REGIONAL DISTRICT
of Fraser-Fort George

Main Office: 155 George Street, Prince George, BC V2L 1P8
Telephone: (250) 960-4400 / Fax: (250) 563-7520
Toll Free: 1-800-667-1959 / www.rdffg.ca

REPORT FOR CONSIDERATION

TO: Chair and Directors File No.: LAND 1.6.3

FROM: Laura Zapotichny, General Manager of Environmental Services

DATE: December 9, 2024

SUBJECT: Cell Two – Foothills Boulevard Regional Landfill - Development Design Update

SUMMARY: Purpose: For Information

Attachments:
1. Backgrounder – Cell Two Development Stages
2. Technical Memo – Cell Two Development Design

Previous Reports:
1. Item No. 6.2, February 2024
2. Item No. 5.1, July 2023

RECOMMENDATION(S):

THAT the report dated December 9, 2024 regarding "Cell Two – Foothills Boulevard Regional Landfill – Development Design Update" be received for information.

ENTITLEMENT	HOW VOTE COUNTED
All 1 Director/1 vote	Majority

ISSUE(S):

In July 2023, the Board approved entering into an agreement with Tetra Tech Canada Inc. as the engineer of record for engineering services for Cell Two Development at the Foothills Boulevard Regional Landfill.

During spring/summer 2024 the Cell Two project moved forward with the logging, grinding and grubbing components. Once completed a Geotechnical Survey along with a detailed land survey was undertaken and completed in the fall of 2024.

Concurrently work on the required Operational Certificate amendments and a new Design Operations and Closure Plan (DOCP) was undertaken and will continue in 2025.

The DOCP is a regulatory compliance activity which must be carried out every five years. The previous Integrated Landfill Management Plan is from 2011. This updated document will outline the steps required as the Regional District moves to final closure of Cell One of the Foothills Boulevard Regional Landfill and will incorporate and identify Cell Two development and location.

The Cell Two Development Design Brief document prepared by Tetra Tech explains the current regulatory and physical settings driving the construction methodology and the environmental standards within which the project will proceed. It identifies the physical characteristics of the site, design challenges, engineered solutions and the initial proposed Cell Two design for the site. Through this initial design, a preliminary high level cost estimate has been developed into two phases, one being the major earthworks project to be carried out in 2025, which will shape the base of the future cell and the other covers the remaining costs for the construction of Cell Two.

Environmental Services Administration and Tetra Tech (remotely) will be in attendance for a presentation.

RELEVANT POLICIES:

1. *Environmental Management Act:* Landfill Criteria for Municipal Solid Waste
   - provides key elements that pertain to municipal solid waste landfill development.

2. Ministry of Environment and Parks: Landfill Criteria for Municipal Solid Waste 2nd Edition (2016)
   - establishes guideline criteria for the development of municipal solid waste landfills to maximize reduction of environmental impact through sound engineered design and construction methodologies.

STRATEGIC PRIORITIES ALIGNMENT:

☐ Indigenous and Intergovernmental Partnerships	☐ Organizational Strength and Adaptability	☒ Quality Community Services	☒ Environmental Stewardship and Climate Action
☐ Awareness and Engagement	☐ Statutory or Routine Business		

SERVICE RELEVANCE:

Solid waste is a region wide service. The Foothills Boulevard Regional Landfill receives 98% of the RDFFG's municipal solid waste. The remaining air space in Cell One is not expected to exceed the summer of 2028 and therefore a lateral expansion into Cell Two is required for the site to continue to accept municipal solid waste beyond 2028.

FINANCIAL CONSIDERATION(S):

Budget implications for Cell Two at the Foothills Boulevard Regional Landfill are reflected in the proposed 2025 Solid Waste Management (3305) Budget.

OTHER CONSIDERATION(S):

N/A

DECISION OPTIONS:

1. Approve recommendations.
   - report will be received

COMMENTS:

The Cell Two Development Design Brief outlines the current regulatory conditions, the physical settings driving the construction methodology and the environmental standards within which the project will proceed. To ensure that the Cell Two Development 2025 project timelines are met, and engineering budget costs are maintained; the required Operational Certificate amendments, and the DOCP will require completion in 2025; concurrently with the Cell Two earthworks while the project is proceeding to conceptual and schematic design.

Environmental Services Administration recommends proceeding with the recommendations and preliminary design as presented in the Cell Two Development Design Brief which will enable the Project to realize the 2025 project timelines while also keeping the budgeted engineering costs on track.

Respectfully submitted,

"Laura Zapotichny"

Laura Zapotichny
General Manager of Environmental Services

LZ:jt

REGIONAL DISTRICT
of Fraser-Fort George

BACKGROUNDER– CELL TWO DEVELOPMENT STAGES

The ongoing development of Cell Two at the Foothills Boulevard Regional Landfill, a lateral expansion on the current footprint, is scheduled to proceed in stages, defined by a series of structured projects carried out both sequentially and concurrently. These stages were identified in the request for proposal for engineering services for this project.

An overview of these required stages and their anticipated timing are as follows:

Preliminary Design Stage: Completed

The Preliminary Design Phase was completed in 2024 with the logging of the remaining forested area on the landfill site of approximately 9.2 hectares. Following the completion of the logging in spring of 2024, the grubbing and grinding of the 7-hectare project area was completed by fall of 2024. The removal of all vegetation and organic overburden was also completed at this time. Once these two initial steps were completed a Land Survey along with a drilling site investigation was completed in Fall of 2024.

Concurrently, the RDFFG is required to update to the existing Operational Certificate (OC) to include Cell Two and complete a new Design Operation and Closure Plan (DOCP). The amendments to the Operational Certificate for the Foothills Boulevard Regional Landfill were submitted to the Ministry of Environment and Parks in December 2024. Work will continue on updating the DOCP into 2025, as final design elements become known for the Cell Two expansion.

Conceptual Design Stage: Completed

The Conceptual Design stage included information sharing with key stakeholders; verifying the regulatory obligations for the project with the identified agencies responsible for project oversight; conceptual plans; and order of magnitude costing. Stakeholder engagement will continue throughout the project life cycle.

Initial project costs will be estimated at this time. The engineer will present the Design Brief (10% detail) to the RDFFG Board in December 2024.

Schematic Design Stage

Once a conceptual design is presented, the engineer will continue to work with the Environmental Services Administration to prepare all permit applications, including the Operational Certificate Amendment, Design Approval by the Ministry of Environment and Parks, an updated DOCP for the Foothills site, and any municipal requirements.

This stage will see the engineer submit a Class C cost estimate and prepare the schematic design (30% detail). The estimated date of completion for this stage is early summer 2025.

Detailed Design Stage

Once Environmental Services Administration approves the schematic design and Class C cost estimate; including ongoing communication with the Ministry of Environment and Parks; the detailed design work, (60% design detail) can begin. It is anticipated this work will take place in Fall of 2025 and will include a Class B Cost Estimate.

Once a Class B estimate of the project is approved, RDFFG Administration will work to secure funding for the entirety of the project with the Municipal Financial Authority. Estimated completion of this stage is Fall 2025.

Final Design Stage

The final design stage (90% design detail) will begin in the winter of 2025/2026. This includes the final design of Cell 2 and a Class A cost estimate. This will be presented to the RDFFG Board by the engineer.

With approval of the final design, the engineer will provide Construction Quality Assurance and Construction Quality Control Plans.

Construction Documents and Award of Tender Stage:

With approval from the RDFFG Board and financing secured, the engineer will work with Environmental Services Administration to finalize all permits and regulatory approvals for the project, as well as prepare the tender documents for the procurement of construction of Cell Two.

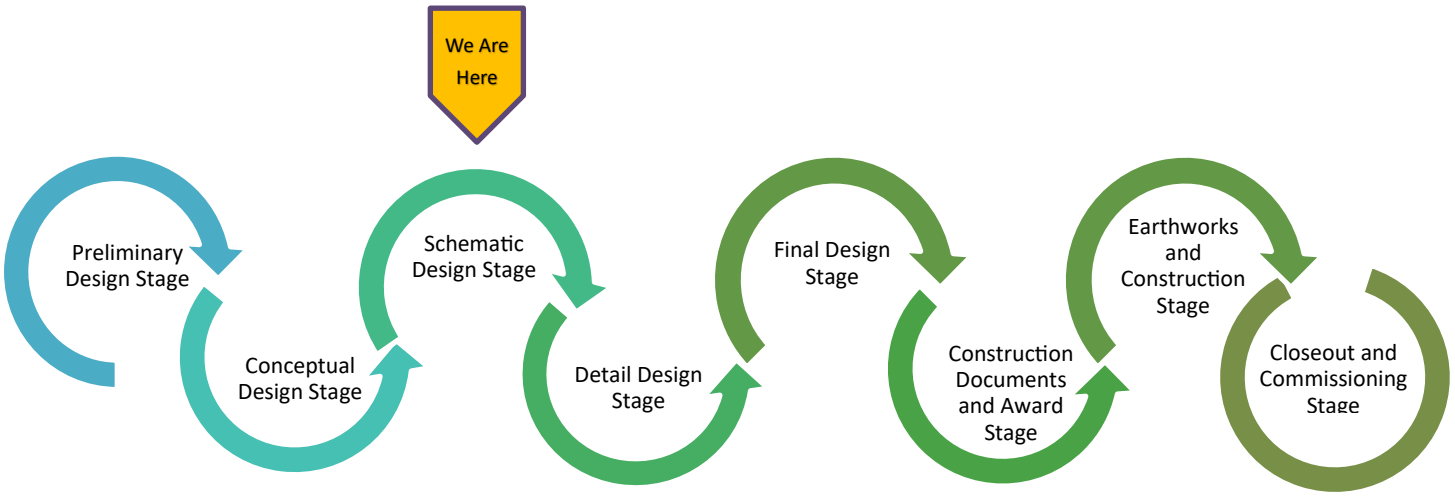
During this stage, the issuance of the construction tender will take place as well as the award of the construction contract by the RDFFG Board. It is anticipated that two different construction tenders will be issued – one for the earthworks in summer of 2025 and another for the remaining earthworks and construction for 2026 and 2027.

Earthworks and Cell Construction Stage:

It is anticipated that the construction of Cell Two, beginning with the earthworks required for the development of Cell Two will be undertaken in spring of 2025. These works will continue into 2026 followed by the technical construction of Phase One of Cell Two in 2027.

Close Out and Warranty Stage:

Upon construction completion and inspection, commissioning will be undertaken. The site should become operational late fall 2027. The RDFFG will enter into the closeout and warranty period of this project.



TETRA TECH

TECHNICAL MEMO

ISSUED FOR USE

To:	Laura Zapotichny, General Manager of Environmental Services Darwin Paton, Environmental Services Technologist	**Date:**	December 6, 2024
		Memo No.:	1
From:	Michel Lefebvre, M.Sc., P.Eng. Spencer Smith, P.Eng. Michelle Jelinski, P.Eng. Rana Mandour, P.Eng.	**File:**	704-SWM.SWOP04864-01
Subject:	Regional District of Fraser-Fort George – Foothills Boulevard Regional Landfill Cell 2 Development Design Brief		

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Regional District of Fraser-Fort George (RDFFG) to undertake the Cell 2 Development at the Foothills Boulevard Regional Landfill (FBRL, Site). The FBRL operates under Operational Certificate (OC) No. MR-01697, issued on October 31, 2005, by the British Columbia (BC) Ministry of Environment (currently the Ministry of Environment and Parks [MEP]). A copy of the OC is provided in Appendix A.

The Site is located at 6595 Foothills Boulevard, Prince George, BC. The legal description of the Site is Block A of the northeast ¼ of District Lot 4053 and Block A of the northwest ¼ of District Lot 4048, Cariboo District. The landfill is owned and operated by the RDFFG. The attached Figure 1 shows the existing Site layout.

Cell 2 is the next lateral expansion cell to be constructed and is shown on Figure 1. The existing topography of this area and the proposed layout is shown in Appendix B. The design rationale, assumptions, and criteria included in this technical memorandum (report) form the basis of the Cell 2 design.

The principal objectives of this report are as follows:

- Describe the regulatory setting for the Cell 2 design;
- Describe the regional and local setting for the Site; and
- Present the design basis of Cell 2.

This report is based on the design criteria and proposed Cell 2 layout at the conceptual design stage (Appendix B) and is considered to be a snapshot in time as a documented record of the design basis intended to represent a guideline to be carried into the detailed design stage. The design criteria may be subject to change (in consultation with the MEP and RDFFG), and design details will be further refined during the detailed design stages. Similarly, the drawings presented in this report (Appendix B) are at a conceptual design stage and are subject to change. They are included for the purposes of this report but are not to be used for tendering or construction purposes.

Tetra Tech Canada Inc.
14940 - 123 Avenue
Edmonton, AB T5V 1B4 CANADA
Tel 780.451.2121 Fax 780.454.5688

2.0 REGULATORY SETTING

Landfill design and operation in BC is regulated under the following:

- *Environmental Management Act* (2003) – covers waste disposal, Municipal Solid Waste (MSW) management, contaminated sites, and greenhouse gas (GHG) generation;
- *Landfill Criteria for Municipal Solid Waste* (2016) (Landfill Criteria) – guidance document for siting, design, operation, and closure of landfills;
- *Landfill Gas (LFG) Management Regulation* (2008) – covers subsurface LFG monitoring and management;
- *Guidelines for Environmental Monitoring at MSW Landfills* (1996) – covers parameters for environmental monitoring and reporting; and
- *BC Contaminated Sites Regulation* (1996) – covers parameters for assessing groundwater quality at contaminated sites.

The FBRL was issued the current OC No. MR-01697 on October 31, 2005, by the MEP. The OC predates the second edition of the *BC Landfill Criteria for Municipal Solid Waste*, (June 2016). Condition 4.2.3. of the OC states that the facilities must be developed and operated in accordance with the Design and Operation Plan.

The previous design, operations, and closure plan (DOCP) was prepared by XCG Consulting Ltd. (XCG) named the Integrated Landfill Management Plan (March 25, 2010). An updated DOCP document is currently in development by Tetra Tech. In addition, an application for amendment to the OC is concurrently in development by Tetra Tech and the RDFFG. Both the updated DOCP and OC will be developed to reflect the existing Cell 1 footprint and future Cell 2 footprint.

3.0 PHYSICAL AND TOPOGRAPHIC SETTING

The Site's physical setting is partially summarized from the *2010 Integrated Landfill Management Plan* by XCG (2010) and the *2021 Annual Operations Report — Foothills Regional Landfill by the Regional District of Fraser-Fort George* (RDFFG 2021).

The Site property encompasses an area of approximately 87.3 hectares. The landfill, composting, and recycling activities conducted at the Site encompass an area of approximately 25 hectares within the permitted landfill property. The site topography is hummocky with relief across the Site of approximately 30 m.

The Site's topography and hydrology is summarized from the *2006 Design and Operations Plan* by AMEC Earth & Environmental Ltd. (AMEC 2006) and from the *Foothills Boulevard Regional Landfill Site Hydrogeological Data Gap Analysis* by Ecoplans Ltd. (Ecoplans 2010) quoted in the *2010 Integrated Landfill Management Plan* by XCG (2010).

Topographically, the Site exists in a series of depressions formed in a knob and kettle outwash plain area with up to 30 m of relief across the Site. Prior to development, surface elevations at Site ranged between approximately 735 to 790 metres above mean sea level (m amsl) (XCG 2010).

Within the vicinity of site, the primary drainage feature is the Nechako River which flows to the east where this tributary enters the Fraser River. Southwest of the Site, seasonal and intermittent drainage features exist which flow towards the Nechako River at times of exceptional rainfall or snowmelt (XCG 2010).

The area encompassing the proposed Cell 2 footprint was logged, cleared, and grubbed, and stripped of organics and topsoil in 2024 prior to the beginning of the drilling phase of the site investigation. The topography of the proposed Cell 2 area as of the September 2024 survey is included in Appendix C and shown on Figure 1 of Appendix B.

4.0 GEOLOGICAL / HYDROGEOLOGICAL SETTING

The following section presents an overview and summary of the regional settings with respect to geological and hydrogeological conditions.

4.1 Regional Geology and Hydrogeology

Information regarding the regional geology and hydrogeology is summarized from the *2006 Design and Operations Plan* by AMEC (2006) as quoted in *2010 Integrated Landfill Management Plan* by XCG (2010).

Surficial deposits in the vicinity of the Site are comprised of lacustrine sand and silt with intermittent gravel content, underlain by clay till. In the vicinity of the Site, the glacial drift overlying the clay till ranges from 70 to 140 m thick. The top of the clay till in the vicinity of the Site has been found at elevations of approximately 680 to 700 m amsl corresponding to an approximate depth of 75 m below ground (XCG 2010).

4.2 Site Geology and Hydrogeology

Information regarding the Site geology and hydrogeology was summarized from the *2006 Design and Operations Plan* by AMEC (2006) as quoted in the *2010 Integrated Landfill Management Plan* by XCG (2010).

The Site is separated from a two (2) kilometer lowlands area near the Nechako River by a highlands area produced by an east-west trending esker complex. The surficial soils throughout the area are likely continuous with shallower Site soil having an increasing silt content to the north and an increasing coarse sand and gravel content to the south corresponding to the vicinity of the esker complex (XCG 2010).

The expected bedrock is estimated to lie at a depth of 50 m below ground surface (XCG 2010). However, it is noted that bedrock was not encountered during the field investigation undertaken by Tetra Tech in 2024 (further detail noted in Section 5.0).

At the Site, shallow groundwater movement in the horizontal direction is predominantly to the southwest towards the Nechako River (XCG 2010).

Unsaturated sand at the Site extends to a depth ranging from approximately 55 to 83 m below ground surface (mbgs). The overburden sand constitutes an unconfined aquifer with a water table elevation recorded between 696 and 704 m amsl. The saturated sand is reported to range in thickness from 0 to approximately 5 m. The hydraulic conductivity of the sand is reported to range from 1.2×10^{-4} to 6×10^{-5} m per second (XCG 2010).

5.0 SITE INVESTIGATION

The following section presents a summary of the field investigation and laboratory program completed in support of the site investigation activities. The site investigation program was undertaken within the footprint of Cell 2 to confirm geological conditions and inform the design basis and conceptual design. Laboratory soil testing and interpretation from the site investigation program is ongoing and will provide further detail as part of the detailed design stage.

5.1 Field Investigation Program

A field investigation and associated analytical testing of soil samples were undertaken by Tetra Tech on July 29 through August 10, 2024, to support the future Cell 2 development. Prior to the field program, Tetra Tech completed the verification of buried utilities for the property utilizing a private locating service which completed a 50 m sweep of the proposed borehole locations.

The field investigation program was comprised of four (4) borehole locations with Standard Penetration Tests (SPTs), including three (3) boreholes drilled to 40 m (BH-01, BH-02, BH-03) and one (1) borehole to 80 m (BH-04) with a groundwater monitoring well installation. The groundwater monitoring well was completed with the installation of a two-inch polyvinyl chloride (PVC) standpipe. The locations of the boreholes are shown in Appendix B and the borehole logs are included in Appendix D.

Drilling was conducted with a TerraSonic TSI 150 Compact Crawler track mounted sonic rig. Tetra Tech logged the soils encountered using the modified Unified Soil Classification System (USCS). Soils were visually classified in the field noting individual soil strata, the interfaces between them, and depth of encountered water tables. Disturbed soil samples were collected at select depths within each borehole to allow field personnel to characterize the stratigraphy of each borehole.

SPTs were conducted at:

- An interval of 5 feet (1.5 m) at 24BH-01;
- An interval of 10 feet (3 m) at 24BH-02;
- An interval of 5 feet (1.5 m) for the upper 20 feet and an interval of 10 feet (3 m) to borehole target depth at 24BH-03; and
- An interval of 10 feet (3 m) for the upper 160 feet and an interval of 20 feet (6 m) to borehole target depth at 24BH-04.

A total of one (1) Shelby tube sample was collected within the underlying clay till. Other attempts at collecting Shelby tubes were unsuccessful.

A groundwater piezometer was installed at the site of 24BH-04 to confirm groundwater elevation. The piezometer installation consisted of a 50 mm (2 inch) schedule 40 solid pipe PVC casing with a slotted screen at the bottom of the borehole. The piezometer construction details are outlined on the borehole log attached in Appendix D.

Following completion of the drilling program, the water level was recorded by Tetra Tech on October 25, 2024 (approximately 11 weeks after the program) to allow the water levels to stabilize.

5.2 Laboratory Program

Select soil samples collected during the drilling program were tested in the laboratory for moisture content, Atterberg limits, grain size analysis, standard proctor tests, and direct shear tests. The results of the laboratory analyses form the basis for the design of Cell 2, and are attached to this report under Appendix E.

5.3 Site Investigation Results

The details of the soil and groundwater conditions encountered at each borehole location are presented on the borehole logs in Appendix D. The following sections present a summary of the soil conditions at the borehole locations drilled at the project site.

Based on the available results from the site investigation, the lithology was consistent with the previously reported geology. The Cell 2 footprint comprised sand and silt deposits with intermittent gravel content, underlain by clay till. The sand deposits, which dominated the encountered materials, was typically compact to dense, damp to moist, predominately brown, with varying silt content ranging from trace to silty.

The water elevation at 24BH-04 was recorded to be 65.26 mbgs.

5.4 Results of Laboratory Testing

Soil samples selected for laboratory testing were chosen from the depths that would best represent the materials to be used in the construction of the embankments and clay liner. Laboratory tests were conducted at Tetra Tech's geotechnical laboratory to determine the engineering properties of representative samples collected from boreholes distributed across the Site. The testing program included the following items to support the detailed design of the composite lined cells as well as provide preliminary data for future earthworks-related compaction testing:

- Twenty (20) moisture contents;
- Four (4) Atterberg limits;
- Five (5) grain size analyses;
- Four (4) sieve analyses;
- Four (4) standard proctor tests;
- Two (2) direct shear testing.

Results are presented in Table 1, and copies of the laboratory reports are contained in Appendix E. The following sections summarize the site investigation test results.

5.4.1 Natural Moisture Content

Soil samples were collected at various intervals from all boreholes and submitted for natural moisture content. The results of the analyses are summarized in Table 1. The moisture content of the collected samples ranged between 3.1% and 33.9%, and was on average 18.8% with a geometric mean of 16.2%.

5.4.2 Particle Size Distribution

A total of five (5) soil samples were selected for particle size analysis using the Hydrometer method, and a total of four (4) soil samples were selected for particle size analysis using the sieve method. These results are summarized in Table 1.

5.4.3 Atterberg Limits

A total of 4 soil samples were tested to determine the Atterberg limits on the cohesive materials. The laboratory results indicate that the plasticity index (PI) ranged from 5 to 18 (average of 11.3), the liquid limit (LL) ranged from 19 to 33 (average of 18.8), and the plastic limit (PL) ranged between 14 to 23 (average of 16.5) classifying two of the soil samples as low plastic, and two samples classified as medium plastic. These results are summarized in Table 1.

5.4.4 Standard Proctor

Four samples were submitted for standard proctor testing. Optimum moisture content ranged from 14.4% to 17.5% and maximum dry density ranged from 1,645 kg/m^3 to 1,785 kg/m^3. The laboratory results are provided in Table 1.

5.4.5 Direct Shear

Two samples (one bulk sample and one Shelby tube sample) were submitted for direct shear testing. For the analysis conducted on Bulk 1 of BH-01, and at a cohesion intercept of 5 kPa, the peak strength and residual strength and the inferred angle of shearing resistance were recorded to be 37.4 degrees and 31.8 degrees respectively. For the analysis conducted on SH02 of BH-04, and at a cohesion intercept of 5 kPa, the peak strength and residual strength and the inferred angle of shearing resistance were recorded to be 28.7 degrees and 25.2 degrees respectively. Further details regarding the laboratory results can be found in Appendix E.

5.5 Survey

A topographical survey of the proposed Cell 2 area was completed by Allnorth on September 6, 2024. Results are included in Appendix C.

6.0 PROPOSED CELL 2 DESIGN

The following section presents a summary of the design criteria incorporated into the proposed Cell 2. This incorporates requirements from the OC, Design Criteria (Section 5.0) of the Landfill Criteria, and previous cell design and construction experience.

6.1 Design Overview

The design of Cell 2 is proposed to incorporate the following:

- The cell depth to be constructed approximately 20 m below the perimeter berm and a top of waste elevation of approximately 810 m amsl based on a minimum 10% top slope and maximum 33% side slopes.
- The landfill cell to be developed as a lined cell with a continuous leachate collection layer to facilitate ongoing leachate management, where the average leachate head on the liner can be controlled to less than 0.3 m.

- The nature of the hydrogeology, the existing topography, and the cut and fill requirements have been considered to optimize the depth of cell development. A conservative approach to landfill liner design has been taken with the objective of enhancing protection of the environment.
- The design of the landfill liner will meet or exceed the requirements of the Landfill Criteria, which includes a high-density polyethylene (HDPE) geomembrane with a thickness of 1.5 mm (60 mil) underlain by a geosynthetic clay liner (GCL).

