



To:	Ben Campbell – Senior Project Manager	Date:	February 7, 2023
Client:	YG – Land Development Branch	Memo No.:	001
From:	Myles Plaunt, CET	File:	704-ENG.WARC04344-01
Subject:	Geotechnical Support – Group 2 and Group 3 Lot Release Grizzly Valley Subdivision - North Klondike Highway		

1.0 INTRODUCTION

At the request of Mr. Ben Campbell, Senior Project Manager, Government of Yukon – Community Services – Land Development Branch, Tetra Tech Canada Inc. (Tetra Tech) is providing geotechnical support for the Group 2 and Group 3 lot lottery in the Grizzly Valley Subdivision.

Authorization to proceed with this project was in the form of the executed Government of Yukon Consultant Services Agreement C00069118. This memorandum is subject to Tetra Tech's Limitations on the Use of this Document, which is attached in Appendix A.

2.0 PROPOSED DEVELOPMENT

2.1 2023 Lot Lottery Locations & Work To Date

The current lot release will include eight Group 2 lots (lots 2-1 to 2-8 located between Station 101+920 and Station 102+580 on the north side of Ursa Way) as well as four Group 3 lots (lots 3-1 to 3-4). Lots 3-1 to 3-3 are located along the north leg of Ursa way between Station 101+000 and Station 101+845 and Lot 3-4 is located along the south leg of Ursa Way between Station 105+880 and 106+035. Note that chainages are based on the civil drawings 2495-00-C-200 and 2495-00-C-300 generated by Associated Engineering (AE). Also presented on the civil drawings (which are attached to this memo) are proposed driveway and building site locations which will ensure that site distances are compliant with TAC guidelines for 50 km/hr roadways.

All Tetra Tech (formerly EBA Engineering Consultants) geotechnical reports for the Grizzly Valley Subdivision have been reviewed, including:

- The 2005 Planning and Design Report, which also included a detailed terrain mapping component (EBA File 1200161).
- The 2011 report that was specific to providing geotechnical recommendation pertaining to the two wildlife access multiple locations and the large cut area at approximately 101+550 (current chainage) on Ursa Way (EBA File W14101536.004).
- The 2015 Geotechnical Assessment Report (Tetra Tech File W14103622-01) that dealt with areas along Ursa Way showing significant signs of erosion.
- Numerous private lot developments throughout the subdivision area.

2.2 Terrain Conditions

The Grizzly Valley Subdivision is located along an east facing slope overlooking Lake Laberge. The slopes throughout the subdivision range from gentle to moderate and during roadway construction, significant cuts and fills were required to meet TAC standards. The long cut backslopes and fill sideslopes has complicated access to some of the lots but the recent design work completed by AE has hopefully resolved the site access issues.

The areas that will be included in the current lottery are undeveloped and tree covered.

2.3 Geotechnical Conditions

Soil deposition throughout the Group 2 and Group 3 areas is anticipated to of silty SAND TILL with isolated areas comprised of cleaner glaciofluvial SAND and GRAVEL with trace to some silt.

In general, the TILL soils are compact near the surface and become very dense with depth. Large boulders should be expected during driveway, building pad and on-site sewage disposal system excavations.

No bedrock or groundwater was encountered during the geotechnical or construction phases completed in the Grizzly Subdivision.

2.4 Site Drainage

The slopes on all lots have positive drainage. This will simplify the control of surface water but up-gradient surface water will have to be directed away from all building sites and on-site sewage disposal system absorption field locations.

3.0 DEVELOPMENT POTENTIAL

The potential for residential development is considered very good, aside from the lot access issues which are being addressed in a separate engineering report being prepared by AE. The lots are all quite large, ranging from 4.08 ha (Lot 2-6) to 9.47 ha (Lot 3-4). This will allow flexibility for prospective lot owners to select preferred building sites and on-site sewage disposal system locations. However, as stated on the two AE figures, *“access alignments and house locations within each lot are conceptual only and lot owners are responsible for developing the driveway alignment within their lots”*.

4.0 RESIDENTIAL FOUNDATION RECOMMENDATIONS

TILL and Glaciofluvial soils, in an unsaturated state, are considered acceptable foundation soils for conventional shallow foundation systems including strip and spread footings and thickened monolithic slab-on-grade.

