



MATERIALS TESTING • SOILS
CONCRETE • ASPHALT • CORING
GEOTECHNICAL ENGINEERING

#1 – 1965 MOSS COURT
KELOWNA, B.C. V1Y 9L3
250-860-6540
INFO@INTERIORTESTING.COM

City of Salmon Arm
Public Works Department
100 30th Street SE
Salmon Arm, BC V1E 4N2

March 11, 2024
Job 24.019

Attention: Mr. Darin Gerow, AScT

Dear Sir:

Re: **Geotechnical Report
Proposed Addition
Fire Hall #2 – 200 30th Street SE
Salmon Arm, BC**

As requested, and further to our proposal dated December 12, 2023, Interior Testing Services Ltd. (ITSL) has carried out a geotechnical investigation for the above noted project. Please see attached to this report the following:

- Site Plan and Schematic Logs : Drawing 24.019-1
- Test Hole Logs : Drawings 24.019-2 to 24.019-4
- Sieve Analysis : Drawing 24.019-5

At the end of this letter report, ITSL attaches a copy of our standard two-page *Terms of Engagement* that governs our work on this project, which has been previously accepted and signed.

1.0 INTRODUCTION

ITSL understands that a one-story addition to the existing fire hall is proposed for the subject property. Based on the architectural drawings provided, the addition will be roughly 13 m by 8 m in plan area. ITSL anticipates that the proposed slab elevation will match the grade of the existing building.

The purpose of our investigation was to identify the underlying soil and groundwater conditions with respect to general geotechnical comments for site development.

The following report presents our investigation results, along with general geotechnical comments and recommendations for foundation preparation and design, building drainage, utility installation and onsite pavement structure.

2.0 SITE DESCRIPTION

The subject property is located at 200 30th Street in Salmon Arm, BC. The site is currently occupied by the existing fire hall, a paved parking lot, and a retaining wall along the east side of the property. In general, the building area is flat, and the property is bordered by the City of Salmon Arm works yard to the north, Little Mountain Sports Complex to the east and south, and 30th Street to the west.

3.0 FIELD and LABORATORY WORK

3.1 Field Work

On February 20, 2024, a tracked excavator operated by Mounce Construction Ltd. was used to advance a total of 3 test pits (TP) across the site to as deep as 3.1 m below current site grades. The soil profile of each test hole was continuously logged in the field and occasional, representative samples were recovered and returned to our laboratory for further testing.

The locations of all the test pits are approximately shown on the attached site plan (Drawing 24.019-1), which was adapted from the site plan provided by Avex Architecture.

3.2 Soil Profile and Groundwater Conditions

The schematic logs of the test pits are shown on Drawing 24.019-1. Detailed soil descriptions are shown on Drawings 24.019-2 to 24.019-4, which we recommend be used in preference to the generalized soil descriptions that follow.

In general, the test pits encountered 1.8 to 2.6 m of FILL. Generally, the FILL consisted of sand, gravel and cobble. However, old asphalt / construction debris was observed at roughly 2.2 m in TP2. Within TP2, the surface asphalt thickness was measured to be roughly 75 mm. Below the FILL materials, natural SILTs and SANDs were encountered to the base of each test pit, between approximately 2.7 to 3.1 m below surface grades.

Groundwater was not observed during our investigation. As a general comment, groundwater levels will likely vary seasonally and may be affected by local drainage and infiltration conditions.

3.3 Laboratory Work

Regular, representative samples were recovered during the investigation for further testing in our laboratory. A brief summary of the laboratory work completed is discussed below.

i. Water Content

The water content of all recovered samples was determined in our laboratory by oven-drying. These results are shown on Drawings 24.019-2 to 24.019-4. The water content of the FILL materials ranged from roughly 5 to 8%, and the natural soils ranged from roughly 9 to 20%.

ii. Sieve Analysis

To provide additional information with respect to soil type, we carried out a sieve analysis on a sample of the FILL materials recovered from TP2. The sample was limited to approximately 38 mm sizes. The results are shown on Drawing 24.019-5 and indicate mainly sand and gravel soils.

4.0 GENERAL SITE DEVELOPMENT

4.1 Site Preparation

Based on the results of our field investigation, natural soils are anticipated to be roughly 1.8 to 2.6 m below the current site grade within the area of the proposed addition. Two foundation preparation options are discussed below.

