KONTUR
GEOTECHNICAL CONSULTANTS

October 8, 2021
Project No.: **K-180335-00**

Davide Ehrhardt
28165 Yukon Inc.
5403 Buckingham Ave
Burnaby, BC
V5E 1Z9

Attention: **David Ehrhardt**
dehrhardt@telus.net

RE: **Geotechnical Review**
Residential Development
Lot 12, Wedge Woods, Whistler, BC (SL12, DL 2247, Gp 1, NWD Strata Plan BCS3916)

Dear David Ehrhardt,

1.0 INTRODUCTION

In accordance with your recent authorization, Kontur Geotechnical Consultants Inc. (Kontur) has completed this geotechnical review for the above-referenced project. This geotechnical provides an opinion with respect to the presence of potential naturally occurring geologic hazards that could influence the proposed development and guidance for geotechnical aspects for the project. Previously completed geotechnical hazard assessments completed for the Wedge Woods development address larger scale hazards such as debris flows, snow avalanches and flooding that could influence the property and this review are intended to review site specific hazards such as ground subsidence and slope stability.

Review and use of this letter should be completed in accordance with the attached *Interpretation and Use of Study and Report* document. It is included as an integral part of this letter and should be read in conjunction with all parts of this letter.

2.0 SOURCES OF INFORMATION

Sources of information for this addendum include those listed in the referenced report and:

- Lot Layout "*Community Housing – Wedgwoods*";
- Site reconnaissance by senior Kontur personnel;
- Relevant information obtained from the Squamish Lillooet Regional District (SLRD) online web-mapping application; and,
- Topographic information provided by Creus Engineering.

3.0 UNDERSTANDING OF PROJECT

Based on a review of the proposed lot layout for the subject property a subdivision of the property into 11 single family residential lots is proposed.

4.0 SITE DESCRIPTION

The subject property (Lot 12, Wedge Woods, Whistler) was located within the northwestern portion of the Wedge Woods subdivision. The property is irregular in shape with the northern boundary oriented approximately in an east-west direction with a length of about 43m, the western boundary parallels Highway 99 with a length of about 212m with a turn to the east in the northern about 20m, the western and southern boundaries conform to Riverside Drive with a length of about 295m. The property has a total area of about 1.42ha.

The property was bounded by Highway 99 to the west, Riverside Drive to the east and south and an undeveloped property to the north.

A gravel road had been constructed near the centre of the property from Riverside Drive that accessed a sales building to the south and a covered area to the north. Access roads to a site trailer used for construction of the Wedge Woods development had been constructed west of the proposed development.

Topography within the subject property generally consisted of a relatively flat lying area in the eastern half of the property from the northern boundary to the about 15m north of the southern boundary. The western portion of the property consisted of an east facing slope with an inclination of about 1.5H: 1V (Horizontal: Vertical) and a height of about 2m. A cut slope along the southern property boundary ranged in height from about 4m at the eastern end to about 10m at the western end with an inclination of about 1.5H: 1V.

A review of the surficial geology map "Surficial Geology and Landslide Inventory of the Upper Sea to Sky Corridor" (Open File 5324) indicates the subject property is underlain by bedrock. Exposed soils in the cut slope along the southern property boundary and previous experience with excavations within the subject property indicates the subject property is underlain by compact to dense sand with trace to some silt and some gravel.

Green River is located about 220m to the east and 50m below the subject property.

Vegetation generally consisted of widely spaced coniferous trees with minimal underbrush.

5.0 COMMENTS AND RECOMMENDATIONS

5.1 General

The proposed development area is located in an area with generally flat lying topography with the exception of the area near the southern property boundary where a south facing slope 4m to 10m high had an inclination of about 1.5H: 1V. The potential geologic hazard that could influence the property is considered to be slope stability of the cut slopes along the southern property boundary.

The native granular soils, or structural fill placed thereon, would provide adequate bearing support for proposed single-family residential buildings within typically acceptable settlement tolerances.