It is anticipated that most of the foundations will be constructed on soils that are not considered to be “free draining” (for example, tills and silty gravels). According to local building codes, any new building constructed with below grade foundations must adhere to prescribed standards for drainage. The relevant standards include the following:

- Permanent Wood Foundations, as outlined in CAN/CSA S-406-92, Construction of Preserved Wood Foundations and identified in the National Building Code of Canada (NBCC 2020).

- Concrete Foundations, also described in NBCC 2020, Section 9.14, identifies the minimum requirements for foundation drainage, drainage tile and associated piping, granular drainage layers, drainage disposal, and control of surface runoff.

The prescriptive measures are based on CSA and NBCC specifications as summarized in the following sections.

4.1 Permanent (Preserved) Wood Foundation Recommendations

If the use of permanent (preserved) wood foundations (PWF) is desired, a granular drainage layer should be installed beneath all footings and basement slabs, in accordance with CAN-CSA S406, because of the dense till soils which are fairly impervious.

There may be some areas of free draining glaciofluvial material encountered on the Group 3 lots, allowing the opportunity to waive the requirements in this standard.

The granular drainage layer should be constructed using a clean crushed stone or screened drain rock material of maximum particle size 40 mm and having less than 10% sand (passing the 5 mm sieve). This layer shall be at least 125 mm thick and shall extend at least 300 mm beyond the footing perimeter. The granular drainage layer shall drain to a sump which, in turn, shall drain to a point of final disposal beyond the building's footprint. It is common to use bedding stone that is produced to satisfy the City of Whitehorse 25 mm Bedding Stone Specification. However, if alternative granular materials are being considered, testing can confirm suitability for use.

In accordance with CAN-CSA S406, the use of perimeter drainage tile or pipe is not recommended with preserved wood foundations. However, it should be noted that the long-term performance of this system is dependent upon the foundation wall waterproofing.

All backfill material placed within 600 mm of the foundation walls shall be free of deleterious debris, frozen materials, and boulders larger than 150 mm in diameter.

Existing site soils can be used as backfill around foundations. All backfill materials should be compacted to at least 95% of Standard Proctor Maximum Dry Density.

4.2 Concrete Foundation Recommendations

If the use of concrete foundations is desired, the drainage tile and pipe, granular drainage layers, drainage disposal and surface drainage specifications as presented in NBCC, Section 9.14 "Drainage" must be followed. As mentioned above, there may be areas of free draining material encountered, allowing opportunity to waive the requirements in this standard.

Concrete footing and foundation wall systems are required to have perimeter drainage tile which terminates in a sump pit. A sump pit is to be installed to assist in the removal of water from the foundation area (should water accumulation in the sump pit warrant it).

4.3 Perimeter Insulation and Lot Grading

For frost heave to occur, there must be sub-zero temperatures and frost susceptible soils that have been allowed to become saturated. Since the Yukon experiences sub-zero temperatures through the fall, winter and early spring, and the subject site is underlain with frost susceptible till soils, the best way to mitigate potential for frost heave is to prevent surface water infiltration into the soils under the footings and to reduce seasonal frost penetration by installing adequate perimeter insulation around the foundation wall.

Tetra Tech typically recommends an equivalent of 2.5 m of equivalent frost protection. Therefore, additional perimeter insulation will be required where there is less than 2.5 m of foundation wall backfill. For example, if strip footings are constructed at 1.2 m below finished site elevations, additional perimeter insulation will be required. Tetra Tech uses a “rule of thumb” determination, where 25 mm (1”) of moisture resistant, backfillable, rigid insulation is the equivalent of 300 mm (1’) of soil cover; therefore, an additional 100 mm (4”) of insulation will be required to satisfy the 2.5 m minimum if the footings are founded at a depth of 1.2 m.

Attached or detached garages are often problematic, as they are typically constructed on near surface footings or a thickened monolithic slab-on-grade foundation. As well, temperatures in garage structures are often kept much cooler than the adjoining residence. Therefore, using a footing depth of 300 mm, along with 300 mm of non-frost susceptible granular structure beneath the footings, an additional 150 mm of perimeter would be required to mitigate potential for movement and damage caused by seasonal frost.

To ensure that foundations are adequately protected, it is recommended that builders or developers contact Tetra Tech so that site specific perimeter insulation solutions can be provided.

For the Group 2 and Group 3 lots, it is recommended that the perimeter insulation extend 1.2 m (4’) out from the building’s perimeter.

