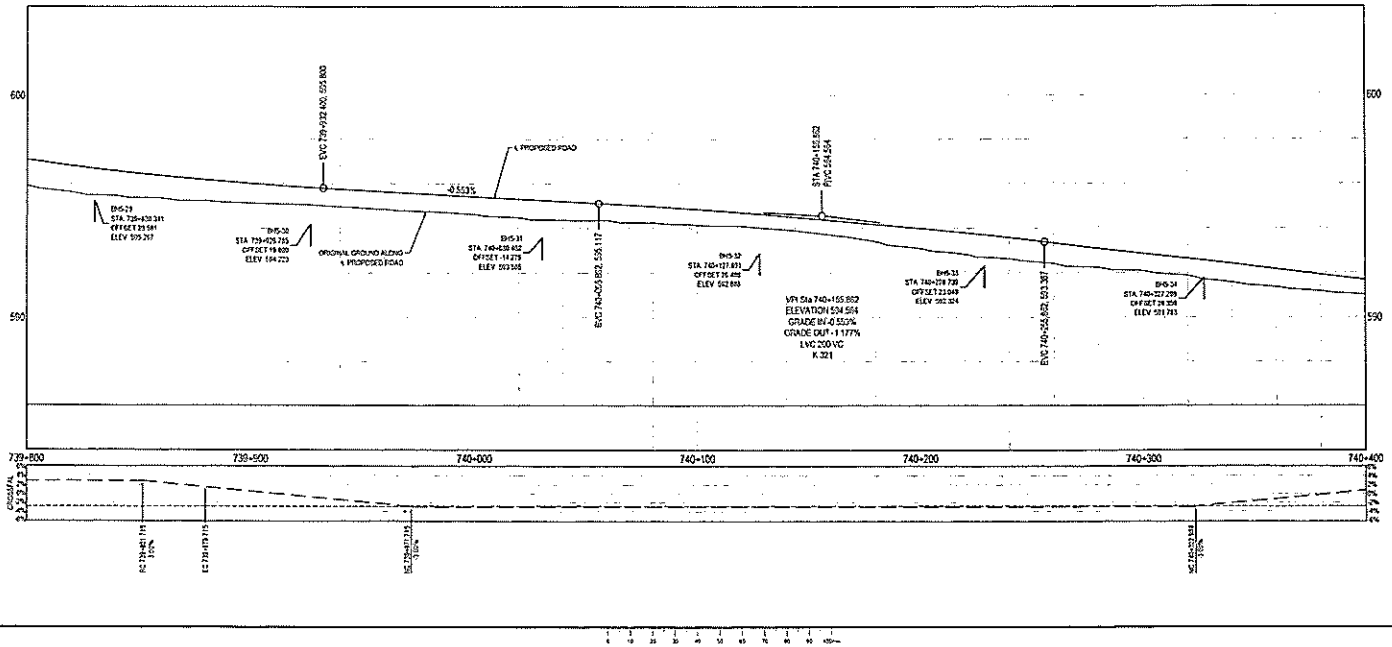
KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

PUBLIC WORKS GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 739+200 TO 739+800

R.017173.701	C105	0





REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

GENERAL NOTES

1. DIMENSIONS, COORDINATES, ELEVATIONS ARE SHOWN IN METRES UNLESS NOTED
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PROFILE
TOP OF EX. EST
TOP OF PROP. EST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

0 10 1:1000 50m

0	ORIGINAL ISSUED SUBMISSION	15/10/27

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

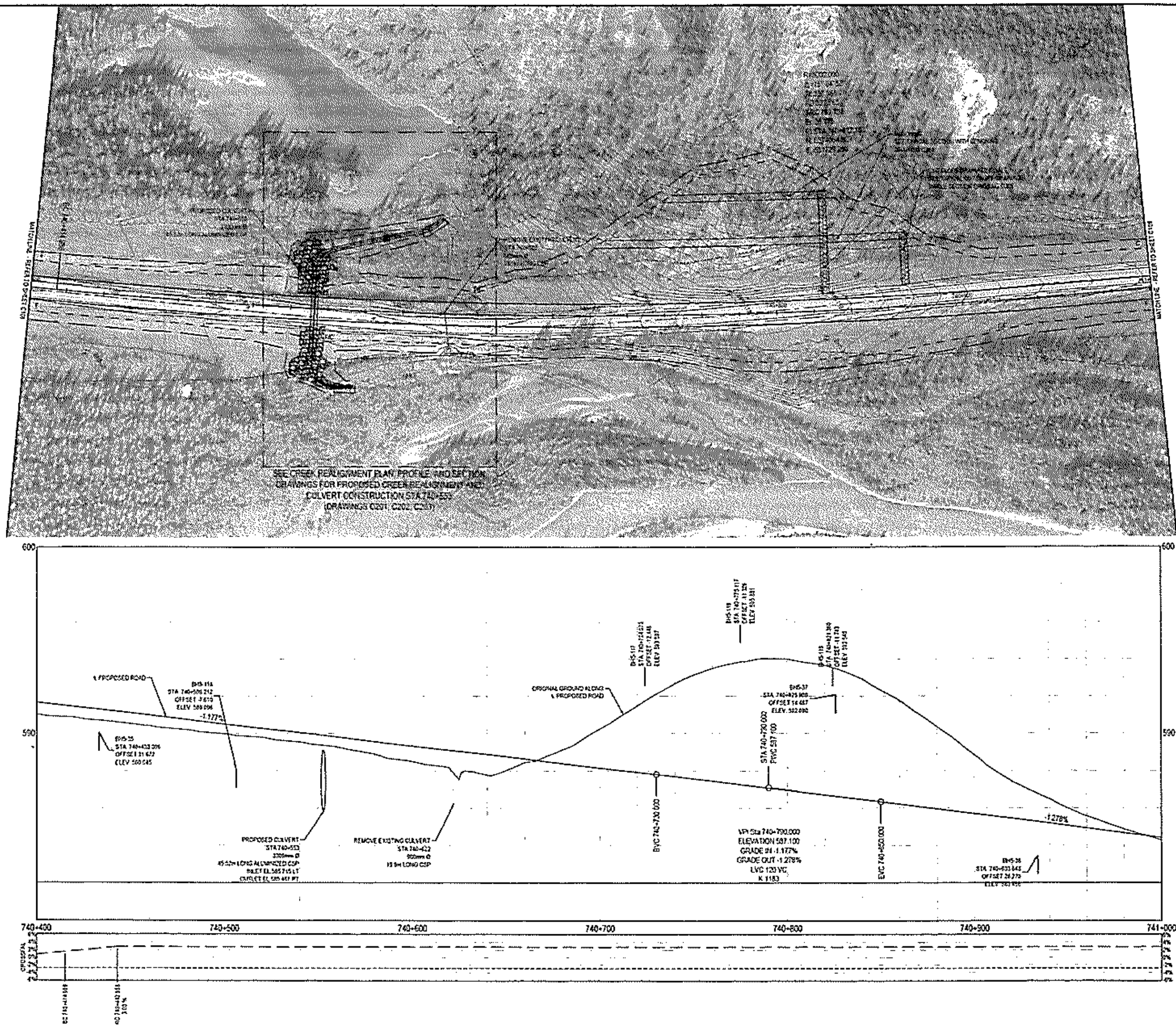
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G. WILKINS
A. HOPWOOD / S. MATSUDA
A. DEEPWELL
A. TAHERI
PUBLIC WORKS GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 739+800 TO 740+400

R.017173.701	C106	0



Real Property Services
Western Region
Services Immobiliers
Région de l'ouest

ISSUED FOR TENDER

GENERAL NOTES.
1. DIMENSIONS, COORDINATES, ELEVATIONS ARE SHOWN IN METRES UNLESS NOTED
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PROFILE
TOP OF EX. BST
TOP OF PROP. BST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