5.2 Slope Stability

The subject property contains a steep cut slope therefore the potential for such naturally occurring events slope stability to influence the proposed development should be considered. The steep slopes may influence proposed lots CH10 and CH11.

The slopes within the proposed development are generally comprised of compact to dense granular soils. Based on previous experience in the Wedge Woods subdivision proposed single-family residential buildings should be setback from the slopes such that building foundations are located below a 2H:1V gradient line projected up from the toe of nearby slopes.

5.3 Temporary Slopes and Dewatering

Temporary cuts within the soils should be inclined no steeper than 1H: 1V and should be scaled of larger rocks which could become dislodged and create an unsafe workspace. Excavation guidelines provided by WorkSafeBC must be followed. An initial review of temporary cut slopes greater than 1.2m in height should be conducted by the Geotechnical Engineer. Temporary slopes should be continually reviewed by the contractor, who will be on site on a full-time basis and will be able to observe changes in slope profile and monitor the performance of the cut slope. Kontur should be notified immediately of any significant changes in the condition of temporary cut slopes.

Temporary construction dewatering of the excavations should be carried out as required to facilitate the excavations and placement of structural fill in the dry. Groundwater seepage can potentially be encountered at the interface of bedrock and overlying soils or from within the overlying soils. Based on previous experience within the Wedge Woods development area, conventional ditch and pumped sump methods would likely be sufficient for construction dewatering. However, the contractor would need to select a dewatering system in response to actual seepage volumes encountered during construction

5.4 Site Preparation

Subgrade preparations for building, driveway, patios and other hard landscape features should include removal of all vegetation and loose or soft soils to expose compact to dense native granular soils or bedrock.

In areas requiring increases or reinstatement of grade, structural fill consisting of 150mm minus shot rock with less than 5% fines passing the 0.075mm (#200) sieve should be placed in lifts with a maximum thickness of 300mm and compacted with heavy ride-on type vibratory roller to achieve at least 95% MPMDD.

5.5 Seismic Considerations

The British Columbia Building Code (BCBC 2018) provides guidelines and parameters for seismic design. The design earthquake corresponds to a 2% probability of exceedance min 50 years which is equivalent to a 1 in 2475-year return period. The Natural Resources Canada website provides interpolated site-specific seismic hazard values and indicates a peak horizontal firm ground acceleration of 0.18g for the subject property.

Based on the characterization of anticipated subsurface conditions within the subject property provided in this report, compact to dense granular soils, liquefaction of subsurface soil layers during the design earthquake is not considered likely. A Site Classification of Site Class C for Seismic Response Table 4.1.8.4.A is considered appropriate for the subject site.

5.6 Foundation Design

It is considered that conventional strip and pad footings placed on the native granular soils or structural fill placed thereon would provide adequate support for the proposed building. Post construction settlement is expected to be less than 25mm with differential settlement within 12mm over an 10m span. The following foundation values should be used for design of footings:

Foundation Material	Factored Ultimate Bearing Resistance	Allowable Bearing Pressure
Structural fill placed on bedrock or structural fill placed thereon	225 kPa	150 kPa

The bearing capacities provide above are subject to the following conditions:

- Footings are setback a suitable distance from finished fill or cut slopes with locations approved by the geotechnical engineer;
- Strip and pad footings have minimum widths of 450mm and 600mm, respectively;
- Footings are founded at least 600mm below adjacent finished grade for confinement and frost protection purposes;
- Site preparations have been completed as described in Section 5.2 "Site Preparation" and load bearing surfaces have been reviewed by the geotechnical engineer.

5.7 Slab-on-Grade

Slab-on-grade should be supported on suitably prepared subgrade as described in Section 5.3 "Site Preparation". A 100mm thick layer of 19mm clear crushed gravel should be placed beneath concrete slabs to provide a bedding and drainage layer for potential seepage zones. The clear crushed gravel layer should have an outlet to the perimeter drains via weep holes through the foundation walls of the building. A layer of 6 mil poly vapour barrier should be placed over the clear crushed gravel to protect the gravel from concrete contamination and to limit dampness of the slab from capillary moisture which may damage floor coverings.

