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March 1, 2024

GeoWest File: GA23-1294-00

McElhanney Consulting Services Ltd.
200 – 858 Beatty Street
Vancouver, BC V6B 1C1

Attention: Valentino Tjia, P. Eng., P.E. – Transportation Engineer
Email: vtjia@mcelhanney.com

Dear Sir:

Project: University of British Columbia South Campus, Widening of Nurseries Road, Vancouver, BC

Subject: Geotechnical Assessment Report

1. INTRODUCTION

At the request of McElhanney Consulting Services Ltd. (the Client), GeoWest Engineering Ltd. (GeoWest) provides herein a geotechnical site assessment report for proposed widening of Nurseries Road at the South Campus of the University of British Columbia (UBC) in Vancouver. The site location is shown on the attached Figure 1. Our scope of work for this project did not include assessment of the soil and groundwater at the site with respect to environmental considerations or corrosion potential.

This geotechnical site assessment report has been completed in accordance with our proposal P23-1260-00 dated August 21, 2023. Authorization to proceed with the scope of work was received from the Client via signed services agreement on December 18, 2023.

An on-site geotechnical assessment report for UBC South Campus Works Yard was prepared by GeoWest under a separate cover.

2. PROPOSED CONSTRUCTION

According to UBC South Campus Development Site Plan "2121-01100-SK-01" provided to us by the client and attached to Appendix A, the proposed construction includes widening of Nurseries Road from Westbrook Mall to about 380 m to the south, with a possible inclusion of curb and gutter/ sidewalk along the subject section of the road. Two, approximately 9 m long truck scales, with 12.7 m long ramps on each side of the scales are proposed at the south terminus of the subject road section. Bypass lanes, 3.5 m wide, are proposed on each side of the ramps and the scales. No other details about the proposed scales were available at the time of preparation of this report.

We understand that the subject section of the road will be travelled mostly by recycling and garbage trucks with a heaviest vehicle comprising H25 trucks with front and rear axle loading of approximately 45 kN and 178 kN, respectively.

Once the final design drawings for the proposed road widening are completed, they should be provided to GeoWest for review so that we have the opportunity to update the geotechnical recommendations contained in this report, as necessary.

3. SITE DESCRIPTION

The subject section of Nurseries Road is an asphalt paved road with no centreline. The existing road is approximately 6 m wide. There are no ditches or sidewalks along the road. Work yards and utility buildings are located on the east side of the road. The west side of the road is mostly bordered by shrubs and trees, with a warehouse building at the intersection of Nurseries Road and Wesbrook Mall.

The existing asphalt along Nurseries Road was visually judged to be in generally good condition, with localized alligator and transverse cracking along the roadway. Photos of the existing pavement conditions are provided in Appendix C herein.

4. METHODOLOGY

4.1 Subsurface Investigation

To assess the soil and groundwater conditions along the subject section of Nurseries Road, GeoWest conducted a subsurface investigation on January 8, 2024. The investigation comprised of advancement of three (3) auger holes (AH24-01 to AH24-03) using a truck mounted drill rig equipped with solid-stem continuous flight augers. All the auger holes extended to depths of 1.5 m below existing grade. The approximate locations of the auger holes are shown on the attached Figure 2. Soil logs with description of the conditions observed at the auger holes are attached to this report.

Dynamic Cone Penetration Tests (DCPTs) were conducted adjacent to the auger holes. This test is widely used by local geotechnical practitioners and involves advancing a steel cone with the same diameter as a Standard Penetration Test (SPT) split-spoon sampler into the ground using an automatic trip hammer with a weight of 63 kg and a free-fall drop of 750 mm (the same driving energy as the SPT). The number of blows required for each 305 mm interval of depth of advancement of the cone is recorded. The blow counts for the DCPT provide a continuous indication of the *in-situ* relative density/consistency of the soils. The DCPT adjacent to AH24-01 encountered practical penetration refusal (more than 100 blows required to advance the steel cone a depth of 305 mm) at a depth of about 1.2 m below existing grade. The DCPTs adjacent to AH24-02 and AH24-03 extended to about 2.3 m and 1.5 m below existing grade, respectively. The recorded DCPT blow counts are graphically shown on the soil logs.

The field work was conducted under the full-time review of a member of our geotechnical staff, who logged the soil and groundwater conditions encountered at the auger holes and collected representative disturbed soil samples from the auger flights for visual classification and moisture content. The moisture contents of the tested samples are shown graphically on the soil logs.

The auger holes were backfilled with the drill cuttings and bentonite in accordance with provincial groundwater protection requirements immediately upon completion of logging and sampling the soils and sealed with a surface treatment of cold patch asphalt.

4.2 Benkelman Beam Testing

Benkelman Beam Testing (BBT) was completed by GeoWest on January 8, 2024, in the northbound and southbound lanes of Nurseries Road to evaluate the structural performance of the existing pavement structure. The BBT is a well-established testing method in the Lower Mainland and Fraser Valley, with the City of Surrey having undertaken road specific BBT work in the 1970's to develop local seasonal correction factors that are applicable for use in the Lower Mainland and Fraser Valley. The BBT consists of a commonly employed non-destructive deflection test of the existing pavement by employing a standard dual-tired single rear axle truck loaded to 18,000 lbs. (80 kN) on its rear axle.

The BBT was completed in 20 m intervals, alternating between the inner and outer wheel paths of the northbound and southbound lanes, resulting in a total of 40 pavement rebound readings (20 readings in each direction). The rebound data collected was corrected for seasonal and temperature effects, and the data statistically analyzed to derive a Most Probable Spring Rebound (MPSR) for the pavement. The stationing system adopted by GeoWest for recording the BBT results is shown on the attached Figures 3 and 4.