0 10 1:1000 50m

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

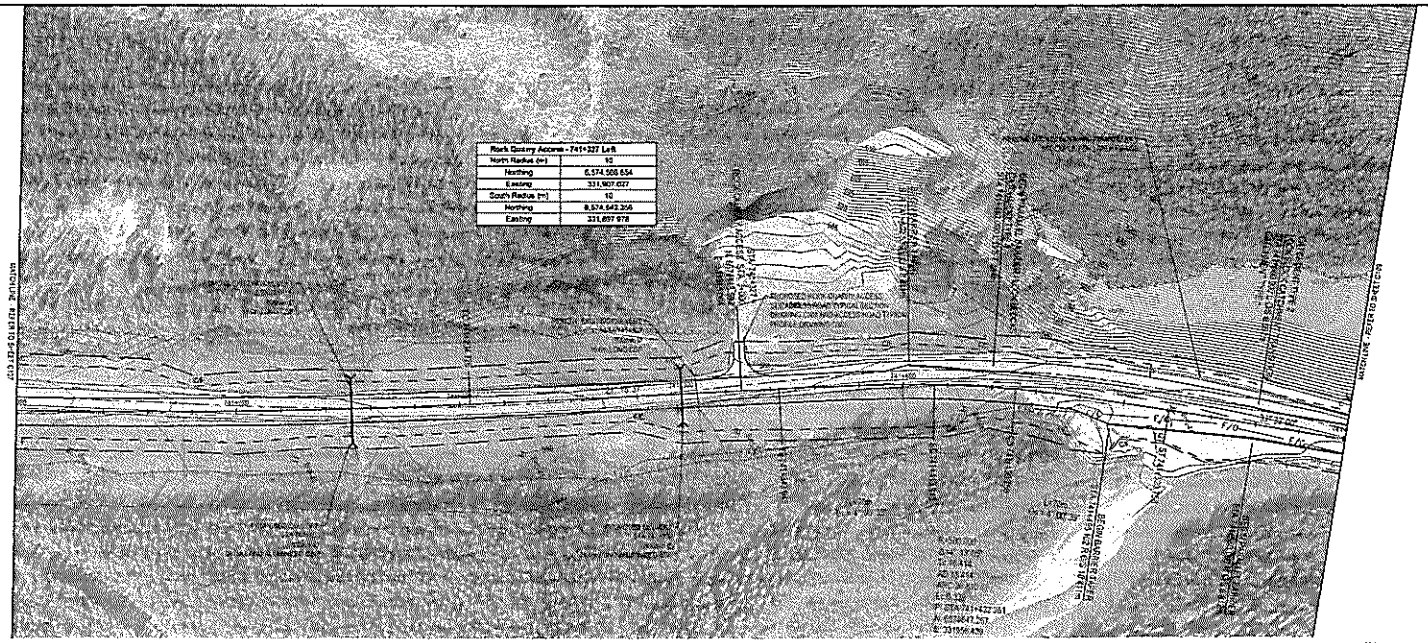
TETRA TECH EBA

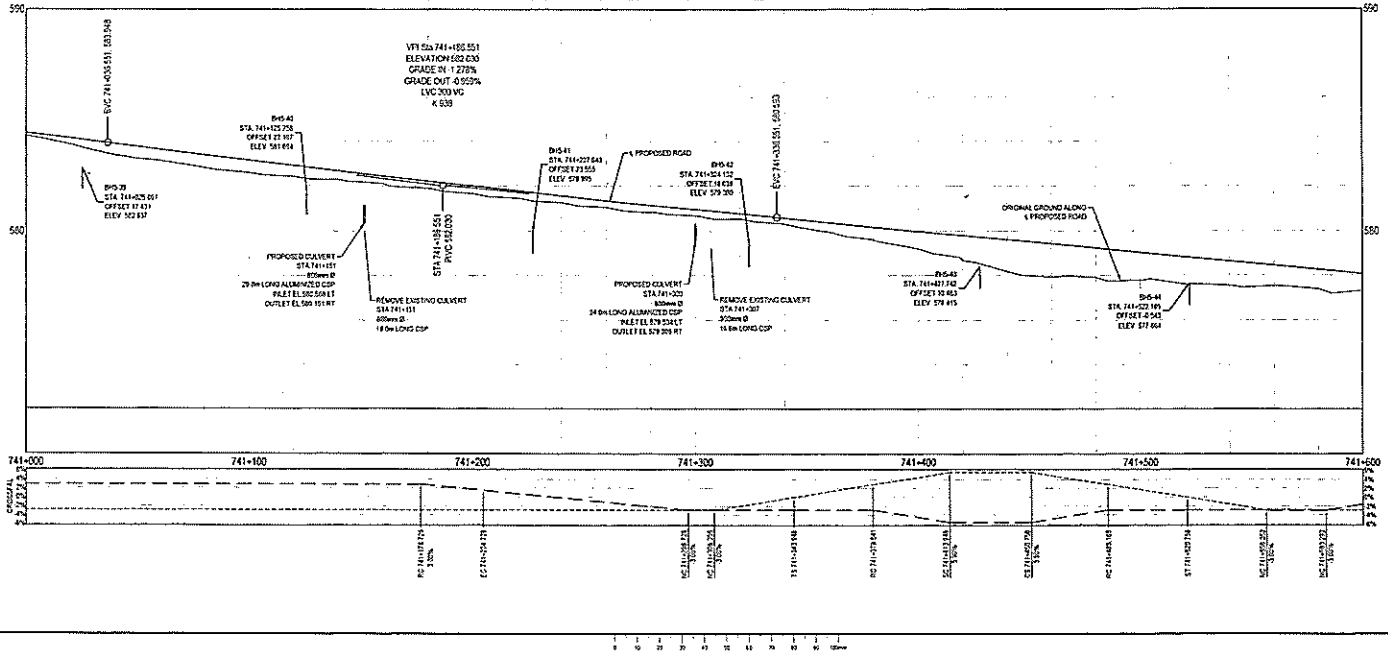
KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G.WILKINS
A.HORWOOD / S. MATSUDA
A.DEEPWELL
A.TAHOS
PUBLIC WORKS GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 740+400 TO 741+000

R.017173.701	C107	0





REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

GENERAL NOTES
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PROFILE
TOP OF EX BST
TOP OF PROP BST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

0 10 1:1000 50m

#		
0	ORIGINAL ISSUE SUBMISSION	15/MAY

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

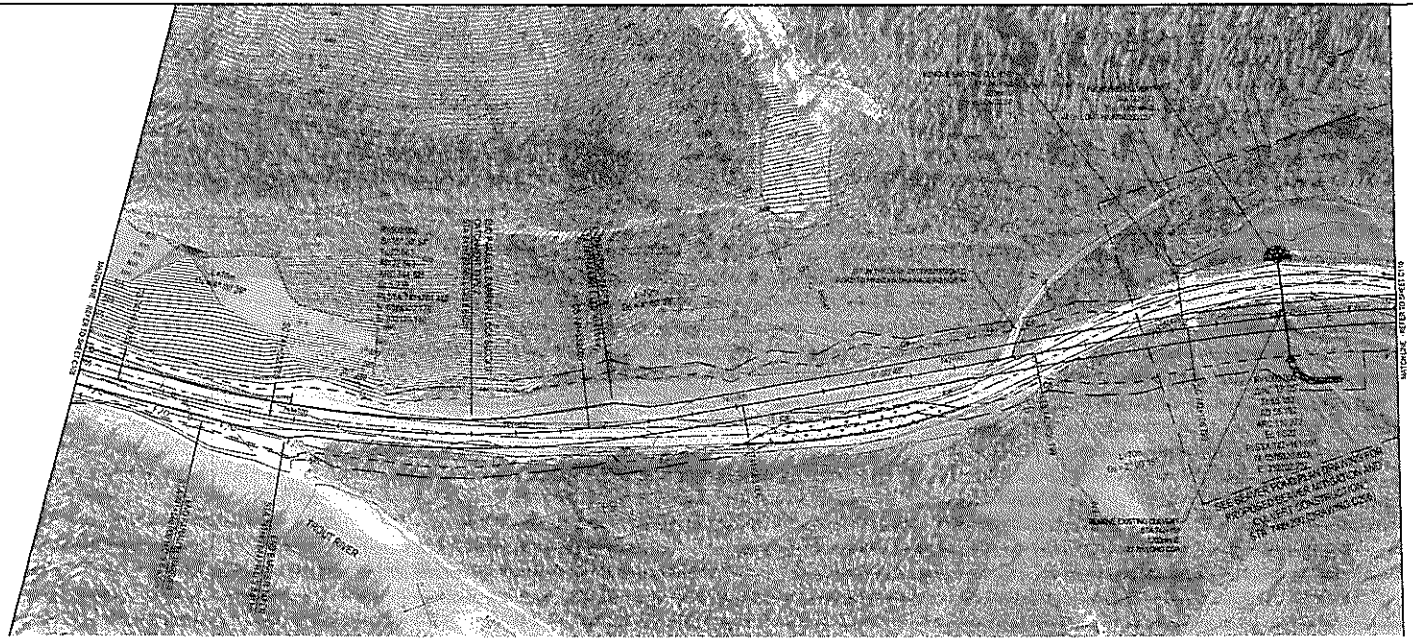
TETRA TECH EBA

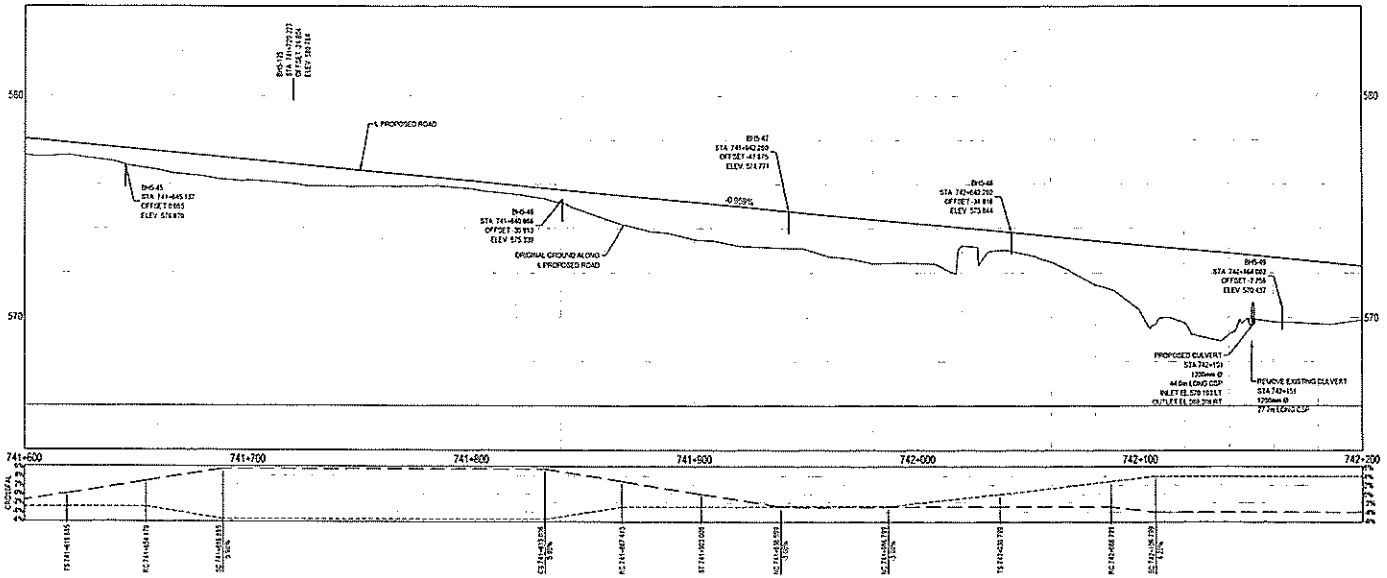
KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G. THILWIS
A. HORWOOD / E. WATSUDA
A. DEEPWELL
A. TAHIN
PUBLIC WORKS GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 741+000 TO 741+600

R.017573.701	C108	0





REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

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PROFILE
TOP OF EX. RST
TOP OF PROP. RST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

0 10 1:1000 50m

F	ORIGINAL TENDER SUBMISSION	13/05/27

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

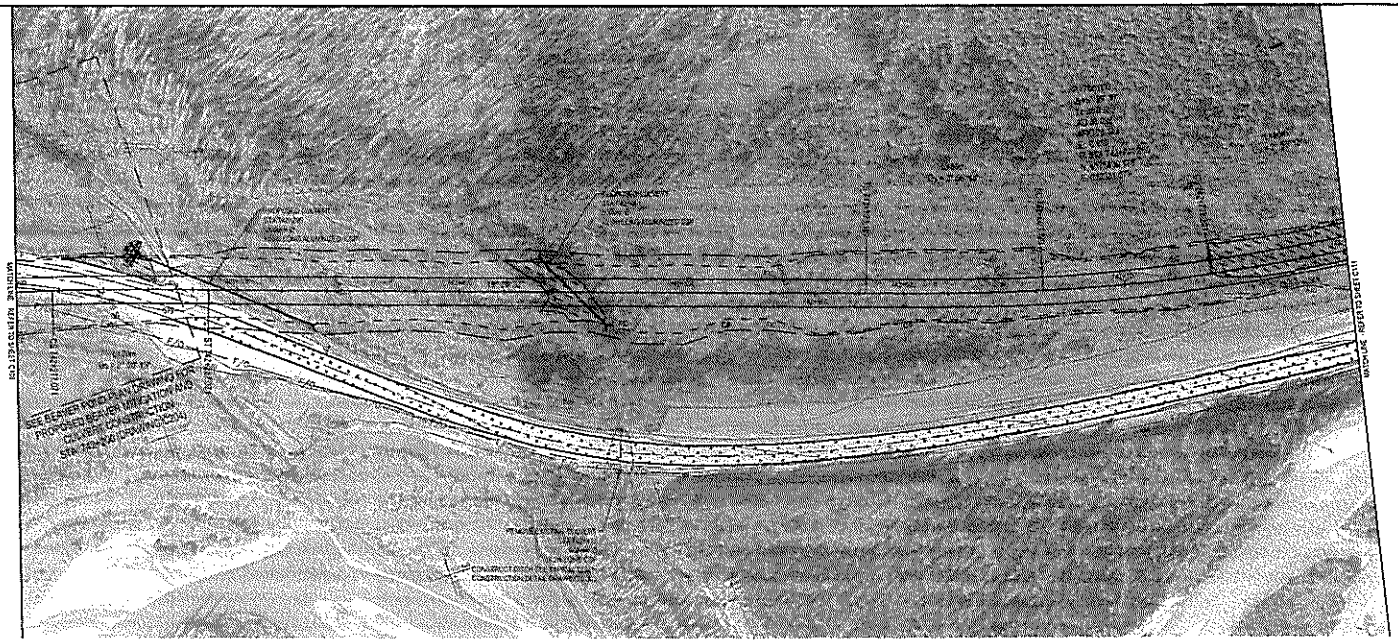
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