6.2 Buffer Zones

The Landfill Criteria requires a minimum 50 m buffer zone between the landfill footprint and the landfill site boundary. The 20 m buffer closest to the landfill shall be used for access roads, firebreaks, and leachate or landfill gas (LFG) infrastructure, as required. The outer 30 m buffer should be comprised of natural or landscaped screening.

The north extent of the proposed Cell 2 design is more than 50 m from the site boundary. The west, north, and northeast portions of Cell 2 consist of a minimum 30 m buffer of natural (forested) screening. A perimeter access road is proposed to be located around the east and north portions of the Cell 2 area, within the 20 m buffer zone closest to the landfill footprint.

There may be additional setbacks required to accommodate the proposed FortisBC infrastructure planned for future construction.

6.3 Landfill Geometry

The proposed geometry of Cell 2 has been developed to meet the requirements of the Landfill Criteria.

The description of the proposed Cell 2 geometry is described in the subsections below and illustrated in the conceptual design drawings attached in Appendix B.

6.3.1 Waste Slopes

The description of the proposed Cell 2 wastes slopes are as follows:

- Maximum waste side slopes of 3H:1V (33%) grade; and
- Minimum waste plateau (top slope) of 10H:1V (10%) grade.

6.3.2 Base Grades

The description of the proposed landfill cell base grades of Cell 2 are as follows:

- Maximum allowable side slopes for the base liner of 3 horizontal to 1 vertical (3H:1V). The conceptual design proposes base liner side slopes of 4H:1V.
- A minimum 2% grade for the primary drainage path (leachate collection piping). The conceptual design proposed a primary grade of 3%.
- A minimum 0.5% grade for the secondary drainage path. The conceptual design proposes a secondary grade of 2%.

6.3.3 Depth to Groundwater

The Landfill Criteria requires a minimum 1.5 m separation between the bottom of the cell and the depth to groundwater. On October 25, 2024, a measurement was obtained from BH-04 located in the northwest portion of Cell 2 and the depth-to-water was measured to be more than 65 m below surface. Even with the anticipated surface elevation changes (cut and fill) associated with the proposed cell design, the depth to groundwater is anticipated to be approximately 43 m below the bottom of the cell, significantly exceeding the 1.5 m minimum separation requirement.

6.4 Liner System

The landfill liner system has been designed to meet or exceed the base liner requirements of the Landfill Criteria. The liner system is proposed to consist of the following components from bottom to top:

- A GCL (secondary liner).
- A 60 mil (1.5 mm) textured (double-sided), black, HDPE geomembrane (primary liner).
- A heavy non-woven geotextile (to protect the geomembrane liner from potential puncture).
- A minimum 300 mm layer of drainage material (leachate system).
- A light non-woven geotextile filter layer (applicability dependent upon initial lift waste composition and general long-term waste composition).

Per the Landfill Criteria, continuous Quality Assurance (QA) and Quality Control (QC) inspections are to be carried out by a Qualified Professional (QP) during installation of the liner system. A leak detection survey is recommended to be performed after the HDPE installation to identify any areas that may have been damaged during placement.

6.4.1 Clay Materials for Engineered Clay Liner

The preliminary results of the site investigation and material characterization results indicate that there will not be available clay material for clay liner construction. Silt and sand material are anticipated to be encountered during excavation; therefore, no engineered clay liner is proposed as part of this design basis.

6.5 Leachate Collection System

The leachate collection system will be designed to allow for control of the internal piezometric level of leachate within the landfill. The Landfill Criteria requires the average leachate head (depth) on the liner to be less than 300 mm. The acceptable leachate head is defined as the depth of leachate above the lowest point of the liner, not including sumps or leachate trenches. The leachate collection system will be designed to handle the quantity and composition of leachate anticipated during both the operation and post-closure periods of the landfill.

6.5.1 Leachate Collection Infrastructure

A 50 mm diameter drainage aggregate material will be placed at a minimum thickness of 300 mm overtop the cell floor as well as within any leachate collection trenches and leachate sump. An engineered filter layer will be placed above the drainage material to minimize the potential for fines to make their way into the drainage layer.

Per the Landfill Criteria, leachate collection piping is to be installed with a lateral spacing of no more than 15 m and a maximum drainage path of 50 m. Based on the current conceptual design, the proposed leachate trench will have

an average spacing of 50 m from the side slopes resulting in an exemption required for the 15 m collection piping spacing and the maximum drainage path of 50 m. The leachate system, and therefore exemption, will be based on detailed calculations demonstrating the drainage system is capable of managing expected leachate flows based on local environmental rainfall data to maintain a leachate head of less than 300 mm during peak flows.

SDR11 HDPE perforated leachate piping with minimum 150 mm diameter is proposed for use in the leachate collection trench system. The collection pipes will be designed with a minimum slope of 2% along the primary flow path. The collector pipes will drain to a sump at the low point of the cell floor. The design will incorporate risers at each end of the collector pipes which will allow for the monitoring and removal of leachate as well as maintenance of the leachate system. The proposed leachate trench configuration and drainage aggregate layer will provide a support for a smooth solid walled flexible HDPE pipe, thereby guarding against lateral deflection of the pipe. Perforations in the leachate collection pipe will be along the bottom of the pipe offset from the invert of the pipe to collect leachate and reduce sediment loading within the pipe structure.

Per the Landfill Criteria, QA and QC inspections will be carried out during installation of the leachate collection system.

6.5.2 Leachate Removal Infrastructure

Leachate will be removed via a leachate riser pipe extending from the Cell 2 sump to the top of the east berm. The removal system will be equipped with a leachate level monitoring and pumping system that will allow operators to monitor the leachate head at the low point of the base of the cell, and to facilitate pumping the leachate out of Cell 2.

Leachate from Cell 2 is ultimately intended to be directed to the Prince George sanitary sewer system via an existing force main located near the main entrance of the Site. The leachate from Cell 2, once pumped from the sump, will be pumped into a new force main that ties directly into the existing force main. For added storage capacity, a leachate tank is intended adjacent to the Cell 2 leachate riser pipe to allow landfill operators flexibility when pumping to the force main.

6.6 Surface Water Management

Surface water management infrastructure, such as ponds and ditches will be incorporated into the Cell 2 design to direct surface water runoff away from the active operation, and to minimize the potential for erosion and sediment loading to downstream water courses. The goal of surface water management is to minimize the impact of the landfill on the downstream environment, while preserving the hydrologic cycle.

The Landfill Criteria requires the following design criteria for surface water management works:

- Surface water ditches and retention ponds shall be designed for the control and retention of a 1:100-year, 24-hour storm event;
- Ditch surfaces are to be armoured with appropriate protection for expected flow velocities (i.e., rip rap, erosion control matting, or vegetative cover); and
- Ditches are to maintain a minimum 1% grade to prevent sedimentation and maintain hydraulic design capacity.

Further assessment as part of the detailed design stage will be undertaken to develop the surface water management infrastructure required to meet the objectives and requirements set out in the OC and Landfill Criteria.

6.7 Cell Access

An access road will be incorporated into the design to provide access to Cell 2. The access road is proposed to extend north of the existing haul road and access into Cell 2 is proposed to be from the south or west portion of the cell.

Per the Landfill Criteria, access roads are required to be designed with the following:

- Provide safe, all-weather access to waste disposal areas;
- Road surface to be a minimum of four (4) m wide for one lane and seven (7) m wide for two lanes;
- Roads for public and commercial traffic shall not exceed 8% grade; and
- Surface water ditches shall be maintained to promote proper drainage. Armoured ditches are recommended for road steeper than 2%.

The access road is proposed to consist of the following components:

- 150 mm prepared subgrade;
- Engineered fill (depth as required); and
- 150 mm granular base course.

7.0 COST ESTIMATE

A preliminary, high-level cost estimate associated with the construction of Cell 2 has been developed prior to the results of the site investigation findings. The cost estimate is comprised of two components: one for earthworks and one for the remaining cell construction. Both cost estimates are provided under separate cover.

8.0 NEXT STEPS

Next steps include requesting an exemption to increase the leachate collector pipe lateral spacing and maximum drainage path, as part of the next stages of detailed design based on calculations showing that the Cell 2 leachate system will be capable of maintaining a leachate head of less than 300 mm during peak leachate flows.

9.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the Regional District of Fraser-Fort George and their agents. Tetra Tech Canada Inc. 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 the Regional District of Fraser-Fort George, 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. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

10.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

[redacted]

Prepared by:
Rana Mandour, P.Eng.
Project Engineer
Solid Waste Management Practice
Direct Line: 587.460.3481
Rana.Mandour@tetratech.com

[redacted]

Prepared by:
Michelle Jelinski, P.Eng.
Project Engineer – Team Lead
Solid Waste Management Practice
Direct Line: 587.460.3449
Michelle.Jelinski@tetratech.com

2024-12-06

[redacted]

M.E. LEFEBVRE
#26071
BRITISH

704-SWM.SWOP04864-01
704-SWM.SWOP04864-01

Reviewed by:
Michel Lefebvre, M.Sc., P.Eng.
Senior Project Engineer
Solid Waste Management Practice
Direct Line: 587.460.3549
Michel.Lefebvre@tetratech.com

[redacted]

Reviewed by:
Spencer Smith, P.Eng.
Project Engineer
Solid Waste Management Practice
Direct Line: 403.723.6933
Spencer.Smith@tetratech.com

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
PERMIT NUMBER: 1001972

/js

Enclosures: Figure 1: Existing Site Plan and Proposed Cells
Appendix A: Operational Certificate MR-01697
Appendix B: Drawings – Cell 2 Conceptual Design
Appendix C: Topographical Survey (September 2024) – Allnorth
Appendix D: Borehole Logs
Appendix E: Lab Results
Appendix F: Limitations on the Use of this Document

REFERENCES

BC Ministry of Environment. 2016. Landfill Criteria for Municipal Solid Waste, Second Edition. June 2016.

DataBC (Province of British Columbia). 2018. BC Water Resources Atlas.
Website: http://maps.gov.bc.ca/ess/hm/wrbc/ (Accessed October 2024).

Regional District of Fraser-Fort George. 2021 Annual Operations Report — Foothills Regional Landfill.

XCG Consulting Ltd. 2010. Integrated Landfill Management Plan.

TABLES

Table 1: Soils Lab Program Results Summary

Table 1: Soils Lab Program Results Summary

Borehole Number	Sample Number	Sample Depth (Below Ground Level)		Sample Depth (Below Ground Level)		Soil Description Modified USCS	Moisture Content (%)	Atterberg Limits			Grain Size Analysis					Sieve Analysis (mm)												Standard Proctor		Direct Shear
		Top (ft)	Bottom (ft)	Average (ft)	Average (m)			LL	PL	PI	P_{fines} (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	40	25	19	12.5	9.5	4.75	2.0	0.85	0.425	0.250	0.150	0.075	SPMDD (kg/m^3)	Opt. MC (%)	
																% Passing														
BH-01	Bulk 1	13	20	16.5	5.0																							1645	16.6	
	Bulk 2	35	40	37.5	11.4																							1785	14.4	See Results on PDFs
	B15	81	82	81.5	24.8		3.9									-	100	89	81	79	61	46	30	11	4	3	1.9			
BH-02	B01	2	3	2.5	0.8		24.5																							
	B02	10	11	10.5	3.2		20.6																							
	B03	18	19	18.5	5.6		19.9																							
	B04	21	22	21.5	6.6		20.3																							
	Bulk 1	35	40	37.5	11.4		16.8				48	4	44	52	0													1780	14.8	
	Bulk 2	53	57	55	16.8		10.8									-	-	-	-	100	100	100	99	76	33	13	7.7			
BH-03	B01	3	4	3.5	1.1		33.9																							
	SS01	5	7	6	1.8		27.8																							
	B04	16	17	16.5	5.0		24.8																							
	B09	40	41	40.5	12.3		10									-	-	-	-	100	96	87	47	12	5	2	0.6			
BH-04	B01	3	4	3.5	1.1	ML	28.5	29	23	6																				
	B02	8	9	8.5	2.6		25.1																							
	B03	11	12	11.5	3.5		26.6																							
	Bulk 1	13	17	15	4.6		19				84	1	83	16	0													1700	17.5	
	B05	23	24	23.5	7.2		24.2																							
	B06	26	27	26.5	8.1						87	2	85	13	0															
	Bulk 2	61	65	63.0	19.2		3.1									100	83	77	67	59	48	33	14	6	4	3	2.1			
	B31	232	233	232.5	70.9						97	2	95	2	1															
	B32	237	238	237.5	72.4	CL-ML	7.8	19	14	5																				
	B33	244	245	244.5	74.5	CL-CI	12.9	30	14	16																				
	SH02	250	250.75	250.4	76.3						62	19	43	27	11															See Results on PDFs
	B34	255	256	255.5	77.9	CI	15.9	33	15	18																				

Notes:

LL - Liquid Limit.

MC - Moisture Content.

PI - Plasticity index.

PL - Plastic Limit.

SPMDD - Standard Proctor Maximum Dry Density.

USCS - Unified Soil Classification System.

FIGURES

Figure 1: Existing Site Plan and Proposed Cells

0 200 m

Scale: 1: 4 000

CLIENT

REGIONAL DISTRICT of Fraser-Fort George

TETRA TECH

2024 DESIGN BRIEF
FOOTHILLS BOULEVARD REGIONAL LANDFILL

EXISTING SITE PLAN AND PROPOSED CELLS

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04864-01	DRG	MJ	0
OFFICE: EDM	DATE: September 26, 2024		

Figure 1

Q:\Edmonton\Drafting\00_MASTER PROJECT BASE PLANS\Regional District of Fraser-Fort George\Production\SWM.SWOP04864-01\Figures\Conceptual Cell 2 Design\ROFFG Design Brief-FIG 1.dwg [FIGURE 1] October 31, 2024 - 1:01:28 pm (BY: GAMMIE, DON)

APPENDIX A

OPERATIONAL CERTIFICATE MR-01697

MINISTRY OF ENVIRONMENT

OPERATIONAL CERTIFICATE

MR-01697

Under the Provisions of the Environmental Management Act
and in accordance with the
Regional District of Fraser-Fort George
Solid Waste Management Plan

Regional District of Fraser-Fort George

155 George Street

Prince George, British Columbia

V2L 1P8

is authorised to manage recyclable material and municipal solid waste at a sanitary landfill located at **6595 Foothills Boulevard**, Prince George, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may result in prosecution.

1. LOCATION OF AUTHORISED FACILITY

The location of the facility for the management of recyclable material and municipal solid wastes to which this Operational Certificate is applicable is the Foothills Landfill, Block A of the Northeast ¼ of District Lot 4053 and Block A of the Northwest ¼ of District Lot 4048, Cariboo District as shown in the attached plan and containing 87 hectares more or less.

2. ENTRANCE FACILITIES

The authorised facility includes recyclable material and municipal solid waste drop-off facilities, weigh scales and related appurtenances approximately as shown on the attached Site Plan.

3. MANAGEMENT OF MUNICIPAL SOLID WASTE

3.1. Sanitary Landfill

3.1.1. The authorised facilities are a sanitary landfill area, composting area, landfill gas management, recyclable material storage areas and related appurtenances approximately as shown on the attached Site Plan. The site reference number for the discharge is E211018

[redacted]

Date Issued: OCT 3 1 2005

Del Reinheimer, P.Eng.
for Director, Environmental Management Act

3.1.2. The characteristics of the discharge must be municipal solid waste as defined under the *Environmental Management Act* and other wastes as approved in writing by the Director.

3.1.3. Waste may be discharged to the areas specified in the Regional District's Design and Operation Plan, approximately located as shown on the attached Site Plan.

4. GENERAL REQUIREMENTS

4.1. Qualified Professionals

All facilities and information, including works, plans, assessments, investigations, surveys, programs and reports, must be certified by qualified professionals.

4.2. Plans

4.2.1. The Regional District shall prepare a Design and Operation Plan that will include considerations for site operation and development, leachate and landfill gas management, composting operations, monitoring programs and environmental impact mitigation management.

The Design and Operation Plan must be submitted to the Director by November 30, 2005.

4.2.2. The Design and Operation Plan must address, but not be limited to, each of the subsections in the *Landfill Criteria for Municipal Solid Waste* including performance, siting, design, operational and closure and post-closure criteria.

4.2.3. The facilities must be developed and operated in accordance with the Design and Operation Plan.

4.2.4. Any updates to the plan shall be immediately submitted to the Director.

4.3. Additional Facilities or Works

The Director may require investigations, surveys, and the construction of additional facilities or works. The Director may also amend information requirements of this Operational Certificate including plans, programs, assessments and reports.

[redacted]

Del Reinheimer, P.Eng.
for Director, Environmental Management Act

Date Issued: OCT 3 1 2005

5. OPERATIONAL REQUIREMENTS

5.1. Operator Training and Development

At a minimum, the Regional District will ensure that operating personnel are trained to industry standards and at least one member of the on-site personnel are trained and current in a SWANA recognized landfill operator course or equivalent.

5.2. Wildlife Management and Control

At the time of issuance of this certificate the Regional District is not required to install electric fencing for the purpose of preventing access to the site by bears.

The Regional District is required to monitor wildlife (medium and large carnivores) activity at the facility and keep records of occurrences and observations of wildlife (medium and large carnivores).

The Director may request the Regional District to develop a Wildlife Management Plan that presents solutions for preventing wildlife access to the facility.

5.3. Compost

Composting facilities shall be operated and maintained in accordance with the *Organic Matter Recycling Regulation.*

5.3. Management of Landfill Gas

The management of landfill gas shall be managed in accordance with sections 4.2 and 6.4 of the *Landfill Criteria for Municipal Solid Waste.* In addition, the Regional District will have a qualified professional prepare an Operations and Maintenance Manual for the landfill gas management system.

6. HAZARDOUS WASTE MANAGEMENT

6.1. Hazardous Waste

"Hazardous Wastes" as defined by the *Hazardous Waste Regulation* pursuant to the *Environmental Management Act* are prohibited from disposal unless expressly authorised by the *Hazardous Waste Regulation*, approved by the Director or as specified in the Operational Certificate.

[redacted]

Date Issued: OCT 3 1 2005

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for Director, Environmental Management Act

6.2. Waste Asbestos

Waste asbestos is authorized for disposal subject to compliance with the requirements of section 40 of the *Hazardous Waste Regulation* **and** the following conditions:

6.2.1. The asbestos waste may not be mixed with any other hazardous waste.

6.2.2. The Regional District must approve the disposal before disposal takes place.

6.2.3. All other applicable requirements of the *Hazardous Waste Regulation*, including but limited to manifesting and waste record keeping, must also be complied with.

6.3. Handling of Impacted Soil

The *Environmental Management Act*, the *Contaminated Sites Regulation* and the *Hazardous Waste Regulation* are applicable for the disposal of impacted (contaminated) soil at the facility.

6.4. Hazardous Wastes from Accidental Spills or Abandonment

Hazardous wastes resulting from accidental spills or abandonment of dangerous goods may be accepted at the facility only under the authority of Section 52(1) of the *Hazardous Waste Regulation*.

7. MONITORING

7.1. Monitoring Program

7.1.1. A monitoring program shall be developed by a qualified professional to identify potential impacts to the environment and public health from the facility.

7.1.2. The monitoring program shall be submitted as part of the Design and Operation Plan.

7.1.3. The monitoring program must address, but not be limited to, subsections 4.1, 4.2 and 7.15 of the *Landfill Criteria for Municipal Solid Waste* and the *Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills.*

7.1.4. Monitoring must be conducted in accordance with the monitoring program.

[redacted]

Del Reinheimer, P.Eng.
for Director, Environmental Management Act

Date Issued: OCT 31 2005

8. REPORTING

All reports and drawings shall be submitted in electronic format unless otherwise requested by the Director.

8.1. Drawings

All drawings shall be certified correct and sealed by a qualified professional. Drawings shall be submitted to the Director within 30 days of completion or as otherwise specified by the Director.

8.2. Annual Report

The Regional District shall submit an Annual Report to the Director on or before June 30 each year for the previous calendar year. The report shall contain, but not be limited to the following information:

i.) an executive summary;

ii.) the type and tonnage of waste received, recycled and landfilled for the year;

iii.) a current topographic map detailing airspace consumption, on-site borrow pit changes and future developments;

iv.) updated estimates for the remaining capacity, closure date for the current phase and closure date for the current landfill footprint;

v.) any new information or proposed changes relating to the facilities and Design and Operation Plan;

vi.) composting operation activity including amount of material received for composting, material composted, material sold and number of composting cycles;

vii.) occurrences or observations of wildlife (medium and large carnivores) at the facility;

viii.) a statement regarding the facility's progress in reducing the regional solid waste stream, in accordance with the hierarchy of reduce, reuse and recycle principles; and,

ix.) the results of all monitoring programs as specified in this Operational Certificate. Data interpretation and comparison to the performance criteria in the *Landfill Criteria for Municipal Solid Waste* and the *Guidelines for Environmental Monitoring and Municipal Solid Waste*

[redacted]

Date Issued: OCT 3 1 2005

Del Reinheimer, P.Eng.
for Director, Environmental Management Act

Landfills. Trend analysis, as well as an evaluation of the impacts of the discharges on the receiving environment in the previous year shall be carried out by a qualified professional.

9. CLOSURE PLAN

At least one year in advance of decommissioning the landfill, or as otherwise specified by the Director, a Closure Plan shall be submitted which includes at least the following information:

i) a topographic plan showing the final elevations contours of the landfill and surface water diversion and drainage controls;

ii) specifications for the final cap and proposed end use of the site; and,

iii) provisions for a minimum 25 year post-closure care period at the facility which, at a minimum, considers the following: groundwater monitoring, surface water monitoring, landfill gas management, erosion and settlement monitoring and management.

10. CLOSURE AND POST-CLOSURE FUND

The Regional District will conform to the Public Sector Accounting and Auditing Board's requirements (PS 3270) to recognize solid waste landfill closure and post-closure liability. The Regional District will develop a plan to ensure that sufficient funds are available for closure and post-closure care work.