Option 1

Where the preferred scheme is to place new foundations on the existing old FILL, ITSL recommends additional test pits and field density testing at the time of construction, or potentially drilling and Dynamic Cone Penetration Testing (DCPT), to confirm FILL thickness below the foundations and that the materials are satisfactory for building support.

Typically, assuming a frost protection depth of 0.9 m, approximately 0.9 to 1.7 m of FILL material will remain below the proposed foundations. This option has risk of some foundation movement in excess of normal geotechnical objectives related to settlement of old FILL material, as ITSL was not involved with the original design or construction of the existing FILL.

Option 2

Alternatively, where the risk of foundation movement in excess of normal geotechnical objectives is not acceptable, ITSL recommends that all old FILL materials be removed from below the proposed foundations to expose suitable subgrade soil. Following a field review by ITSL, new engineered FILL or concrete foundations may be placed on the approved subgrade material.

All earthwork activities will need to be aware of the retaining wall to the east, to avoid damage and / or disturbance to the structure. ITSL recommends the original wall design be provided to the contractor prior to starting site preparation.

4.2 Engineered FILL

Where site grades are to be raised to achieve the design foundation elevations, ITSL recommends that engineered FILL materials be placed, compacted and tested. ITSL recommends that engineered FILL be placed above an approved subgrade.

ITSL further recommends that engineered FILL materials consist of clean (less than 8% fines), sands and gravels (ie MMCD Pit-Run or Similar), and that ITSL review the proposed materials to confirm suitability. The existing sand and gravel may be adequate for re-use as engineered FILL, based on the results of the attached sieve analysis. However, ITSL recommends additional geotechnical review at the time of construction.

ITSL recommends that the engineered FILL be placed and compacted in maximum 300 mm thick, level lifts to at least 95% Modified Proctor Density (MPD) and within 2% of optimum moisture content. Maximum particle diameters are to be maintained at 200 mm, or less, within the FILL materials. Field density testing should be carried out on every second lift of FILL placed (every 600 mm) to confirm suitable compaction is being achieved.

We recommend that engineered FILL extend beyond the edge of the building foundations a distance at least equal to the depth of fill placed to provide an adequate 1H:1V load spread through the fills to the underlying natural soils.

4.3 Utility Service Installation

Depending on final design invert elevations; ITSL anticipates that the proposed utility services will likely be set on existing FILL materials. Where appropriate, further geotechnical review can be provided at the time of construction.

The existing sand, gravel and cobble, FILLs are expected to be reasonable for re-use as trench backfill material. Depending on the gradation of the material, some screening and / or removal of unsuitable material may be required. ITSL recommends that particle diameters of the backfill materials be limited to 200 mm or less, and that we review the trench backfill material to confirm product suitability. ITSL recommends that all trench backfill work should be carried out as per the local bylaw. Alternatively, trench backfill can be placed and compacted as outlined in 4.1 above, as engineered FILL.

4.4 Temporary Excavations

Conventional Worksafe BC (OHS Regulation Part 20) slopes of 3 Horizontal to 4 Vertical (3H:4V) should be reasonable for trench work up to a total excavated height of 3 m, in satisfactorily dry conditions. Where steeper slopes or deeper excavations are proposed and / or if groundwater is encountered, ITSL recommends that a geotechnical engineer be given the opportunity to review conditions at the time of construction.

4.5 Onsite Pavement Preparation

The following pavement structure is expected to meet or exceed the minimums required by the City of Salmon Arm, *Schedule B of Bylaw No. 4293*.

| Thickness (mm) | Material |
|----------------|--|
| 75 | Hot Mix Asphalt |
| 100 | Crushed Gravel Base (19 mm minus) – compacted to a min. of 95% of MPD |
| 400 | Granular Subbase (75 mm minus) – compacted to a min. of 95% of MPD |
| Overlying | Suitable Subgrade (min CBR of 5-10) – proof rolled to check for soft spots |

Table 1 – Onsite Pavement Structure

The above pavement structure is expected to be reasonable from a frost protection perspective as well.

In areas of tight turning and / or heavier traffic loading, increasing the asphalt thickness to 100 mm could be contemplated to improve long-term performance.

ITSL recommends that the subgrade soils be proof-rolled to be checked for soft spots and / or deflections. Where soft spots are observed, ITSL recommends that the soft materials be over-excavated and replaced with additional granular subbase materials.

Alternatively, for reconstruction of the existing parking lot, consideration could be given to matching the existing structure as best as reasonably possible.