D. WILKINS	
B. NORWOOD / S. MATSUDA	
A. DEERWELL	
A. TAHERI	
PUBLIC WORKS GOVERNMENT SERVICES CANADA	

PLAN / PROFILE
STA 741+600 TO 742+200

R.017173.701	C109	0



REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

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PROFILE:
TOP OF EX EST
TOP OF PROP EST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

0 10 1:1000 50m

0	ORIGINAL TENDER SUBMISSION	13/12/27

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

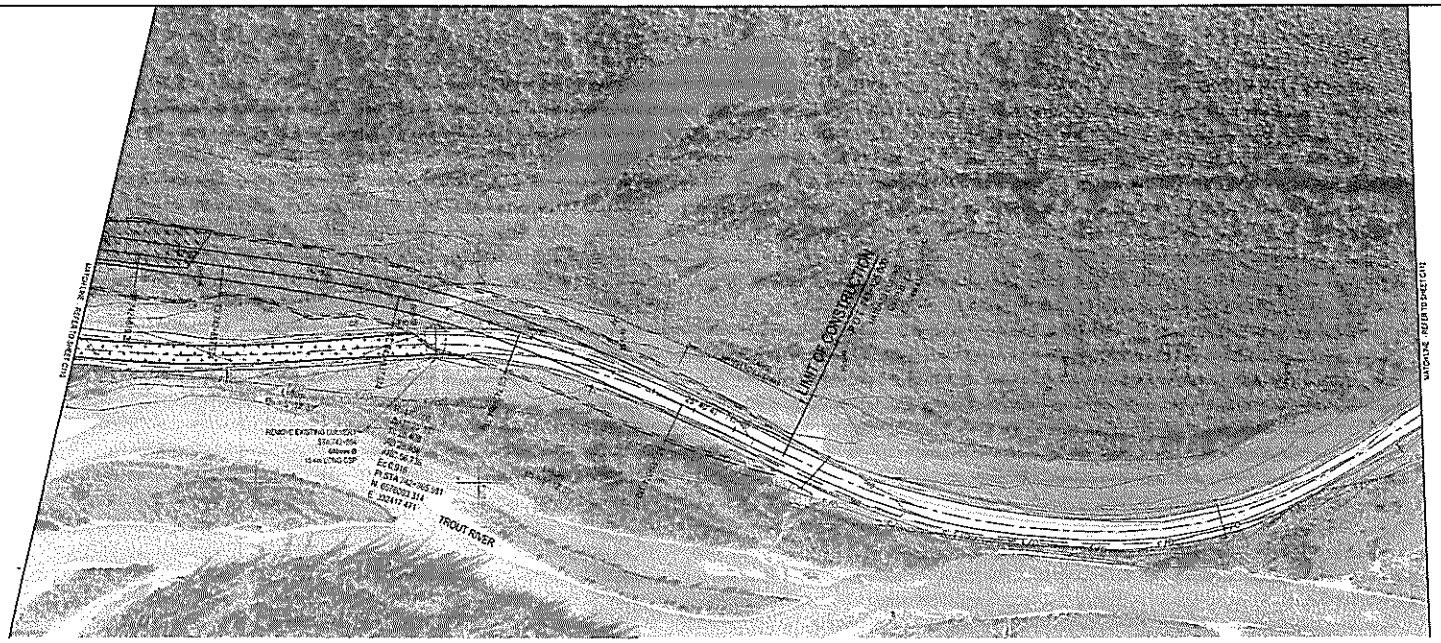
TETRA TECH EBA

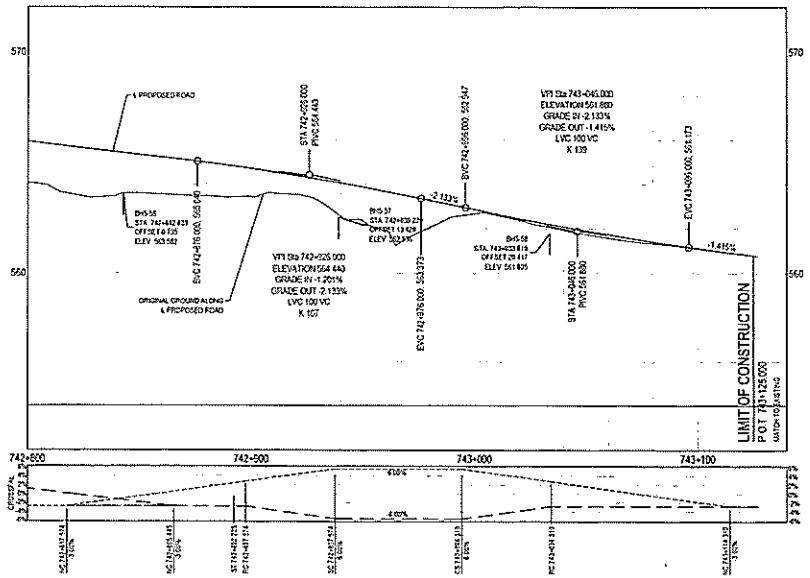
KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G. HALPAS
K.NORWOOD / S. MATSUDA
A.DEEPWELL
A. TAHEN
PUBLIC WORKS &GOVERNMENT SERVICES CANADA

PLAN / PROFILE
STA 742+200 TO 742+800

R.017173.701	C110	0





REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

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PROFILE
TOP OF EX BST
TOP OF PROP BST

SUPERELEVATION
RIGHT HAND SIDE
LEFT HAND SIDE

DESIGN SPEED 100 km/h

0 10 1:1000 50m

0	ORIGINAL ISSUE FOR SUBMISSION	13/03/27

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

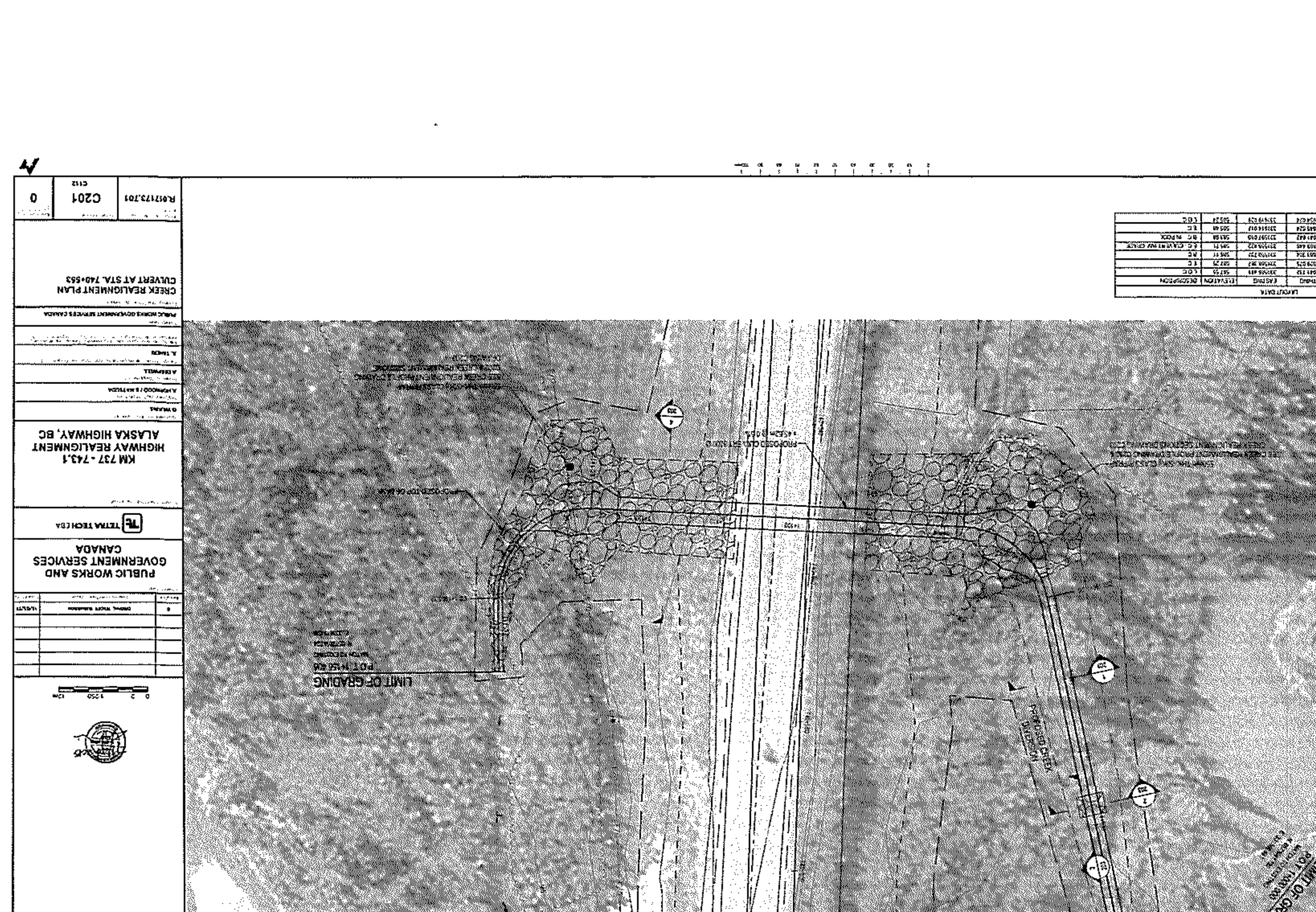
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

D BRUNG	
A HERWOOD / B. MATSUDA	
A DEPWELL	
A. TAVEN	
PUBLIC WORKS GOVERNMENT SERVICES CANADA	

PLAN / PROFILE
STA 742+800 TO 743+400

R.017173.701	C111	0



LAYOUT DATA					
STATION	OFFSET	NORTHING	EASTING	ELEVATION	DESCRIPTION
1+000.001	0.0	6573841.732	331556.481	587.55	L.O.C.
1+012.640	0.0	6573829.075	331568.357	587.25	T.C.
1+064.252	0.0	6573863.304	331550.732	586.11	P.C.
1+076.864	0.0	6573869.446	331555.622	585.71	E.C. - CULVERT INV. GRADE
1+127.610	0.0	6573841.647	331597.010	583.68	B.C. - IN ROCK
1+146.539	0.0	6573845.524	331614.917	585.48	T.C.
1+156.406	0.0	6573854.624	331619.629	585.24	L.O.C.