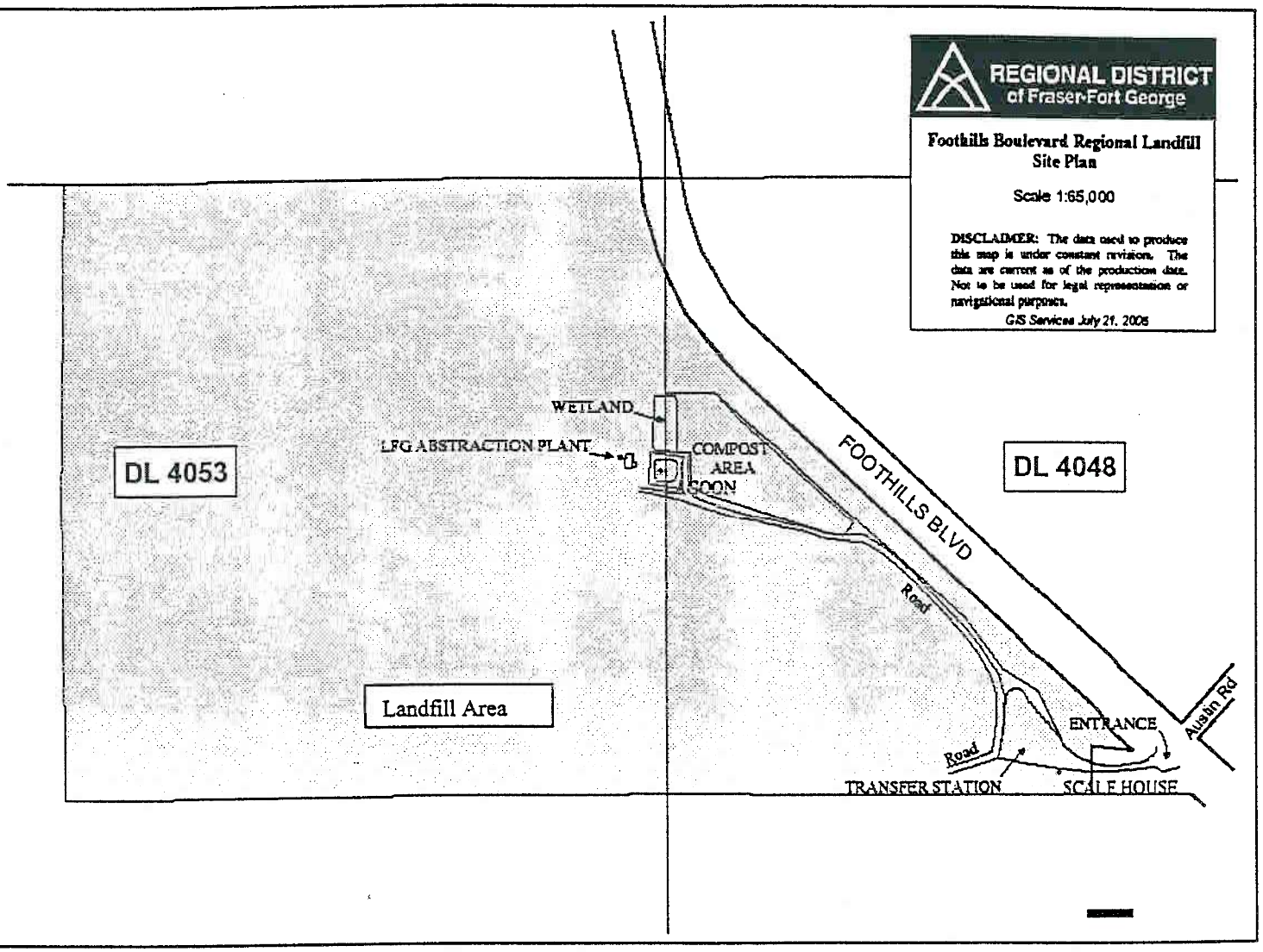
[redacted]

Del Reinheimer, P.Eng.
for Director, Environmental Management Act

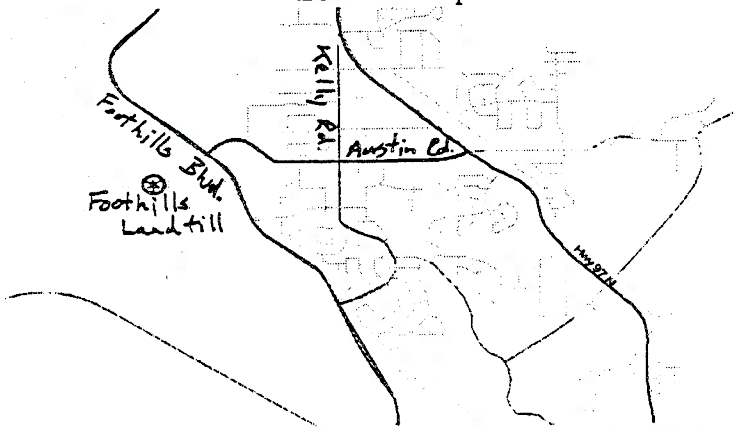
Date Issued: OCT 31 2005

SITE PLAN

N



Location Map



Scale: Not to Scale

OCT 3 1 2005

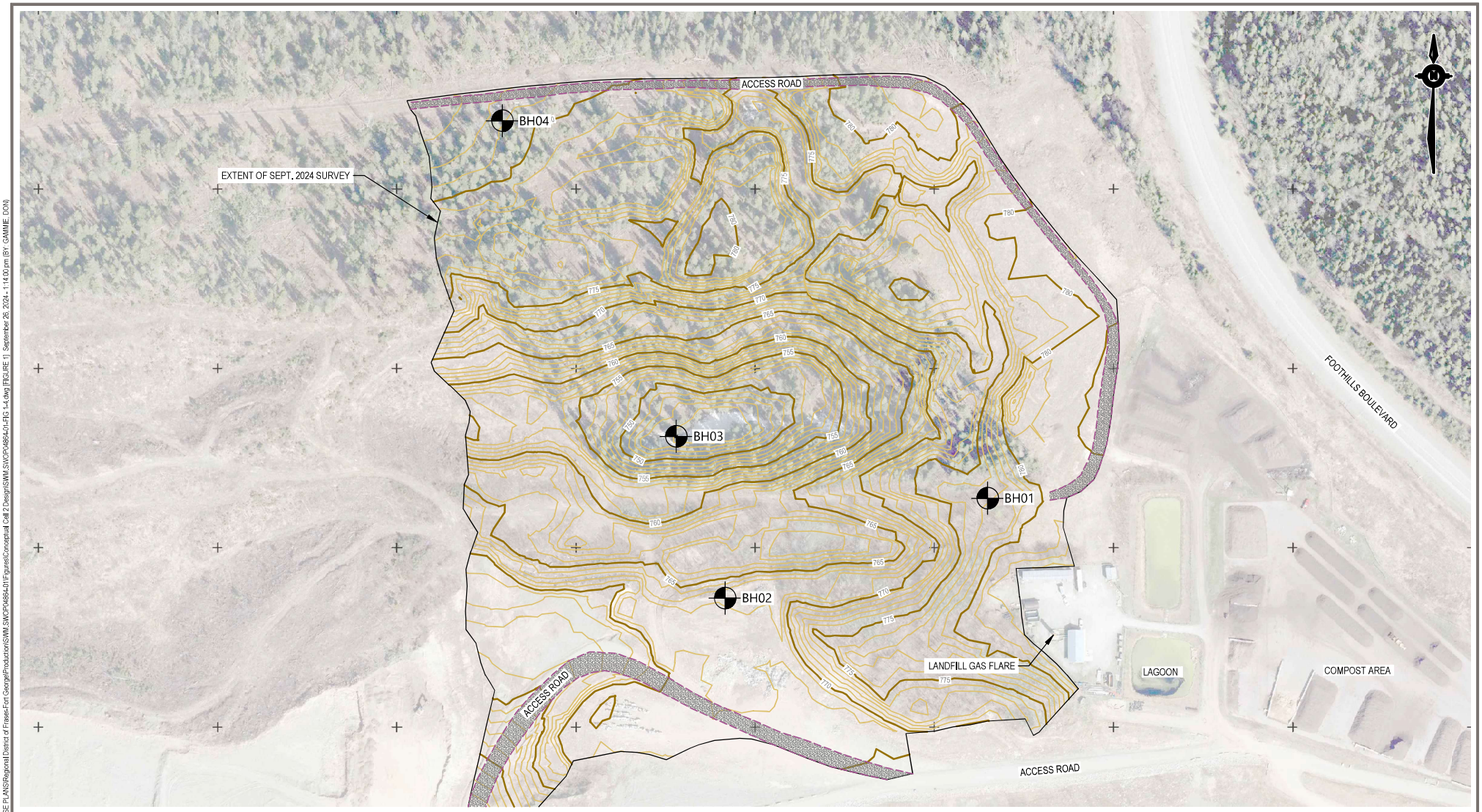
Operational Certificate No. MR-01697

[redacted]

Del Reinheimer, P.Eng.
for Director, Environmental Management Act
Omineca and Peace Regions

APPENDIX B

DRAWINGS – CELL 2 CONCEPTUAL DESIGN



CLIENT

REGIONAL DISTRICT of Fraser-Fort George

TETRA TECH

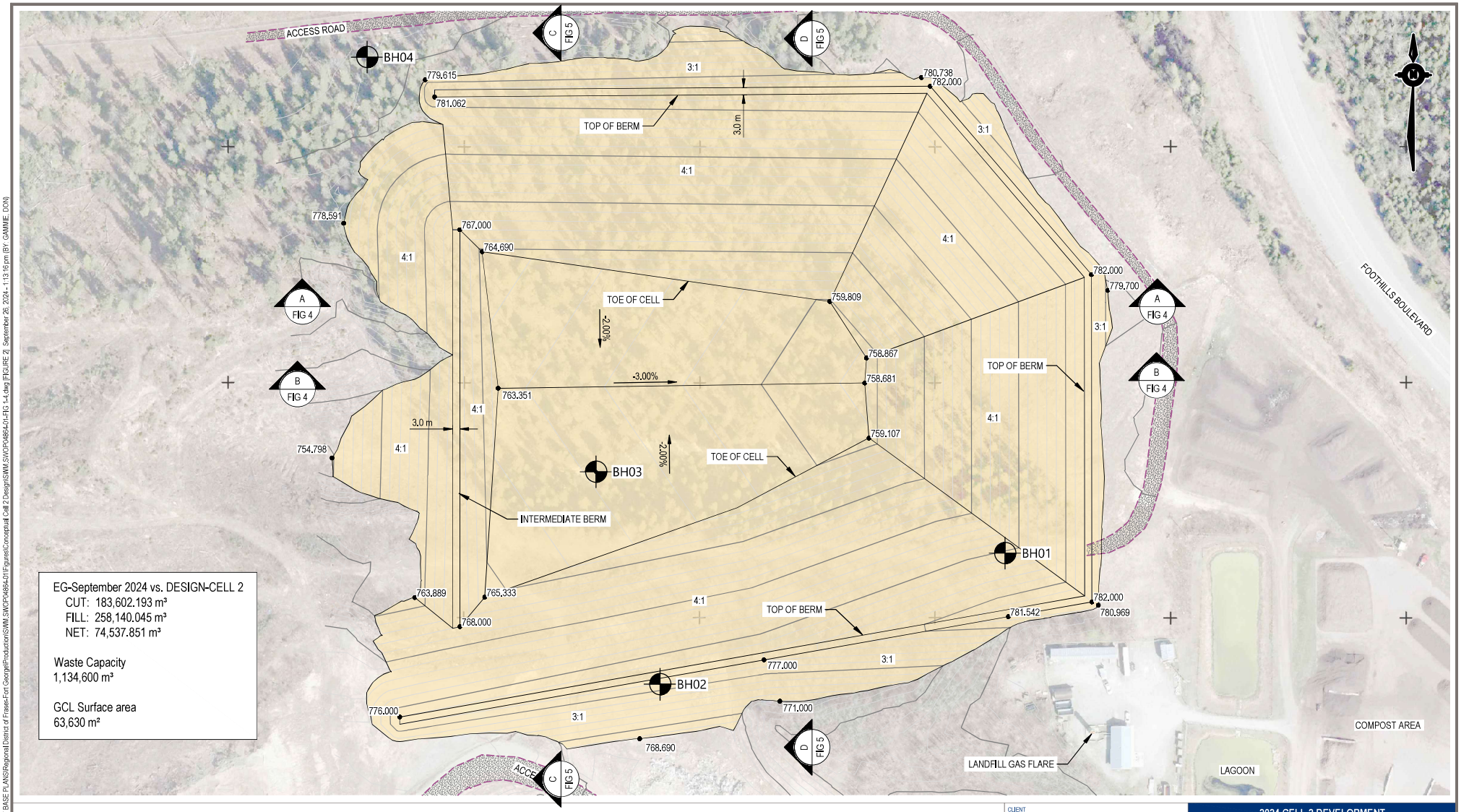
2024 CELL 2 DEVELOPMENT
FOOTHILLS BOULEVARD REGIONAL LANDFILL

EXISTING SITE PLAN
SEPTEMBER 2024 SURVEY

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04864-01	DRG	MJ	0

OFFICE: EDM
DATE: September 26, 2024

Figure 1



EG-September 2024 vs. DESIGN-CELL 2
CUT: 183,602.193 m³
FILL: 258,140.045 m³
NET: 74,537.851 m³

Waste Capacity
1,134,600 m³

GCL Surface area
63,630 m²

0 50 m
Scale: 1: 1 500

CLIENT
REGIONAL DISTRICT of Fraser-Fort George

TETRA TECH

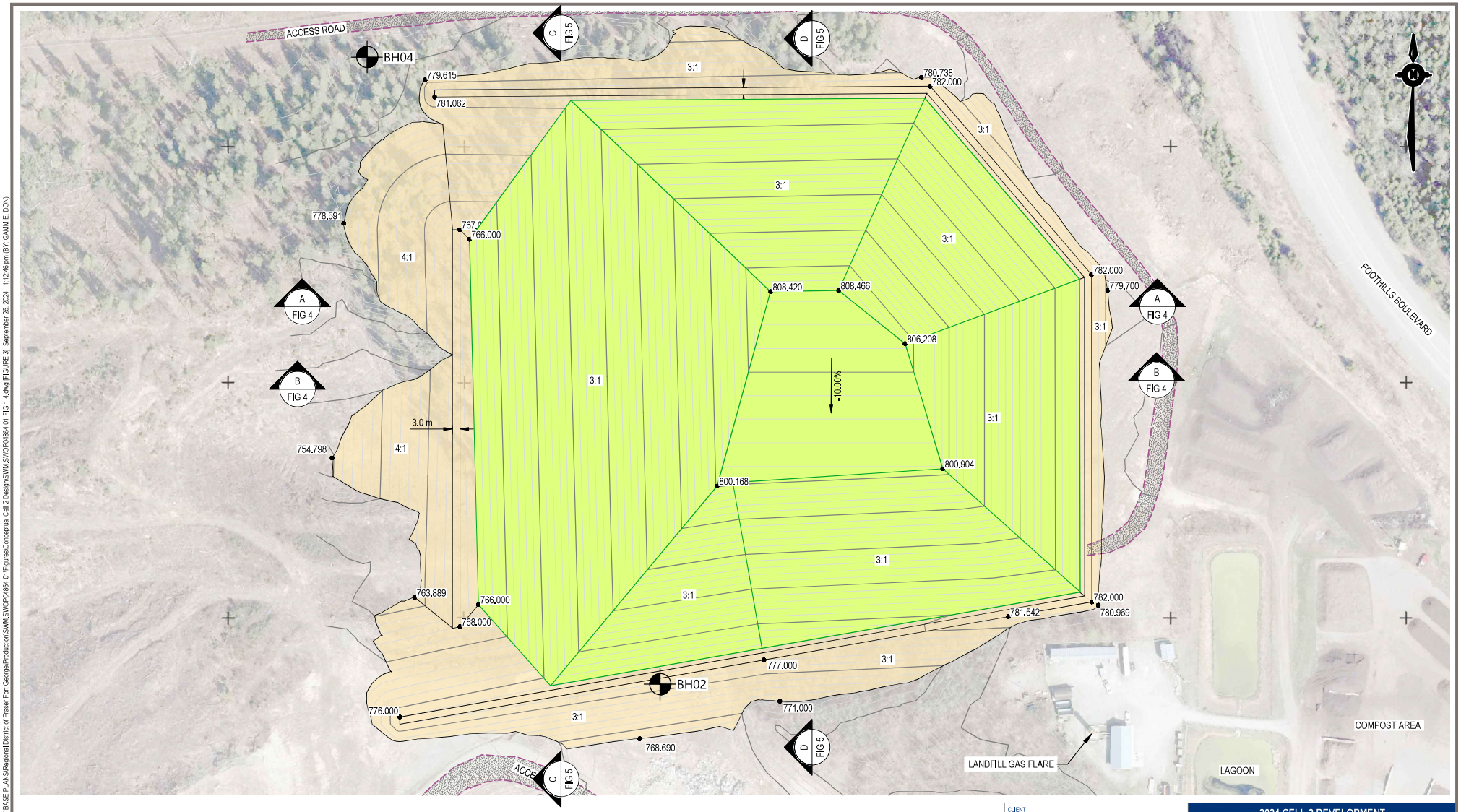
2024 CELL 2 DEVELOPMENT
FOOTHILLS BOULEVARD REGIONAL LANDFILL

PLAN
CONCEPTUAL CELL 2 DESIGN

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04864-01	DRG	MJ	0
OFFICE: EDM	DATE: September 26, 2024		

Figure 2

Q:\Edmonton\Drafting\00_MASTER PROJECT BASE PLANS\Regional District of Fraser-Fort George\Production\SWM.SWOP04864-01\Figures\Conceptual Cell 2 Design\SWM.SWOP04864-01-FIG 1-4.dwg [FIG1RE 2] September 26, 2024 - 1:13:16 pm (BY: GAMMIE, DON)



CLIENT

REGIONAL DISTRICT of Fraser-Fort George

TETRA TECH

2024 CELL 2 DEVELOPMENT
FOOTHILLS BOULEVARD REGIONAL LANDFILL

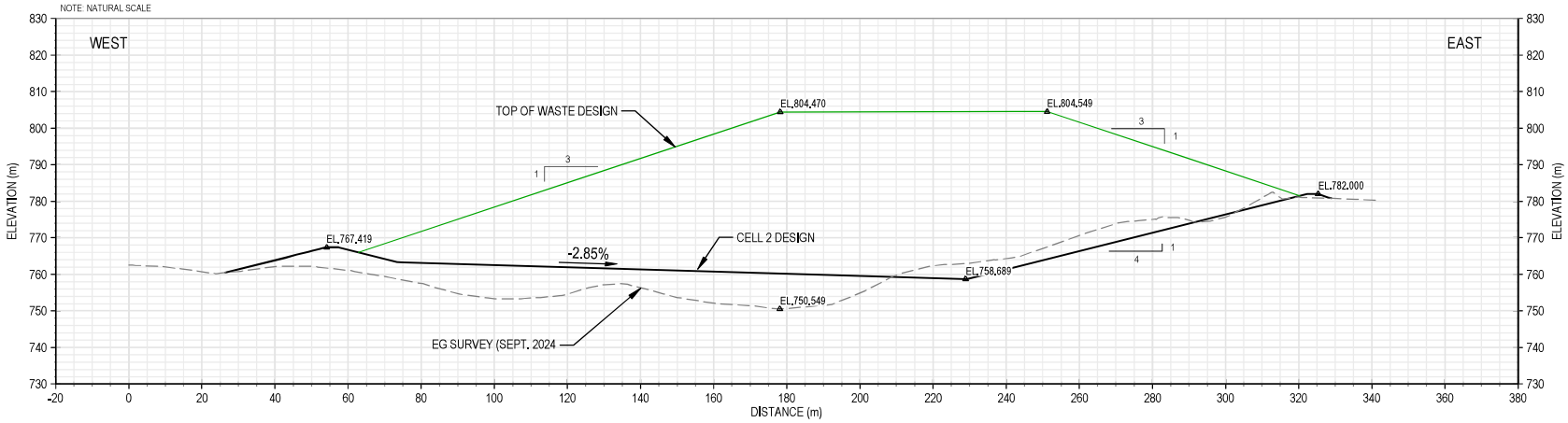
PLAN
CONCEPTUAL CELL 2 TOP OF WASTE

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04864-01	DRG	MJ	0

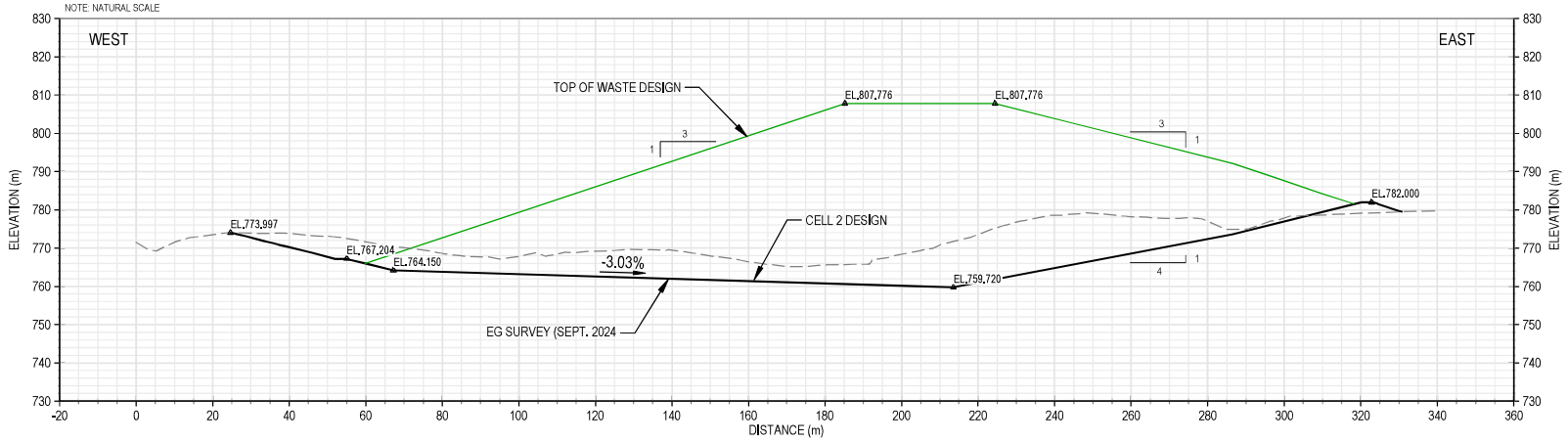
OFFICE: EDM
DATE: September 26, 2024

Figure 3

Q:\Edmonton\Drafting\00_MASTER PROJECT BASE PLANS\Regional District of Fraser-Fort George\Production\SWM.SWOP04864-01\Figures\Conceptual Cell 2 Design\SWM.SWOP04864-01-FIG 1-4.dwg [FIG3_RE 3] September 26, 2024 - 1:12:46 pm (BY: GAMME, DON)



SECTION A



SECTION B

0 50 m

Scale: 1: 1 250

CLIENT

REGIONAL DISTRICT of Fraser-Fort George

TETRA TECH

2024 CELL 2 DEVELOPMENT
FOOTHILLS BOULEVARD REGIONAL LANDFILL

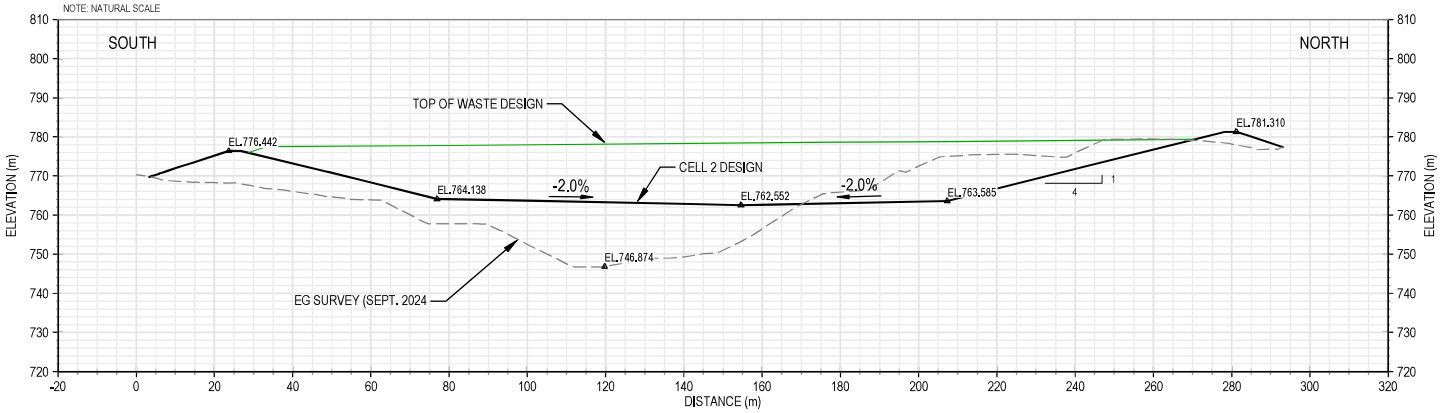
CROSS-SECTION A AND B

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04864-01	DRG	MJ	0

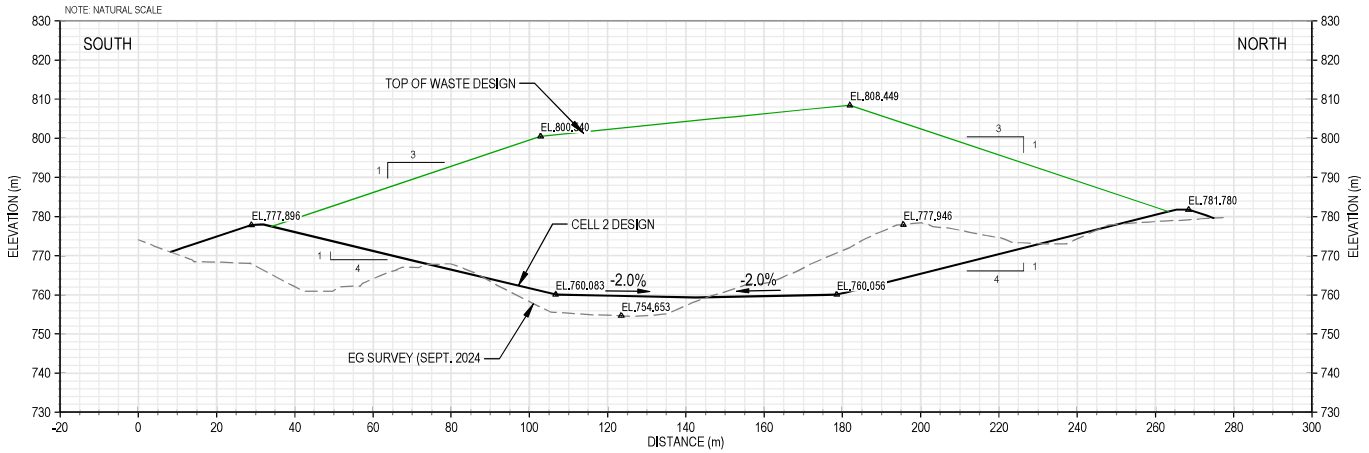
OFFICE: EDM

DATE: September 26, 2024

Figure 4



SECTION C



SECTION D

0 50 m

Scale: 1: 1 250

CLIENT

REGIONAL DISTRICT of Fraser-Fort George

TETRA TECH

2024 CELL 2 DEVELOPMENT
FOOTHILLS BOULEVARD REGIONAL LANDFILL

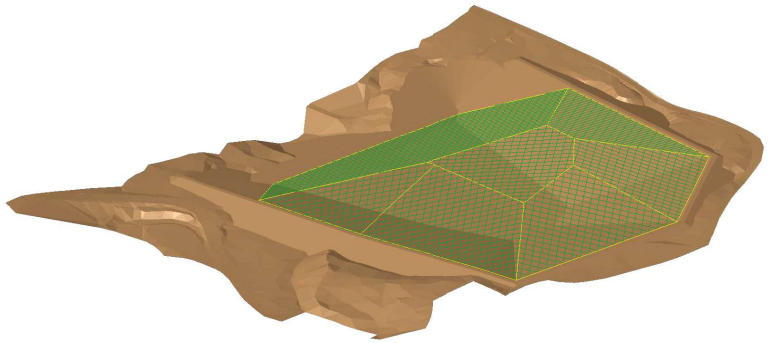
CROSS-SECTION C AND D

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04864-01	DRG	MJ	0

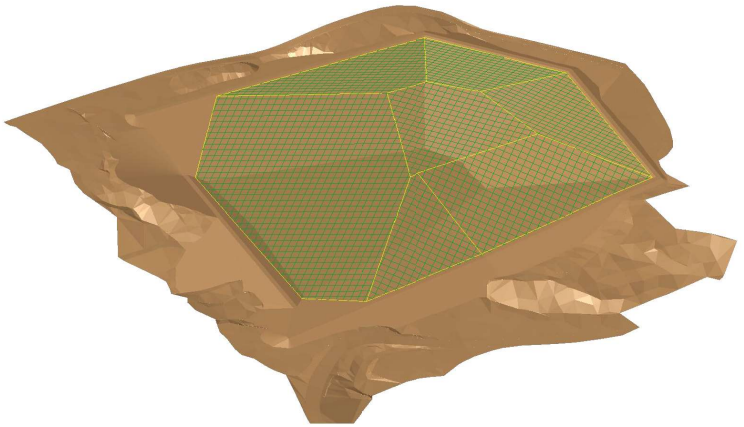
OFFICE: EDM

DATE: September 26, 2024

Figure 5



LOOKING NORTHWEST



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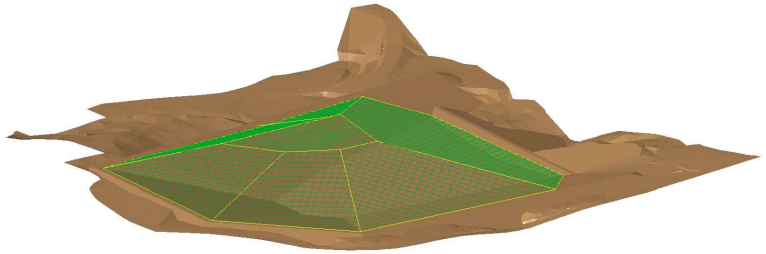
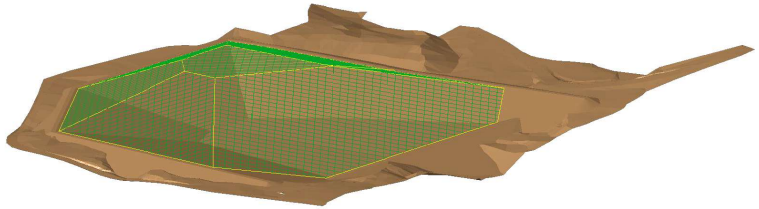