Where residential structures are constructed along a slope, swales or berms should be constructed as necessary to direct surface water around and away from all foundations.

Along with drainage control, it is important that the structure have functioning rain gutters and downspouts installed to direct surface water away from the foundation elements.

5.0 ON-SITE SEWAGE DISPOSAL SYSTEM

This office has been involved in numerous on-site sewage disposal system installations throughout the Grizzly Valley Subdivision, proving that there is good potential for on-site sewage disposal. For the Group 2 and Group 3 lots, consider the following:

- The underlying TILL soils become very dense with depth (percolation rates of 55 to 60 minutes/25mm have been recorded at depth. Therefore, shallow absorption systems should be considered to take advantage of quicker near surface percolation rates in the glaciofluvial sands and gravels or weathered TILL soils.
- The large lot sizes throughout the Group 2 and Group 3 areas should allow locating residential structures up-gradient of the absorption fields. This will increase the potential for shallow absorption field construction.
- Absorption field, shallow absorption trench, and chamber systems are all considered appropriate for the lots being released in the current lottery.
- All systems installed in the Yukon must comply with the “*Sewage Disposal System Regulation*” and specifically, Section 21 – *Design Specifications For The Septic Tank and Soil Absorption System*. Additionally, designs

must be reflective of the information presented in *CSA B65-12 – Installation Code For Decentralized Wastewater Systems*. Homeowners or installers will likely be asked to submit a sample of the accepting soil from each proposed absorption field location so that testing can confirm the textural classification of the soil, which will then be used for absorption field sizing calculations.

6.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the Government of Yukon 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 Government of Yukon, 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 A.

7.0 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.

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Attachments: Appendix A - Limitations on the Use of this Document
Figures Prepared By Associated Engineering

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE [Signature]
Date Feb 7/23
PERMIT NUMBER PP003
Association of Professional
Engineers of Yukon

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL – YUKON GOVERNMENT

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the use of TETRA TECH's Client, its officers, employees, agents, representatives, successors and assigns (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH. Any changes to the conclusions, opinions, and recommendations presented in TETRA TECH's Professional Document must be authorized by TETRA TECH.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems, as per agreed project deliverable formats. TETRA TECH makes no representation about the compatibility of these files with the Client's future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be brought to the attention of TETRA TECH within a reasonable time.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, and subject to the standard of care herein, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage, except where TETRA TECH has subcontracted for such information.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

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.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to make, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

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.

1.8 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.9 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.10 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.11 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.12 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.13 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.14 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.15 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.16 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.17 DESIGN PARAMETERS