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

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0 2 1:250 12m

0	ORIGINAL TENDER SUBMISSION	15/03/31

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

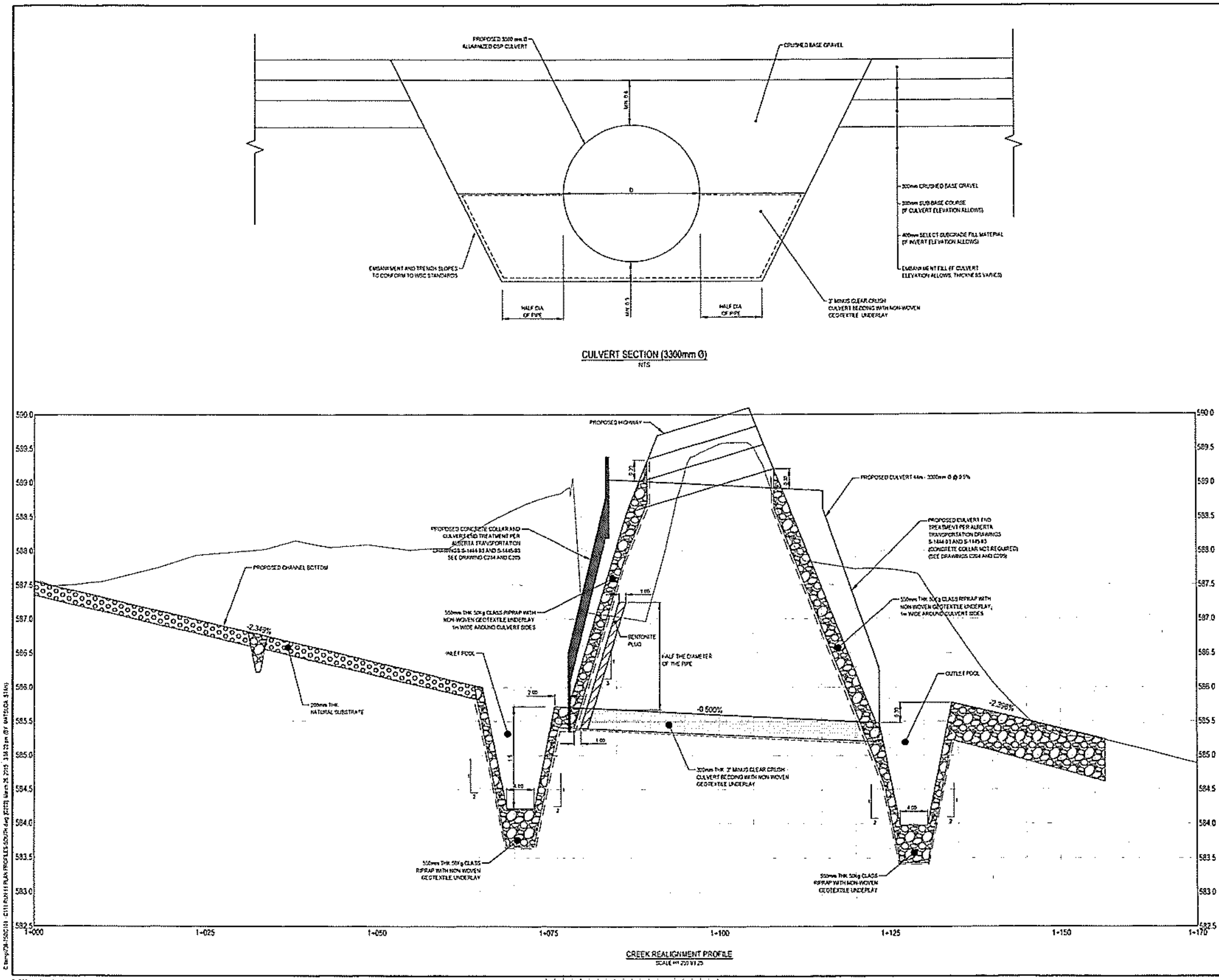
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G. WILKINS
A. HOPWOOD / S. MATSUDA
A. DEEPWELL
A. TAHOIN
PUBLIC WORKS GOVERNMENT SERVICES CANADA

CREEK REALIGNMENT PLAN
CULVERT AT STA. 740+553

R.017173.701	C201 (C112)	0



REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'Ouest

ISSUED FOR TENDER

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PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

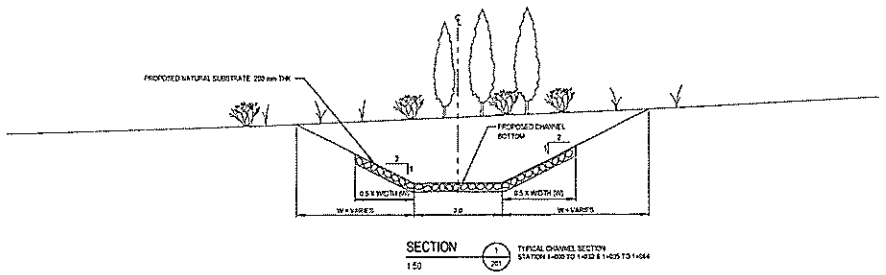
TETRA TECH EBA

KM 737 - 743.1 HIGHWAY REALIGNMENT ALASKA HIGHWAY, BC

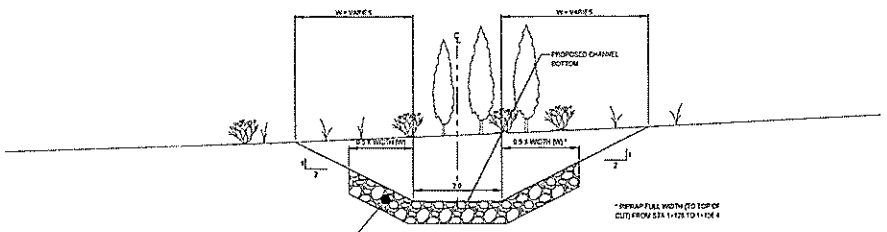
G. WILKINS
A. NORWOOD / S. MATSUDA
A. DEDWELL
A. TAHERI
PUBLIC WORKS GOVERNMENT SERVICES CANADA

CREEK REALIGNMENT PROFILE CULVERT AT STA. 740+553

R.017173.701 | C202 | 0
C112

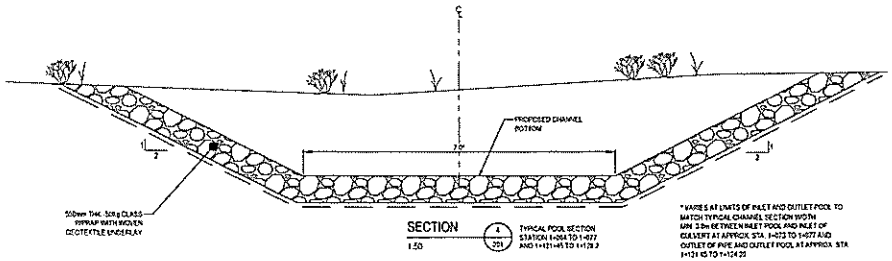


SECTION 1 / 201 — TYPICAL CHANNEL SECTION
1:50 — STATION 1+000 TO 1+403 & 1+425 TO 1+554



SECTION 2 / 201 — TYPICAL RIPRAP CHANNEL SECTION
1:50 — STA 1+000 TO 1+403, 1+432 TO 1+555, & 1+128 TO 1+155.4

SECTION 3 / 201 — TYPICAL ROCK CHANNEL SUPPORT
1:50



SECTION 4 / 201 — TYPICAL POOL SECTION
1:50 — STATION 1+064 TO 1+077 AND 1+121.65 TO 1+178.2

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

ISSUED FOR TENDER

GENERAL NOTES
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0 0.5 1.50 2.5m

0	ORIGINAL TENDER SUBMISSION	19/MAY/21

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

D. WILKINS
A. NORWOOD / S. MATSUDA
A. DESPAWELL
A. TANGU
PUBLIC WORKS GOVERNMENT SERVICES CANADA

CREEK REALIGNMENT SECTIONS
CULVERT AT STA. 740+553

R.017173.701	C203 C112	0

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'Ouest

ISSUED FOR TENDER

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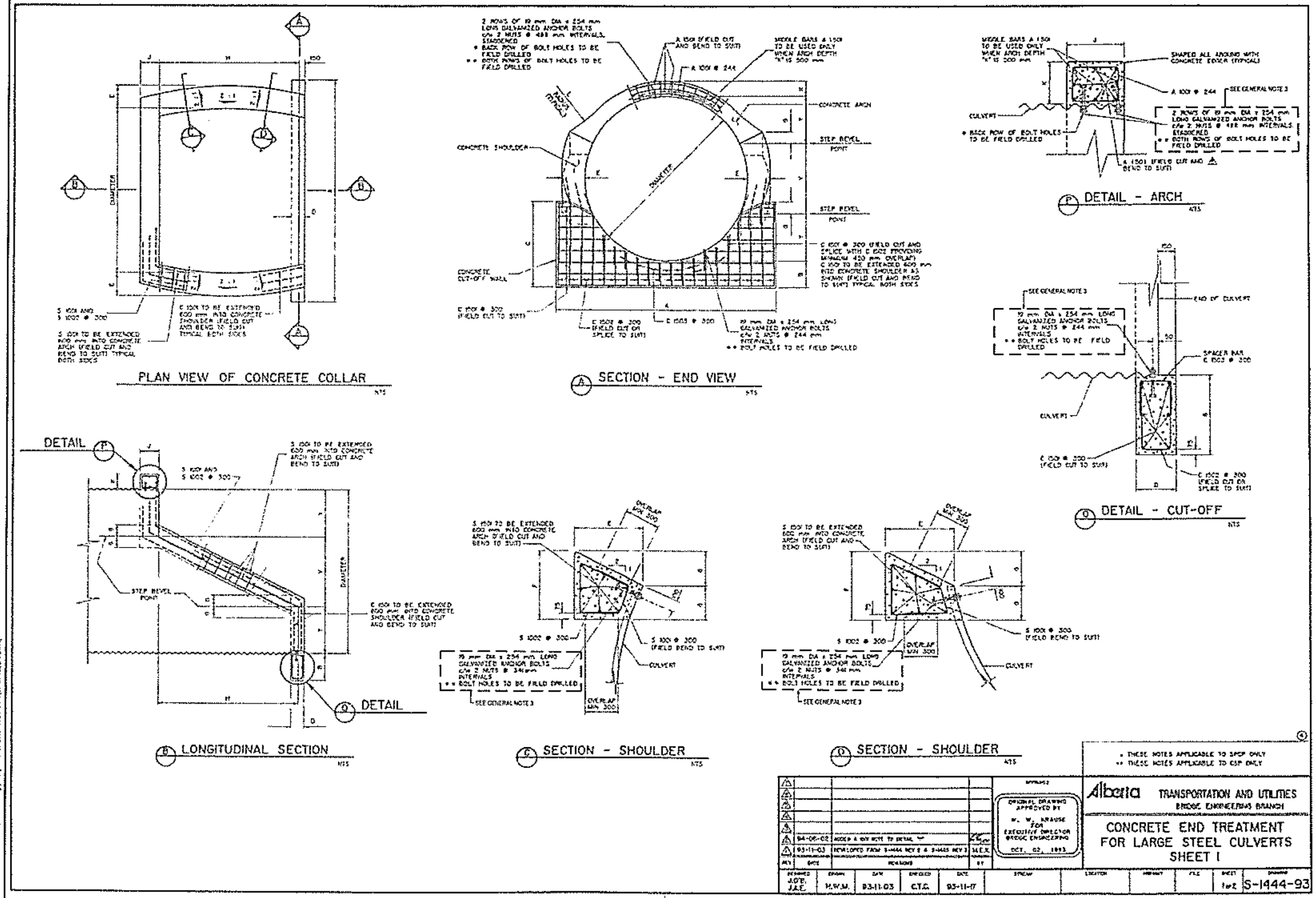
3. CONTRACTOR MAY ELECT TO USE ALTERNATIVE ANCHOR BOLT. REFER TO SPECIFICATION SECTION 03 30 00 - CONCRETE CULVERT END TREATMENT FOR DETAILS.