LOOKING SOUTHWEST



LOOKING SOUTHEAST

0 50 m

Scale: 1: 1 250

CLIENT

REGIONAL DISTRICT of Fraser-Fort George

TETRA TECH

2024 CELL 2 DEVELOPMENT
FOOTHILLS BOULEVARD REGIONAL LANDFILL

3D VIEWS

PROJECT NO.	DWN	CKD	REV
SWM.SWOP04864-01	DRG	MJ	0

OFFICE: EDM

DATE: September 26, 2024

Figure 6

APPENDIX C

TOPOGRAPHICAL SURVEY (SEPTEMBER 2024) – ALLNORTH

APPENDIX D

BOREHOLE LOGS

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-01**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511328 E; 5982827 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
0		SILT - sandy, trace clay, trace gravel, rootlets, fine grained sand, damp, stiff, non plastic, brown				
				B01		
1						
				SS01	14	
2		SAND - silty, trace clay, trace gravel, damp, loose to dense, brown		B02		
		SILT - sandy, trace clay, trace gravel, moist, non to low plastic, brown		B03		
3				SS02	11	
		- rootlets, thin dark layer				
4		SAND - trace silt, trace clay, fine to medium grained sand, poorly graded, damp, compact, brown				
		- some silt				
5		- trace silt		Bulk1		
6		- some silt		SS04	16	
				B04		
7	Sonic	- trace silt				
		- some silt, moist		SS05	19	
8		- cross bedded sand				
9		- trace silt, damp				
		- some silt, moist		SS06	17	
10		- trace silt, damp		B05		
				B06		
11				SS07	20	
				Bulk2		
12		- some silt, 50 mm thick lamination				
		- trace silt		SS08	24	
13		- interbedded some silt layers				
				B07		
14				SS09	28	
				B08		
15						

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

Backfill

Depth (ft): 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 41.15 m
Equipment Type: Terra Sonic 150	Start Date: 2024 July 30
Logged By: LL/SS/TS	Completion Date: 2024 August 1
Reviewed By: ML	Page 1 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-01**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511328 E; 5982827 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	Backfill	Depth (ft)
15	Sonic	- dense	SS	SS10	32					50
16				B09						52
17		- compact	SS	SS11	17					54
				B10						56
18				B11						58
		- some gravel, fine to coarse grained sand, subangular gravel to 55 mm diameter, well graded, dense, light brown	SS	SS12	45					60
19		- trace gravel, subrounded gravel to 30 mm diameter								62
				B12						64
20			SS	SS13	41					66
21				B13						68
		- fine to medium grained sand, poorly graded, brown	SS	SS14	36					70
22				B14						72
										74
23		- compact	SS	SS15	28					76
24										78
			SS	SS16	34					80
25		- some gravel, fine to coarse grained sand - (Gravel - 39%; Sand - 59.1%; Silt & Clay - 1.9%) - trace gravel, fine to medium grained sand		B15		3.9	●			82
										84
26		- very dense - gravelly, fine to coarse grained sand, gravel to 60 mm diameter - trace gravel, gravel to 15 mm diameter, well graded, dense	SS	SS17	61					86
				B16						
27										88
			SS	SS18	50					90
28										92
										94
29		- gravel to 40 mm diameter, very dense	SS	SS19	95					96
				B17						
30										98

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 41.15 m
Equipment Type: Terra Sonic 150	Start Date: 2024 July 30
Logged By: LL/SS/TS	Completion Date: 2024 August 1
Reviewed By: ML	Page 2 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-01**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511328 E; 5982827 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
30						
31				SS20	79	
32		- some gravel, some silt				
		GRAVEL - trace sand, gravel to 30 mm diameter, medium to coarse grained sand, poorly graded, damp, very dense, greyish brown		SS21	87	
				B18		
33		SAND - trace gravel, trace silt, fine to coarse grained sand, well graded, damp, very dense, brown				
		0 hrs.				
34		- trace clay		SS22	84	
		- silty, gravel to 15 mm diameter, dry, light brown		B19		
35	Sonic	- no visible clay, gravel to 25 mm diameter, moist, brown		SS23	76	
36		- damp				
				SS24	96	
37				B20		
38		- trace clay, gravel to 10 mm diameter		SS25	80	
39						
				SS26	69	
40						
		- gravel to 15 mm diameter				
41						
		END OF BOREHOLE (41.15 metres) slough - 41.00 metres at 0 hrs. water - 33.38 metres at 0 hrs. Note: Backfilled at completion				
42						
43						
44						
45						

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

Backfill

Depth (ft)
100
102
104
106
108
110 (0 hrs.)
112
114
116
118
120
122
124
126
128
130
132
134
136
138
140
142
144
146

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 41.15 m
Equipment Type: Terra Sonic 150	Start Date: 2024 July 30
Logged By: LL/SS/TS	Completion Date: 2024 August 1
Reviewed By: ML	Page 3 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-02**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511220 E; 5982760 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	Backfill	Depth (ft)
0	Sonic	SILT - sandy, trace gravel, trace clay, fine grained sand, moist, soft, non plastic, brown		B01		24.5				0
1		SAND - trace gravel, trace silt, trace clay, fine to medium grained sand, poorly graded, damp, loose, brown								2
2										4
3				B02	7	20.6				6
		SILT - sandy, trace gravel, trace clay, fine grained sand, damp, stiff, non plastic, brown		SS01						8
4		- some sand								10
5										12
		- stiff to very stiff, non to low plastic		B03		19.9				14
6		- sandy, firm		B07	9					16
				SS02		20.3				18
7		SAND - trace gravel, trace silt, trace clay, fine to medium grained sand, poorly graded, damp to moist, loose, brown		B04						20
8										22
				B05						24
9		SILT - sandy, trace gravel, trace clay, fine grained sand, poorly graded, damp, stiff, non to low plastic, brown								26
		- trace sand, moist, firm to stiff, low to medium plastic		SS03	12					28
10				B06						30
										32
11		- sandy, damp, stiff, non to low plastic - (Gravel - 0%; Sand - 52%; Silt - 44%; Clay - 4%)								34
				Bulk1		16.8				36
		- firm								38
12		SAND - some silt, trace gravel, trace clay, poorly graded, damp, compact, brown								40
		- fine to coarse grained sand, subrounded gravel to 35 mm diameter, damp to moist		B08	21					42
13				SS04						44
14										46
		- subrounded to rounded gravel, well graded, damp								48
15										

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 40.08 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 2
Logged By: LL/SS/TS	Completion Date: 2024 August 2
Reviewed By: ML	Page 1 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-02**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511220 E; 5982760 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
15				B09		
		- subrounded gravel, moist		SS05	16	
16				B10		
		- (Gravel - 0%; Sand - 92.3%; Silt & Clay - 7.7%)		Bulk2		10.8
17		- trace silt, poorly graded, damp				
18				B11		
		- some silt, moist		SS06	22	
19						
				B12		
20		- trace silt				
		- damp		B13		
21						
				SS07	27	
22		- compact				
	Sonic					
23				B14		
24		- dense				
				SS08	42	
25						
26						
27		- some gravel, subrounded to subangular gravel to 40 mm diameter, well graded, dry, light brown		B15		
				SS09	41	
28		- trace gravel, fine to medium grained sand, poorly graded, damp, brown				
29				B16		
30						

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

Backfill

Depth (ft): 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 40.08 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 2
Logged By: LL/SS/TS	Completion Date: 2024 August 2
Reviewed By: ML	Page 2 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-02**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511220 E; 5982760 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
30						
31	Sonic	- fine to coarse grained sand, very dense - some silt, fine to medium grained sand, poorly graded		SS10	54	
		- some gravel				
32		- trace gravel, trace silt, fine to coarse grained sand, gravel to 430 mm diameter, well graded		B17		
33						
34		- some gravel, coarse grained sand - some silt, trace gravel		SS11	53/ 150mm	
35		- dry				
36				B18		
37		GRAVEL - some sand, trace silt, subrounded gravel to 30 mm diameter, fine to coarse grained sand, poorly graded, damp, very dense, grey		B19 SS12	62	
38		SAND - some gravel,t race silt, fine to coarse grained sand, subrounded gravel, well graded, damp, very dense, greyish brown - some gravel, brown - trace gravel				
39				B20		
40				SS13	100	
41		END OF BOREHOLE (40.08 metres) slough - 39.47 metres at 0 hrs. water - 37.75 metres at 0 hrs. Note: Backfilled at completion				
42						
43						
44						
45						

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

>100

Backfill

0 hrs.

Depth (ft): 100 102 104 106 108 110 112 114 116 118 120 122 124 126 128 130 132 134 136 138 140 142 144 146

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 40.08 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 2
Logged By: LL/SS/TS	Completion Date: 2024 August 2
Reviewed By: ML	Page 3 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-03**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511153 E; 5982860 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
0		SILT - sandy, trace gravel, trace clay, rootlets, fine grained sand, damp, soft, non to low plastic, brown, woody debris				
		- trace sand, no visible rootlets or woody debris, soft to firm, low plastic				
1		- moist, low to medium plastic		B01		33.9
				SS01	6	27.8
2		- rootlets, damp, low plastic, woody debris		B02		
		- moist				
		SAND - some silt, fine to medium grained sand, poorly graded, damp, compact, brown				
3		SILT - trace sand, fine grained sand, damp, very soft to soft, low plastic, brown		SS02	14	
4		SAND - trace silt, fine to medium grained sand, poorly graded, damp, loose, brown		B03		
		SILT - trace sand, fine grained sand, damp, firm to stiff, low to medium plastic, brown		SS03	15	
5		- some sand		B04		24.8
		SAND - silty, fine grained sand, poorly graded, damp, compact, brown				
6				SS04	18	
		SILT - trace sand, fine grained sand, damp, stiff, low plastic, brown				
7	Sonic					
				B05	24	
8		- some sand		SS05		
		- fine to coarse grained sand, damp				
9		SAND - trace silt, fine to medium grained sand, poorly graded, damp, compact		B06		
		- moist				
10				B07		
11						
				B08		
12		- trace gravel, moist		B09	14	10
		- (Gravel - 4%; Sand - 95.4%; Silt & Clay - 0.6%)		SS06		
13				Bulk1		
14						
15		- some gravel, gravel to 35 mm diameter, well graded, damp, brown				

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

Backfill

Depth (ft): 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 40.08 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 3
Logged By: LL/SS/TS	Completion Date: 2024 August 4
Reviewed By: ML	Page 1 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-03**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511153 E; 5982860 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
15	Sonic			B10		
		- trace gravel		SS07	29	
16				B11		
		- fine to medium grained sand, poorly graded, dense				
17						
				B12		
18						
		- very dense		SS08	53	
		SILT - some sand, trace clay, damp, soft, low plastic		B13		
19				Bulk2		
		- firm to stiff				
		SAND - some silt, fine to medium grained sand, poorly graded, damp, compact, brown				
20		- trace gravel, fine to coarse grained sand, gravel to 7 mm diameter, well graded				
		- no visible gravel, fine to medium grained sand, poorly graded		B14		
21						
		- trace silt, moist, dense		SS09	35	
22						
23						
		- damp		B15		
24						
		- dense		SS10	37	
25						
26		- some silt				
27		- silty, trace clay, fine grained sand		B16		
		- some silt, fine to medium grained sand, dense				
		- moist		SS11	47	
28		- trace silt, no visible clay				
29				B17		
30						

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

Backfill

Depth (ft)
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 40.08 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 3
Logged By: LL/SS/TS	Completion Date: 2024 August 4
Reviewed By: ML	Page 2 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-03**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511153 E; 5982860 N; Z 10

Depth (m)	Method	Soil Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
30						
31	Sonic	- some silt, very dense		SS12	56	
		- trace silt, damp				
32				B18		
		0 hrs. ▼				
33						
34		- some silt, moist		SS13	58	
35		- damp				
36		- trace clay, silt nodules		B19		
		- very dense				
37		- fine grained sand		SS14	64	
38						
39		- mottled with black streaks - brown - mottled grey to black		B20		
40		- dense		SS15	35	
41		END OF BOREHOLE (40.08 metres) slough - 39.85 metres at 0 hrs. water - 32.00 metres at 0 hrs. Note: Backfilled at completion				
42						
43						
44						
45						

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

■ SPT (N) ■: 20 40 60 80

▲ Pocket Pen. (kPa) ▲: 100 200 300 400

Backfill

Depth (ft): 100 102 104 106 108 110 112 114 116 118 120 122 124 126 128 130 132 134 136 138 140 142 144 146

0 hrs. ▼

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 40.08 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 3
Logged By: LL/SS/TS	Completion Date: 2024 August 4
Reviewed By: ML	Page 3 of 3

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-04**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511032 E; 5983043 N; Z 10

Depth (m)	Method	Soil Description	SOIL SYMBOL	USC	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
0		SILT - trace sand, trace clay, trace rootlets, fine grained sand, damp, very stiff, medium plastic, brown						
		- no visible rootlets						
1		- stiff		ML		B01		28.5
		- soft						
2								
		- some clay, low plastic				B02		25.1
3		- trace clay, firm to stiff				SS01	11	
						B03		26.6
4		- moist						
		- (Gravel - 0%; Sand - 16%; Silt - 83%; Clay - 1%)				Bulk1		19
		- soft						
5		SAND - some silt, fine grained sand, poorly graded, damp, loose, brown						
		SILT - trace sand, fine grained sand, damp, soft, low plastic, brown				B04		
6		- some sand, trace clay				SS02	10	
7	Sonic					B05		24.2
		- rim						
8		SAND - silty, trace clay, fine grained sand, poorly graded, damp, compact, brown				B06		
		- (Gravel - 0%; Sand - 13%; Silt - 85%; Clay - 2%)						
9		SILT - some sand, trace clay, fine grained sand, poorly graded, damp, non platic, brown				SS03	16	
						B07		
10		- soft						
		SAND - some silt, trace clay, fine grained sand, poorly graded, damp, compact, brown						
11		- trace silt				B08		
		- silty						
		- some silt						
12		- compact				SS04	29	
		- trace silt, fine to medium grained sand, moist				B09		
13		- damp						
		- some silt, grey rims on silt nodules				B10		
14		- trace silt						
15								

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

Standpipe

Depth (ft): 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 80.39 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 6
Logged By: LL/SS/TS	Completion Date: 2024 August 9
Reviewed By: ML	Page 1 of 6

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-04**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511032 E; 5983043 N; Z 10

Depth (m)	Method	Soil Description	SOIL SYMBOL	USC	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	Standpipe	Depth (ft)
15												50
	Sonic	- dense				SS05	40					
16		- trace gravel, fine to coarse grained sand, subrounded gravel to 35 mm diameter, well graded, damp, very dense				B11						52
17		- no visible gravel, fine to medium grained sand, poorly graded, dense										54
		- some gravel, fine to coarse grained sand, subrounded gravel to 50 mm diameter, well graded, very dense				B12						56
18		- compact										58
		- trace gravel, gravel to 25 mm diameter, wet				B13						60
		- (Gravel - 52%; Sand - 45.9%; Silt & Clay - 2.1%)				SS06	29					62
19						Bulk2		3.1				
		- some gravel										64
20		- some silt, trace gravel										66
		- trace silt, damp										68
21						B14						70
		- dense				SS07	33					
22		- gravel to 50 mm diameter, wet										72
		- some gravel										74
23		- trace gravel				B15						76
		- damp										78
24												80
		- compact										
		- moist				SS08	24					82
25		- gravel to 20 mm diameter, poorly graded, damp										84
26		- no visible gravel, fine to medium grained sand				B16						86
27												88
		- trace gravel, trace coarse grained sand, dense				SS09	40					90
28		- no visible gravel or clay										92
						B17						94
29												96
30												98

Contractor: Geotech Drilling	Completion Depth: 80.39 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 6
Logged By: LL/SS/TS	Completion Date: 2024 August 9
Reviewed By: ML	Page 2 of 6

TETRA TECH

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-04**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511032 E; 5983043 N; Z 10

Depth (m)	Method	Soil Description	SOIL SYMBOL	USC	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	Standpipe	Depth (ft)
30												
31	Sonic	- wet				SS10	35					100
32												102
33						B18						104
		- trace gravel, trace coarse grained sand, subrounded gravel to 15 mm diameter										106
		- very dense				SS11	50/ 50mm			>100		108
34		- some gravel, fine to coarse grained sand, gravel to 17 mm dimeter, well graded										110
		- trace gravel, gravel to 25 mm diameter										112
35		- gravelly, subrounded to rounded gravel to 40 mm diameter				B19						114
36												116
		- some silt, trace gravel, gravel to 30 mm diameter, damp										118
		- trace silt, subrounded gravel, moist				SS12	61					120
37												122
38						B20						124
												126
39		- damp										128
		- moist, dense				SS13	40					130
40												132
		- gravelly, trace clay, subangular to rounded gravel to 35 mm diameter, damp										134
41												136
		- silty, some gravel										138
		- trace gravel, trace silt, no visible clay, gravel to 25 mm diameter				B21						140
42												142
		- some gravel, trace clay, gravel to 35 mm diameter										144
		- greyish brown				SS14	31					146
43		- some silt, trace clay, moist										
		- trace gravel, gravel to 10 mm diameter										
		- trace silt										
44		- some silt										
		- trace silt				B22						
		- some silt										
45		- interbedded gravel layers										

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 80.39 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 6
Logged By: LL/SS/TS	Completion Date: 2024 August 9
Reviewed By: ML	Page 3 of 6

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-04**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511032 E; 5983043 N; Z 10

Depth (m)	Method	Soil Description	Sample Number	SPT (N)	Depth (ft)
45		- some gravel - interbedded gravel layers - some silt, some gravel	SS15	50/	148
46		- moist, very dense	B23	50mm	150
		- trace silt, no visible gravel, fine to medium grained sand, poorly graded, damp			152
47					154
					156
48					158
49			SS16	53	160
			B30		162
50					164
					166
51			B24		168
		- trace clay			
52	Sonic	- gravel to 5 mm diameter			170
					172
53					174
		- some silt	B25		176
54		- trace silt			178
		- some silt			
55		- trace coarse grained sand	SS17	75	180
		- gravel to 20 mm diameter			182
56			B26		184
		- some silt, mottled brown to grey, grey coatings on silty nodules			186
57					188
58		- trace silt, fine to coarse grained sand, rounded to subangular gravel to 20 mm diameter, well graded, brown			190
					192
59		- some silt			194
			B27		
60					196

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

>100

Standpipe

Contractor: Geotech Drilling	Completion Depth: 80.39 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 6
Logged By: LL/SS/TS	Completion Date: 2024 August 9
Reviewed By: ML	Page 4 of 6

TETRA TECH

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-04**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511032 E; 5983043 N; Z 10

Depth (m)	Method	Soil Description	SOIL SYMBOL	USC	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	Standpipe	Depth (ft)
60												198
61	Sonic	- wet - moist				SS18	75			■		200
62												202
63												204
64		- damp				B28						206
65												208
66		- silty - some gravel, gravel to 25 mm diameter, dry				B29						210
67		- trace gravel, trace silt, no visible clay, moist				SS19	50/ 125mm			>100		212
68												214
69		- damp										216
70												218
71		CLAY - trace gravel, trace sand, trace silt, gravel to 7 mm diameter, damp, soft to firm, medium plastic, brown to grey - (Gravel - 1%; Sand - 2%; Silt - 95%; Clay - 2%) - grey				B31				▲		220
72		CLAY (TILL) - some gravel, some silt, trace sand, subangular to rounded gravel to 35 mm diameter, dry to damp, very stiff to hard, low plastic, grey		CL-ML		B32		7.8	● H	▲		222
73		- hard				SS20	50/ 50mm			>100		224
74		CLAY - trace gravel, trace sand, trace silt, subangular to rounded gravel to 60 mm diameter, fine to coarse grained sand, damp, hard, medium to high plastic, grey								▲		226
75				CL-CI		B33		12.9	● H	▲		228
												230
												232
												234
												236
												238
												240
												242
												244

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 80.39 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 6
Logged By: LL/SS/TS	Completion Date: 2024 August 9
Reviewed By: ML	Page 5 of 6

Regional Deistrict of Fraser-Fort George

Borehole No: **24BH-04**

Project: RDFFG BC 2024 Cell 2 Geotechnical Investigation	Project No: SWM.SWOP04864-01
Location: RDFFG Landfill	
Prince George, British Columbia	UTM: 511032 E; 5983043 N; Z 10

Depth (m)	Method	Soil Description	SOIL SYMBOL	USC	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	Standpipe	Depth (ft)
75												
76	Sonic	- (Gravel - 11%; Sand - 27%; Silt - 43%; Clay - 19%) - some gravel				SH02 SS21	84					248 250
77		- trace gravel, very stiff - firm to stiff										252 254
78		- some gravel, gravel to 40 mm diameter - hard		CI		B34		15.9				256 258
79												260
80						SH03						262 264
81		END OF BOREHOLE (80.39 metres) slough - none at 0 hrs. water - 17.75 metres at 0 hrs. Standpipe installed to 80.16 metres										266
82												268 270
83												272
84												274 276
85												278
86												280 282
87												284
88												286 288
89												290
90												292 294

TETRA TECH

Contractor: Geotech Drilling	Completion Depth: 80.39 m
Equipment Type: Terra Sonic 150	Start Date: 2024 August 6
Logged By: LL/SS/TS	Completion Date: 2024 August 9
Reviewed By: ML	Page 6 of 6

APPENDIX E

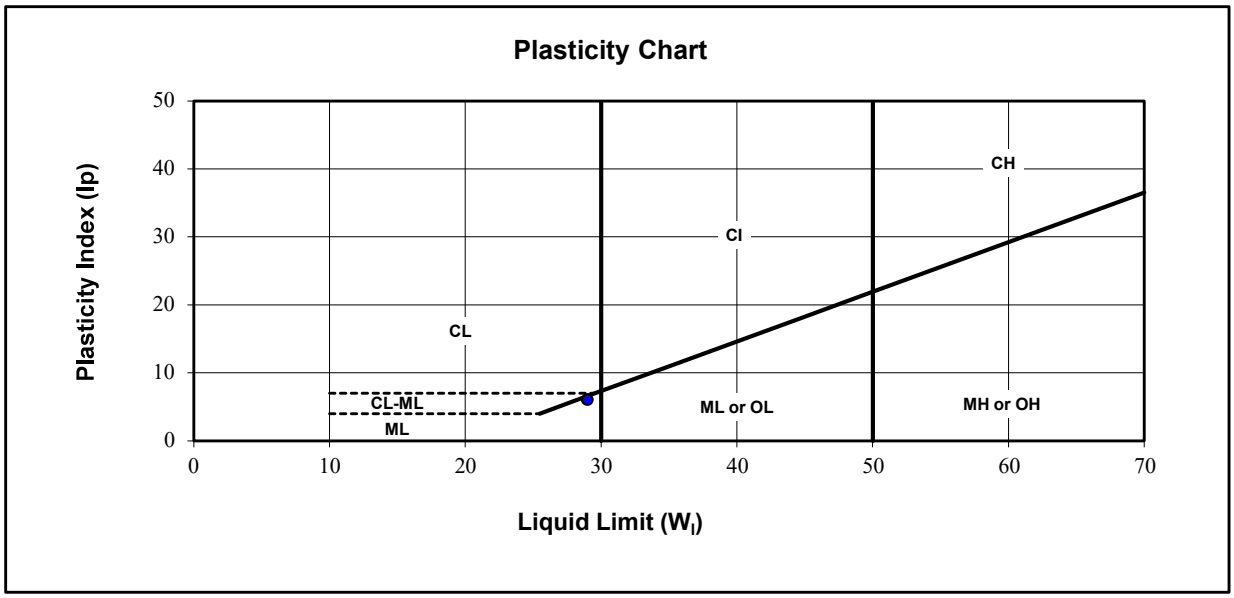
LAB RESULTS

ATTERBERG LIMITS TEST REPORT

ASTM D4318

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample Number:	B01
		Borehole:	BH-04
Project No:	SWM.SWOP04864-02	Depth:	3.0 - 4.0 ft
Client:	Regional District of Fraser - Ft. George	Sampled By:	LL/TS/SS Tested By: LL
Attention:	Darwin Paton	Date Sampled:	August 15, 2024
Email:	dpaton@rdffg.bc.ca	Date Tested:	October 8, 2024

Sample Description: SILT, trace sand, clay, brown



Liquid Limit ($W_{1)}$:	29	Natural Moisture (%)	28.5
Plastic Limit :	23	Soil Plasticity:	Low
Plasticity Index (Ip) :	**6**	Mod.USCS Symbol:	ML

Remarks:

Reviewed By: [redacted] P.Eng.

