

March 24, 2026

City of Whitehorse
Land and Development
Development Services
187 Range Road
Whitehorse, YT Y1A 1C2

ISSUED FOR USE
FILE: 704-ENG.WARC04791-01 Task 002
Via Email: Taylor.Eshpeter@whitehorse.ca

Attention: Taylor Eshpeter, Manager, Land and Development, Development Services

Subject: Lot Development and Foundation Design Bulletin
Phase 9 Whistle Bend Subdivision, Whitehorse, Yukon

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by the City of Whitehorse to provide geotechnical recommendations pertaining to residential lot development and foundation design for Phase 9 of the Whistle Bend Subdivision, Whitehorse, YT.

This bulletin was prepared to be used by builders and developers and its contents incorporated into design and construction plans for single detached structures, cottage cluster homes, and residential townhouses.

2.0 SCOPE OF SERVICES

Tetra Tech's scope of services included the following:

- Describing the site and soil conditions that will be anticipated throughout Phase 9;
- Discussing the site and soil conditions that may affect lot grading and site drainage, along with presenting appropriate methods of controlling surface water flow and disposal; and
- Summary of considerations for foundation design and construction including descriptions of foundation systems considered most appropriate for Phase 9.

3.0 SITE CONDITIONS

3.1 Location and Surficial Features

Phase 9 in the Whistle Bend Subdivision is located north of Phase 6 and Phase 7 and is east of Phase 10 and Phase 11. The main corridors allowing access into the area are Witch Hazel Drive, Rampart Avenue and Alert Avenue.

We understand the proposed zone designations selected for Phase 9 includes Comprehensive Residential Multiple Family (RCM), Comprehensive Residential Single Family (RCS) and Comprehensive Residential Single Family 2 (RCS2). Cottage Cluster Homes (RCM3), Comprehensive Residential Single Family 3 (RSC3) and Comprehensive Residential Townhouses (RCT).

The site has been cleared of tree cover and graded to promote surface water management, directing most of the storm runoff to the storm outfalls located on the north side of Rampart Avenue.

3.2 Soil Conditions

Underlying the surficial organic root mat and the silty sand veneer is glaciolacustrine silt. The silt encountered during the geotechnical evaluation and construction, was found to be clayey and to increase in plasticity at a depth between 4.0 m to 4.5 m indicating a possible increase in the content of clay. The moisture content of the silt soils was also found to increase with depth and ranged from approximately 17% to 30%.

3.3 Groundwater

Groundwater was not noted in any of the boreholes advanced within Phase 9.

During Phase 9 civil construction and installation of deep utility infrastructure, mitigative measures (trench plugs) were constructed to reduce the potential for water conveyance within the deep utility bedding zones. The presence of water in Phase 9 deep utility bedding zones has not been observed to date; however, there is potential it may be encountered during water and sanitary service connection work, or foundation and basement excavation. Developers should seek guidance from a geotechnical engineer if water is encountered during an excavation of the services or foundations.

4.0 LOT GRADING AND DRAINAGE CONSIDERATIONS

Grading plans for all residential developments should ensure positive drainage of surface water onto paved roadways and/or into the storm sewer system. Rock pits constructed on individual lots for stormwater management are not considered suitable or feasible for Phase 9. Functional eavestroughs and downspouts are critical for diverting surface water runoff away from foundations. Downspouts should be discharged a minimum of 1.2 m from foundation walls. Splash pads are recommended.

5.0 FOUNDATION CONSIDERATIONS

The design and construction of residential housing typically falls under Part 9 of Division B in the National Building Code of Canada (NBCC) This includes Group C residential structures that are three stories or less in building height and having a building footprint area not exceeding 600 m². As new versions of the NBCC are released, it is the builder's responsibility to ensure they are following the current edition.

This section of the building code provides general guidelines for the design and construction of residential housing, often without the requirement of additional geotechnical input. Typical foundation systems, as described below are expected to perform suitably in Phase 9, provided the guidelines in Part 9 of the current version of the NBCC, including Section 9.4.4.4 – Soil Movement (which discusses seasonal frost movement), and the recommendations included in this bulletin, are followed.

Tetra Tech understands that there have been some occurrences of ground movement impacting residential foundations in the Whistle Bend subdivision. It is our understanding that these occurrences have been predominately caused by frost-related ground movement, which can be mitigated as discussed in Section 6 of this report, as well as in the referenced sections of the current version of the NBCC.

Foundation systems that are considered appropriate for Phase 9 include:

- Thickened edge monolithic slab-on-grade;
- Shallow strip footings foundation systems;
- Strip footings supporting a partial or full basement if the soils at depth are not excessively wet and soft; and
- Helical piles are also considered acceptable.

For the foundation systems listed, the requirements for damp proofing and seasonal frost protection measures should be reviewed for each development.

If the development falls under Part 4 of Division B of the current version of the NBCC additional geotechnical evaluation of the site may be required. This may include a geotechnical drilling program, seismic cone penetration, and laboratory testing to assess foundation soil conditions, determine an appropriate Seismic Designation, and assess liquefaction risk. A geotechnical engineering firm should be contacted to provide pricing to complete a site-specific geotechnical evaluation if required.

Slab-on-grade and helical piles require geotechnical design and field review. Additionally, slab-on-grade foundations necessitate structural engineering. Builders will be required to retain the services of the appropriate engineer(s) to obtain a building permit.