0 ORIGINAL TENDER SUBMISSION

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

PUBLIC WORKS GOVERNMENT SERVICES CANADA

CONCRETE END TREATMENT FOR LARGE STEEL CULVERTS
SHEET 1 OF 2

R.017173.701	C204 C112	0

BAR LISTS FOR PIPE DIAMETERS 2 700 mm AND 2 740 mm

DIA	MARK	SIZE	NO.	TYPE	LENGTH (mm)	MASS (kg)
2 700 mm CSP	A 1001	10	14	A	1 480	18
	A 1501	15	6	STR	3 300	31
	C 1501	15	4	STR	12 000	75
	C 1502	15	15	D	2 050	48
	C 1503	15	15	E	900	21
	S 1001	10	30	C	995	19
	S 1002	10	30	B	1 075	24
	S 1501	15	14	STR	5 000	110
					TOTAL	344
2 740 mm SPCSP	A 1001	10	15	A	1 480	17
	A 1501	15	6	STR	3 500	33
	C 1501	15	4	STR	12 000	75
	C 1502	15	15	D	2 030	48
	C 1503	15	15	E	900	21
	S 1001	10	30	C	865	18
	S 1002	10	30	B	1 005	24
	S 1501	15	14	STR	4 800	106
					TOTAL	343

BAR LISTS FOR PIPE DIAMETERS FROM 3 000 mm TO 4 610 mm

DIA	MARK	SIZE	NO.	TYPE	LENGTH (mm)	MASS (kg)
3 000 mm CSP	A 1001	10	16	A	1 650	21
	A 1501	15	6	STR	4 000	38
	C 1501	15	6	STR	12 000	94
	C 1502	15	16	D	2 250	57
	C 1503	15	16	E	900	23
	S 1001	10	37	C	995	23
	S 1002	10	32	B	1 270	33
	S 1501	15	14	STR	6 200	134
					TOTAL	423
3 050 mm SPCSP	A 1001	10	17	A	1 650	22
	A 1501	15	6	STR	4 250	41
	C 1501	15	6	STR	12 000	113
	C 1502	15	16	D	2 250	57
	C 1503	15	16	E	900	23
	S 1001	10	30	C	995	23
	S 1002	10	30	B	1 320	31
	S 1501	15	14	STR	4 600	106
					TOTAL	418
3 300 mm CSP	A 1001	10	16	A	1 650	21
	A 1501	15	6	STR	4 500	39
	C 1501	15	6	STR	12 000	113
	C 1502	15	17	D	2 250	60
	C 1503	15	17	E	900	24
	S 1001	10	36	C	995	24
	S 1002	10	36	B	1 325	37
	S 1501	15	14	STR	5 000	150
					TOTAL	452
3 360 mm SPCSP	A 1001	10	18	A	1 650	25
	A 1501	15	6	STR	4 900	46
	C 1501	15	6	STR	12 000	113
	C 1502	15	17	D	2 250	60
	C 1503	15	17	E	900	24
	S 1001	10	30	C	995	23
	S 1002	10	30	B	1 220	31
	S 1501	15	14	STR	4 800	106
					TOTAL	428
3 600 mm CSP	A 1001	10	18	A	1 660	24
	A 1501	15	6	STR	4 500	42
	C 1501	15	6	STR	12 000	113
	C 1502	15	18	D	2 250	64
	C 1503	15	18	E	900	25
	S 1001	10	38	C	995	30
	S 1002	10	38	B	1 220	36
	S 1501	15	14	STR	6 200	135
					TOTAL	473
3 670 mm SPCSP	A 1001	10	21	A	1 620	27
	A 1501	15	6	STR	5 400	51
	C 1501	15	7	STR	12 000	132
	C 1502	15	18	D	2 400	64
	C 1503	15	18	E	900	25
	S 1001	10	30	C	975	23
	S 1002	10	30	B	1 320	31
	S 1501	15	14	STR	4 800	105
					TOTAL	460
3 990 mm SPCSP	A 1001	10	23	A	1 640	30
	A 1501	15	6	STR	5 900	56
	C 1501	15	8	STR	12 000	151
	C 1502	15	19	D	2 250	67
	C 1503	15	19	E	900	27
	S 1001	10	30	C	995	23
	S 1002	10	30	B	1 370	31
	S 1501	15	14	STR	4 800	106
					TOTAL	491
4 300 mm SPCSP	A 1001	10	25	A	1 620	33
	A 1501	15	6	STR	6 400	60
	C 1501	15	9	STR	12 000	170
	C 1502	15	20	D	2 250	71
	C 1503	15	20	E	900	28
	S 1001	10	30	C	995	23
	S 1002	10	30	B	1 320	24
	S 1501	15	14	STR	4 800	106
					TOTAL	522
4 610 mm SPCSP	A 1001	10	27	A	1 640	36
	A 1501	15	6	STR	6 900	65
	C 1501	15	10	STR	12 000	188
	C 1502	15	21	D	2 250	74
	C 1503	15	21	E	900	30
	S 1001	10	30	C	995	23
	S 1002	10	30	B	1 320	31
	S 1501	15	14	STR	4 800	106
					TOTAL	553

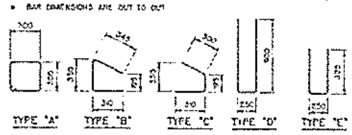
BAR LISTS FOR PIPE DIAMETERS FROM 4 920 mm TO 6 160 mm

DIA	MARK	SIZE	NO.	TYPE	LENGTH (mm)	MASS (kg)
4 920 mm SPCSP	A 1001	10	25	A	1 880	37
	A 1501	15	6	STR	6 400	60
	C 1501	15	12	STR	12 000	226
	C 1502	15	24	D	2 950	111
	C 1503	15	24	E	1 000	38
	S 1001	10	48	C	1 195	45
	S 1002	10	48	B	1 940	73
	S 1501	15	14	STR	7 500	165
					TOTAL	770
5 230 mm SPCSP	A 1001	10	27	A	1 880	40
	A 1501	15	6	STR	6 900	87
	C 1501	15	13	STR	12 000	245
	C 1502	15	25	D	2 950	116
	C 1503	15	25	E	1 000	39
	S 1001	10	48	C	1 195	45
	S 1002	10	48	B	△ 1 940	73
	S 1501	15	14	STR	7 500	165
					TOTAL	810
5 540 mm SPCSP	A 1001	10	29	A	1 880	43
	A 1501	15	8	STR	7 400	93
	C 1501	15	14	STR	12 000	264
	C 1502	15	26	D	2 950	120
	C 1503	15	26	E	1 000	41
	S 1001	10	48	C	1 195	45
	S 1002	10	48	B	1 940	73
	S 1501	15	14	STR	7 500	165
					TOTAL	844
5 850 mm SPCSP	A 1001	10	28	A	1 880	41
	A 1501	15	8	STR	7 200	90
	C 1501	15	14	STR	12 000	264
	C 1502	15	27	D	2 950	125
	C 1503	15	27	E	1 000	42
	S 1001	10	56	C	1 195	53
	S 1002	10	56	B	1 940	85
	S 1501	15	14	STR	9 000	198
					TOTAL	898
6 160 mm SPCSP	A 1001	10	30	A	1 880	44
	A 1501	15	8	STR	7 700	97
	C 1501	15	15	STR	12 000	283
	C 1502	15	28	D	2 950	130
	C 1503	15	28	E	1 000	44
	S 1001	10	56	C	1 195	53
	S 1002	10	56	B	1 940	85
	S 1501	15	14	STR	9 000	198
					TOTAL	934

BAR TYPES FOR PIPE DIAMETERS 2 700 mm AND 2 740 mm

NTS

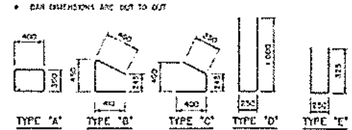
- BAR DIMENSIONS ARE OUT TO OUT



BAR TYPES FOR PIPE DIAMETERS FROM 3 000 mm TO 4 610 mm

NTS

- BAR DIMENSIONS ARE OUT TO OUT



DATA FOR STANDARD CONCRETE END TREATMENT

	DATA \ DIAMETER mm		2 700 CSP	2 740 SPCSP	3 000 CSP	3 050 SPCSP	3 300 CSP	3 360 SPCSP	3 600 CSP	3 670 SPCSP	3 990 SPCSP	4 300 SPCSP	4 610 SPCSP	4 920 SPCSP	5 230 SPCSP	5 540 SPCSP	5 850 SPCSP	6 160 SPCSP
CUT-OFF	WIDTH	A	4 300	4 240	4 500	4 650	4 800	4 810	5 100	5 170	5 490	5 600	6 110	6 820	7 220	7 540	7 850	8 160
	DEPTH - MIN.	B	600	600	700	700	700	700	700	700	700	700	700	1 000	1 000	1 000	1 000	1 000
	DEPTH - MAX.	C	1 250	1 305	1 500	1 610	1 500	1 725	1 600	1 920	2 040	2 233	2 390	2 334	2 401	2 646	2 496	2 651
	THICKNESS	D	350	350	350	350	350	350	350	350	350	350	350	450	450	450	450	450
SHOULDER	WIDTH	E	500	500	600	600	600	600	600	600	600	600	600	800	800	800	800	800
	DEPTH	F	500	500	600	600	600	600	600	600	600	600	600	800	800	800	800	800
		G	250	250	300	300	300	300	300	300	300	300	300	400	400	400	400	400
ARCH	WIDTH	J	400	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	DEPTH	K	400	400	400	400	400	400	400	400	400	400	400	500	500	500	500	500
	RADIUS	L	1 750	1 770	1 900	1 525	2 050	2 080	2 200	2 235	2 395	2 550	2 705	2 960	3 115	3 270	3 425	3 580
BEVEL	LENGTH	H	3 800	3 658	4 000	3 658	4 600	3 658	4 800	3 658	3 658	3 658	3 658	6 096	6 096	6 096	7 315	7 315
	CENTRE	V	1 900	1 830	2 000	1 830	2 300	1 830	2 400	1 830	1 830	1 830	1 830	3 048	3 048	3 048	3 658	3 658
	TOP & BOTTOM	Y	400	455	500	410	500	765	600	920	1 080	1 235	1 390	938	1 091	1 246	1 096	1 251
CONCRETE	CUT-OFF WALL (m³)		1.6	1.8	2.0	2.0	2.2	2.2	2.4	2.4	2.7	3.0	3.3	5.5	5.9	6.3	6.4	6.9
	SHOULDER (m³)		1.8	1.6	2.6	2.2	2.8	2.2	3.0	2.2	2.2	2.2	2.2	6.6	6.6	6.6	8.0	8.0
	ARCH (m³)		0.6	0.7	0.8	0.9	0.9	1.0	0.9	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.8	2.0
	TOTAL (m³)		4.0	3.9	5.4	5.1	5.9	5.4	6.3	5.7	6.1	6.5	6.9	13.7	14.2	14.7	16.3	16.8
BOLTS	NUMBER OF ANCHOR BOLTS (c/w 2 NUTS)		46	46	50	50	54	54	58	54	62	66	70	80	84	88	94	98

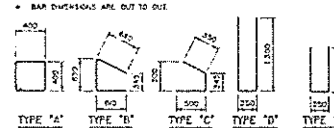
DIMENSION REVISED FOR THIS PROJECT TO 6900

NOTE :
INDIVIDUAL BAR LISTS AND DATA QUANTITIES ARE GIVEN FOR ONE CONCRETE END TREATMENT ONLY.