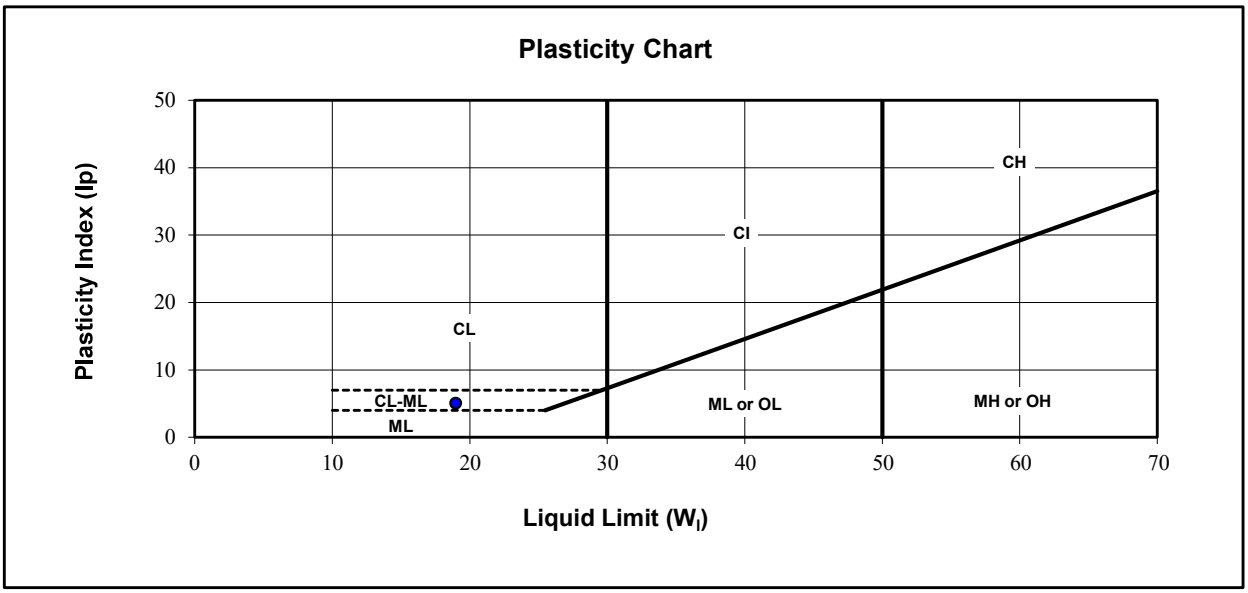
TETRA TECH

ATTERBERG LIMITS TEST REPORT

ASTM D4318

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample Number:	B32
		Borehole:	BH-04
Project No:	SWM.SWOP04864-02	Depth:	237.0 - 238.0 ft
Client:	Regional District of Fraser - Ft. George	Sampled By:	LL/TS/SS Tested By: LL
Attention:	Darwin Paton	Date Sampled:	August 15, 2024
Email:	dpaton@rdffg.bc.ca	Date Tested:	October 8, 2024

Sample Description: SILT, some gravel, trace clay, trace sand, greyish brown



Liquid Limit ($W_{1)}$:	19	Natural Moisture (%)	7.8
Plastic Limit :	14	Soil Plasticity:	Low
Plasticity Index (Ip) :	**5**	Mod.USCS Symbol:	CL - ML

Remarks:

Reviewed By: [redacted] P.Eng.

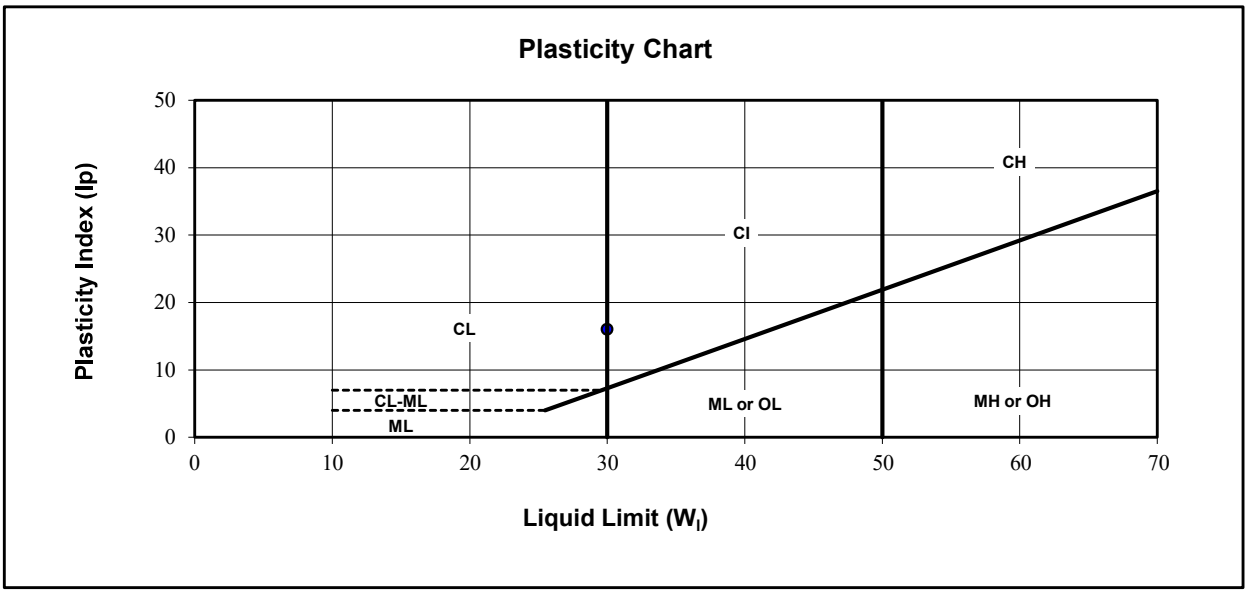
TETRA TECH

ATTERBERG LIMITS TEST REPORT

ASTM D4318

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample Number:	B33
		Borehole:	BH-04
Project No:	SWM.SWOP04864-02	Depth:	244.0 - 245.0 ft
Client:	Regional District of Fraser - Ft. George	Sampled By:	LL/TS/SS Tested By: LL
Attention:	Darwin Paton	Date Sampled:	August 15, 2024
Email:	dpaton@rdffg.bc.ca	Date Tested:	October 8, 2024

Sample Description: CLAY, silty, trace sand, gravel, greyish brown



Liquid Limit ($W_{1)}$):	30	Natural Moisture (%)	12.9
Plastic Limit :	14	Soil Plasticity:	Low to Medium
Plasticity Index (Ip) :	**16**	Mod.USCS Symbol:	CL-CI

Remarks:

Reviewed By: [redacted] P.Eng.

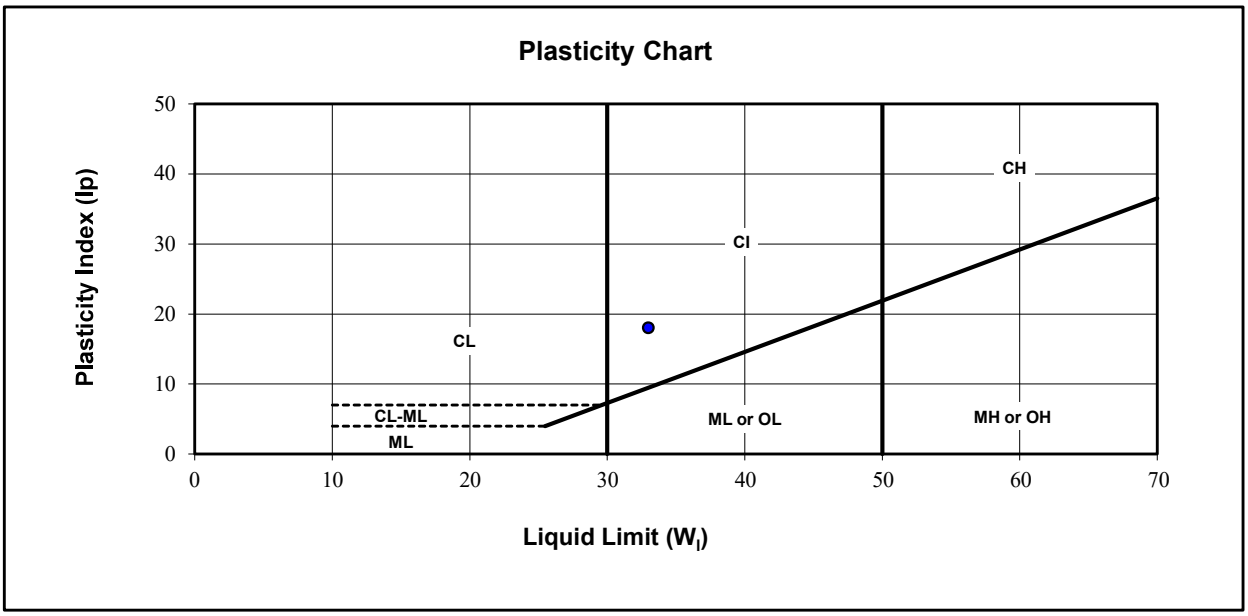
TETRA TECH

ATTERBERG LIMITS TEST REPORT

ASTM D4318

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample Number:	B34
		Borehole:	BH-04
Project No:	SWM.SWOP04864-02	Depth:	255.0 - 256.0 ft
Client:	Regional District of Fraser - Ft. George	Sampled By:	LL/TS/SS Tested By: LL
Attention:	Darwin Paton	Date Sampled:	August 15, 2024
Email:	dpaton@rdffg.bc.ca	Date Tested:	October 8, 2024

Sample Description: CLAY, silty, trace sand, gravel, dark greyish brown



Liquid Limit ($W_{1)}$:	33	Natural Moisture (%)	15.9
Plastic Limit :	15	Soil Plasticity:	Medium
Plasticity Index (Ip) :	**18**	Mod.USCS Symbol:	CI

Remarks:

Reviewed By: [redacted] P.Eng.

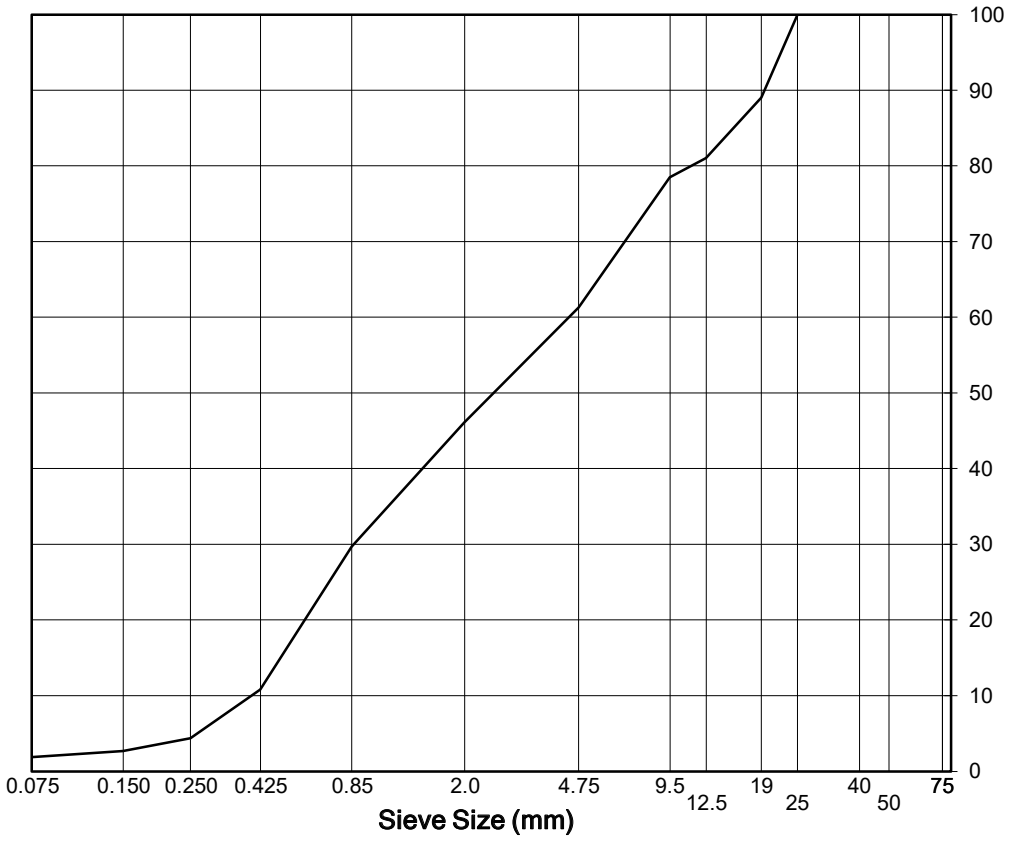
TETRA TECH

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	SWM.SWOP04864-02	Sample No.:	B15
Project:	RDFFG Cell 2 Geotechnical Investigation	Date Received:	August 15, 2024
Client:	Regional District of Fraser - Fort George	Sampled by:	LL/TS/SS
Attention:	Darwin Paton	Date Tested:	October 8, 2024
Email:	dpaton@rdffg.bc.ca	Tested by:	LL Office: Edmonton
Description:	SAND and GRAVEL, trace fines (silt/clay), brown	Moisture Content (as received):	3.9%
		No. Crushed Faces:	Two (2) or Three (3)
Borehole No.:	BH-01	By Particle Mass:	
Depth:	81-82 ft		
Supplier:			
Specification:			

Sieve Size	Percent Passing
25	100
19	89
12.5	81
9.5	79
4.75	61
2.0	46
0.85	30
0.425	11
0.250	4
0.150	3
0.075	1.9



Remarks:

Reviewed By: [redacted] P.Eng.

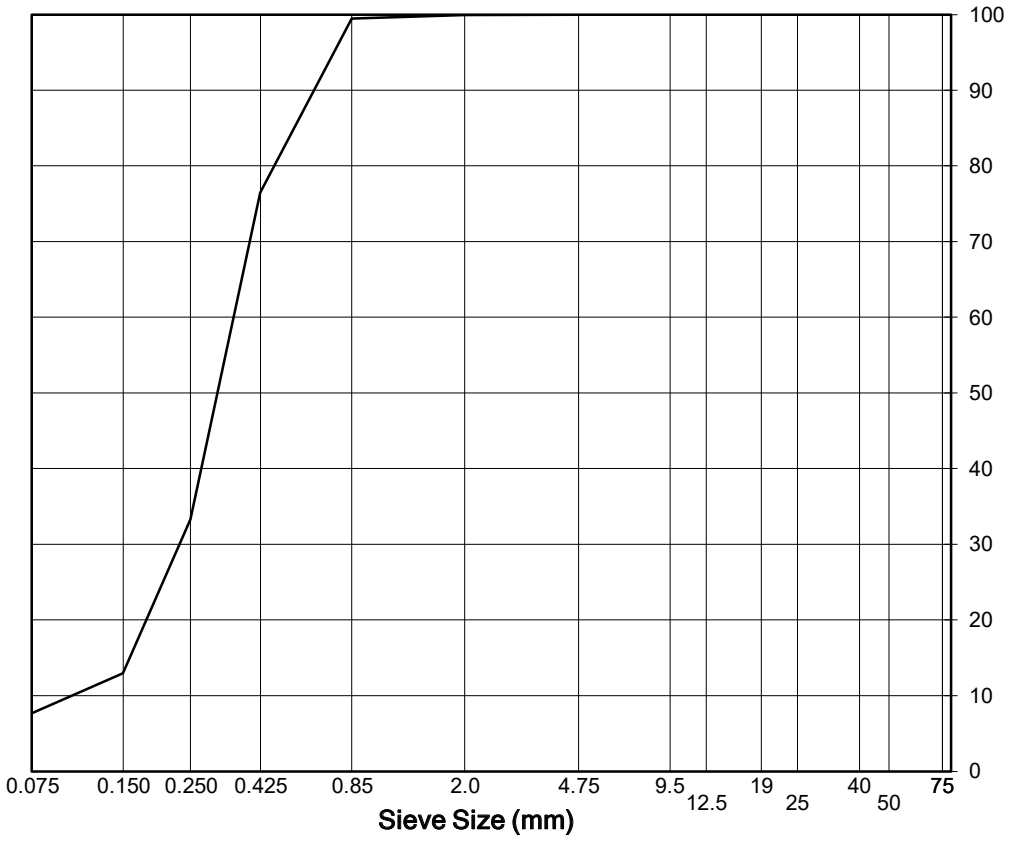
TETRA TECH

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	SWM.SWOP04864-02	Sample No.:	Bulk 2
Project:	RDFFG Cell 2 Geotechnical Investigation	Date Received:	August 15, 2024
Client:	Regional District of Fraser - Fort George	Sampled by:	LL/TS/SS
Attention:	Darwin Paton	Date Tested:	October 8, 2024
Email:	dpaton@rdffg.bc.ca	Tested by:	LL Office: Edmonton
Description:	SAND, trace fines (silt/clay), brown	Moisture Content (as received):	10.8%
		No. Crushed Faces:	Two (2) or Three (3)
Borehole No.:	BH-02	By Particle Mass:	
Depth:	53-57 ft		
Supplier:			
Specification:			

Sieve Size	Percent Passing
9.5	100
4.75	100
2.0	100
0.85	99
0.425	76
0.250	33
0.150	13
0.075	7.7



Remarks:

Reviewed By: [redacted] P.Eng.

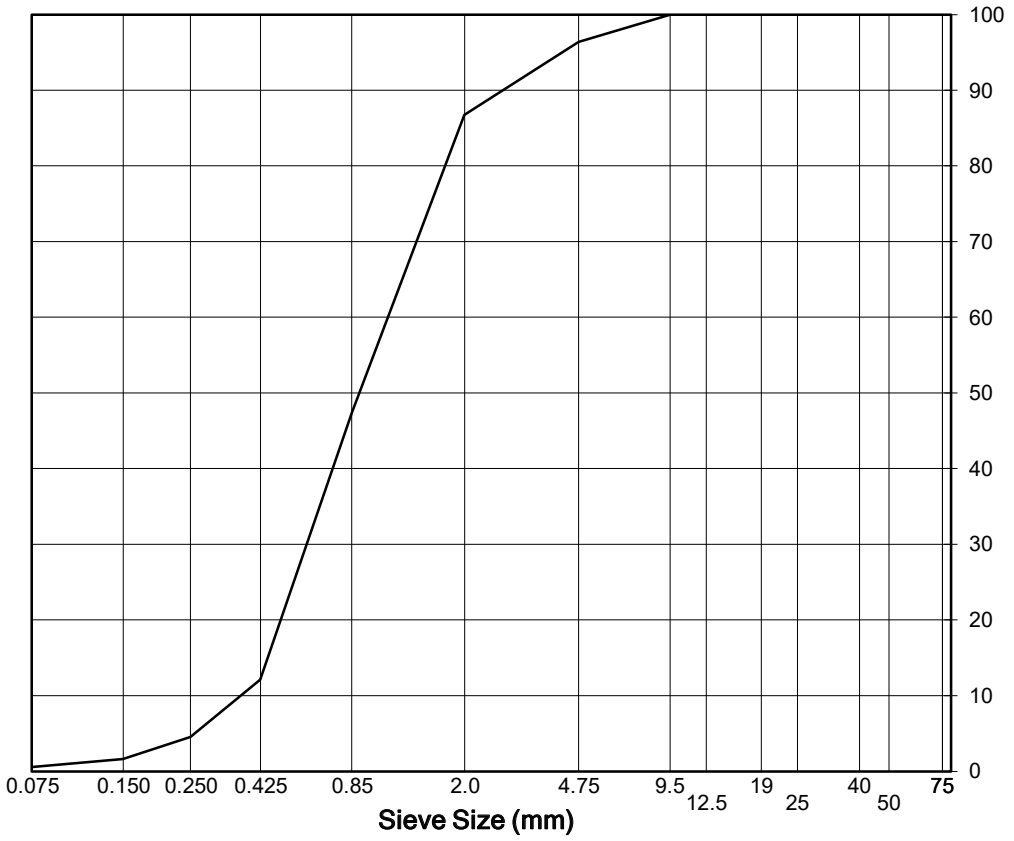
TETRA TECH

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	SWM.SWOP04864-02	Sample No.:	B09
Project:	RDFFG Cell 2 Geotechnical Investigation	Date Received:	August 15, 2024
Client:	Regional District of Fraser - Fort George	Sampled by:	LL/TS/SS
Attention:	Darwin Paton	Date Tested:	October 8, 2024
Email:	dpaton@rdffg.bc.ca	Tested by:	LL Office: Edmonton
Description:	SAND, trace gravel, fines (silt/clay), brown	Moisture Content (as received):	10.0%
		No. Crushed Faces:	Two (2) or Three (3)
Borehole No.:	BH-03	By Particle Mass:	
Depth:	40-41 ft		
Supplier:			
Specification:			

Sieve Size	Percent Passing
9.5	100
4.75	96
2.0	87
0.85	47
0.425	12
0.250	5
0.150	2
0.075	0.6



Remarks:

Reviewed By: [redacted] P.Eng.