5. SOIL AND GROUNDWATER CONDITIONS

5.1 Surficial Geology

The Geological Survey of Canada surficial geology map covering the site area (Vancouver, Map 1486A) describes the site soils as Vashon Drift and Capilano Sediments comprised of "*glacial drift including lodgment and minor flow till with lenses and interbeds of sub stratified glaciofluvial sand to gravel and lenses and interbeds of glaciolacustrine laminated stoney silt which is underlain by bedrock more than 10 m below the surface (VCb).*"

The native soils encountered during the GeoWest subsurface investigation were generally consistent with the mapped surficial geology.

5.2 Soil Conditions in Auger Holes

The attached soil logs should be referred to for the specific soil conditions encountered at each auger hole location. The soil logs attached to this report provides description of the soil conditions encountered at discrete locations. Actual soil conditions remote from the auger holes may vary across the site. Contractors should make their own interpretation of the soil logs and the site conditions for the purposes of bidding and performing work at the site. A summary of the conditions observed at the auger holes is provided below.

5.2.1 Asphalt and Fill

The asphalt surface at the north end of Nurseries Road (AH24-01) was observed to be about 50 mm in thickness at the auger hole location. The asphalt at this location was underlain by fill comprising of 100 mm thick 19 mm minus sand and gravel (base fill). The base fill was further underlain by a 300 mm thick layer of very dense 75 mm minus sand and gravel (subbase fill) with a moisture content of 4.5%.

The asphalt surface along the southern portion of Nurseries Road (AH24-02 and AH24-03) was observed to be about 75 mm in thickness at each of the auger hole locations. The asphalt at these locations were underlain by 75 mm to 100 mm thick 19 mm minus sand and gravel (base fill). At AH24-03 the base fill was underlain by 300 mm of dense sand with some gravel and trace silt (subbase fill) with a moisture content of 8.7%. No subbase fill was observed at AH24-02.

5.2.2 Sand, Silty Sand and Silt

At AH24-01 the fill was underlain by native soils comprising of dense to very dense sand with variable gravel content and trace to some silt to a depth of 1.5 m below grade. Samples obtained from the native soil had moisture contents ranging from 10% to 13%. DCPT refusal was encountered at a depth of 1.2 m below existing grade in this material.

At AH24-02 and AH24-03, the fill was underlain by native soil comprising of compact to dense silty sand and hard to very stiff sandy silt with some gravel to a depth of 1.5m, respectively. Samples obtained from these layers had moisture content ranging from 20% to 25%.

5.3 Groundwater Conditions

No groundwater seepage was encountered in the auger holes during the time they remained open.

The static groundwater table is located at depth and is not expected to have any design or construction impacts on the proposed widening works. However, perched groundwater can develop during wetter periods of the year in the surficial fills overlying the lower permeability native soils.

6. BENKELMAN BEAM TEST RESULTS AND PAVEMENT VISUAL REVIEW

The combined MPSR for the northbound and southbound lanes of Nurseries Road from Sta. 0+000 to 0+380 was calculated to be 0.62 mm. The results of the BBT are provided in Appendix B.

Section 32 12 17 - 1.6 of the City of Vancouver's Construction Specifications indicates that the maximum allowable MPSR for "Industrial/ Arterial – Streets" pavement is 0.60 mm. Considering that Nurseries Road will be subject to heavy truck traffic, the allowable MPSR of 0.60 mm was used for our analysis. The results of our analysis indicate that the MPSR of the subject road marginally exceeds the MPSR design value specified by the City of Vancouver.

Existing asphalt along the north end of Nurseries Road (STA 0+000 to 0+100) was generally in good condition with localized alligator, transverse, and longitudinal cracks along the roadway. Some minor longitudinal cracking was observed between Sta. 0+160 and 0+220 along the road centreline. Utility patch works also extended from Sta. 0+100 to 0+260 and from Sta. 0+280 to 0+300 with some alligator cracking present on the older asphalt. The alligator cracking was more persistent between Sta. 0+280 and 0+300. Different ages of asphalt were noted between Sta. 0+240 and 0+260 and at the south end of the roadway (Sta. 0+320 to 0+380).

7. RECOMMENDATIONS

7.1 General

Based on the results of subsurface investigation, BBT, visual review of the existing pavement and expected heavy vehicle loading, it is our opinion that the existing asphalt and 19 mm minus sand and gravel fill should be removed to expose the undisturbed native compact to very dense/very stiff to hard sand and silt. The existing 75 mm minus sand and gravel may remain in place as subbase fill provided that its thickness and suitability is confirmed by test pits and a proof roll under a review of a Geotechnical Engineer.

Alternatively, the existing asphalt surface could be partially milled followed by placement of an overlay that results in a finished pavement thickness of at least 85 mm in the existing paved portion of the road. We caution that incipient bottom-up cracking may be present within the existing asphalt after the milling which could pose a risk of reflective cracking of the overlay. To reduce the risk of reflective cracking, we recommend that, prior to a placement of an overlay, a product such as Nilex's GlasGrid or Petrotac be employed atop the milled surface at any observed crack locations prior to placement of the overlay. Similar products from other manufacturers may also be considered, subject to UBC approval. GeoWest can review and assess specific products upon request. All road reinforcement products should be installed in accordance with the manufacturer's specification. Alternatively, full depth milling of the entire asphalt surface could be completed to avoid the risk of reflective cracking. The new asphalt surface in this circumstance should also be 85 mm thick.

Consideration can be given to re-using the on-site fill materials as road subbase and base fills subject to the materials meeting required gradation specifications outlined in the Master Municipal Construction Documents (MMCD).