5.0 PRELIMINARY FOUNDATION DESIGN and CONCRETE SLABS

5.1 Preliminary Foundation Design

For footings set on suitable, natural soil or adequately compacted engineered FILL material, an allowable bearing pressure of 150 kPa (3000 psf) may be assumed for foundation design purposes, subject to the following considerations.

- a) Bearing surfaces to be clean, dry, free of any TOPSOIL and in a well compacted condition.
- b) Minimum footing width to be 400 mm (16 inches).
- c) Minimum depth of footing to be 900 mm (36 inches) below final adjacent grade, or as per local by-law, for frost protection.

The above allowable bearing pressure can also be taken as the Service Limit State resistance. For the factored geotechnical resistance at the Ultimate Limit State, a resistance of 225 kPa (4500 psf)

can be assumed for foundation design purposes, using a resistance factor of 0.5 as taken from the *Canadian Foundation Engineering Manual* (CFEM, 4th Ed).

We recommend that foundations be set below and behind a 1 Horizontal to 1 Vertical (1H:1V) plane projected up from the base of the existing retaining wall to the east of the proposed addition.

For seismic design purposes, we recommend a Site Class D from the *2024 BC Building Code* (BCBC) Table 4.1.8.4.B. This recommendation is based on our shallow test pit investigation and is preliminary as the BCBC requires investigation of the soil properties to 30 m below grade. ITSL can carry out additional investigations as needed.

5.2 Slabs on Grade

ITSL recommends that engineered FILL be placed and compacted as outlined in 4.2 above, where FILL materials are required to achieve the desired slab elevations.

ITSL recommends that a minimum thickness of 100 mm of 19 mm crushed gravel be placed and compacted to at least 95% of MPD to act as the final slab bearing surface. Where radon rock is required (determined and designed by others) ITSL can review the material as needed to provide comment on suitability for slab support.

6.0 BUILDING DRAINAGE and FINAL SITE GRADING

6.1 Foundation Drainage

For typical slab on grade structures where the interior slab elevations are above the exterior elevations, conventional foundation drainage can be omitted if desired, as the drainage system will likely not reduce the potential of water infiltration into the building, resulting in an unnecessary system.

Where interior slabs are below exterior grade, typical foundation drainage is to be provided and directed to a suitable location or to the local storm collection system (designed by others).

6.2 Roof Drainage

ITSL recommends that the roof drainage be directed to splash pads, set well away from the building and engineered FILLs. Alternatively, roof drainage could be directed to the local storm collection system (designed by others).

6.3 Final Site Grading

All finished grades (soil, asphalt and / or concrete) are to be sloped away from the building to reduce the potential for water infiltration into the backfill zone. Additionally, all drainage should be directed below and well away from any FILLs or buildings to limit the potential for saturation induced settlement or movement.

7.0 CONCLUSIONS

As requested, ITSL has carried out a geotechnical investigation for the proposed addition. Recommendations for foundation preparation and design, building drainage, utility installation, and onsite pavement structure have been provided in the previous sections of this report.

At time of construction, we recommend ITSL be given the opportunity to carry out site inspections of the stripped subgrade prior to placing foundations and / or engineered FILLS, in order to confirm soil conditions are as expected or to advise of suitable alternative measures if necessary. If / where engineered FILLS are required, regular field density testing is to be carried out by ITSL to confirm that adequate compaction is being achieved.

We trust the above comments are sufficient at this stage. After your review, please feel free to call and discuss if you have any questions.

Best Regards,
Interior Testing Services Ltd
Permit to Practice Number: 1001971

Prepared By:



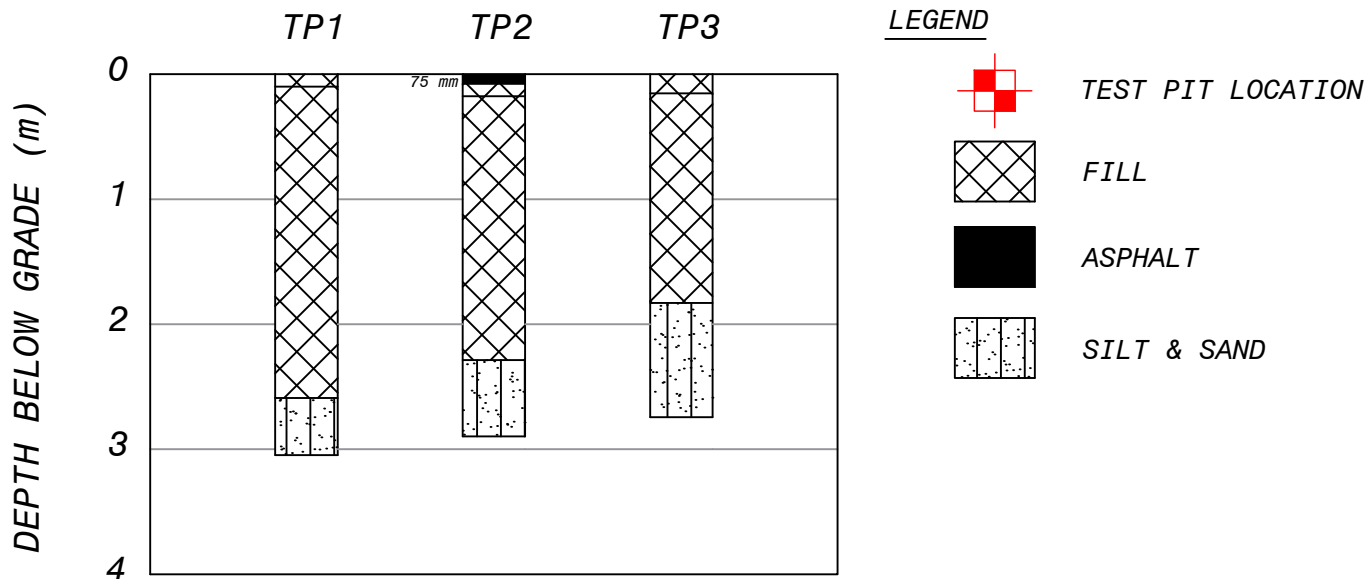
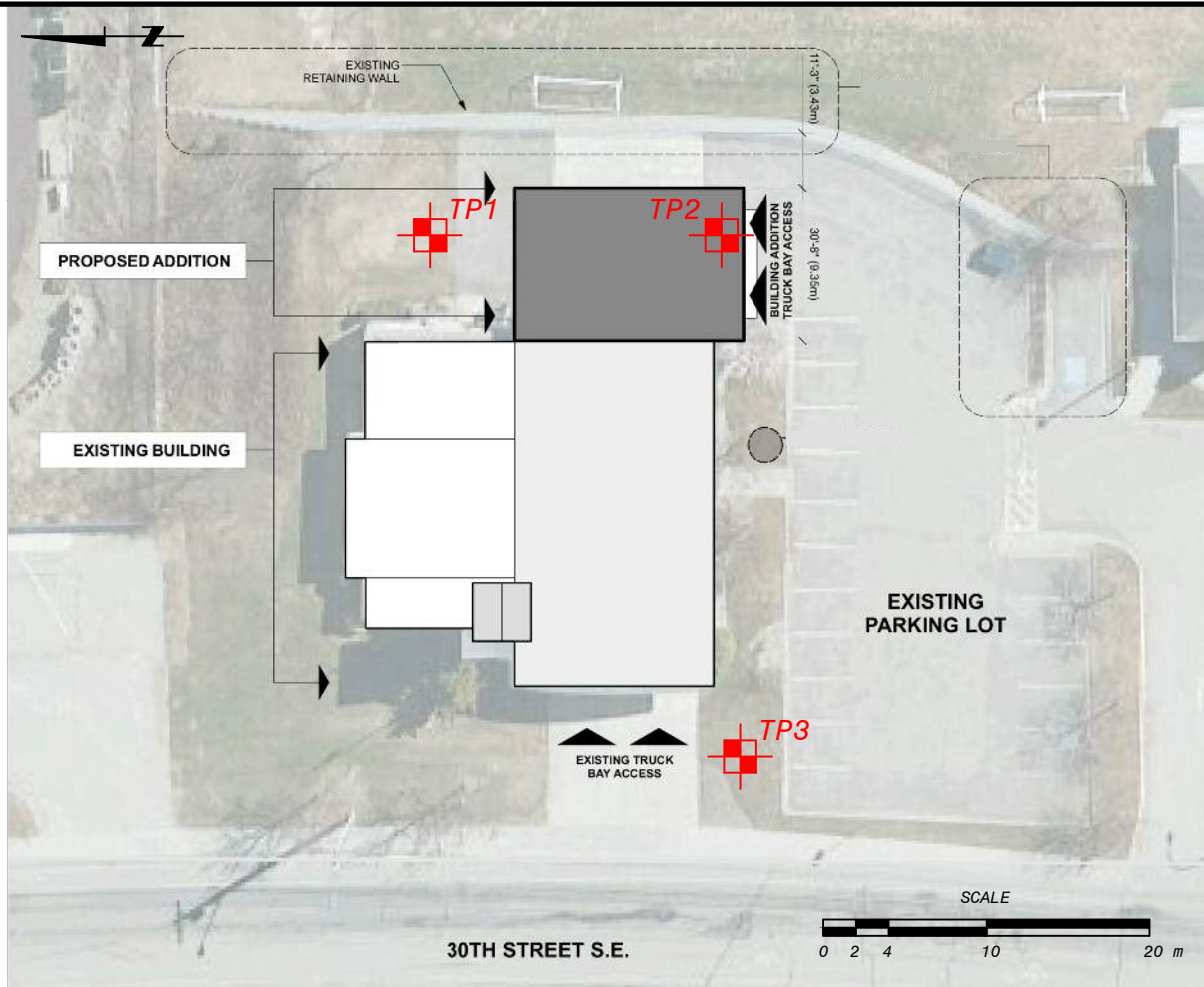
Darien Folk, E.I.T.
Junior Geotechnical Engineer