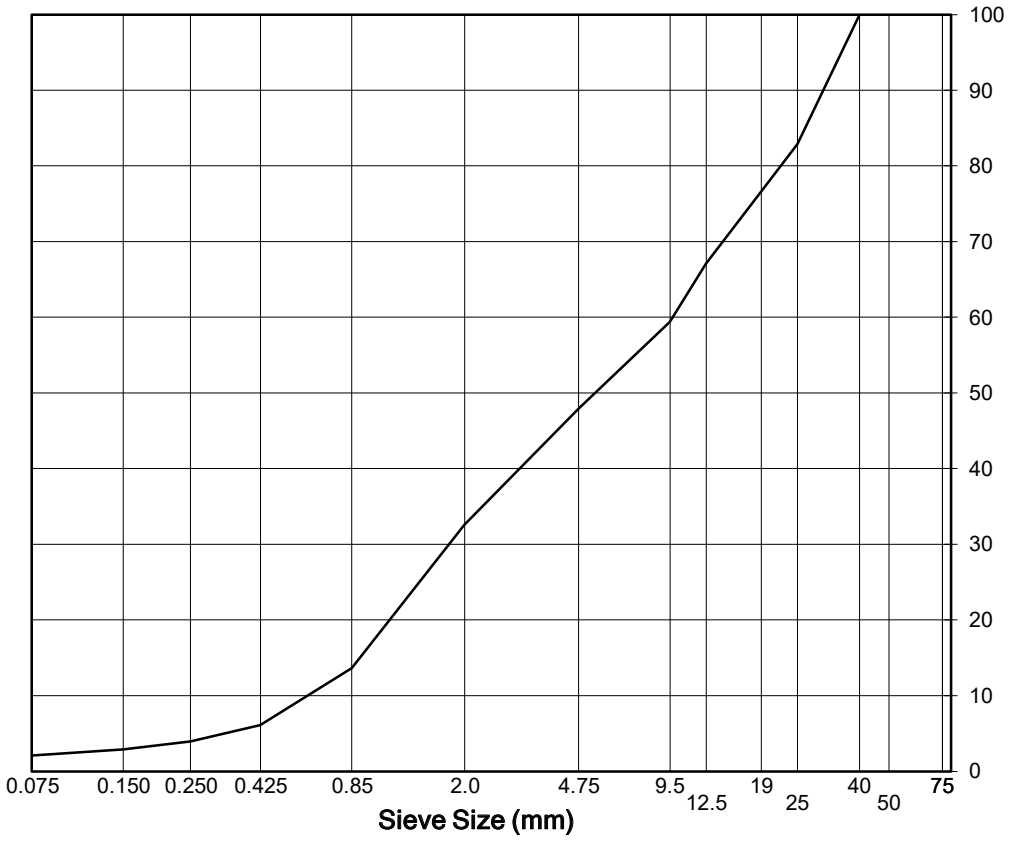
TETRA TECH

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	SWM.SWOP04864-02	Sample No.:	Bulk 2
Project:	RDFFG Cell 2 Geotechnical Investigation	Date Received:	August 15, 2024
Client:	Regional District of Fraser - Fort George	Sampled by:	LL/TS/SS
Attention:	Darwin Paton	Date Tested:	October 8, 2024
Email:	dpaton@rdffg.bc.ca	Tested by: LL	Office: Edmonton
Description:	GRAVEL and SAND, trace fines (silt/clay), brown	Moisture Content (as received):	3.1%
		No. Crushed Faces:	Two (2) or Three (3)
Borehole No.:	BH-04	By Particle Mass:	
Depth:	61-65 ft		
Supplier:			
Specification:			

Sieve Size	Percent Passing
40	100
25	83
19	77
12.5	67
9.5	59
4.75	48
2.0	33
0.85	14
0.425	6
0.250	4
0.150	3
0.075	2.1



Remarks:

Reviewed By: [redacted] P.Eng.

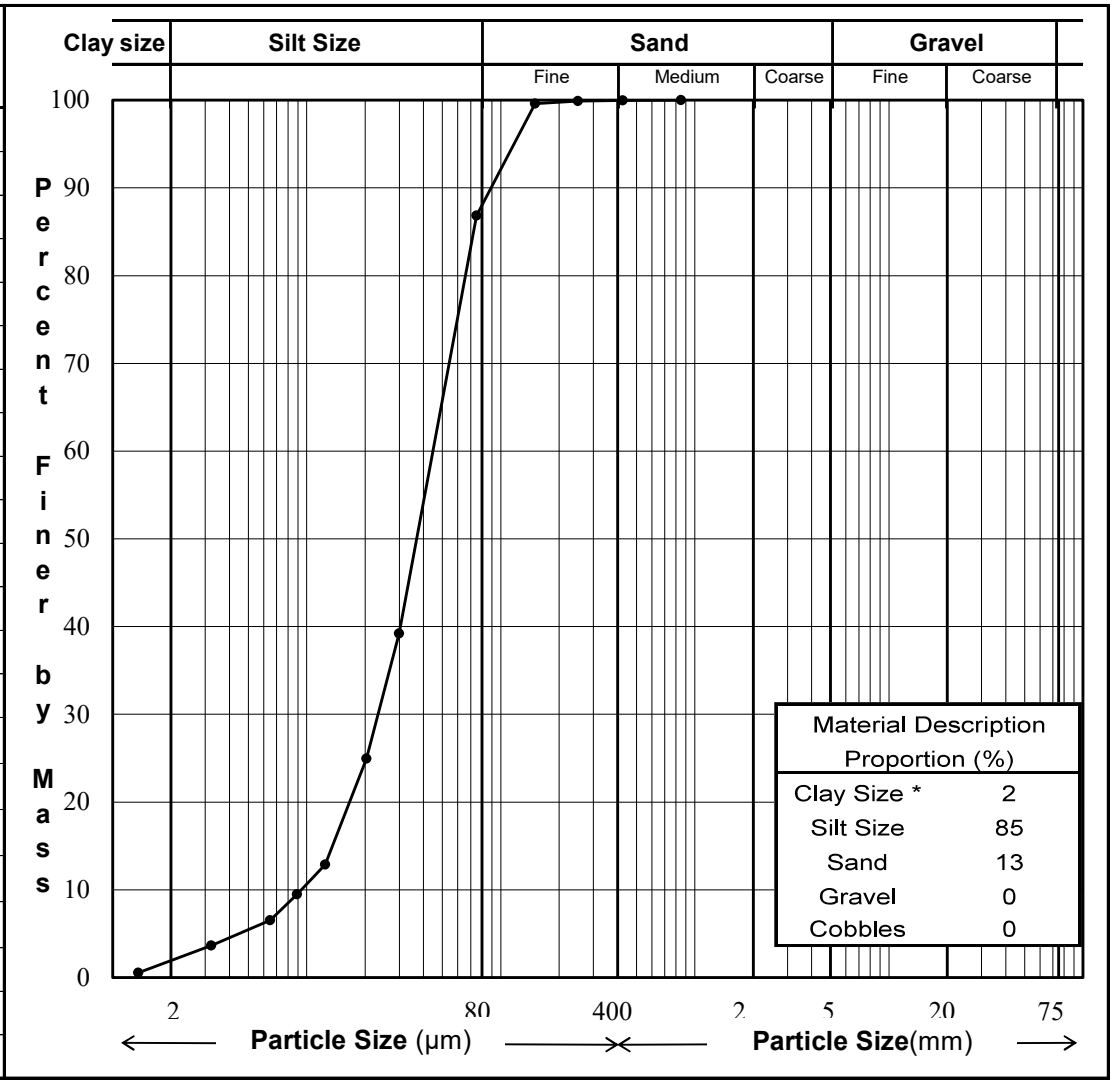
TETRA TECH

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D7928 †

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	B06
Client:	Regional District of Fraser - Fort George	BH Location:	BH-04
Project No.:	SWM.SWOP04864-02	Depth:	26.0 - 27.0 ft
Location:		Date Tested	October 8, 2024
Description:	SILT, some sand, trace clay, brown	Tested By:	LL

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
37.5 mm	
25 mm	
19 mm	
12.5 mm	
9.5 mm	
4.75 mm	
2.0 mm	
850 µm	100
425 µm	100
250 µm	100
150 µm	100
75 µm	87
30 µm	39
20 µm	25
12 µm	13
9 µm	9
6 µm	7
3 µm	4
1 µm	1



Remarks: † Unless expressly stated, this test was performed by the Air Dry Method

* The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

Reviewed By: [redacted] P.Eng.

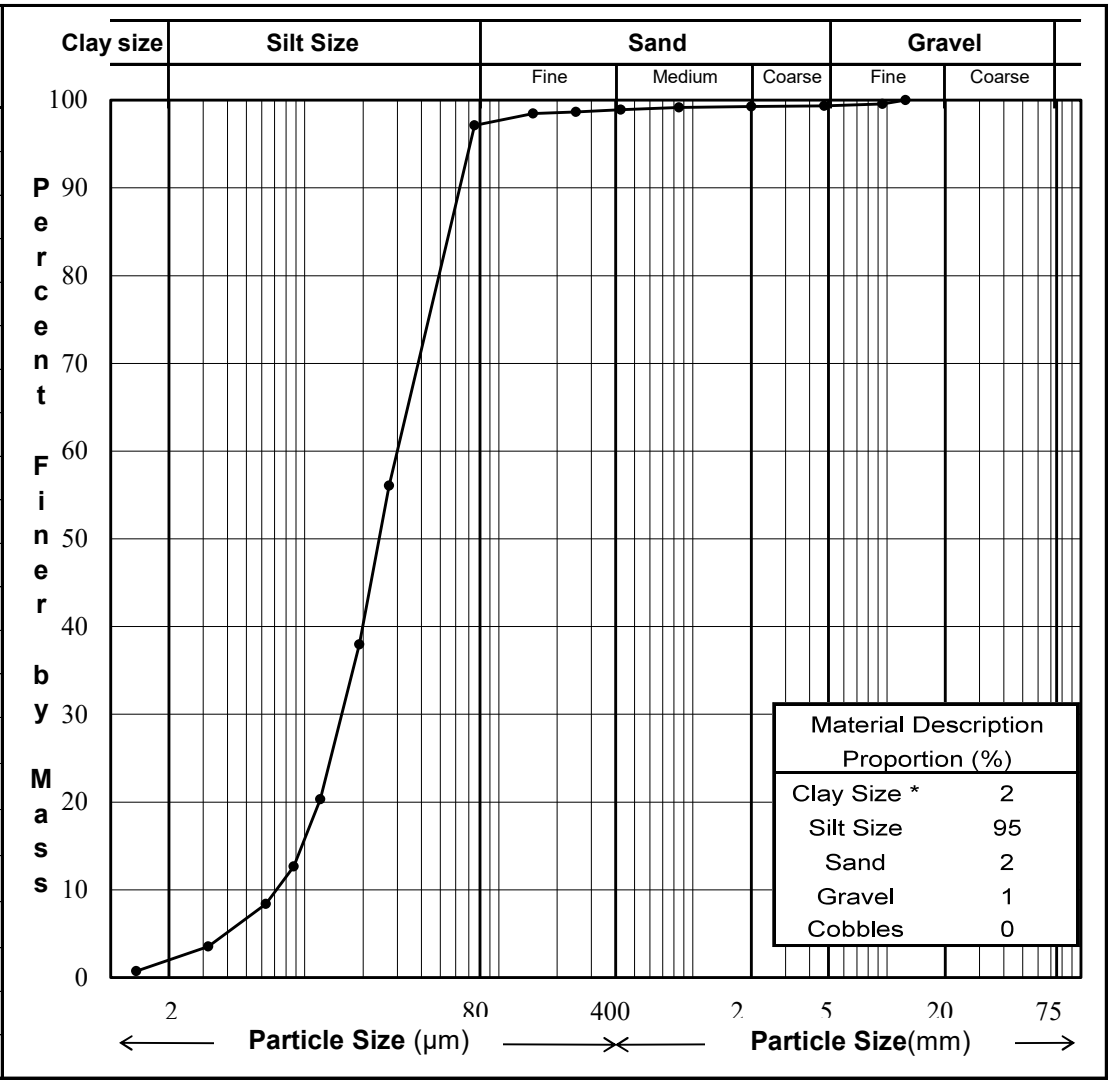
TETRA TECH

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D7928 †

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	B31
Client:	Regional District of Fraser - Fort George	BH Location:	BH-04
Project No.:	SWM.SWOP04864-02	Depth:	232.0 - 233.0 ft
Location:		Date Tested	October 8, 2024
Description:	SILT, trace clay, sand, gravel, brown	Tested By:	LL

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
37.5 mm	
25 mm	
19 mm	
12.5 mm	100
9.5 mm	100
4.75 mm	99
2.0 mm	99
850 µm	99
425 µm	99
250 µm	99
150 µm	98
75 µm	97
27 µm	56
19 µm	38
12 µm	20
9 µm	13
6 µm	8
3 µm	4
1 µm	1



Remarks: † Unless expressly stated, this test was performed by the Air Dry Method

* The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

Reviewed By: [redacted] P.Eng.

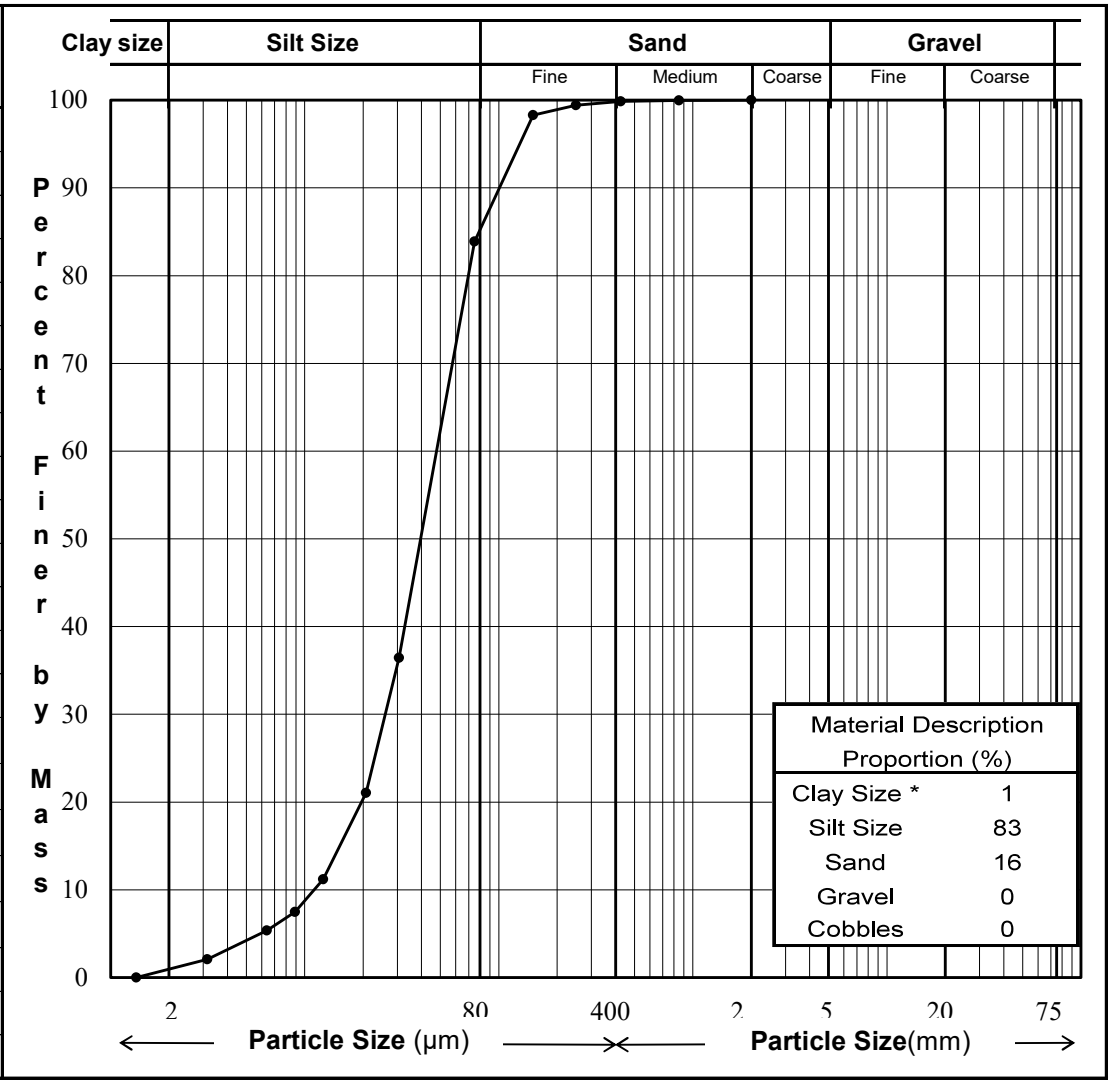
TETRA TECH

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D7928 †

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	Bulk 1
Client:	Regional District of Fraser - Fort George	BH Location:	BH-04
Project No.:	SWM.SWOP04864-02	Depth:	13.0 - 17.0 ft
Location:		Date Tested	October 8, 2024
Description:	SILT, some sand, trace clay, brown	Tested By:	LL

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
37.5 mm	
25 mm	
19 mm	
12.5 mm	
9.5 mm	
4.75 mm	
2.0 mm	100
850 µm	100
425 µm	100
250 µm	99
150 µm	98
75 µm	84
31 µm	36
21 µm	21
12 µm	11
9 µm	7
6 µm	5
3 µm	2
1 µm	0



Remarks: † Unless expressly stated, this test was performed by the Air Dry Method

* The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

Reviewed By: [redacted] P.Eng.

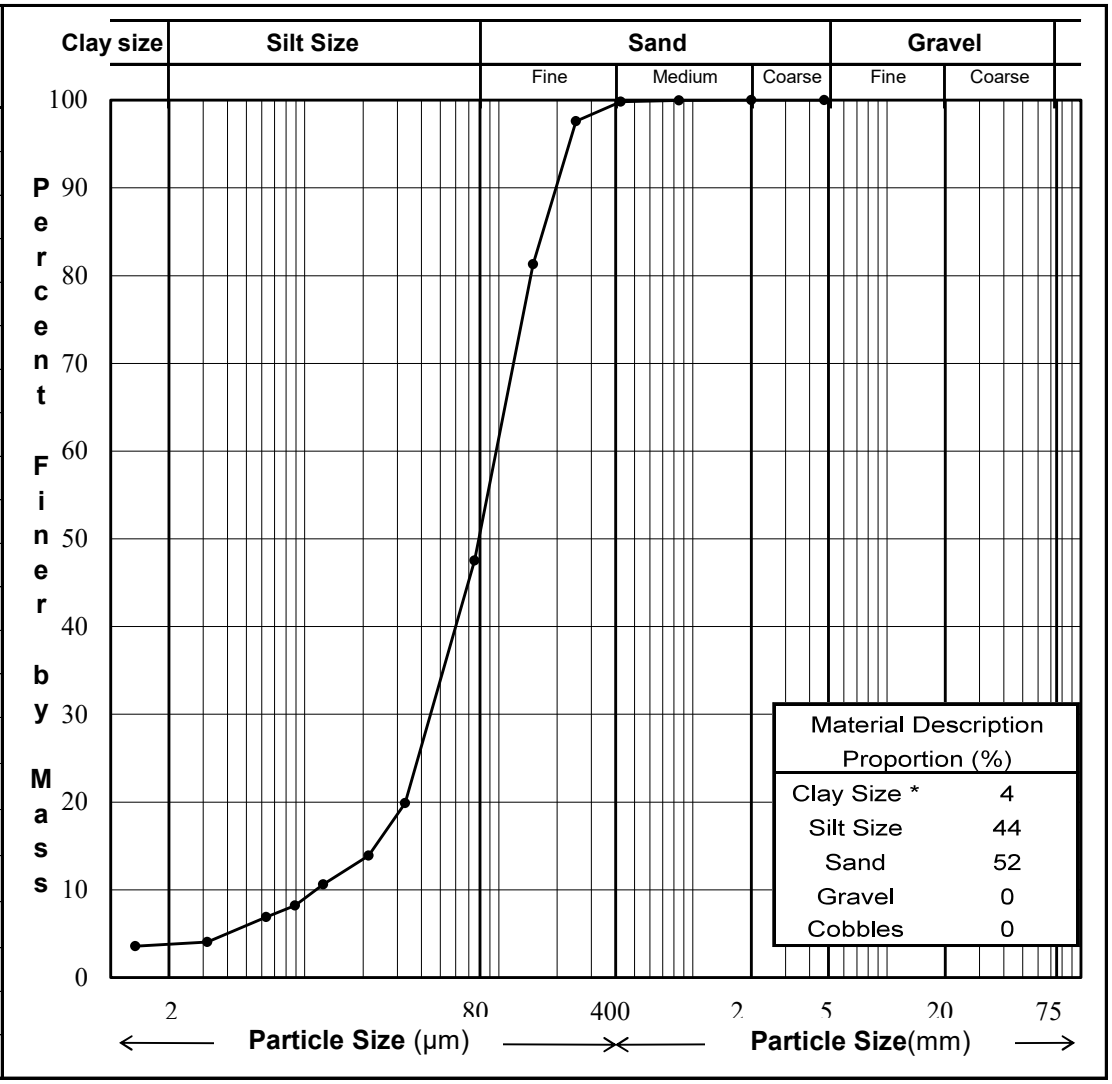
TETRA TECH

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D7928 †

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	Bulk 1
Client:	Regional District of Fraser - Fort George	BH Location:	BH-02
Project No.:	SWM.SWOP04864-02	Depth:	35.0 - 40.0 ft
Location:		Date Tested	October 8, 2024
Description:	SAND and SILT, trace clay, brown	Tested By:	LL

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
37.5 mm	
25 mm	
19 mm	
12.5 mm	
9.5 mm	
4.75 mm	100
2.0 mm	100
850 µm	100
425 µm	100
250 µm	98
150 µm	81
75 µm	48
33 µm	20
21 µm	14
12 µm	11
9 µm	8
6 µm	7
3 µm	4
1 µm	4



Remarks: † Unless expressly stated, this test was performed by the Air Dry Method

* The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

Reviewed By: [redacted] P.Eng.

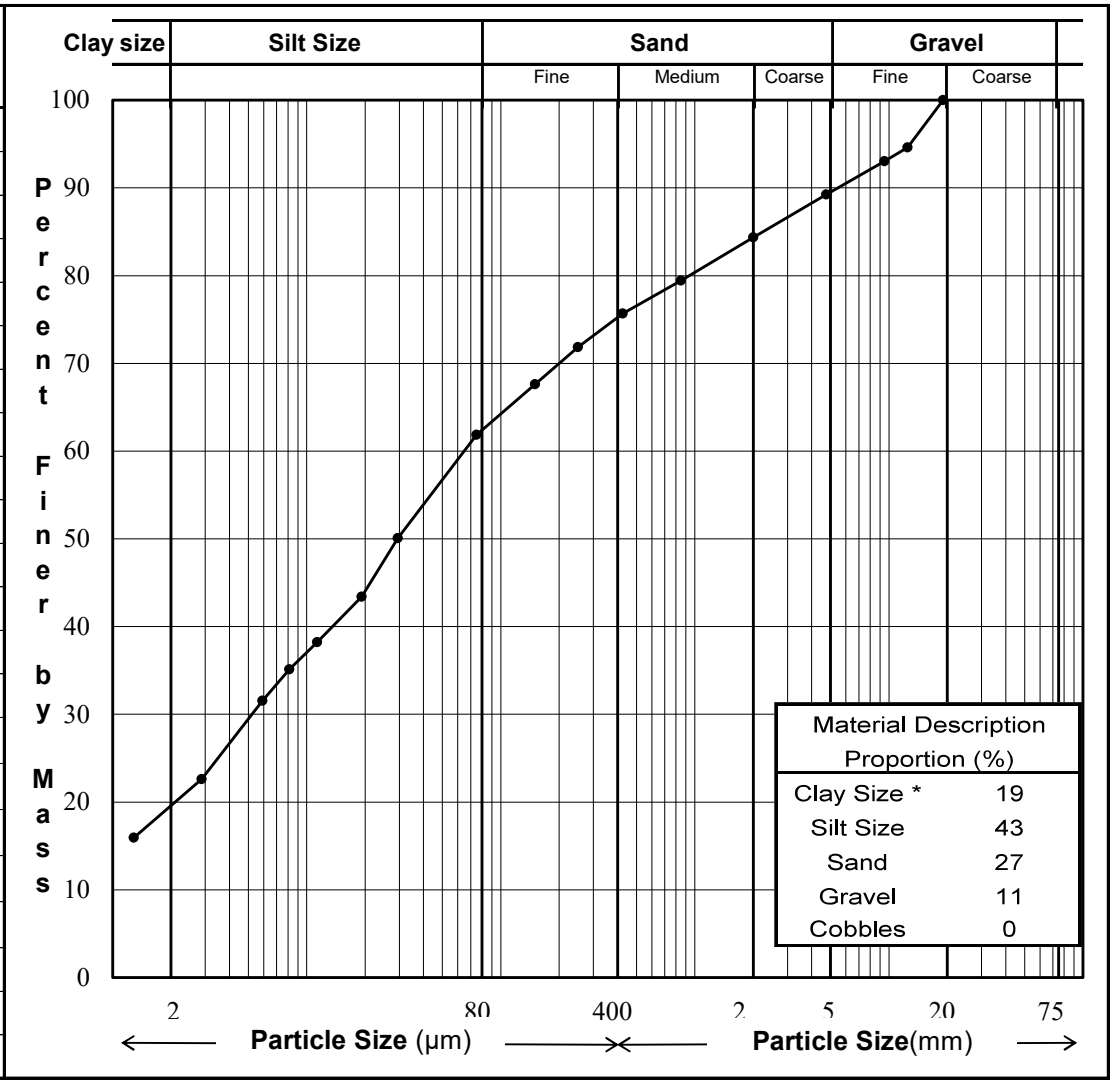
TETRA TECH

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D7928 †

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	SH02
Client:	Regional District of Fraser - Fort George	BH Location:	BH-04
Project No.:	SWM.SWOP04864-02	Depth:	250-250.75 ft
Location:		Date Tested	October 2, 2024
Description:	SILT, sandy, some clay, gravel, greyish brown	Tested By:	LL

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
37.5 mm	
25 mm	
19 mm	100
12.5 mm	95
9.5 mm	93
4.75 mm	89
2.0 mm	84
850 µm	79
425 µm	76
250 µm	72
150 µm	68
75 µm	62
29 µm	50
19 µm	43
11 µm	38
8 µm	35
6 µm	32
3 µm	23
1 µm	16