7.2 Site Preparation

Site preparation for widening of existing road, including areas of possible curb and gutter/sidewalk or where a full reconstruction of existing pavement is required s should include stripping of existing asphalt, fill, vegetation, topsoil and any other deleterious materials to expose a subgrade comprising undisturbed native compact to very dense/very stiff to hard sand and silt. Based on the auger holes, the stripping depths at the auger hole locations are expected to be limited to the thickness of the new road structure, i.e. 0.53 to 0.6 m but may be greater in areas remote from the auger holes and beyond the existing pavement. We recommend that the stripping should extend out horizontally at a 1H:1V offset taken down from the base of new subbase layer. For example, if the depth of stripping extends 300 mm below the base of the proposed subbase layer, stripping should extend horizontally outside the pavement area by 300 mm.

The contractor performing the work should confirm the location of all existing underground utilities prior to start of any excavation.

Proof compaction of soil exposed at the subgrade design elevation should be completed with a large vibratory drum compactor in the presence of the Geotechnical Engineer. Any soft or loose areas encountered during the proof compaction should be recompacted in-situ or if this is not possible, they be excavated with grade reinstated with engineered fill as described below.

The Geotechnical Engineer should review the prepared subgrade prior to the placement of any fill.

7.3 Engineered Fill

Engineering fill is defined in this report as fill material required to reinstate grade below load bearing areas such as asphalt, truck scales and sidewalks. Imported engineered fill should consist of clean sand to sand and gravel with less than 8 percent fines (material passing the 0.075 mm sieve) by weight compacted in 300 mm thick loose lifts to at least 95 percent Modified Proctor maximum dry density (MPD) (ASTM D698). If construction proceeds during the rainy season, we recommend that the fines content of the engineered fill be limited to a maximum of 5 percent.

Engineered fill should be placed over Geotechnical Engineer approved subgrade. The Geotechnical Engineer should also review the engineered fill placement and compaction to confirm the lift thickness and adequacy of compaction.

The onsite soils granular soils (sand, some gravel to gravelly) may be re-used as engineered fill provided it is reviewed and approved for re-use by the Geotechnical Engineer prior to placement. The moisture content for the on-site soils to be re-used as engineering fill should be within 2% of its optimum moisture content. Geotechnical Engineer approval will be required for re-use of any site soils.

7.4 Dewatering

It is expected that groundwater and rainwater entering temporary excavations could be adequately controlled using sumps and pumps. The stripped subgrade should be graded to temporary perimeter ditches or sumps to limit ponding of groundwater or rainfall on the subgrade. Any subgrade disturbed or softened by construction vehicles or rainfall should be removed and replaced with engineered fill.

Discharge of water collected from temporary excavations should be conducted in accordance with the requirements of the project Erosion and Sediment Control (ESC) plan and should not be directed over the site slopes.

7.5 Asphalt Pavement

Following the site preparation discussed above, the following minimum structure is recommended for the widened and fully reconstructed areas of Nursery Road:

- 75 mm of asphalt course underlain by,
- 150 mm of 19 mm minus crushed gravel base course, underlain by,
- 300 mm of 75 mm minus crushed sand and gravel subbase course, underlain by,
- Geotechnical Engineer-approved subgrade or compacted engineered fill placed over Geotechnical Engineer-approved subgrade.

We recommend that the thickness of the subbase fill be increased to 450 mm below the scale and the ramps.

Sidewalks can be constructed on a 100 mm thick layer of 19 mm minus crushed gravel base course placed over Geotechnical Engineer approved subgrade.

We recommend that the base and sub-base courses conform to the specifications for these materials provided in the Master Municipal Construction Documents (MMCD) Volume II and the City of Vancouver requirements. They should be placed in discrete lifts and should be compacted to not less than 95 percent of their MPD. Adequate compaction of the sub-base and base courses, and any subgrade fill required to achieve/restore the proposed grades, should be confirmed by the Geotechnical Engineer.

7.6 Geotechnical Engineering Review

During design development, site preparation, and construction, the Geotechnical Engineer should be provided with the opportunity to review the following:

- Finalized design drawings. Additional and/or modified recommendations regarding the proposed construction may be required based on our review of the drawings;
- Unsupported temporary cut slopes;
- Prepared subgrade along proposed road widening;
- Imported engineered fill;
- Site soils considered for re-use as engineered fill;
- Placement and compaction of subbase and base fill materials.

A Geotechnical Engineer should be retained to conduct sufficient field reviews during site preparation and construction to ensure that the geotechnical design recommendations contained within this report have been adequately communicated to the design team and to the contractors implementing the design. These field reviews are not carried out for the benefit of the contractors and therefore do not in any way affect their obligations to perform under the terms of their contracts.

8. CLOSURE

This geotechnical assessment report has been prepared by GeoWest Engineering Ltd. exclusively for McElhanney Consulting Services Ltd. and the members of their design team for this specific project. We acknowledge that UBC and the City of Vancouver may also rely upon this report for permitting purposes. The conclusions and recommendations contained in this report reflect our judgement in light of the information provided to us at the time it was prepared.

Any use of this report by third parties, or any reliance on or decisions made based on it, are the responsibility of such third parties. GeoWest does not accept responsibility for damage suffered, if any, by a third party as a result of their use of this report.

The attached Terms of Reference are an integral part of this geotechnical assessment report.

We trust the information provided herein meets your immediate requirements. If you have any questions or require further information, please contact the undersigned.

Yours truly,
GeoWest Engineering Ltd.

PROFESSIONAL
PROVINCE OF
D. JOVANOVIC
30153
BRITISH COLUMBIA
ENGINEER

2024-03-01

Per: Jassimran Singh, EIT
Staff Geotechnical Engineer

Per: Dejan Jovanovic, P.Eng.
Principal, Senior Geotechnical Engineer

Reviewed By:
John Carter, M.Eng., P.Eng.
Principal, Senior Geotechnical Engineer

Attachments: Terms of Reference
Figures 1 to 4
Soil Logs
Appendix A – Site Plan
Appendix B – Benkelman Beam Testing Results
Appendix C – Visual Pavement Assessment Photos

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b. **Reliance on Information:** The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site investigation and field review and on the basis of information provided by GeoWest. GeoWest has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, GeoWest cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.