Reviewed By:




Jeremy Block, P.Eng.
Senior Geotechnical Engineer

| Revision No. | Date | Comments |
|--------------|----------------|-----------------|
| 0.0 | March 11, 2024 | Issued for use. |
| | | |



- NOTES**
1. REFERENCE PLAN SUPPLIED BY AVEX ARCHITECTURE.
 2. TEST PIT LOCATIONS ARE APPROXIMATE AND MAY VARY FROM THAT SHOWN.
 3. FOR DETAILED SOIL DESCRIPTIONS REFER TO TEST PIT LOGS. (DRAWINGS 24.019-2 TO 24.019-4)

| | | | |
|---|---|---|--------------------------|
| CITY OF SALMON ARM | SITE PLAN AND SCHEMATIC LOGS | INTERIOR TESTING SERVICES LTD | |
| PROPOSED FIREHALL ADDITION 200 30TH STREET SALMON ARM, BC | | 1-1965 MOSS COURT, KELOWNA, BC V1Y 9L3 PH: 250-860-6540 EM: info@interiortesting.com | |
| | | DATE OF INVESTIGATION: FEBRUARY 20, 2024 | |
| | | JOB NUMBER: 24.019 | DRAWING NUMBER: 24.019-1 |



LOG OF TEST BORING TP 1

Interior Testing Services Ltd
 1 - 1965 Moss Ct
 Kelowna, BC V1Y 9L3
 ph: (250) 860 - 6540
 em: info@interiortesting.com

Project : 24.019 Method : Excavator
 : Proposed Firehall Addition Operator : Mounce Construction Ltd
 : 200 30th Street SE Logged By : DF
 : Salmon Arm, BC Date : February 20, 2024
 Location : See Dwg. No. 24.019-1 Checked By : JB

| Depth in Meters | % Moisture | Water Level | REMARKS | GRAPHIC | Sample Number | Sample Type | Legend | | Depth in Meters |
|-----------------|------------|-------------|-----------------------|---------|---------------|-------------|-------------------------------|--|-----------------|
| | | | | | | | ▼ Water Noted During Drilling | □ Disturbed Sample | |
| | | | | | | | DESCRIPTION | | |
| 0 | | | No groundwater noted. | | | | | | 0 |
| 0.5 | 7% | | | | S1 | □ | | Brown, silty sand, FILL. | |
| 1.5 | 8% | | | | S2 | □ | | Brown, sand and gravel, some cobble, FILL. | |
| 2.5 | 9% | | | | S3 | □ | | Grey, SILT and SAND, some gravel. | |
| 3.1 | | | | | | | | Base of test pit at 3.1 m. | |
| 4 | | | | | | | | | 4 |



LOG OF TEST BORING TP 2

Interior Testing Services Ltd
 1 - 1965 Moss Ct
 Kelowna, BC V1Y 9L3
 ph: (250) 860 - 6540
 em: info@interiortesting.com

Project : 24.019
 : Proposed Firehall Addition
 : 200 30th Street SE
 : Salmon Arm, BC
 Location : See Dwg. No. 24.019-1