Remarks: † Unless expressly stated, this test was performed by the Air Dry Method

* The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

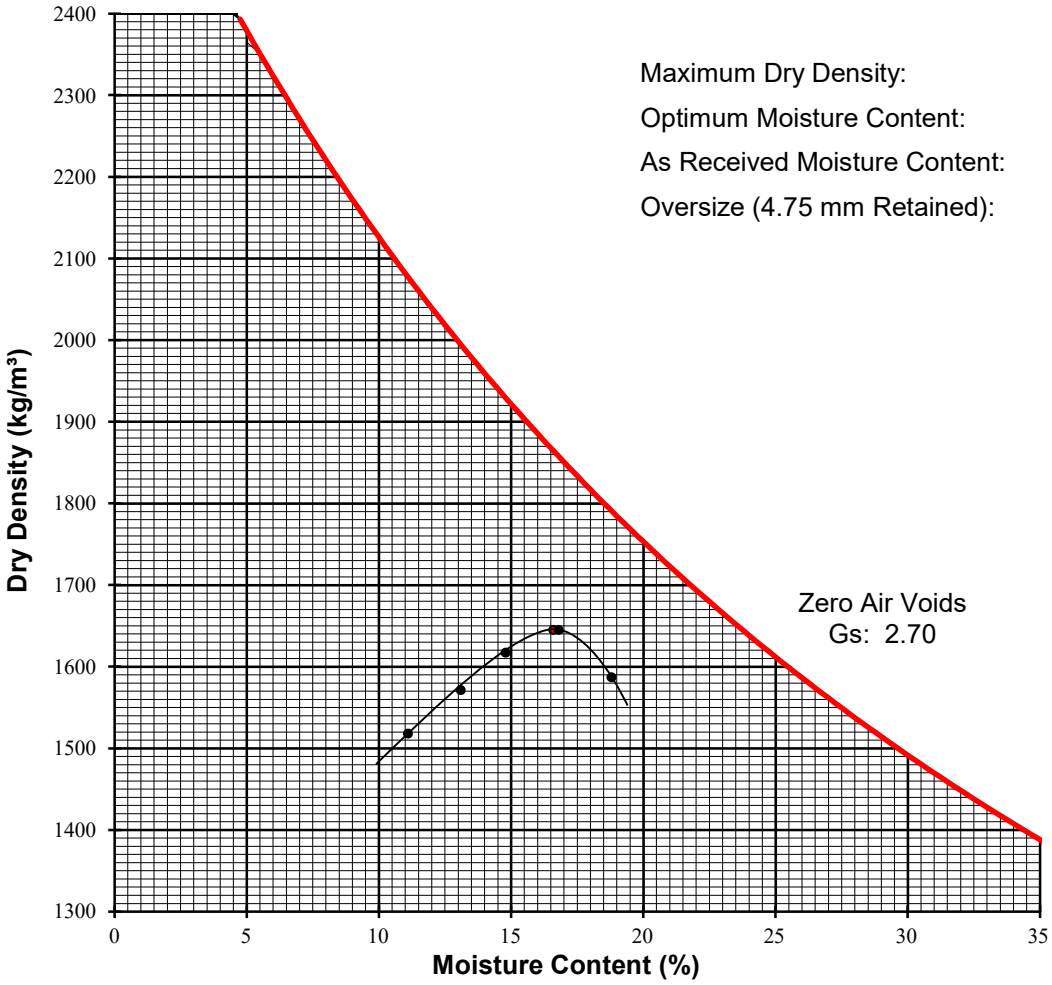
Reviewed By: [redacted] P.Eng.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 (Standard Proctor)

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	Bulk 1
Project No.:	SWM.SWOP04864-02	Sampled By:	LL/TS/SS
Client:	Regional District of Fraser - Fort George	Date Received:	Sep 3, 2024
Attention:	Darwin Paton	Test Date:	Sep 20, 2024
E-mail:	dpaton@rdffg.bc.ca	Test By:	LL
Borehole No.:	BH-01	Test Method:	A (Manual)
Depth:	13-20 ft		
Sample Description:	SAND, trace silt, brown		



Maximum Dry Density:	**1645**	kg/m³
Optimum Moisture Content:	**16.6**	%
As Received Moisture Content:	11.0	%
Oversize (4.75 mm Retained):	0	%

Remarks:

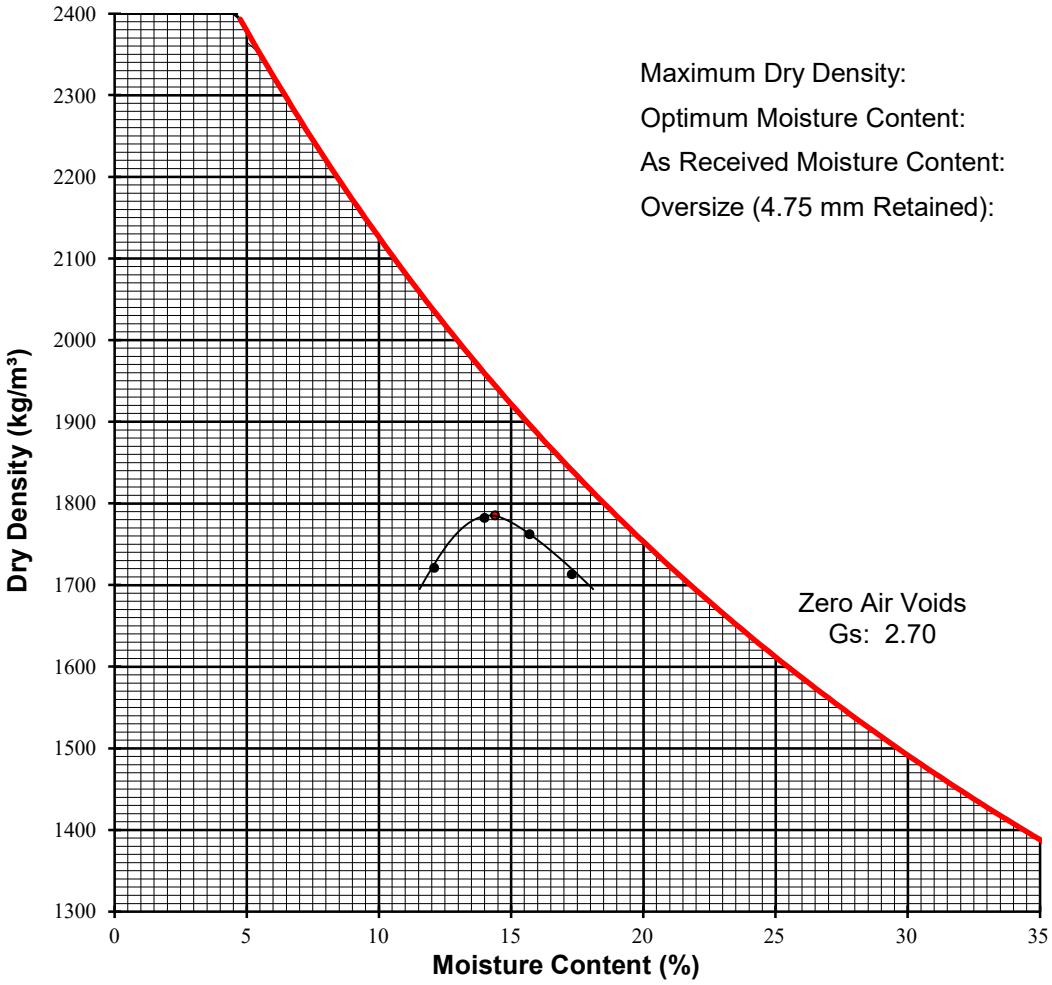
Reviewed By: [redacted] P.Eng.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 (Standard Proctor)

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	Bulk 2
Project No.:	SWM.SWOP04864-02	Sampled By:	LL/TS/SS
Client:	Regional District of Fraser - Fort George	Date Received:	Sep 3, 2024
Attention:	Darwin Paton	Test Date:	Sep 20, 2024
E-mail:	dpaton@rdffg.bc.ca	Test By:	LL
Borehole No.:	BH-01	Test Method:	A (Manual)
Depth:	35-40 ft		
Sample Description:	SAND, trace silt, brown		



Maximum Dry Density:	**1785**	kg/m³
Optimum Moisture Content:	**14.4**	%
As Received Moisture Content:	12.1	%
Oversize (4.75 mm Retained):	0	%

Remarks:

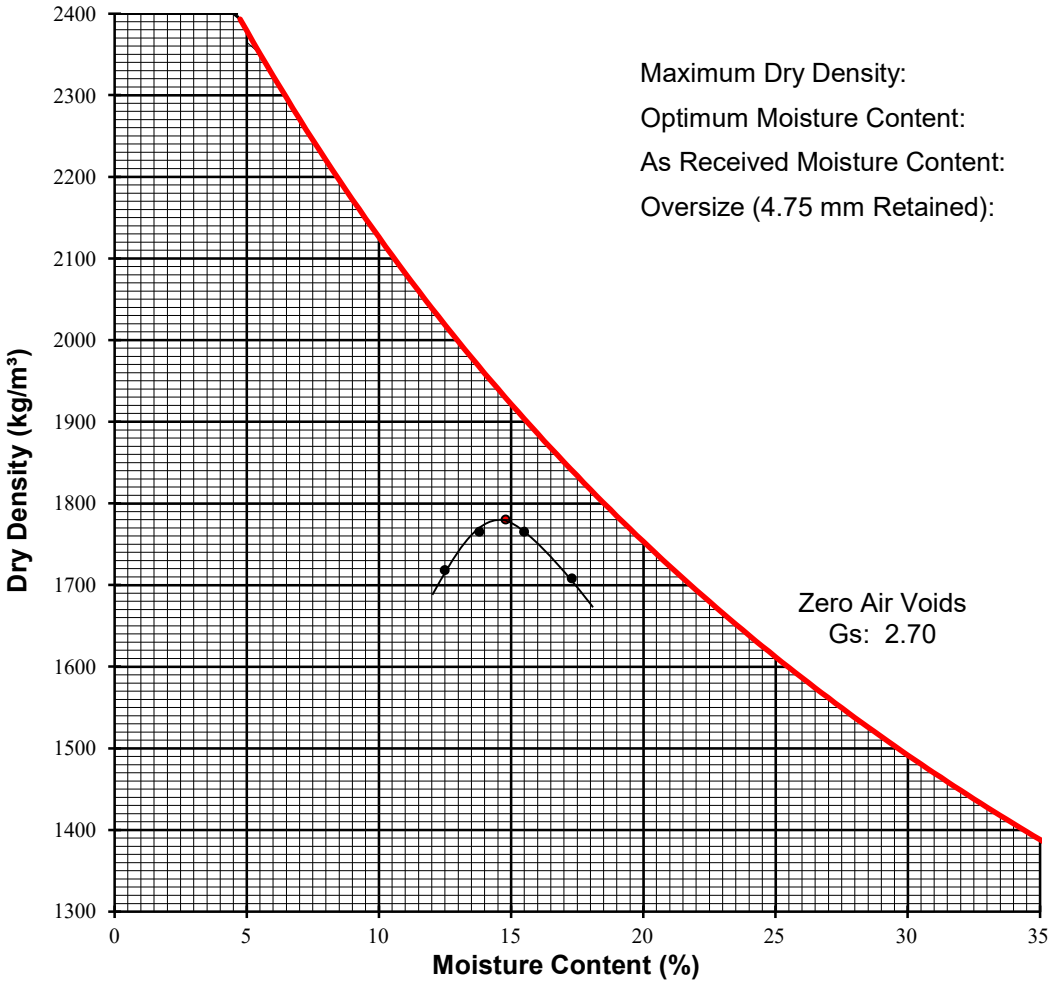
Reviewed By: [redacted] P.Eng.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 (Standard Proctor)

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	Bulk 1
Project No.:	SWM.SWOP04864-02	Sampled By:	LL/TS/SS
Client:	Regional District of Fraser - Fort George	Date Received:	Sep 3, 2024
Attention:	Darwin Paton	Test Date:	Oct 26, 2024
E-mail:	dpaton@rdffg.bc.ca	Test By:	LL
Borehole No.	BH-02	Test Method:	A (Manual)
Depth:	35-40 ft		
Sample Description:	SAND and SILT, trace clay, brown		



Maximum Dry Density:	**1780**	kg/m³
Optimum Moisture Content:	**14.8**	%
As Received Moisture Content:	16.8	%
Oversize (4.75 mm Retained):	0	%

Remarks:

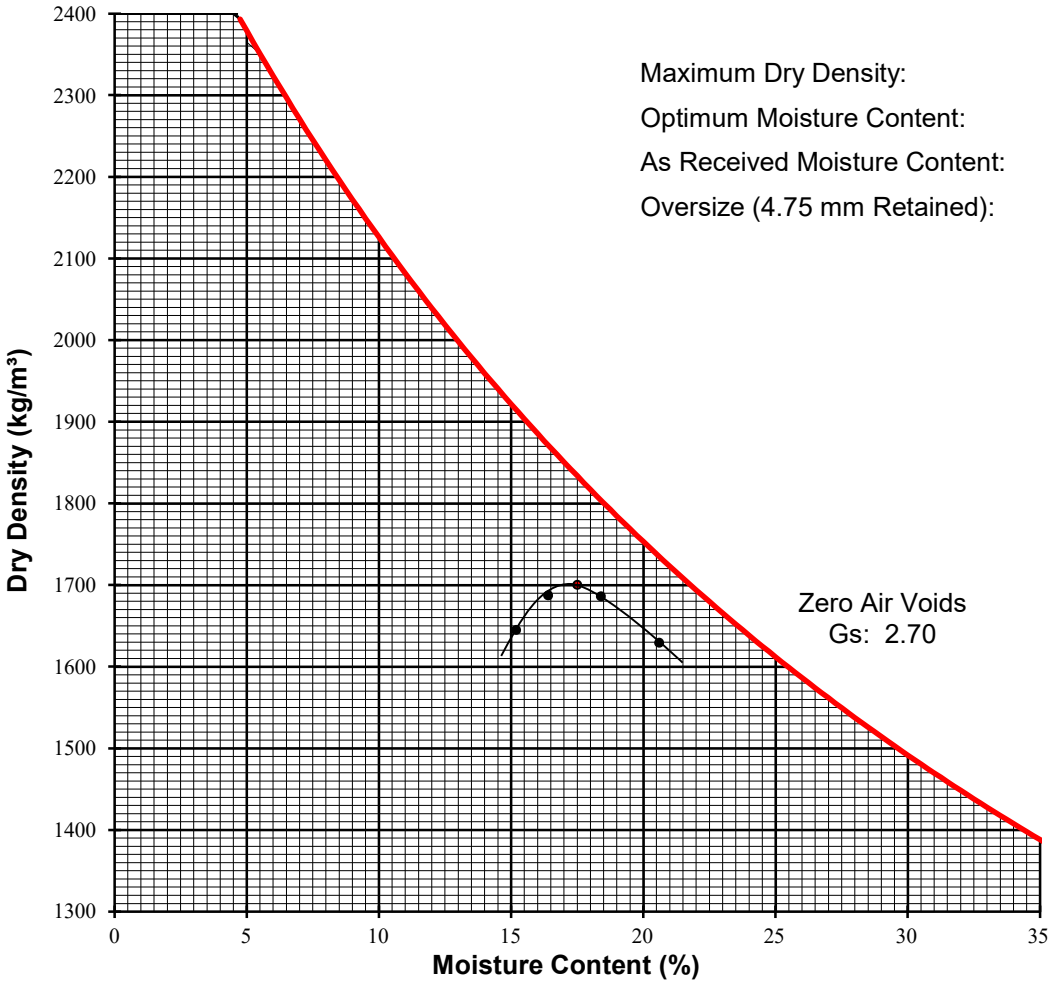
Reviewed By: [redacted] P.Eng.

TETRA TECH

MOISTURE-DENSITY RELATIONSHIP (Proctor) REPORT

ASTM D698 (Standard Proctor)

Project:	RDFFG Cell 2 Geotechnical Investigation	Sample No.:	Bulk 1
Project No.:	SWM.SWOP04864-02	Sampled By:	LL/TS/SS
Client:	Regional District of Fraser - Fort George	Date Received:	Sep 3, 2024
Attention:	Darwin Paton	Test Date:	Oct 26, 2024
E-mail:	dpaton@rdffg.bc.ca	Test By:	LL
Borehole No.:	BH-04	Test Method:	A (Manual)
Depth:	13-17 ft		
Sample Description:	SILT, some sand, trace clay, brown		



Maximum Dry Density:	**1700**	kg/m³
Optimum Moisture Content:	**17.5**	%
As Received Moisture Content:	19.0	%
Oversize (4.75 mm Retained):	0	%

Remarks:

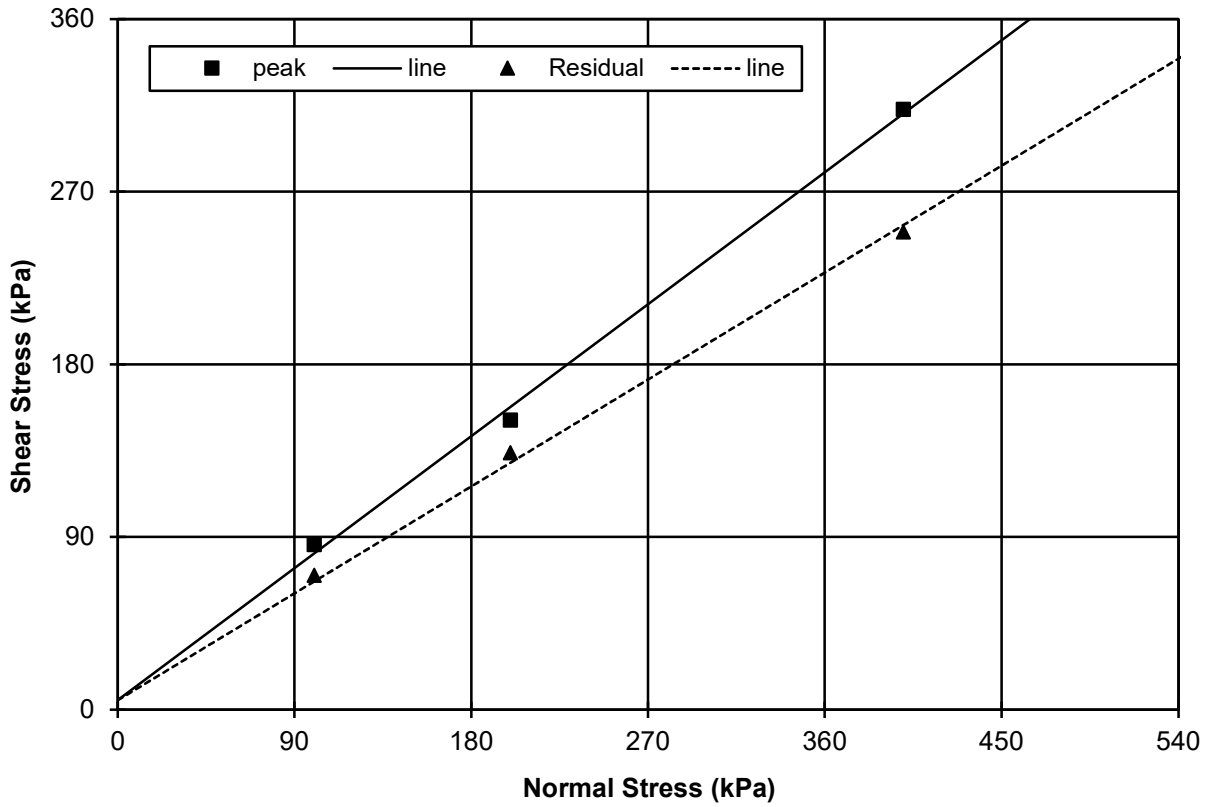
Reviewed By: [redacted] P.Eng.

TETRA TECH

SUMMARY of DIRECT SHEAR TEST RESULTS

ASTM D3080

Project:	RDFFG Cell 2 Geotechnical Investigation	Borehole No.	BH-01 Bulk 2
Project No.:	SWM.SWOP04864-02	Depth:	35-40 ft
Client:	Regional District of Fraser - Fort George	Date:	September 21, 2024
Attention:		Tested By:	TD
Email:		Office:	Edmonton



Inferred Shear Strength Parameters :-

	Cohesion Intercept (kPa)	Inferred Angle of Shearing Resistance (Degrees)
Peak Strength:	**5**	**37.4**
Residual Strength:	**5**	**31.8**

Reviewed By: [redacted] P.Eng.

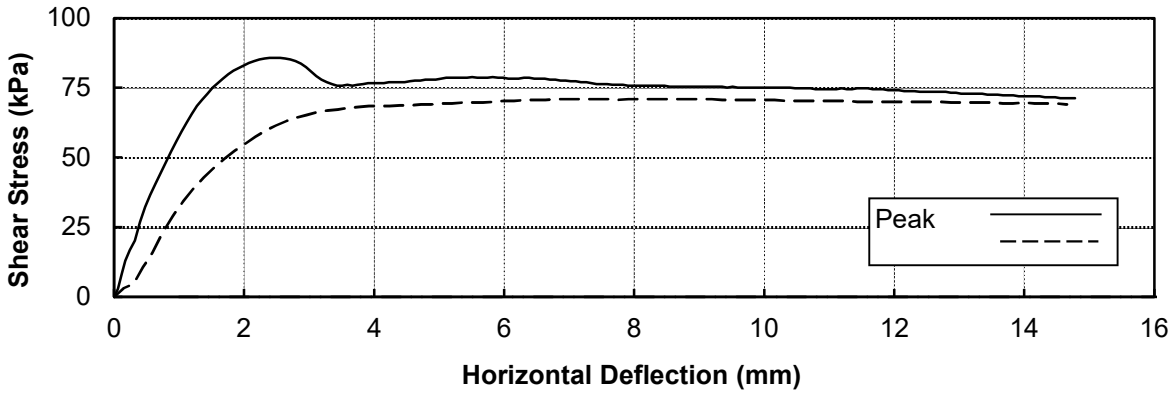
TETRA TECH

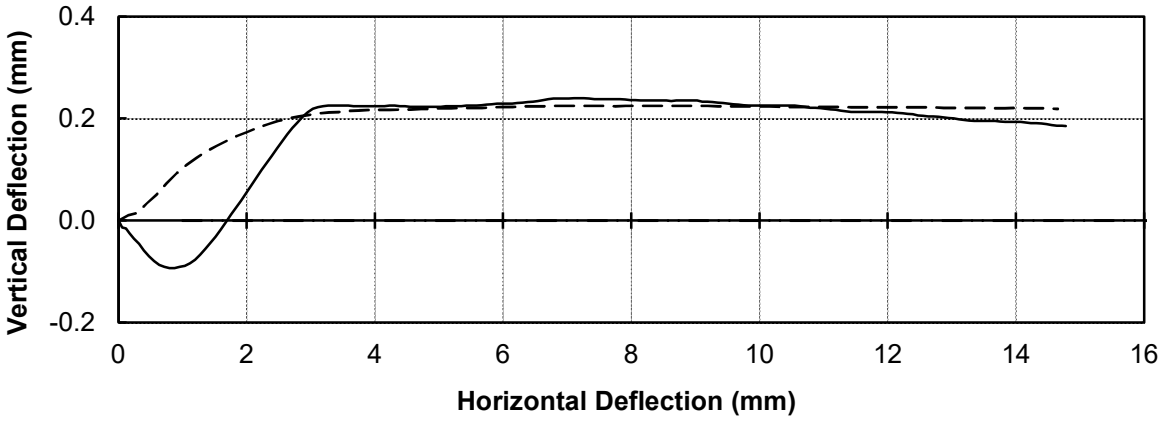
DIRECT SHEAR TEST

ASTM D3080

Project:	RDFFG Cell 2	Borehole No.:	BH-01 Bulk 2
Project No.:	SWM.SWOP04864-02	Depth:	35-40 ft
Client:	Regional District of Fraser - Fort George	Test No.:	DS-1
Date Tested:	September 21, 2024	Machine:	4
Description:	SAND, trace silt, brown	Preparation:	Remolded

Normal Stress (kPa) =	100	Moisture Content (%)	16.5
Peak Stress (kPa) =	86	Wet Density (Mg/m^3)	2.047
Residual Stress (kPa) =	69	Dry Density (Mg/m^3)	1.757





Remarks:

Reviewed By: [redacted] P.Eng.