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When GeoWest submits both electronic and hard copy versions of the Instruments of Professional Services, the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding upon GeoWest. The hard copy versions submitted by GeoWest shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions; furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed and sealed versions of the Instruments of Professional Services maintained or retained, or both, by GeoWest shall be deemed to be the overall originals for the Project.

The Client agrees that the electronic file and hard copy versions of Instruments of Professional Services shall not, under any circumstances, no matter who owns or uses them, be altered by any party except GeoWest. The Client warrants that the Instruments of Professional Services will be used only and exactly as submitted by GeoWest.

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FIGURES

LEGEND

NOTE: ALL LOCATIONS ARE APPROXIMATE

ADAPTED FROM: OPEN STREET MAPS	TITLE: **SITE LOCATION MAP**	DESIGN BY: GeoWest ENGINEERING	SEAL:	DESIGN: N/A	DATE: FEB. 2024
PROJECT/DWG. NO:				DRAWN: JS	SCALE: NTS
DATE:	PROJECT: NURSERIES ROAD WIDENING			CHECK: DJ	GEOWEST FILE: GA23-1294-00
This drawing is the sole property of GeoWest Engineering Ltd. and cannot be used or duplicated in any way without the expressed written consent of GeoWest. The general contractor shall verify all dimensions and report any discrepancies to GeoWest.	ADDRESS: UBc SOUTH CAMPUS, NURSERIES ROAD, VANCOUVER			FIG. NO: 1	
	CLIENT: MCELHANNEY CONSULTING SERVICES LTD.	EGBC PERMIT TO PRACTICE NO. 1000607			

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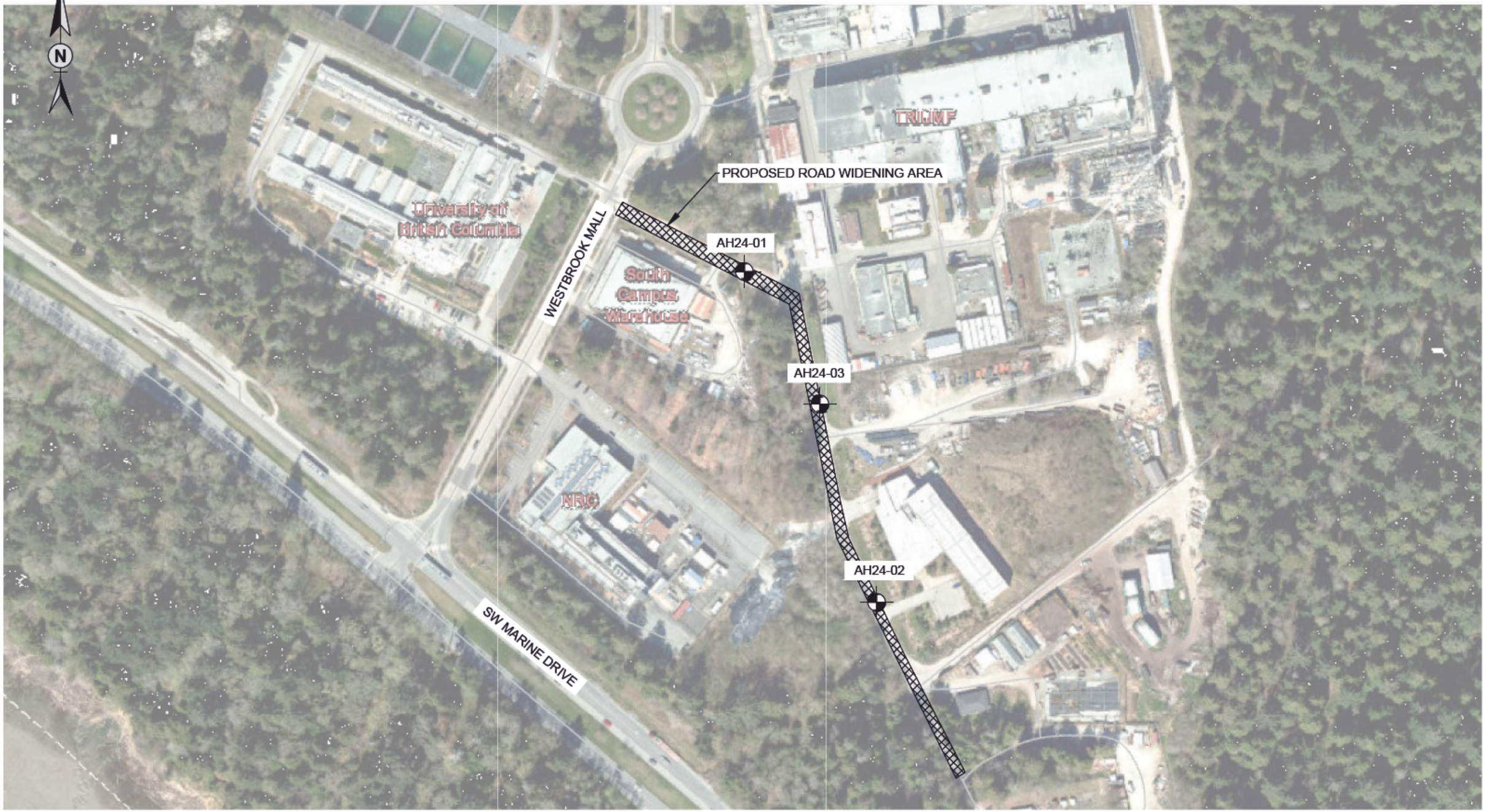

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APPROXIMATE AUGER HOLE LOCATIONS

NOTE: ALL LOCATIONS ARE APPROXIMATE

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TITLE:

AUGER HOLE LOCATION PLAN - NURSERIES ROAD

PROJECT: NURSERIES ROAD WIDENING

ADDRESS: UBc SOUTH CAMPUS, NURSERIES ROAD, VANCOUVER

CLIENT: MCELHANNEY CONSULTING SERVICES LTD.