Method : Excavator
 Operator : Mounce Construction Ltd
 Logged By : DF
 Date : February 20, 2024
 Checked By : JB

| Depth in Meters | % Moisture | Water Level | REMARKS | GRAPHIC | Sample Number | Sample Type | Legend | | DESCRIPTION | Depth in Meters |
|-----------------|------------|-------------|--|---------|---------------|-------------|-------------------------------|--------------------|--|-----------------|
| | | | | | | | ▼ Water Noted During Drilling | □ Disturbed Sample | | |
| 0 | | | No groundwater noted. | | | | | | ASPHALT (75 mm). | 0 |
| | | | | | | | | | Brown, sand and gravel, FILL. | |
| | | | | | | | | | Brown, sand and gravel, some cobble, FILL. | |
| 0.5 | 6% | | | | S1 | □ | | | | |
| 2.0 | 6% | | S2: Sieve Analysis (Drawing 24.019-5) | | S2 | □ | | | Asphalt debris noted at 2.2 m. | |
| 2.5 | 19% | | | | S3 | □ | | | Grey, SILT and SAND, some gravel. | |
| 3.0 | | | | | | | | | Base of test pit at 2.9 m. | |
| 4.0 | | | | | | | | | | 4 |



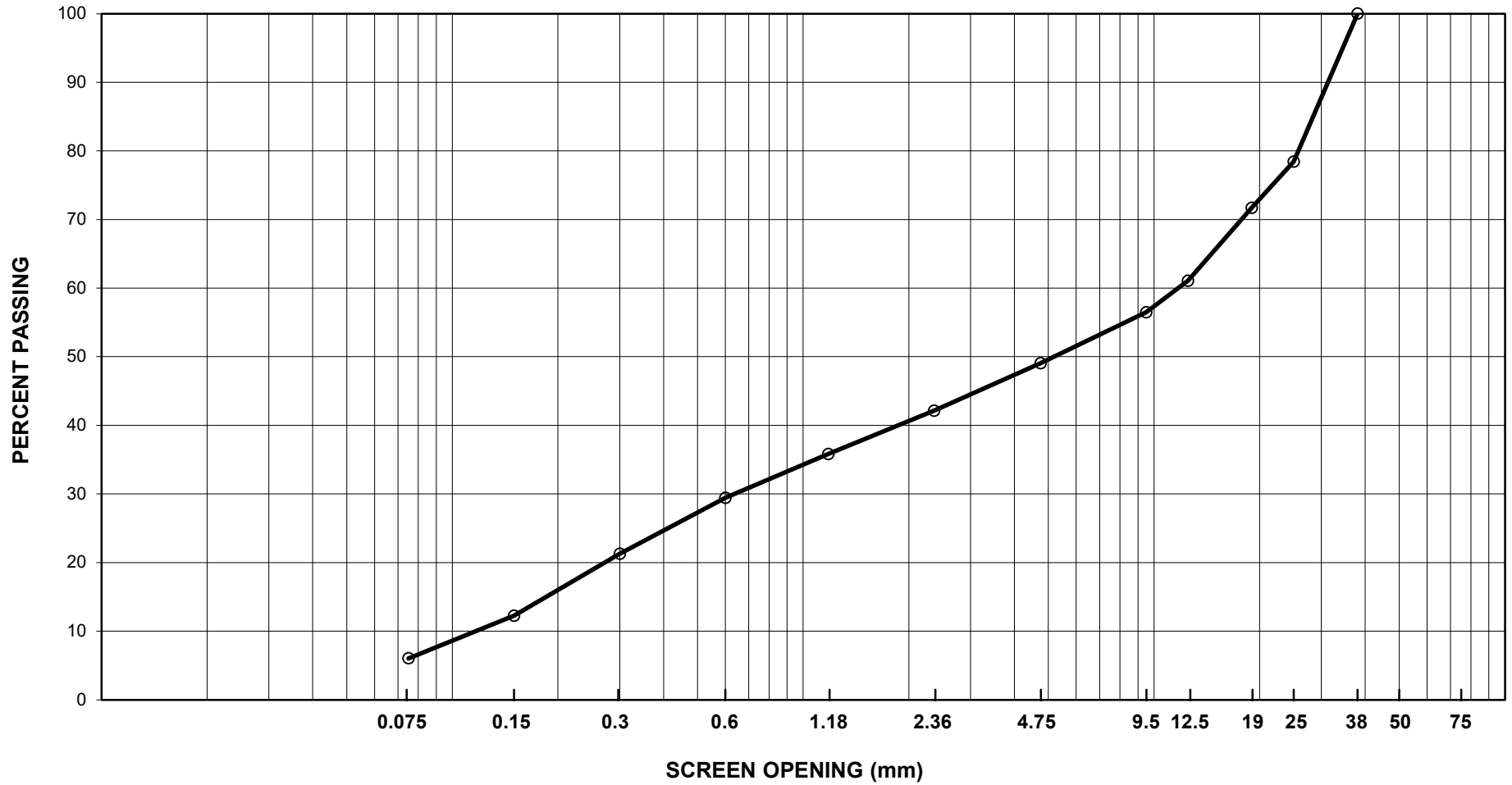
LOG OF TEST BORING TP 3

Interior Testing Services Ltd
 1 - 1965 Moss Ct
 Kelowna, BC V1Y 9L3
 ph: (250) 860 - 6540
 em: info@interiortesting.com

Project : 24.019 Method : Excavator
 : Proposed Firehall Addition Operator : Mounce Construction Ltd
 : 200 30th Street SE Logged By : DF
 : Salmon Arm, BC Date : February 20, 2024
 Location : See Dwg. No. 24.019-1 Checked By : JB

| Depth in Meters | % Moisture | Water Level | REMARKS | GRAPHIC | Sample Number | Sample Type | Legend | | DESCRIPTION | Depth in Meters |
|-----------------|------------|-------------|-----------------------|---------|---------------|-------------|-------------------------------|--------------------|--|-----------------|
| | | | | | | | ▼ Water Noted During Drilling | ☐ Disturbed Sample | | |
| 0 | | | No groundwater noted. | | | | | | Brown, silty sand, FILL. | 0 |
| 0.5 | 5% | | | | S1 | ☐ | | | Brown, sand and gravel, some cobble, FILL. | 0.5 |
| 2.0 | 20% | | | | S2 | ☐ | | | Brown, silty SAND. | 2.0 |
| 2.7 | | | | | | | | | Base of test pit at 2.7 m. | 2.7 |
| 4 | | | | | | | | | | 4 |

AGGREGATE CHART



| Sieve Size (mm) | Specification | Total % Passing |
|-----------------|---------------|-----------------|
| 38 | | 100.0 |
| 25 | | 78.4 |
| 19 | | 71.7 |
| 12.5 | | 61.1 |
| 9.5 | | 56.5 |