BAR TYPES FOR PIPE DIAMETERS FROM 4 920 mm TO 6 160 mm

NTS

- BAR DIMENSIONS ARE OUT TO OUT



GENERAL NOTES FOR SPCSP AND CSP CONCRETE END TREATMENT

- DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS NOTED OTHERWISE.
- HOLES IN THE CULVERT PLATE (22 mm DIA) TO BE FIELD DRILLED TO RECEIVE ANCHOR BOLTS (DO NOT BURN).
- AFTER PIPE HAS BEEN COMPLETELY BACKFILLED, CONCRETE END TREATMENT SHALL BE BUILT STARTING WITH THE CUT-OFF WALL FOLLOWED BY THE SHOULDERS AND THE ARCH. EACH CONCRETE SHOULDER TO BE POURED IN ONE CONTINUOUS POUR BEGINNING FROM THE CUT-OFF WALL.
- △ REINFORCING STEEL SHALL BE IN ACCORDANCE WITH CAN/CSA-G30.18-M92 "BILLET-STEEL FOR CONCRETE REINFORCEMENT".
- △ ALL REINFORCING STEEL SHALL BE GRADE 400 UNLESS NOTED OTHERWISE.
- △ DIAMETERS OF ALL BENDS AND DETAILS OF ALL HOOKS, UNLESS NOTED OTHERWISE SHALL CONFORM TO THE RECOMMENDED SIZES DETAILED IN THE REINFORCING STEEL MANUAL OF STANDARD PRACTICE, FIRST EDITION 1992, PUBLISHED BY THE REINFORCING STEEL INSTITUTE OF CANADA.
- ALL REINFORCING BARS TO HAVE A MINIMUM OF 50 mm COVER UNLESS NOTED OTHERWISE.
- ALL LAP SPLICES TO BE A MINIMUM OF 30 TIMES THE DIAMETER OF THE REBAR.
- REINFORCING STEEL TO BE CONTINUOUS BETWEEN EACH SECTION. WELDING OF REINFORCEMENT IS NOT PERMITTED. REFER TO THE CURRENT VERSION OF B202 "REINFORCEMENT" SECTION 5 OF THE BRIDGE CONSTRUCTION SPECIFICATIONS FOR ADDITIONAL INFORMATION.
- REINFORCING STEEL AS NOTED IN THE BAR LIST IS CALLED UP BY THE FOLLOWING CONVENTION :
  A - CONCRETE ARCH C - CONCRETE CUT-OFF WALL
  S - CONCRETE SHOULDER
- ALL CONCRETE SHALL BE CLASS "B", STRENGTH REQUIREMENT 25MPa AT 28 DAYS.
- CAST-IN-PLACE CONCRETE SHALL BE IN ACCORDANCE WITH THE CURRENT VERSION OF B320 "CAST-IN-PLACE CONCRETE" SECTION 4 OF THE BRIDGE CONSTRUCTION SPECIFICATIONS.
- CONCRETE SHOULDERS AND CONCRETE ARCH TO BE GIVEN A BROOM FINISH AT RIGHT ANGLES TO THE EDGE OF THE CULVERT; EXPOSED VERTICAL FACES TO BE GIVEN A CLASS 1 FINISH.
- ALL OUTSIDE EDGES TO BE SHAPED WITH A CONCRETE EDGER.
- CONCRETE TO BE COVERED WITH A CURING MEMBRANE UPON COMPLETION OF POUR.
- FORMS ARE TO BE LEFT IN PLACE FOR A MINIMUM OF 24 HOURS FOLLOWING POUR.

④

REV	DATE	REVISIONS	BY
△	95-01-25	CHANGED LENGTH OF BAR S1002 FOR 5 230 mm SPCSP	
△	94-06-02	ADDED REINFORCING STEEL NOTES	
△	93-11-03	DEVELOPED FROM S-1444 REV 2 & S-1445 REV 3	M.E.F.

ORIGINAL DRAWING APPROVED BY W. W. KRAUSE FOR EXECUTIVE DIRECTOR BRIDGE ENGINEERING DEC. 2, 1993

Alberta TRANSPORTATION AND UTILITIES
BRIDGE ENGINEERING BRANCH

CONCRETE END TREATMENT FOR LARGE STEEL CULVERTS SHEET 2

DESIGNED	DRAWN	DATE	CHECKED	DATE	SHEET	DRAWING
J.O.B. J.A.E.	H.W.M.	93-11-03	C.T.C.	93-11-17	2 of 2	S-1445-93

ISSUED FOR TENDER

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Région de l'Ouest

GENERAL NOTES
1. DIMENSIONS, COORDINATES, ELEVATIONS ARE SHOWN IN METRES UNLESS NOTED
2. LOCATION OF FIBRE OPTIC CABLE SUPPLIED BY NORTHWESTEL AS OF OCT 2013 AND IS APPROXIMATE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING EXACT LOCATION PRIOR TO CONSTRUCTION

0 2 1:250 12m

0 ORIGINAL TENDER SUBMISSION 15/03/27

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

D.WILKINS
A.HOPWOOD / S.MATSUDA
A.CETWELL
A.TAHIR
PUBLIC WORKS GOVERNMENT SERVICES CANADA

CONCRETE END TREATMENT FOR LARGE STEEL CULVERTS SHEET 2 OF 2

R.017173.701 | C205 (C112) | 0

LAYOUT DATA				
WORKPOINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
WP1	6575214.229	332170.674	570.19	CULVERT INLET
WP2	6575259.171	332171.618	569.31	CULVERT OUTLET
WP3	6575313.915	332236.216	569.13	END OF CURVE
WP4	6575323.531	332238.033	569.03	L.O.C.

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0	ORIGINAL TENDER SUBMISSION	15/03/27

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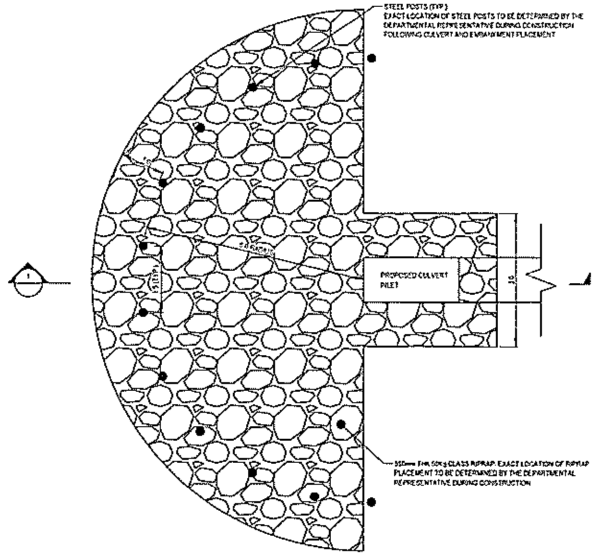
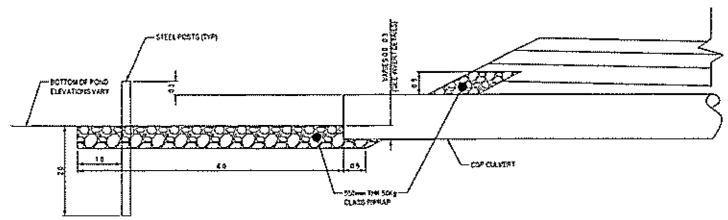
BEAVER POND PLAN
742+200

R.017173.701	C206 C112	0



DETAIL 1:50 — CULVERT INLET BEAVER MITIGATION PLAN VIEW DETAIL



SECTION 1:50 — CULVERT INLET BEAVER MITIGATION SECTION

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GENERAL NOTES
1. DIMENSIONS, COORDINATES, ELEVATIONS ARE SHOWN IN METRES UNLESS NOTED
2. LOCATION OF FIBRE OPTIC CABLE SUPPLIED BY NORTHWESTEL AS OF OCT 2013 AND IS APPROXIMATE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING EXACT LOCATION PRIOR TO CONSTRUCTION

0 2 1:250 12m

0	ORIGINAL TENDER SUBMISSION	15/03/27

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BEAVER MITIGATION DETAILS

R.017173.701	C207 C112	0

CULVERTS ASSOCIATED WITH THIS PROJECT

UNIQUE CULVERT	PROPOSAL	INLET NORTHING	INLET EASTING	INLET INVERT	OUTLET NORTHING	OUTLET EASTING	OUTLET INVERT	LENGTH (m)	DIAMETER (mm)	MATERIAL	WALL THICKNESS (mm)	TYPE	NOTE
737+134	Remove							29.7	600	ALUMINIZED CSP	2.0	Circ	
737+536	New	6570911.782	329993.348	628.525	6570904.249	330029.411	629.030	36.5	600	ALUMINIZED CSP	2.0	Circ	
737+611	Remove							18.3	600	WOOD STAVE	-	-	
737+611	New	6571520.756	330257.779	622.520	6571524.956	330292.514	618.690	35.0	600	ALUMINIZED CSP	2.0	Circ	
738+477	Remove							15.6	750	WOOD STAVE	-		
738+695	New	6572468.680	330424.929	609.999	6572287.149	330444.437	608.013	33.0	1400	ALUMINIZED CSP	2.0	Circ	
739+229	Remove							17.5	900	CSP	-	-	
739+229	New	6572822.103	330717.152	603.238	6572795.865	330756.185	602.499	47.0	1200	ALUMINIZED CSP	2.0	Circ	
740+553	New	6573998.069	331559.934	585.715	6573843.781	331003.795	585.427	45.515	3300	ALUMINIZED CSP	3.5	Circ	740+553 CULVERT INLET/OUTLET INV. SET
740+622	Remove							39.6	800	CSP	-	-	300mm BELOW THE BED OF THE STREAM
741+151	Remove							18.0	800	CSP		-	
741+151	New	6574350.834	331843.332	580.566	6574329.875	331868.157	580.151	29.0	800	ALUMINIZED CSP	2.0	Circ	
741+320	New	6574527.918	331967.537	579.534	6574519.198	331919.897	579.309	24.8	800	ALUMINIZED CSP	2.0	Circ	
741+307	Remove							16.6	800	CSP			
742+125	Remove							21.3	1200	CSP	-	-	
742+151	Remove							27.7	1200	CSP	-	-	
742+151	New	6575314.250	332178.566	570.193	6575305.172	332221.616	569.328	44.0	1200	ALUMINIZED CSP	2.0	Circ	
742+295	New	6575413.870	332238.875	569.496	6575478.111	332273.803	568.345	85.0	1000	ALUMINIZED CSP	2.0	Circ	742+295 CULVERT INLET/OUTLET INV. SET
742+454	New	6575564.838	332279.297	567.960	6575603.129	332517.019	567.740	42.0	600	ALUMINIZED CSP	2.0	Circ	300mm BELOW THE BED OF THE STREAM
742+473	Remove							18.2	900	CSP		-	
742+958	Remove							15.4	600	CSP	-	-	