DESIGN BY: GeoWest ENGINEERING

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FIG. NO: 2	

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0+000 STATIONING FOR BENKELMAN BEAM TEST

NOTE: ALL LOCATIONS ARE APPROXIMATE

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TITLE: **BENKELMAN BEAM PLAN - STATIONING (1 OF 2)**

PROJECT: NURSERIES ROAD WIDENING

ADDRESS: UBc SOUTH CAMPUS, NURSERIES ROAD, VANCOUVER

CLIENT: MCELHANNEY CONSULTING SERVICES LTD.

DESIGN BY: GeoWest ENGINEERING

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FIG. NO: 3	

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0+000 STATIONING FOR BENKELMAN BEAM TEST

NOTE: ALL LOCATIONS ARE APPROXIMATE

ADAPTED FROM: OPEN STREET MAP	TITLE: **BENKELMAN BEAM PLAN - STATIONING (2 OF 2)**	DESIGN BY: GeoWest ENGINEERING	SEAL:	DESIGN: N/A	DATE: JAN. 2024
PROJECT/DWG. NO:				DRAWN: JS	SCALE: NTS
DATE:	PROJECT: NURSERIES ROAD WIDENING			CHECK: DJ	GEOWEST FILE: GA23-1294-00
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SOIL LOGS

GeoWest ENGINEERING

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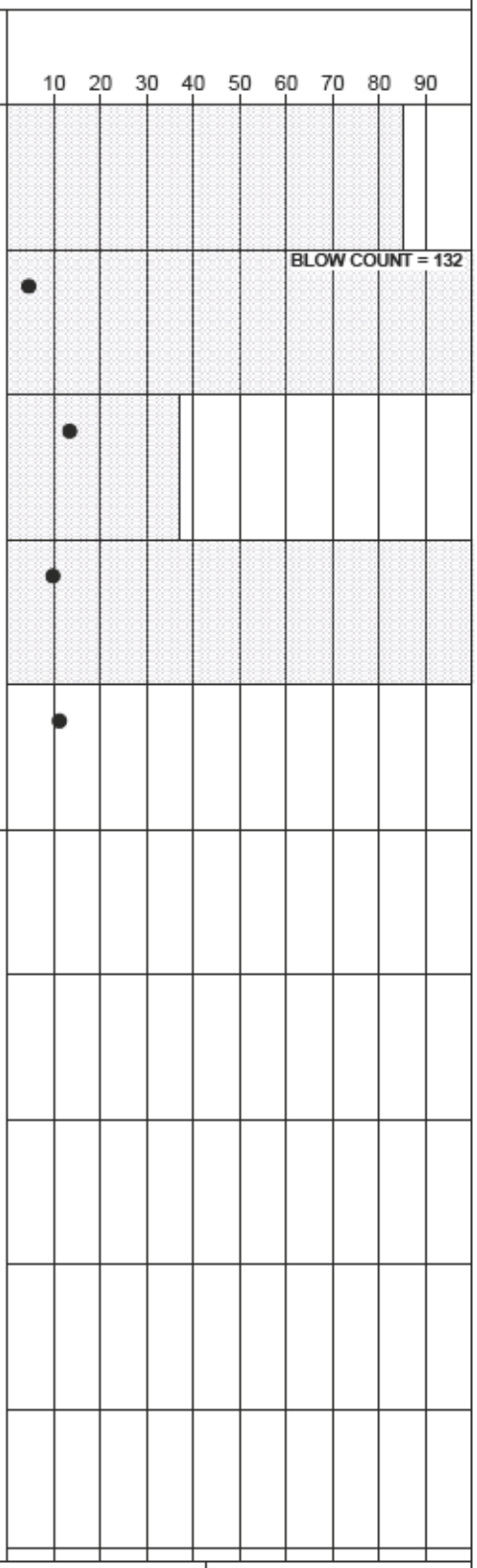
UBC South Campus
McElhanney Consulting Services Ltd.
Nurseries Road
Vancouver, BC

AH23-01

Project No: GA23-1294-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample #	Water Level
		50mm thick ASPHALT				
		100mm thick light grey 19mm minus sand and gravel (fill)				
		Grey 75mm minus and and gravel (fill)				
	1				GS1	
0.5		Very dense to dense, brown, SAND, some gravel, trace silt, moist.				
	2				GS2	
	3					
1.0		Very dense, brown, SAND, some gravel to gravelly, some silt, moist.			GS3	
	4					
		Very dense, light bown, fine SAND, some gravel, trace silt, moist.			GS4	
1.5	5					
		DCPT refusal at 1.2m				
		No groundwater seepage				
		Bottom of hole at 1.5 metres				
	6					
2.0						
	7					
	8					
2.5						
	9					
3.0						



C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
AU: Auger Flight

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type: Trip Hammer

Plastic Limit (%) — Liquid Limit (%)
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

DYNAMIC CONE PENETRATION TEST

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF GEOWEST ENGINEERING LTD, AND CANNOT BE USED OR DUPLICATED IN ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.