| 4.75 | | 49.1 |
| 2.36 | | 42.1 |

| Sieve Size (mm) | Specification | Total % Passing |
|-----------------|---------------|-----------------|
| 1.18 | | 35.8 |
| 0.600 | | 29.4 |
| 0.300 | | 21.3 |
| 0.150 | | 12.2 |
| 0.075 | | 6.0 |

| | | |
|---------------------|------------------------------|--------------------------------|
| Client: | Job 24.019 | |
| Sample Description: | Sand and gravel, FILL | |
| Location: | TP2 S2 2.0 m | |
| Specification: | Line Graph | |
| Sampled by: | DF | Date: February 20, 2024 |
| Screen Analysis: | DF | Date: February 27, 2024 |
| Reviewed By: | JB | Job 24.019 |
| | | Drawing 24.019-5 |

TERMS OF ENGAGEMENT

GENERAL

Interior Testing Services Ltd. (ITSL) shall render the Services performed for the Client on this Project in accordance with the following Terms of Engagement. ITSL may, at its discretion and at any stage, engage subconsultants to perform all or any part of the Services. Unless specifically agreed in writing, these Terms of Engagement shall constitute the entire Contract between ITSL and the Client.

COMPENSATION

Charges for the Services rendered will be made in accordance with ITSL's Schedule of Fees and Disbursements in effect from time to time as the Services are rendered. All Charges will be payable in Canadian Dollars. Invoices will be due and payable by the Client within thirty (30) days of the date of the invoice without hold back. Interest on overdue accounts is 18% per annum, compounded monthly (19.6%)

REPRESENTATIVES

Each party shall designate a representative who is authorized to act on behalf of that party and receive notices under this Agreement.

TERMINATION

Either party may terminate this engagement without cause upon thirty (30) days' notice in writing. On termination by either party under this paragraph, the Client shall forthwith pay ITSL its Charges for the Services performed, including all expenses and other charges incurred by ITSL for this Project.

If either party breaches this engagement, the non-defaulting party may terminate this engagement after giving seven (7) days' notice to remedy the breach. On termination by ITSL under this paragraph, the Client shall forthwith pay to ITSL its Charges for the Services performed to the date of termination, including all fees and charges for this Project.