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GENERAL NOTES:
1. DIMENSIONS, COORDINATES, ELEVATIONS ARE SHOWN IN METRES UNLESS NOTED.
2. PROFILE DRAWN AT 10x VERTICAL EXAGGERATION.
3. LOCATION OF FIBRE OPTIC CABLE SUPPLIED BY NORTHWESTEL AS OF OCT 2013 AND IS APPROXIMATE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING EXACT LOCATION PRIOR TO CONSTRUCTION.
4. UNLESS NOTED OTHERWISE, ALL EXISTING SIGNS AND POSTS WITHIN THE LIMITS OF WORK SHALL BE REMOVED AND STOCKPILED IN A LOCATION DIRECTED BY THE DEPARTMENTAL REPRESENTATIVE.
5. SEE TABLE DRAWING C212 FOR CULVERT LAYOUT DETAILS.
6. REFER TO GEOTECHNICAL DATA REPORT FOR BOREHOLE DETAILS.
7. EXTENTS OF CUT SLOPE STABILIZATION MATERIAL AND SPECIALTY EMBANKMENT TO BE VERIFIED BY DEPARTMENTAL REPRESENTATIVE DURING CONSTRUCTION.

0 10 1:1000 50m

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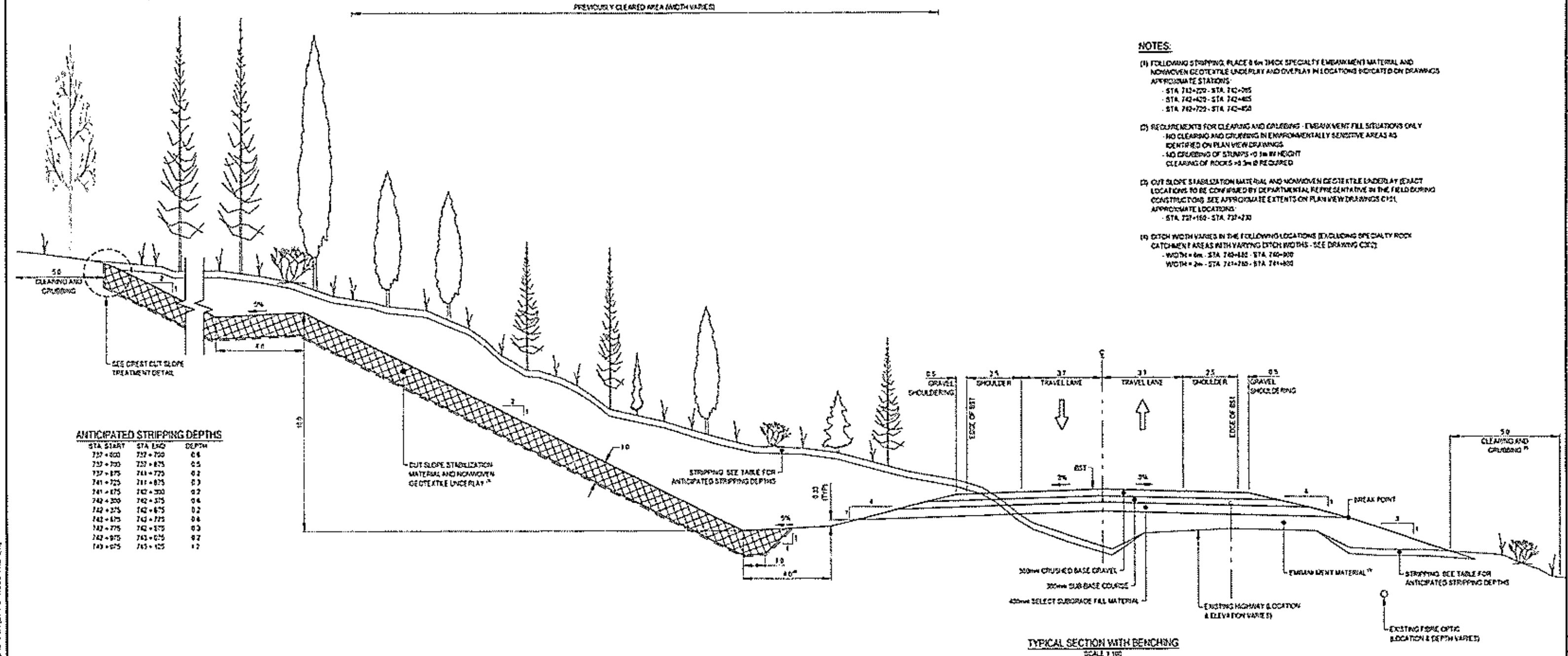
CULVERT AND SIGN DETAILS

R.017173.701 | C208 | 0



TYPICAL SECTION WITH BENCHING

SCALE 1:100

ANTICIPATED STRIPPING DEPTHS

STA START	STA END	DEPTH
737+600	737+750	0.6
737+750	737+875	0.5
737+875	741+725	0.2
741+725	741+875	0.3
741+875	742+300	0.2
742+300	742+375	0.6
742+375	742+675	0.2
742+675	742+775	0.6
742+775	742+875	0.3
742+875	743+075	0.7
743+075	743+125	1.2

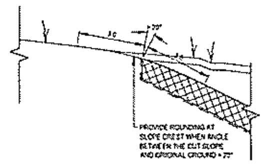
NOTES:

(1) FOLLOWING STRIPPING, PLACE 0.6m THICK SPECIALTY EMBANKMENT MATERIAL AND NONWOVEN GEOTEXTILE UNDERLAY AND OVERLAY IN LOCATIONS INDICATED ON DRAWINGS. APPROXIMATE STATIONS:
- STA. 742+220 - STA. 742+265
- STA. 742+420 - STA. 742+465
- STA. 742+720 - STA. 742+850

(2) REQUIREMENTS FOR CLEARING AND GRUBBING - EMBANKMENT FILL SITUATIONS ONLY
- NO CLEARING AND GRUBBING IN ENVIRONMENTALLY SENSITIVE AREAS AS IDENTIFIED ON PLAN VIEW DRAWINGS
- NO GRUBBING OF STUMPS <0.3m IN HEIGHT
- CLEARING OF ROCKS >0.3m Ø REQUIRED

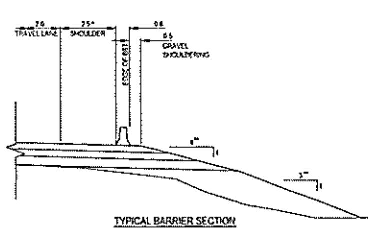
(3) CUT SLOPE STABILIZATION MATERIAL AND NONWOVEN GEOTEXTILE UNDERLAY (EXACT LOCATIONS TO BE CONFIRMED BY DEPARTMENTAL REPRESENTATIVE IN THE FIELD DURING CONSTRUCTION). SEE APPROXIMATE EXTENTS ON PLAN VIEW DRAWINGS C101. APPROXIMATE LOCATIONS:
- STA. 737+150 - STA. 737+230

(4) DITCH WIDTH VARIES IN THE FOLLOWING LOCATIONS (EXCLUDING SPECIALTY ROCK CATCHMENT AREAS WITH VARYING DITCH WIDTHS - SEE DRAWING C302):
- WIDTH = 6m - STA. 740+480 - STA. 740+900
- WIDTH = 2m - STA. 741+780 - STA. 741+800



CREST CUT SLOPE TREATMENT DETAIL

SCALE 1:100

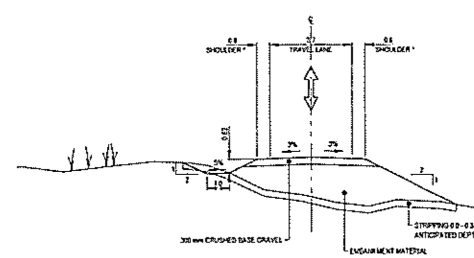


TYPICAL BARRIER SECTION

SCALE 1:100

TYPICAL TO ALL NON ROCK CATCHMENT AREAS (SEE DRAWING C302)

* SHOULDER WIDTH VARIES 1.2m - 2.5m STA. 736+598.257 - STA. 737+058.107
** 2:1 W STA. 741+778 - 741+810



ACCESS ROAD TYPICAL SECTION

SCALE 1:100

* GRAVEL PIT ACCESS ROAD AT STA. 739+460 SHOULDER WIDTH = 1.8 m

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ISSUED FOR TENDER

GENERAL NOTES
1. DIMENSIONS, COORDINATES, ELEVATIONS ARE SHOWN IN METRES UNLESS NOTED
2. LOCATION OF FIBRE OPTIC CABLE SUPPLIED BY NORTHWESTEL AS OF OCT. 2013 AND IS APPROXIMATE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING EXACT LOCATION PRIOR TO CONSTRUCTION