Drill Method: Solid Stem Auger / DCPT
Date Drilled: 1/8/2023
Logged by: JS
Checked by: DJ

GeoWest ENGINEERING

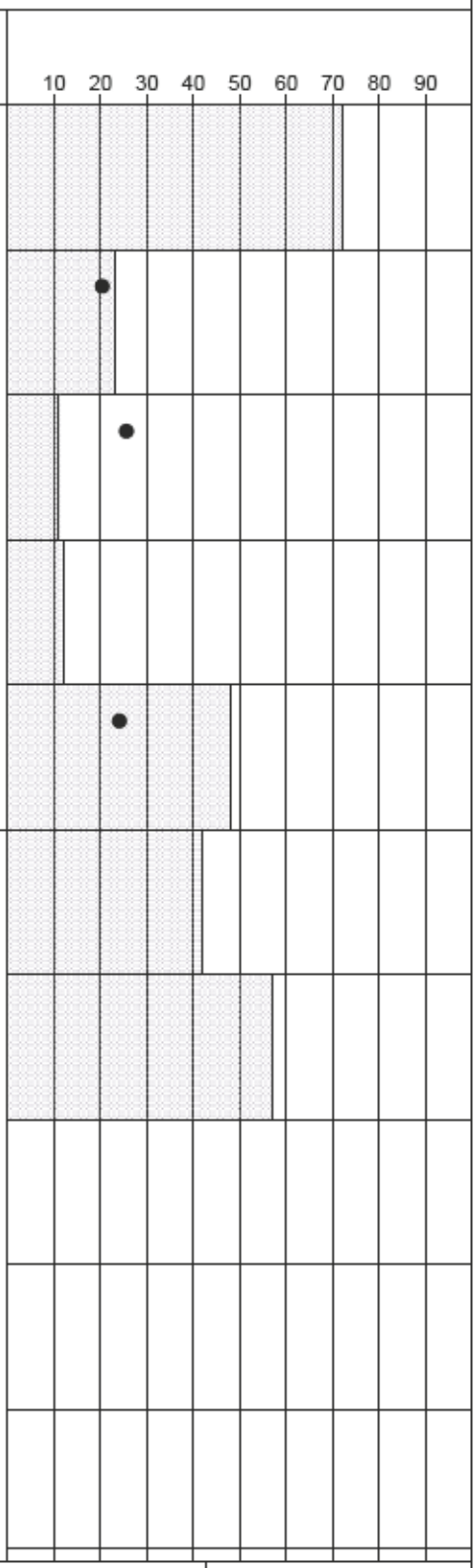
GeoWest Engineering Ltd
200-34425 McConnell Road
Abbotsford, BC V2S 7P1

UBC South Campus
McElhanney Consulting Services Ltd.
Nurseries Road
Vancouver, BC

AH23-02

Project No: GA23-1294-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample #	Water Level
		75mm thick ASPHALT				
		100mm thick 19mm minus sand and gravel (fill).				
	1	Very dense to compact, dark brown, silty SAND, some gravel, moist.			GS1	
0.5	2	Compact, brown, SAND, some silt to silty, trace gravel, moist.			GS2	
1.0	3					
	4	Dense, orange/grey, mottled silty fine SAND, trace to some gravel, moist.			GS3	
1.5	5	No groundwater seepage Bottom of hole at 1.5 metres				
	6					
2.0	7					
	8					
2.5	9					
3.0						



C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
AU: Auger Flight

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type: Trip Hammer

Plastic Limit (%) — Liquid Limit (%)
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

DYNAMIC CONE PENETRATION TEST

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Drill Method: Solid Stem Auger / DCPT
Date Drilled: 1/8/2023
Logged by: JS
Checked by: DJ

GeoWest ENGINEERING

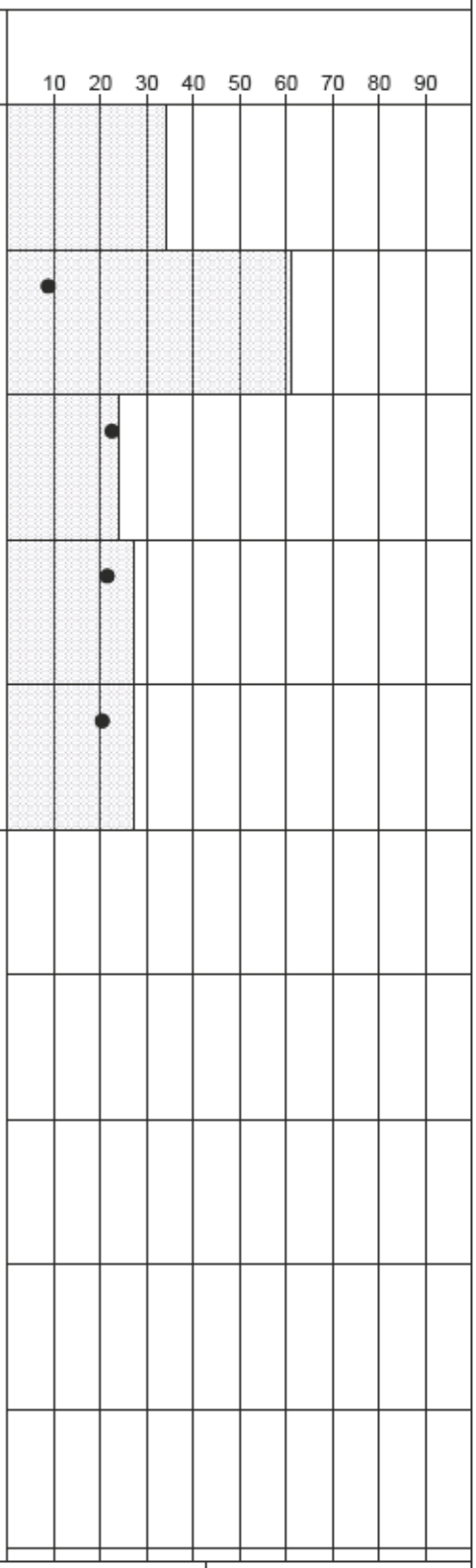
GeoWest Engineering Ltd
200-34425 McConnell Road
Abbotsford, BC V2S 7P1