ENVIRONMENTAL

ITSL's field investigation, laboratory testing and engineering recommendations will not address or evaluate pollution of soil or pollution of groundwater. ITSL will co-operate with the Client's environmental consultant during the field work phase of the investigation.

PROFESSIONAL RESPONSIBILITY

In performing the Services, ITSL will provide and exercise the standard of care, skill and diligence required by customarily accepted professional practices and procedures normally provided in the performance of the Services contemplated in this engagement at the time when and the location in which the Services were performed. ITSL makes no warranty, representation or guarantee, either express or implied as to the professional services rendered under this agreement.

LIMITATION OF LIABILITY

ITSL shall not be responsible for:

- (a) the failure of a contractor, retained by the Client, to perform the work required in the Project in accordance with the applicable contract documents;
- (b) the design of or defects in equipment supplied or provided by the Client for incorporation into the Project;
- (c) any cross-contamination resulting from subsurface investigations;
- (d) any damage to subsurface structures and utilities;
- (e) any Project decisions made by the Client if the decisions were made without the advice of ITSL or contrary to or inconsistent with ITSL's advice;
- (f) any consequential loss, injury or damages suffered by the Client, including but not limited to loss of use, earnings and business interruption;
- (g) the unauthorized distribution of any confidential document or report prepared by or on behalf of ITSL for the exclusive use of the Client.

The total amount of all claims the Client may have against ITSL under this engagement, including but not limited to claims for negligence, negligent misrepresentation and breach of contract, shall be strictly limited to the lesser of our fees or \$50,000.00. Increased liability limits may be negotiated upon the Client's request in consideration of an additional fee.

No claim may be brought against ITSL in contract or tort more than two (2) years after the Services were completed or terminated under this engagement.

PERSONAL LIABILITY

For the purposes of the limitation of liability provisions contained in the Agreement of the parties herein, the Client expressly agrees that it has entered into this Agreement with ITSL, both on its own behalf and as agent on behalf of its employees and principals.

The Client expressly agrees that ITSL’s employees and principals shall have no personal liability to the Client in respect of a claim, whether in contract, tort and/or any other cause of action in law. Accordingly, the Client expressly agrees that it will bring no proceedings and take no action in any court of law against any of ITSL’s employees or principals in their personal capacity.

THIRD PARTY LIABILITY

This report was prepared by ITSL for the account of the Client. The material in it reflects the judgement and opinion of ITSL in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. ITSL accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report may not be used or relied upon by any other person unless that person is specifically named by us as a beneficiary of the Report. The Client agrees to maintain the confidentiality of the Report and reasonably protect the report from distribution to any other person.

INDEMNITY

The client shall indemnify and hold harmless ITSL from and against any costs, damages, expenses, legal fees and disbursements, expert and investigation costs, claims, liabilities, actions, causes of action and any taxes thereon arising from or related to any claim or threatened claim by any party arising from or related to the performance of the Services.

DOCUMENTS

All of the documents prepared by ITSL or on behalf of ITSL in connection with the Project are instruments of service for the execution of the Project. ITSL retains the property and copyright in these documents, whether the Project is executed or not. These documents may not be used on any other project without the prior written agreement of ITSL.

FIELD SERVICES

Where applicable, field services recommended for the Project are the minimum necessary, in the sole discretion of ITSL, to observe whether the work of a contractor retained by the Client is being carried out in general conformity with the intent of the Services.

DISPUTE RESOLUTION

If requested in writing by either the Client or ITSL, the Client and ITSL shall attempt to resolve any dispute between them arising out of or in connection with this Agreement by entering into structured non-binding negotiations with the assistance of a mediator on a without prejudice basis. The mediator shall be appointed by agreement of the parties. If a dispute cannot be settled within a period of thirty (30) calendar days with the mediator, the dispute shall be referred to and finally resolved by an arbitrator appointed by agreement of the parties.

CONFIRMATION OF PROFESSIONAL LIABILITY INSURANCE

As required by by-laws of Engineers & Geoscientists British Columbia (EGBC), it is required that our firm advises whether or not Professional Liability Insurance is held. It is also required that a space for you to acknowledge this information be provided.

Our professional liability insurance is not project specific for the project and should not be regarded as such. If you require insurance for your project you should purchase a project specific insurance policy directly.

Accordingly, this notice serves to advise you that ITSL carries professional liability insurance. Please sign and return a copy of this form as an indication of acceptance and agreement to the contractual force of these Terms of Engagement.

PRINT NAME: _____ DATE: _____

ACKNOWLEDGEMENT: _____