5.1 Foundation Drainage Considerations

According to the City of Whitehorse Building Advisory October 25, 2010, Drainage Standards for Building Foundations (City of Whitehorse, 2010), any new building constructed in Whitehorse with below-grade foundations must adhere to prescribed standards for drainage. The relevant standards referenced in the City of Whitehorse document include the following:

- Permanent Wood Foundations, as outlined in CAN/CSA S-406-92, *Construction of Preserved Wood Foundations* and identified in the 2005 edition of the National Building Code of Canada.
- Concrete Foundations, as described in 2005 edition of the National Building Code of Canada, Section 9.14, which identifies 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, as understood from the current version of the NBCC.

5.1.1 Permanent (Preserved) Wood Foundation Drainage

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 low permeability of the underlying glaciolacustrine material. Adequate thicknesses of free draining soil (sand and/or

gravel) is generally not expected throughout Phase 9, therefore this requirement will not likely be waived for new developments; however, this can be reviewed on a case-by-case basis by a geotechnical engineer if required.

5.1.2 Concrete Foundation Drainage

If the use of concrete foundations (including ICF Block Wall foundations) is desired, the drainage tile and pipe, granular drainage layers, drainage disposal, and surface drainage specifications outlined in the current version of the NBCC, Section 9.14 “Drainage” must be followed. As mentioned above, soil throughout Phase 9 is not generally expected to be free draining; however, this can be reviewed on a case-by-case basis by a geotechnical engineer if required.

5.1.3 Backfill

Backfilling around foundations is important and differs significantly between PWF and concrete wall foundations.

Backfilling materials and method should be reviewed by Geotechnical Engineer.

5.1.4 Sump Pumps

Refer to the latest City documentation for the requirement and installation details for sump pumps.

6.0 SEASONAL FROST CONSIDERATIONS

6.1 Seasonal Frost Related Movement

Seasonal frost-related movement is common in cold climates when three conditions exist, including:

- Ground temperatures are below freezing for a period of time that allows ice lens growth;
- Frost susceptible soils (i.e., fine grained soils susceptible to the formation of ice lenses) are present; and
- Soil pore space is near 100% saturation.

Throughout the Whistle Bend area there is the potential that all three of these conditions exist. We understand that this potential for frost related soil movement is required to be addressed per Part 4 in the current version of the NBCC.

6.2 Foundation Insulation Recommendations

Current local codes dictate the use of insulation around all foundations as under Section 86 of City of Whitehorse’s Building and Plumbing Bylaw 99-50 (City of Whitehorse, 2016). **However, this insulation specification is intended for energy efficiency and may not meet the minimum requirements for preventing frost related movement in frost-susceptible soils.**

Depending on the foundation type and depth additional frost protection measures maybe required. This may consist of installing additional moisture resistant, backfillable, perimeter insulation near the surface or at depth around foundations constructed on frost susceptible soils.

Every new building or renovation with new foundation will require geotechnical recommendations and a Letter of Assurance to obtain a Building Permit from the City of Whitehorse.

6.3 Frost Heave and Lot Drainage Considerations

Drainage is crucial to minimizing the potential of frost heave. Lot drainage requirements are presented in the City of Whitehorse Servicing Standards Manual.

Along with drainage control, it is important that the structure has functioning rain gutters and downspouts installed to minimize potential for water to impact soil along the foundation wall and under the footings.

It is important to limit the infiltration of surface water into foundation soils to minimize seasonal frost-related ground movement. Surface water infiltration should be minimized through site grading, functioning eavestroughs, and snow management. Proper installation of perimeter insulation at a positive slope will also aid in directing water that has infiltrated into the soil away from foundation elements.

6.4 Geotechnical Engineering Review and Assurance

As per the City of Whitehorse building permitting requirements the owner/developer will be required to provide a geotechnical letter of assurance and design for frost protection as required.

7.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of City of Whitehorse and their agents. Tetra Tech Canada Inc. (operating as Tetra Tech) 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 City of Whitehorse, 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.

8.0 CLOSURE

We trust this document 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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Enclosure: References
Appendix A: Tetra Tech Limitations on the Use of this Document

REFERENCES

- Canadian Standards Association. (1992). *Construction of Preserved Wood Foundations*. CAN/CSA-S406-92.
- Canadian Standards Association. (2021). *Specification of permanent wood foundations for housing and small buildings*. S406-16 (R2021).
- City of Whitehorse. (2010). *Building Advisory October 25, 2010 – Drainage Standards for Building Foundations*. City of Whitehorse document ID 9858.
- City of Whitehorse. (2016). *Building and Plumbing Bylaw 99-50*.
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- National Association of Home Builders (NAHB) (2004). *Revised Builder's Guide to Frost Protected Shallow Foundations*.
- National Research Council of Canada (NBCC). (2005). *National Building Code of Canada 2005*.
- National Research Council of Canada (NBCC). (2015). *National Building Code of Canada 2015*.
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APPENDIX A

TETRA TECH LIMITATIONS ON THE USE OF THIS DOCUMENT

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GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

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

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. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

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, 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.

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 document, 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, 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 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.

1.8 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.

1.9 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.

1.10 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.

1.11 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.

1.12 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.

1.13 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.

1.14 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.

1.15 DRAINAGE SYSTEMS

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. Where temporary or permanent drainage systems are installed within or around a structure, these systems must protect the structure from loss of ground due to mechanisms such as internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design details regarding the geotechnical aspects of such systems (e.g. bedding material, surrounding soil, soil cover, geotextile type) should be reviewed by the geotechnical engineer to confirm the performance of the system is consistent with the conditions used in the geotechnical design.

1.16 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.

1.17 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.

1.18 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.