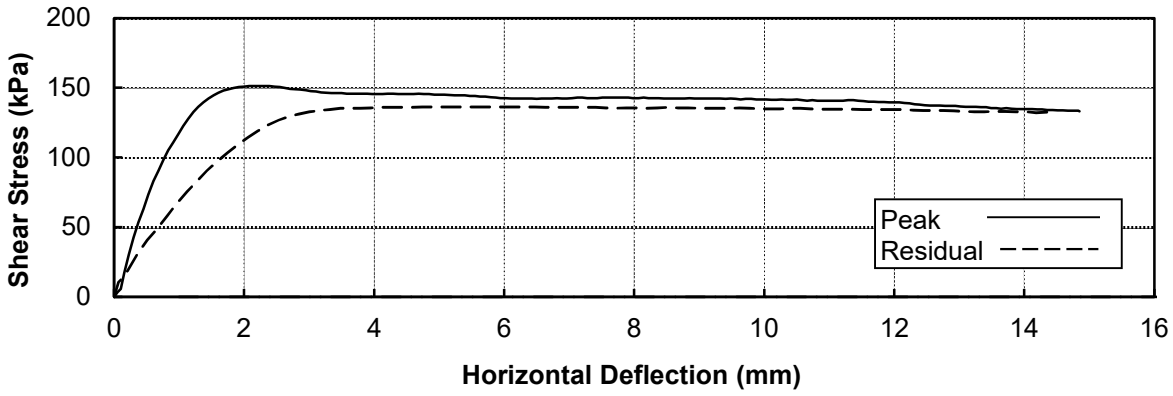
TETRA TECH

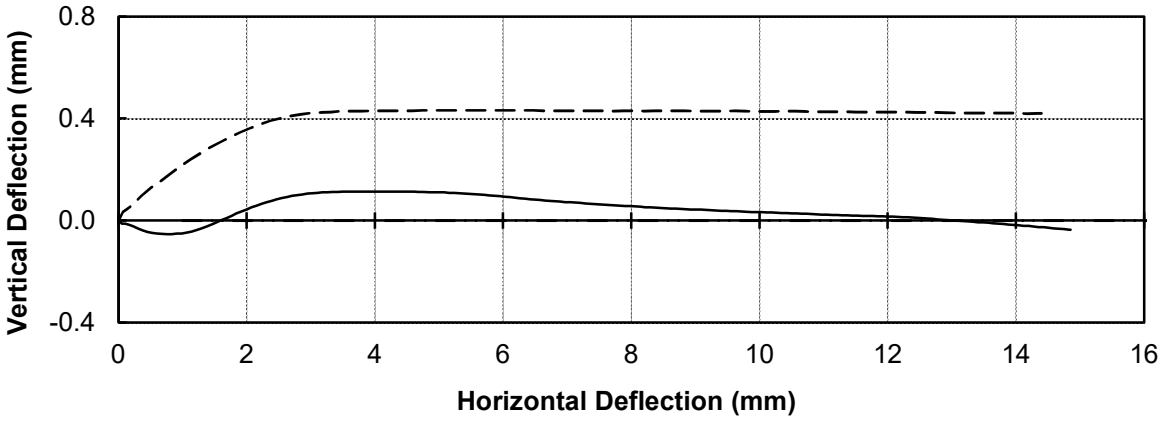
DIRECT SHEAR TEST

ASTM D3080

Project:	RDFFG Cell 2	Borehole No.:	BH-01 Bulk 2
Project No.:	SWM.SWOP04864-02	Depth:	35-40 ft
Client:	Regional District of Fraser - Fort George	Test No.:	DS-2
Date Tested:	September 21, 2024	Machine:	5
Description:	SAND, trace silt, brown	Preparation:	Remolded

Normal Stress (kPa) =	200	Moisture Content (%)	16.4
Peak Stress (kPa) =	151	Wet Density (Mg/m^3)	2.047
Residual Stress (kPa) =	132	Dry Density (Mg/m^3)	1.759





Remarks:

Reviewed By: [redacted] P.Eng.

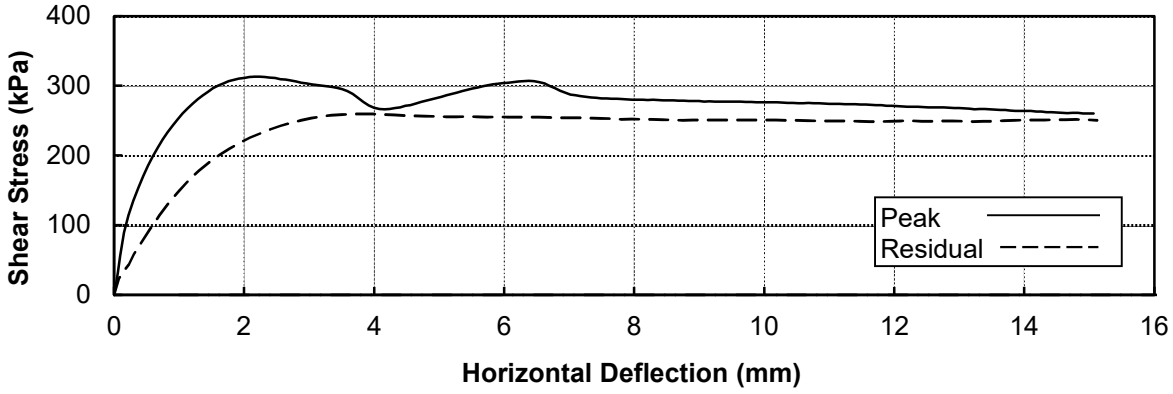
TETRA TECH

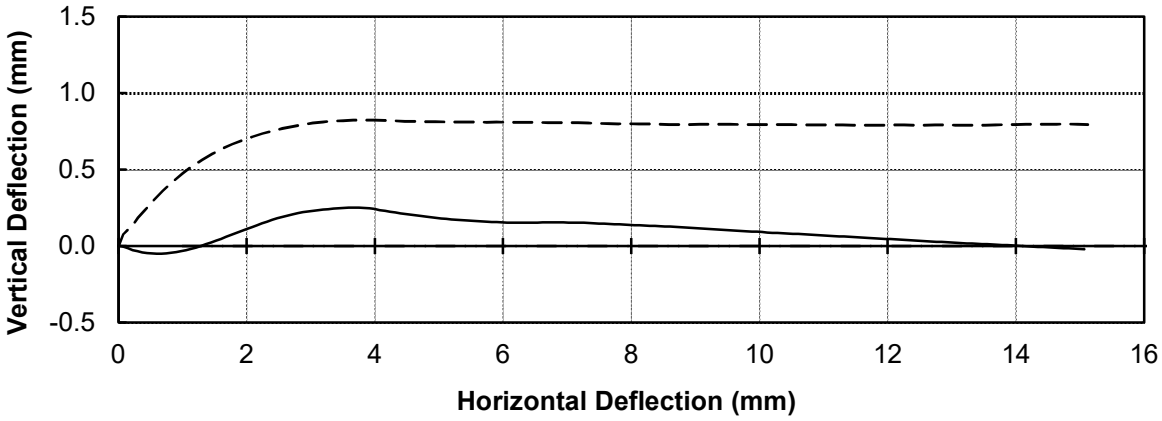
DIRECT SHEAR TEST

ASTM D3080

Project:	RDFFG Cell 2	Borehole No.:	BH-01 Bulk 2
Project No.:	SWM.SWOP04864-02	Depth:	35-40 ft
Client:	Regional District of Fraser - Fort George	Test No.:	DS-3
Date Tested:	September 21, 2024	Machine:	6
Description:	SAND, trace silt, brown	Preparation:	Remolded

Normal Stress (kPa) =	400	Moisture Content (%)	16.5
Peak Stress (kPa) =	313	Wet Density (Mg/m^3)	2.047
Residual Stress (kPa) =	249	Dry Density (Mg/m^3)	1.756





Remarks:

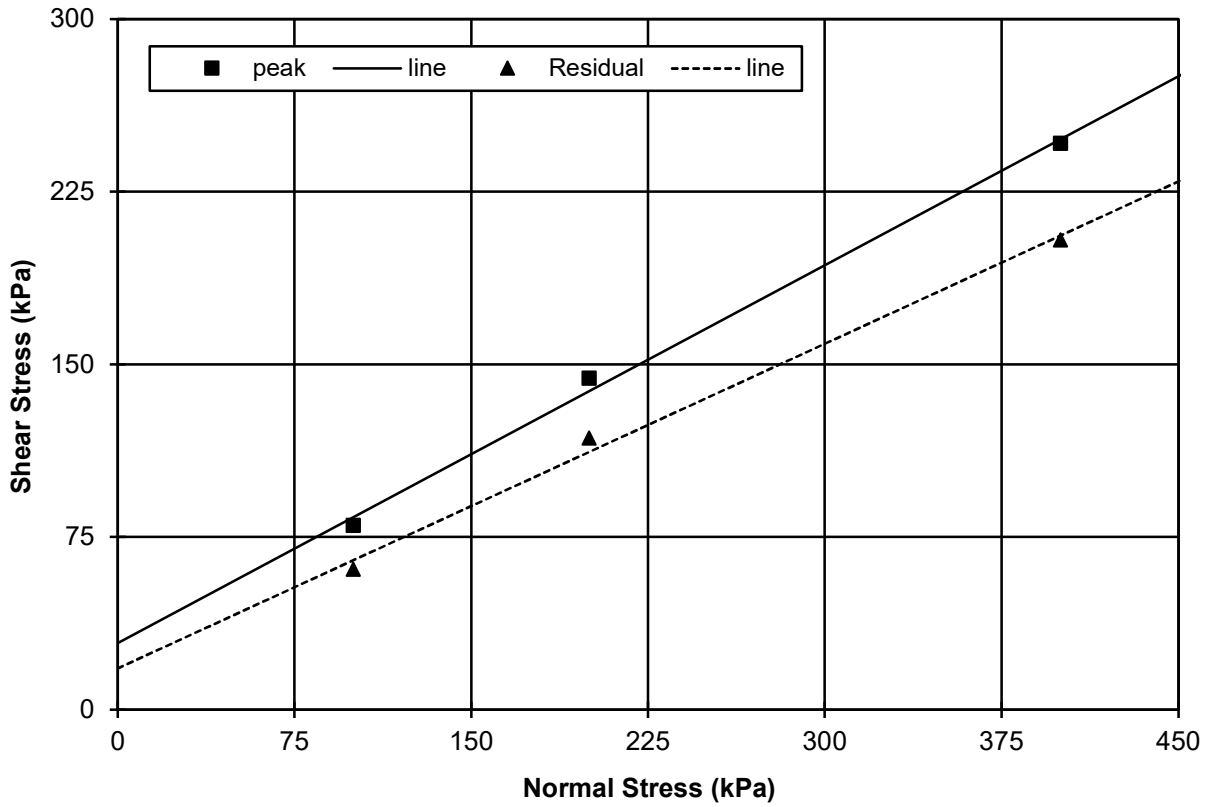
Reviewed By: [redacted] P.Eng.

TETRA TECH

SUMMARY of DIRECT SHEAR TEST RESULTS

ASTM D3080

Project:	RDFFG Cell 2 Geotechnical Investigation	Borehole No.	BH-04 SH02
Project No.:	SWM.SWOP04864-02	Depth:	250-250.75 ft
Client:	Regional District of Fraser - Fort George	Date:	September 17, 2024
Attention:		Tested By:	TD
Email:		Office:	Edmonton



Inferred Shear Strength Parameters :-

	Cohesion Intercept (kPa)	Inferred Angle of Shearing Resistance (Degrees)
Peak Strength:	**29**	**28.7**
Residual Strength:	**18**	**25.2**

Reviewed By: [redacted] P.Eng.

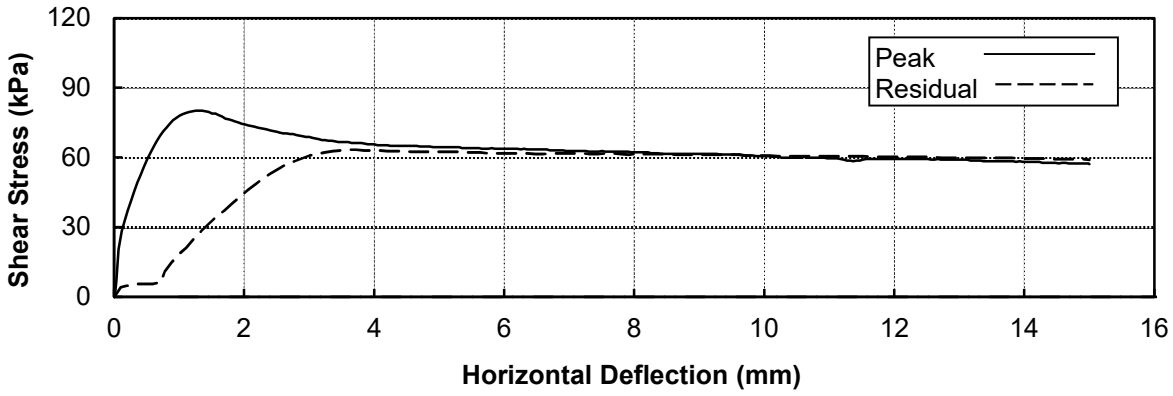
TETRA TECH

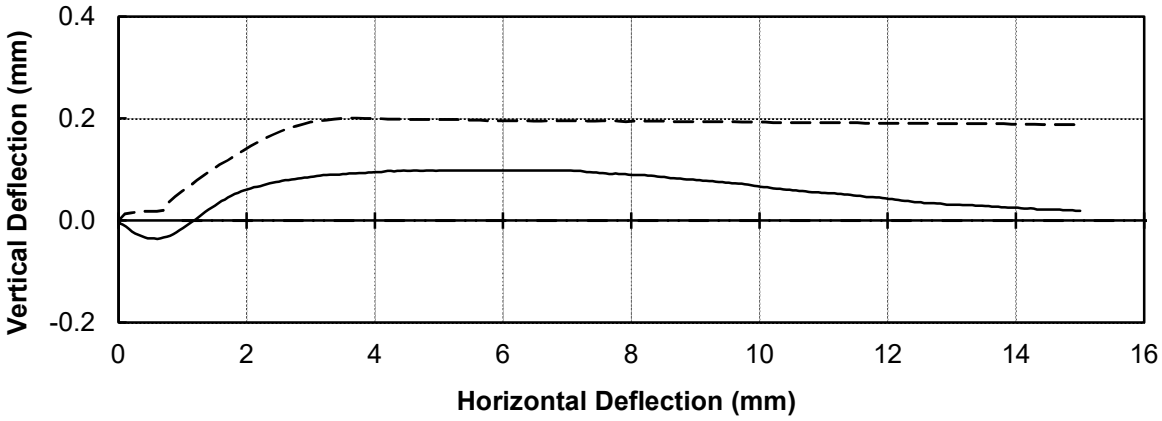
DIRECT SHEAR TEST

ASTM D3080

Project:	RDFFG Cell 2	Borehole No.:	BH-04 SH02
Project No.:	SWM.SWOP04864-02	Depth:	250-250.75 ft
Client:	Regional District of Fraser - Fort George	Test No.:	DS-4
Date Tested:	September 17, 2024	Machine:	4
Description:	SILT, sandy, some clay, gravel, dark grey	Preparation:	Undisturbed

Normal Stress (kPa) =	100	Moisture Content (%)	13.5
Peak Stress (kPa) =	80	Wet Density (Mg/m^3)	2.229
Residual Stress (kPa) =	59	Dry Density (Mg/m^3)	1.965





Remarks:

Reviewed By: [redacted] P.Eng.

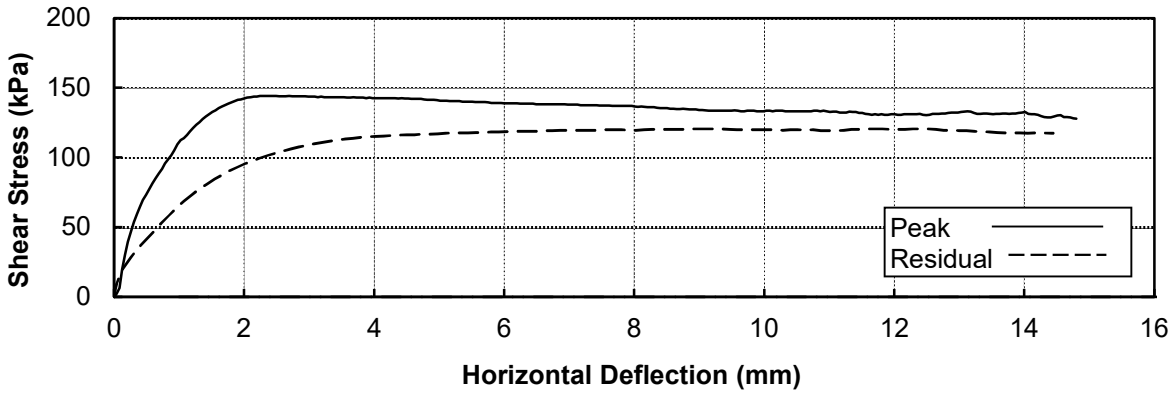
TETRA TECH

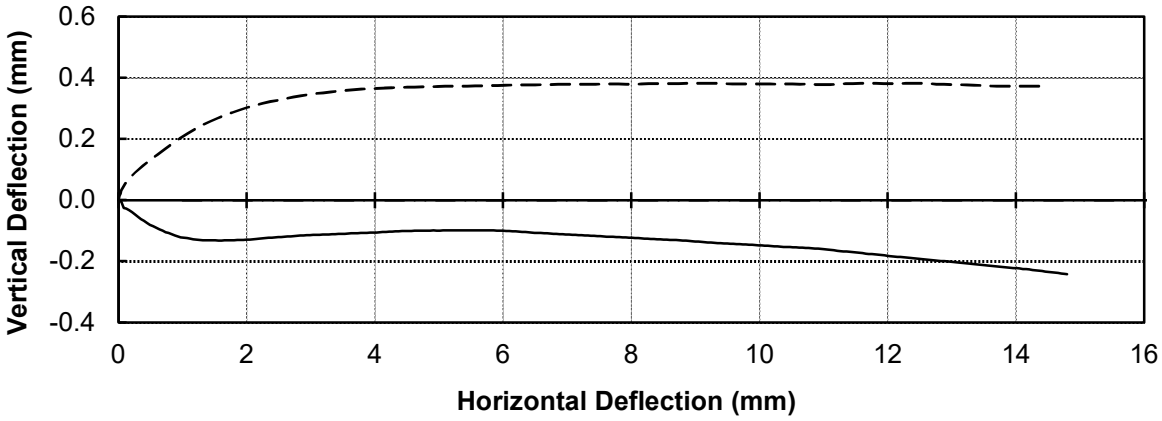
DIRECT SHEAR TEST

ASTM D3080

Project:	RDFFG Cell 2	Borehole No.:	BH-04 SH02
Project No.:	SWM.SWOP04864-02	Depth:	250-250.75 ft
Client:	Regional District of Fraser - Fort George	Test No.:	DS-5
Date Tested:	September 17, 2024	Machine:	5
Description:	SILT, sandy, some clay, gravel, dark grey	Preparation:	Undisturbed

Normal Stress (kPa) =	200	Moisture Content (%)	13.2
Peak Stress (kPa) =	144	Wet Density (Mg/m^3)	2.241
Residual Stress (kPa) =	117	Dry Density (Mg/m^3)	1.979





Remarks:

Reviewed By: [redacted] P.Eng.

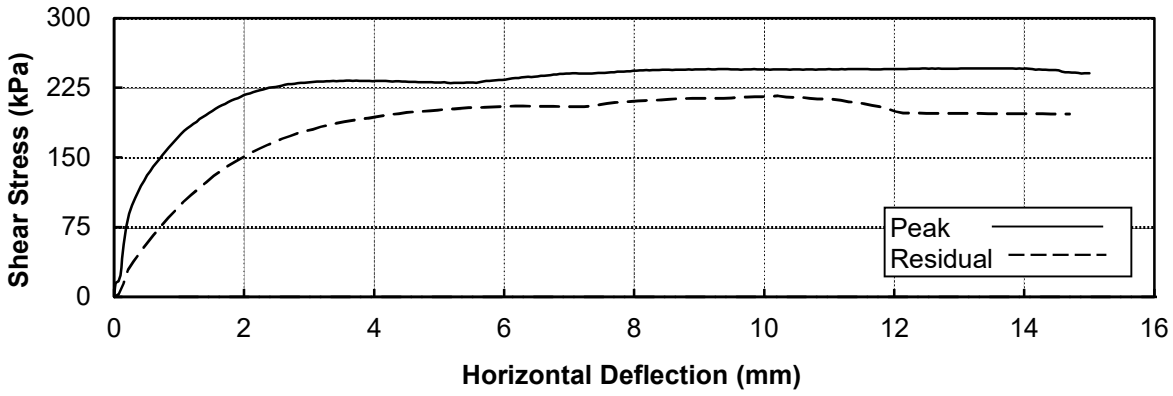
TETRA TECH

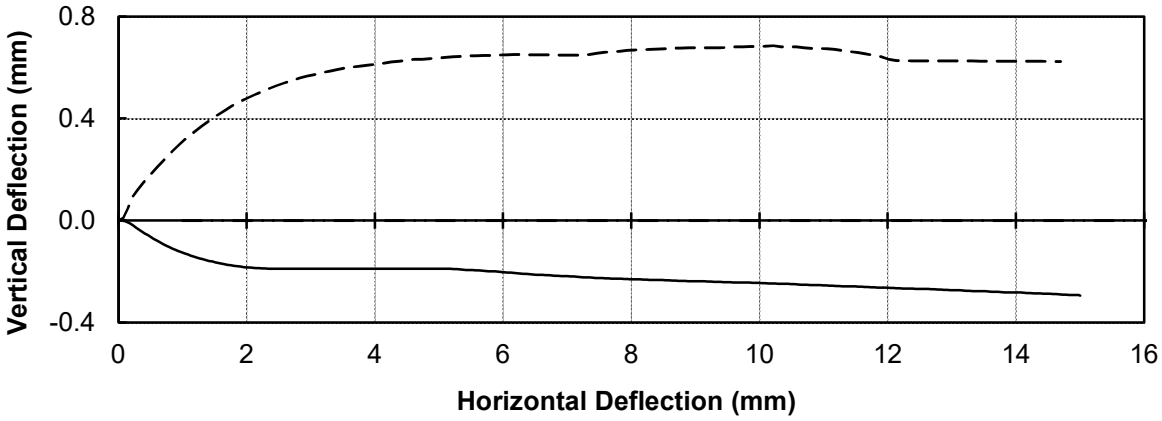
DIRECT SHEAR TEST

ASTM D3080

Project:	RDFFG Cell 2	Borehole No.:	BH-04 SH02
Project No.:	SWM.SWOP04864-02	Depth:	250-250.75 ft
Client:	Regional District of Fraser - Fort George	Test No.:	DS-6
Date Tested:	September 17, 2024	Machine:	6
Description:	SILT, sandy, some clay, gravel, dark grey	Preparation:	Undisturbed

Normal Stress (kPa) =	400	Moisture Content (%)	14.8
Peak Stress (kPa) =	246	Wet Density (Mg/m^3)	2.195
Residual Stress (kPa) =	197	Dry Density (Mg/m^3)	1.913





Remarks:

Reviewed By: [redacted] P.Eng.

TETRA TECH

MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	RDFFG Cell 2 Geotechnical Investigation	Borehole No.:	BH-02
Project Number:	SWM.SWOP04864-02	Date Tested:	October 8, 2024
Client:	Regional District of Fraser - Ft. George	Tested By:	LL
Project Manager:	Michelle Jelinski	Page:	1

Sample Number	Depth	Moisture Content (%)	Visual Description of Soil
B01	2.0-3.0 ft	24.5	SILT, trace sand, brown
B02	10.0-11.0 ft	20.6	SILT, sandy, brown
B03	18.0-19.0 ft	19.9	SILT, trace clay, brown
B04	21.0-22.0 ft	20.3	SILT, trace clay, sand, brown

Reviewed By: [redacted] P.Eng.

TETRA TECH

MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	RDFFG Cell 2 Geotechnical Investigation	Borehole No.:	BH-03
Project Number:	SWM.SWOP04864-02	Date Tested:	October 8, 2024
Client:	Regional District of Fraser - Ft. George	Tested By:	LL
Project Manager:	Michelle Jelinski	Page:	1

Sample Number	Depth	Moisture Content (%)	Visual Description of Soil
B01	3.0-4.0ft	33.9	SILT, trace clay, brown
SS01	5.0-7.0ft	27.8	SILT, trace sand, brown
B04	16.0-17.0 ft	24.8	SILT, trace clay, brown

Reviewed By: _____ [redacted] P.Eng.

TETRA TECH

MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project:	RDFFG Cell 2 Geotechnical Investigation	Borehole No.:	BH-04
Project Number:	SWM.SWOP04864-02	Date Tested:	October 8, 2024
Client:	Regional District of Fraser - Ft. George	Tested By:	LL
Project Manager:	Michelle Jelinski	Page:	1

Sample Number	Depth	Moisture Content (%)	Visual Description of Soil
B02	8.0-9.0 ft	25.1	SILT, trace clay, brown
B03	11.0-12.0 ft	26.6	SILT, trace sand, brown
B05	23.0-24.0 ft	24.2	SILT, trace sand, brown

Reviewed By: [redacted] P.Eng.

TETRA TECH

APPENDIX F

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LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

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The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

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In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.