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

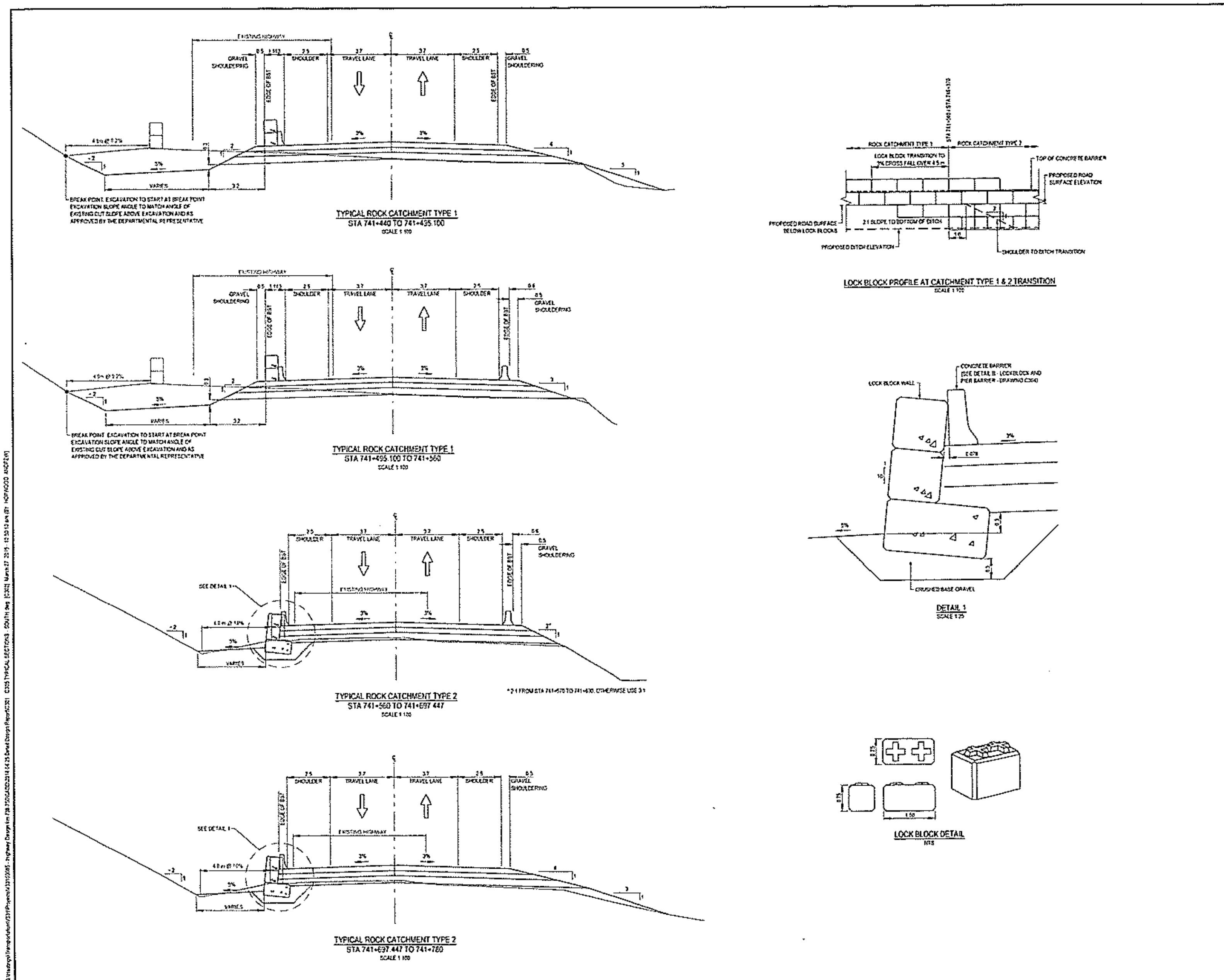
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

D WILKINS
A HOPWOOD / S MATSUDA
A DEEPWELL
A. TAKEN
PUBLIC WORKS GOVERNMENT SERVICES CANADA

TYPICAL SECTIONS

R.017173.701 | C301 | 0
C112



REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'Ouest

ISSUED FOR TENDER

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PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

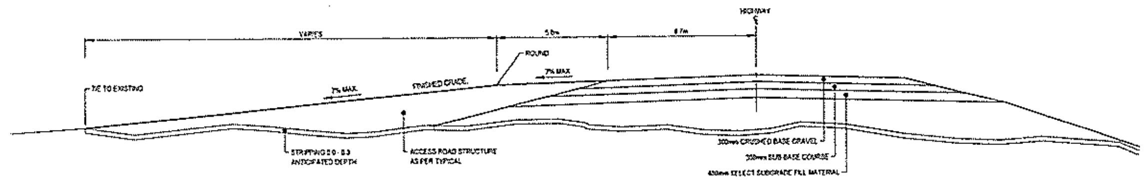
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

G WILKINS
A HOPWOOD / E MATSUDA
A DEEPWELL
A TAHERI
PUBLIC WORKS GOVERNMENT SERVICES CANADA

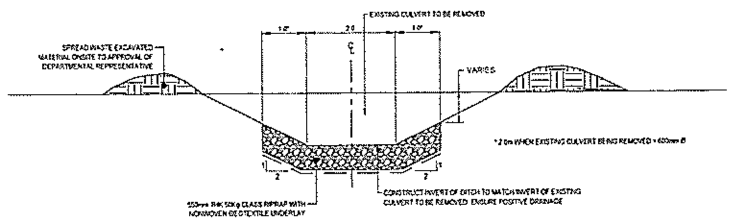
TYPICAL SECTIONS -
ROCK CATCHMENT TYPE 1 & 2

R.017173.701 | C302 | 0



ACCESS ROAD TYPICAL PROFILE

SCALE 1:100



TYPICAL DITCH CONSTRUCTION DETAIL (FOLLOWING CULVERT REMOVAL)

SCALE 1:50

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
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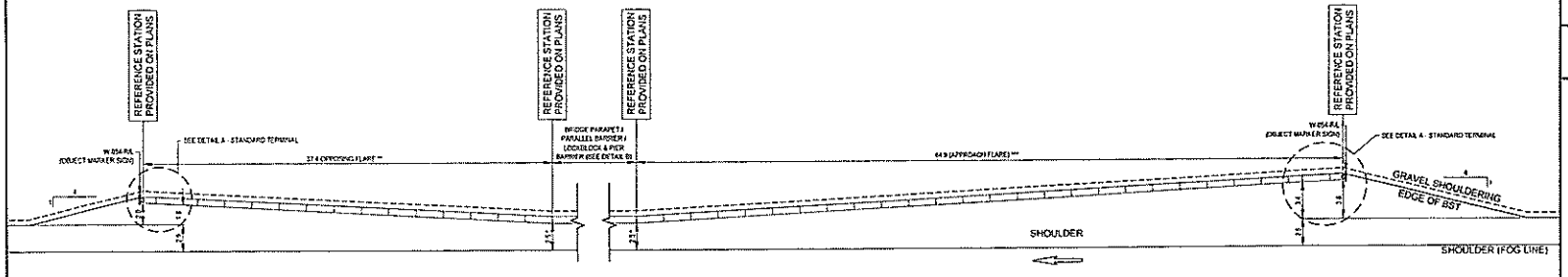
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

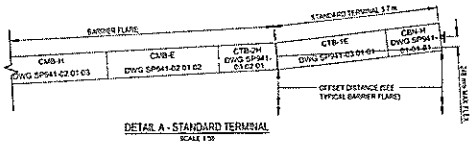
TYPICAL ACCESS ROAD PROFILE
AND DITCH CONSTRUCTION
TYPICAL SECTIONS

R.017173.701 | C303 | 0

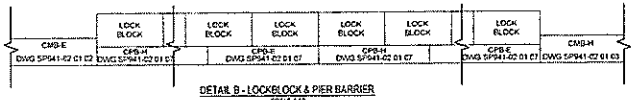


* 1.2 m AT PROCHNIAK CREEK BRIDGE PARAPET (STA 736+958.205)
** 45.24 m AT PROCHNIAK CREEK BRIDGE - RIGHT (STA 736+958.371 - STA 737+046.604)
*** 86.96 m AT PROCHNIAK CREEK BRIDGE - LEFT (STA 736+958.206 - STA 737+075.170)

TYPICAL BARRIER FLARE
SCALE 1:200



DETAIL A - STANDARD TERMINAL
SCALE 1:50



DETAIL B - LOCKBLOCK & PIER BARRIER
SCALE 1:50
* SEE DETAIL 1 - DRAWING C307 FOR ADDITIONAL DETAILS

REAL PROPERTY SERVICES
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0 10 1:1000 50m

1	FINAL TENDER SUBMISSION	15/10/27

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

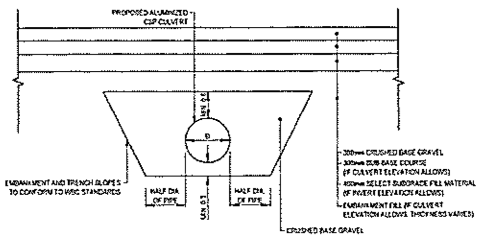
TETRA TECH EBA

KM 737 - 743.1
HIGHWAY REALIGNMENT
ALASKA HIGHWAY, BC

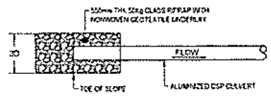
D. WILSON
A. HORWOOD / S. MATSUDA
A. DEEPWELL
A. TANERI
PUBLIC WORKS GOVERNMENT SERVICES CANADA

TYPICAL DETAILS - BARRIER FLARE

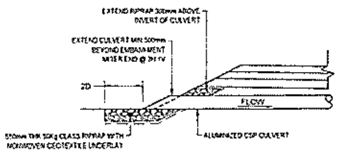
R.017173.701	C304 C112	0



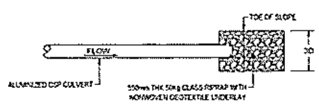
TYPICAL CULVERT EMBANKMENT SECTION (CULVERTS ≤ 1800mm Ø)
SCALE 1:50



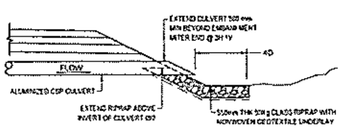
TYPICAL INLET RIPRAP PROTECTION - PLAN (CULVERTS ≤ 1800mm Ø)
SCALE 1:100



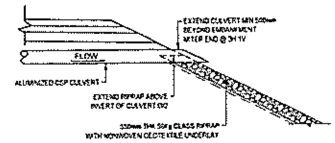
TYPICAL INLET RIPRAP PROTECTION - SECTION (CULVERTS ≤ 1800mm Ø)
SCALE 1:100



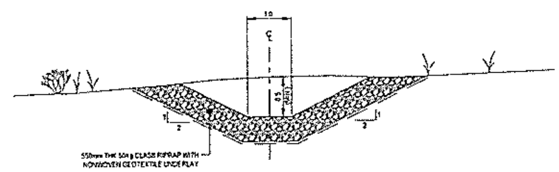
TYPICAL OUTLET RIPRAP PROTECTION - PLAN (CULVERTS ≤ 1800mm Ø)
SCALE 1:100



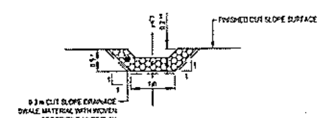
TYPICAL OUTLET RIPRAP PROTECTION - SECTION (CULVERTS ≤ 1800mm Ø)
SCALE 1:100



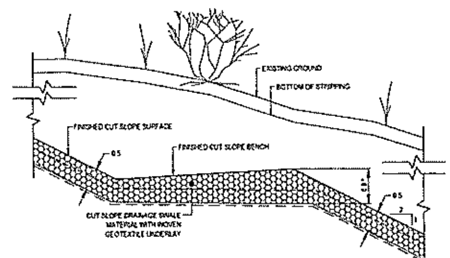
TYPICAL STEEP SLOPE RIPRAP SECTION - OUTLET
SCALE 1:100



TYPICAL STEEP SLOPE RIPRAP SECTION
SCALE 1:50



TYPICAL CUT SLOPE DRAINAGE SWALE SECTION
SCALE 1:50



TYPICAL CUT SLOPE DRAINAGE SWALE SECTION
SCALE 1:50

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PUBLIC WORKS GOVERNMENT SERVICES CANADA

TYPICAL DETAILS - DRAINAGE

R.017173.701 | C305 | 0

R.017173.801
Appendix G

PWGSC Environmental Effects Evaluation (EEE)
Document to be provided via amendment during the tendering period