5.8 Backfill

Backfill for perimeter areas or for support of driveways, walkways or patios areas should consist of well-graded 75mm minus pit run sand and gravel or 150mm minus shot rock with less than 5% fines content. The backfill should be placed in lifts with a maximum loose thickness of 300mm compacted to a minimum of 95% MPMDD. Placed pit run structural fill should be density tested to confirm adequate compaction with shot rock being visually confirmed by the Geotechnical Engineer.

5.9 Perimeter Drains

A perimeter drain should be placed around all portions of the building where the floor slab is less than 150mm above adjacent finished grade. The perimeter drain should consist of 100mm perforated PVC pipe surrounded by at least 150mm of 19mm clear crushed gravel wrapped in non-woven filter fabric. The perimeter drain should be hydraulically connected to a 19mm clear crush gravel chimney drain adjacent to any below ground wall. Perimeter drains should be placed near the bottom, but not below, the adjacent footing level and at least 200mm below adjacent floor slabs. The perimeter drain should be connected to a suitable outlet, preferably by gravity means. Roof drains should not discharge into the perimeter drain system.

All water-proofing and damp-proofing aspects are to be addressed by the Project Architect/Envelope Consultant.

6.0 FIELD REVIEW

Field reviews may be required, but are not limited to, the following stages:

- Bulk excavation, stripping and final excavation;
- Subgrade and bearing surface review and approvals;
- Placement and compaction of fills; and/or,
- Installation of perimeter and/or site drainage.

7.0 CLOSURE

The comments and recommendations presented in this letter are based on the referenced information and Kontur's understanding of the project as described herein. If site conditions or project parameters differ from those described in this letter, Kontur should be notified promptly to review geotechnical aspects of the project and provide additional or modified comments and recommendations, as deemed appropriate. Contractors should make their own assessments of subsurface conditions at this site and select the construction means and methods that are most appropriate for encountered site conditions.

Provided the recommendations of this report are implemented with the proposed lots are considered "safe" for the intended purpose, that being the construction of a single-family residential building. The term "safe" specifically refers to the ability of the subsurface soils to support the proposed building within typically tolerable settlement for such buildings and global slope stability being adequate for static and seismic conditions.

This letter has been prepared for the exclusive use of 28165 Yukon Inc and/or their designated agents or consultants. Any use of the information contained in this letter for other than its intended purpose or by any other party must first be verified in writing by Kontur. Kontur does not accept any responsibility or damages because of any other party relying on or using the information, interpretations, opinions, comments, and/or recommendations that are contained in this letter.

Kontur trusts that the information described above meets your current requirements. If you should have any concerns or questions, please do not hesitate to contact the undersigned.

Sincerely,

Kontur Geotechnical Consultants Inc.

Per:

Evan Sykes, P.Eng.
Principal | Geotechnical Engineer

Reviewed by:

Matthew Yip, M.Eng., P.Eng.
Principal | Geotechnical Engineer

Attachments: Interpretation and Use of Study and Report Document
2015 National Building Code Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 50.182N 122.874W **User File Reference:** Lot 12 Wedge Woods Whistler 2021-10-08 14:31 U

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.218	0.138	0.093	0.035
Sa (0.1)	0.327	0.207	0.141	0.053
Sa (0.2)	0.397	0.261	0.181	0.073
Sa (0.3)	0.376	0.255	0.180	0.076
Sa (0.5)	0.327	0.221	0.155	0.065
Sa (1.0)	0.217	0.143	0.098	0.040
Sa (2.0)	0.143	0.091	0.060	0.024
Sa (5.0)	0.055	0.032	0.019	0.007
Sa (10.0)	0.018	0.011	0.007	0.003
PGA (g)	0.184	0.119	0.081	0.031
PGV (m/s)	0.277	0.179	0.118	0.044

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information