UBC South Campus
McElhanney Consulting Services Ltd.
Nurseries Road
Vancouver, BC

AH23-03

Project No: GA23-1294-00

Depth (m)	Depth (ft)	Description	C	N	Type/ Sample #	Water Level
		75mm thick ASPHALT				
		75mm thick 19mm minus sand and gravel (fill)				
		Dense to very dense, dark grey, SAND, some gravel, trace silt, moist (fill).			GS1	
0.5	1	Hard to very stiff, dark grey, sandy SILT, some gravel to gravelly, moist.			GS2	
1.0	2	Very stiff, grey, sandy SILT, some gravel, moist.			GS3	
1.5	3	Very stiff, grey, SILT, some fine sand, some gravel, trace to some clay, moist.			GS4	
	4	No groundwater seepage Bottom of hole at 1.5 metres				
2.0	5					
2.5	6					
3.0	7					
	8					
	9					



C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
AU: Auger Flight

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type: Trip Hammer

Plastic Limit (%) — Liquid Limit (%)
Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

DYNAMIC CONE PENETRATION TEST

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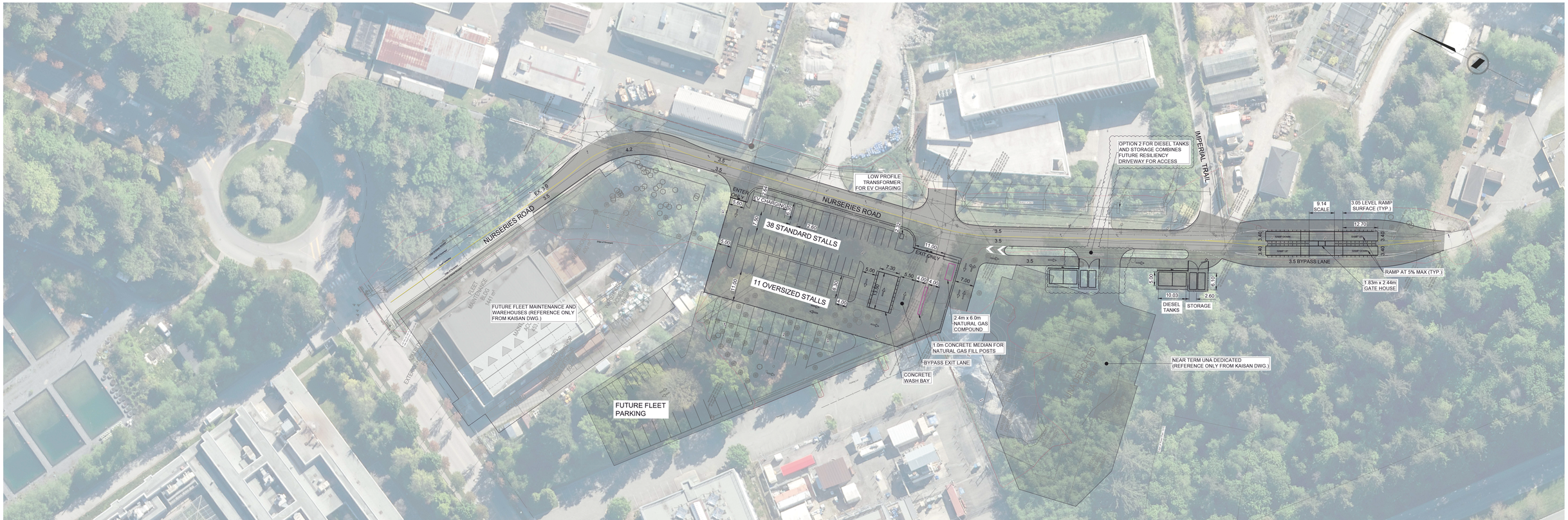
Drill Method: Solid Stem Auger / DCPT
Date Drilled: 1/8/2023
Logged by: JS
Checked by: DJ

APPENDIX A

SITE PLAN



LEGEND

LOCKBLOCK WALL

SURVEY BOUNDARY

Project 2121-01100-00
UBC SOUTH CAMPUS DEVELOPMENT
SK-01 - SITE PLAN
SCALE: 1:250

APPENDIX B

BENKELMAN BEAM TESTING RESULTS

GeoWest Engineering Ltd.
200 - 34425 McConnell Road, Abbotsford, BC V2S 7P1
www.geowestengineering.com
info@geowestengineering.com | 604-852-9088

Client: McElhanney Consulting Services Ltd.
Project Name: UBC South Campus Works Yard - Off-site Investigation
Site Address: Nurseries Road

File No.: GA23-1294-00

SUMMARY OF BENKELMAN BEAM TESTING

Municipality: Vancouver BC
Area Tested: Nurseries road, north and sothbound travel lanes
Classification: Industrial/Arterial - Streets
Surface Type: Asphalt
Specified MPSR: 0.6 mm

Report #: 1
Date Tested: 8-Jan-24
Tested By: J. Singh
Data Analysis By: J. Singh
Rear Axle Weight: 80kN

	Northbound Lane		Southbound lane		Combined
	OWP	IWP	OWP	IWP	
*Number of Test Points:	10	10	10	10	**40**
Average Adjusted Rebound (mm)	0.16	0.19	0.16	0.21	**0.18 mm**
Standard Deviation (mm)	0.20	0.14	0.13	0.13	**0.15 mm**
Seasonal Correction Factor:	1.27	1.27	1.27	1.27	**1.27**
Most Probable Spring Rebound (mm)	0.72	0.60	0.54	0.59	**0.62 mm**

*** Temperature Correction Factor:*	*1.51*	*for*	*1.6 °C*
Seasonal Correction Factor:	*1.27*	*for*	*January*

Comments: Specified MPSR was based on the City of Vancouvers Construction Specifications (Section 32 12 17). Station locations shown on Figure 3 and 4.