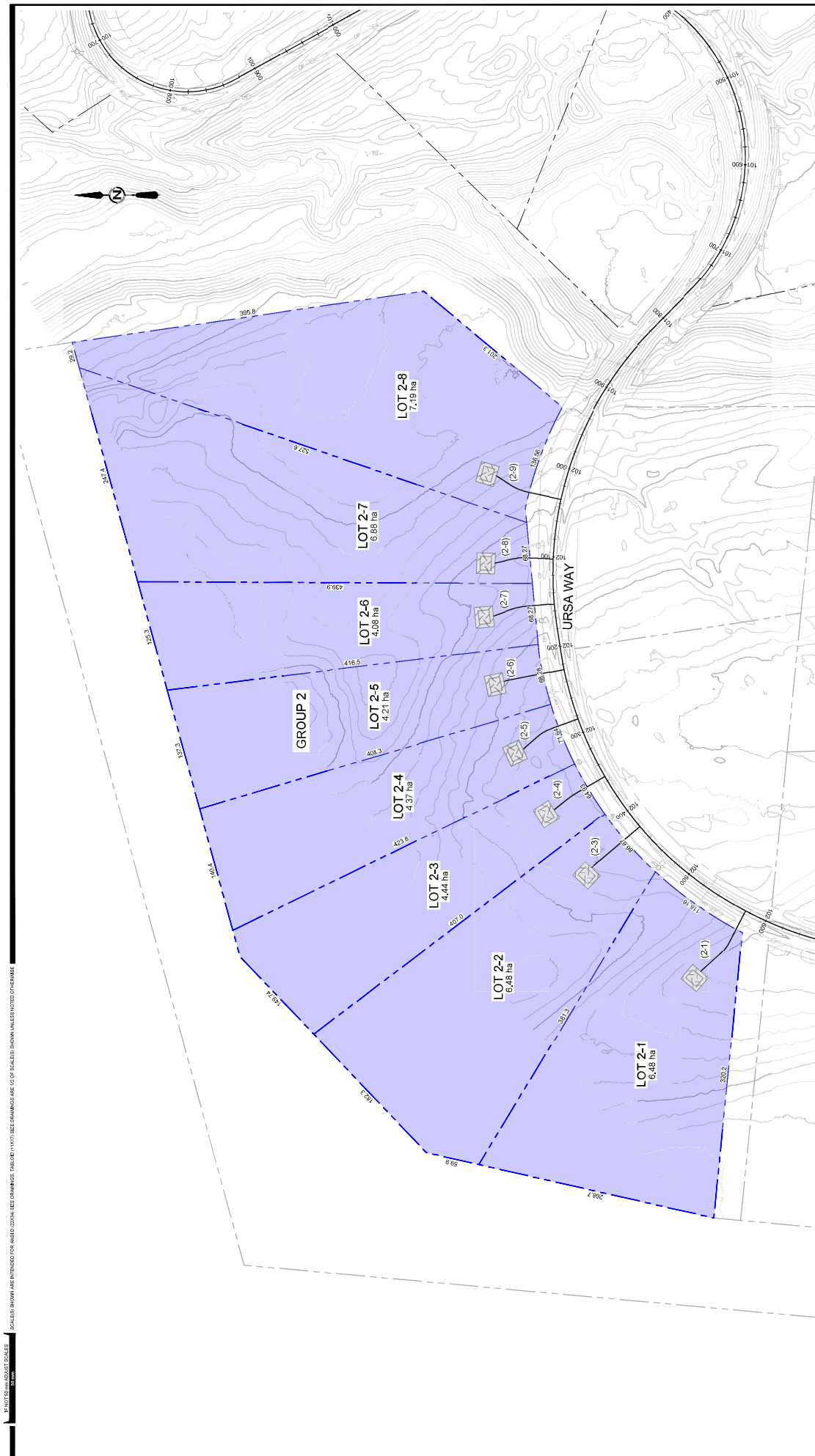
Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.18 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.19 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.



IF NOT TO SCALE SCALES
 1:1000
 1:500
 1:200
 1:100
 1:50
 1:20
 1:10
 1:5
 1:2
 1:1

SCALES SHOWN ARE INTENDED FOR A4D (200mm) DRAWINGS. (NOT) RE-DRAWINGS USE 1:10 OF SCALES SHOWN UNLESS NOTED OTHERWISE

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**YUKON GOVERNMENT
 COMMUNITY SERVICES**
 GRIZZLY VALLEY
 DRIVEWAY ACCESS ASSESSMENT

**PRELIMINARY!
 FOR DISCUSSION
 NOT FOR CONSTRUCTION**

NOTES:
 1. LOTS HAVE BEEN RENUMBERED TO REFLECT THE NEW NUMBER OF PROPOSED LOTS.
 2. ACCESS LOCATIONS SHOWN MEET TAC GUIDELINES FOR ACCESS ONTO A 40 MPH ROAD.
 3. PROPERTY OWNERS ARE RESPONSIBLE FOR DEVELOPING THE DRIVEWAY ALIGNMENT WITHIN THEIR LOTS.
 4. CONTOURS ARE SHOWN AT 2.0m INTERVAL.

LOT 2-1
 6.48 ha
 (2-1)

LOT 2-2
 6.48 ha
 (2-1)

LOT 2-3
 4.44 ha
 (2-3)

LOT 2-4
 4.37 ha
 (2-4)

LOT 2-5
 4.21 ha
 (2-5)

LOT 2-6
 4.08 ha
 (2-6)

LOT 2-7
 6.88 ha
 (2-7)

LOT 2-8
 7.19 ha
 (2-8)

Associated Engineering
 PLSM member

**IBEST
 MANAGED
 CONTRACTORS**
 Platinum member

REV	DATE	DESIGN	DRAWN	DESCRIPTION
A	2022-09-08	g. ltrbtd	g. ltrbtd	REPORT

2022-2495-00
 SCALE: 1:2000

CIVIL
 GROUP 2
 SITE PLAN

2495-00-C-200
 DRAWING
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