GEOWEST ENGINEERING LTD.

Per: _____
Jassimran Singh, EIT

** Data Attached*

***Applied to Raw Data. Not required for granular base*

This report represents a testing service only. No engineering interpretation is expressed or implied. Engineering review and interpretation can be provided on written request.

GeoWest Engineering Ltd.
200 - 34425 McConnell Road, Abbotsford, BC V2S 7P1
www.geowestengineering.com
info@geowestengineering.com | 604-852-9088

Client: McElhanney Consulting Services Ltd.
Project Name: UBC South Campus Works Yard - Off-site Investigation
Site Address: Nurseries Road

File No.: GA23-1294-00

BENKELMAN BEAM TEST - DATA SHEET 1

Area Tested: Nurseries road, north and sothbound travel lanes
*Temperature correction factor: 1.51 for 1.6 °C °C
Seasonal correction factor: 1.27 for January
Specified MPSR: 0.6 mm

Report #: 1
Date Tested: 8-Jan-24
Tested By: J. Singh
Data Analysis By: J. Singh

	Asphalt Temp (°C)	Time	Asphalt Temp (°C)	Time	Asphalt Temp (°C)	Time
1	2	10:30	N/A		N/A	
2	1	11:00	N/A		N/A	
3	1.7	12:00	N/A		N/A	

Comments: Specified MPSR was based on the City of Vancouvers Construction Specifications (Section 32 12 17). Station locations shown on Figure 3 and 4.

Data Point	Station (m)	Northbound Lane			Southbound lane		
		Adjusted Rebound (mm)		Remarks	Adjusted Rebound (mm)		Remarks
		OWP	IWP		OWP	IWP	
1	0+000	0.00			0.00		
2	0+020		0.24	LC		0.15	AC
3	0+040	0.09		LC	0.09		
4	0+060		0.54			0.24	
5	0+080	0.09			0.24		
6	0+100		0.30	UTL		0.15	
7	0+120	0.15		UTL	0.24		
8	0+140		0.15	UTL		0.24	
9	0+160	0.00		UTL	0.09		LC
10	0+180		0.09	UTL		0.54	LC
11	0+200	0.45		UTL + LC	0.15		UTL + LC
12	0+220		0.00	UTL + LC		0.24	UTL + LC
13	0+240	0.24		Different ages of asphalt + TC	0.09		Different ages of asphalt + TC
14	0+260		0.15	Different ages of asphalt		0.24	Different ages of asphalt
15	0+280	0.00		UTL + AC	0.45		UTL + AC
16	0+300		0.15	UTL + AC		0.09	UTL + AC
17	0+320	0.60		Different ages of asphalt	0.00		Different ages of asphalt
18	0+340		0.09			0.09	
19	0+360	0.00			0.24		
20	0+380		0.15			0.09	

*Applied to Raw Data. Not required for granular base

OWP - Outer Wheel Path IWP - Inner Wheel Path MH - man hole cover AC - aligator cracking EA - exposed aggregate LC - longitudinal crack TC - transverse crack UTL - utility patch EC - edge cracking RT - rutting JC - joint cracking TP - patch

APPENDIX C

VISUAL PAVEMENT ASSESSMENT PHOTOS

Photo 1 – Longitudinal cracking in northbound lane of Nurseries Road, at the north end	
Photo 2 – Alligator cracking in southbound lane of Nurseries Road, at the north end	

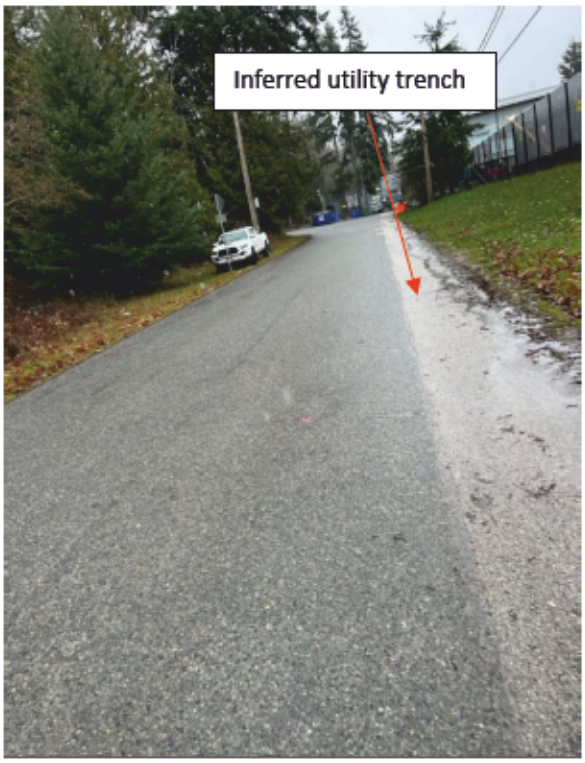
Photo 3 – Inferred utility trench along east side of Nurseries Road	
Photo 4 –Asphalt patches and longitudinal cracks along inferred utility trenches	

Photo 5 – Transverse cracks at approx. Sta. 0+230	
Photo 6 – Intersection of Nurseries Road onsite access road	

Photo 7 – Inferred utility trench and alligator cracks in older asphalt	
Photo 8 – South end of Nurseries Road	