GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

P 604.439.0922
F 604.439.9189
geopacific.ca
1779 W 75th Ave.
Vancouver, B.C. Canada V6P 6P2

Wesgroup Properties
2000 – 595 Burrard Street
Vancouver, BC
V6C 0E4

October 14th, 2021
File:15077-GW

Attention: Ian Patillo

Re: Hydrogeological Investigation Report: Proposed Residential Development
1008 West 41st Avenue & 5763 Oak Street, Vancouver, BC

1.0 INTRODUCTION

We understand that a new residential development is proposed for the above referenced site. Drawings prepared by IBI Group (Canada) Inc. show that the new development will consist of a 16-storey tower and an 8-storey mid rise building constructed over a common 3 level parkade. The lowest P3 slab elevation is shown as 80.1 m geodetic. Considering the design slab grades and existing site grades, we expect the excavation depth will range from approximately 11.0 m to 12.0 m below existing grades.

This report summarizes the groundwater monitoring program completed by GeoPacific between January 31st, 2020 and September 28, 2021. This report has been prepared exclusively for Wesgroup Properties, for their use and the use of others on their design team, as well as for the City of Vancouver for use in the development and permitting process.

2.0 SITE DESCRIPTION

The site is rectangular in shape and is located on the southwest corner of the intersection of West 41st Avenue and Oak Street in Vancouver, BC. The site is bounded by West 41st Avenue to the north, Oak Street to the east, 42nd Avenue to the south and a municipal laneway to the west. The property is currently improved with a community garden in the northern portion of the site and a two-storey commercial building to the south.

According to the site survey issued by Underhill Geomatics Ltd. (dated June 6, 2017), the site gently slopes from the southwest, down towards the northeast with a total elevation change of approximately 0.8 m across the site (91.7 m to 90.9 m geodetic). The total site area is approximately 3,427 m^2.

The approximate locations of test holes across the site are shown on Drawing No. 15077-GW-01, following the text of this report.

3.0 FIELD INVESTIGATION

GeoPacific completed a preliminary geotechnical investigation on June 16th, 2017. At that time, three test holes each supplemented with a Dynamic Cone Penetration Test (DCPT) sounding were advanced to depths up to 7.6 m below existing grades. The site was investigated using a truck-mounted auger drill rig supplied and operated by Southland Drilling Co. Ltd. of Delta, B.C. The test holes were logged by a member of our technical staff from our office and backfilled immediately in accordance with B.C Provincial requirements, following the completion of testing and logging.

A supplementary drill investigation was completed on January 30 and 31, 2020, with a total of three test holes advanced to a maximum depth of 21.3 m below existing grades. The investigation was completed using a track mounted sonic drill rig supplied and operated by BlueMax Drilling of Surrey, B.C.

Once drilling was completed, groundwater monitoring wells and electronic data-loggers were installed at all three test hole locations. The data-loggers were installed to remotely collect and record water level measurements every hour. The test hole locations were located, supervised, logged and sampled by a member of our technical team.

The soil logs and monitoring well details from both investigations are presented in Appendix A. The approximate test hole, DCPT sounding and monitoring well locations are shown on our Drawing No. 15077-GW-01, following the text of this report.

4.0 SUBSURFACE CONDITIONS

4.1 Published Geology

According to the Geological Survey of Canada Map 1486A, the general geology of the region under investigation, is described as Capilano Sediments and Vashon Drift, consisting of near surface raised beach deposited, medium to coarse sand 1 to 5 m thick, overlying glacial drift including lodgment and minor flow till, lenses and interbeds of sub-stratified glaciofluvial sand to gravel, and lenses and interbeds of glaciolacustrine laminated stony silt. The Vashon Drift till sediments in this part of Vancouver are sometimes underlain by the pre-glacial Quadra Formation.

4.2 Onsite Soil Conditions

The subsurface conditions at our test hole locations were observed to consist of ASPHALT underlain by natural deposits of GLACIAL SILTY SAND AND GRAVEL and pre-glacial SAND.

ASPHALT/GRANULAR FILL/SILT

Testholes TH17-01, TH17-02, TH17-03 and TH20-01 were located within asphaltic surfaced driving aisles. The asphalt was noted to be up to 60 mm thick. The 2017 test holes showed a 0.45 m thick layer of fill which consisted of compact sand to sand and gravel road-base over another fill layer consisting of reddish-brown fine sand with trace silt extending to 0.9 m to 1.1 m below grade. The asphalt at TH20-01 was observed to be overlying approximately 1.2 m of brown, compact sand with some gravel and silt. A brown, compact sand and gravel layer with trace amounts of silt was observed at the surface at TH20-02 and TH20-03.

In general, the surficial fill material at all six test hole locations is underlain by a layer of brown/grey, stiff silt to sandy silt, extending to a depth of 3.0 m below grade.

SILTY SAND AND GRAVEL TILL

Dense till was noted beneath the fill and/or silt at depths ranging between 1.8 and 3.0 m below grade at all six test hole locations. Although there were slight variations in silt and gravel content, in general, the predominant grain size of the glacial material was fine to medium sand and gravel with some silt to silty. Our 2020 investigation indicates that the glacial till extends down to depths ranging between 10.7 to 12.2 m at the location of our test holes.

Based on our observations during the investigation of this site, as well as our experience in this area, the glacial till contains sandy lenses, cobbles and boulders locally.

PRE-GLACIAL SAND

A brown to grey, dense to very dense, medium to coarse sand with trace to some silt and gravel was encountered below the till at depths of 10.7 to 12.2 m below existing grades. A decrease in silt and gravel content and an increase in the grain size of the sand was noted with increasing depth. The sand extends to the final depth of exploration of 21.3 m.

For a more detailed description of the subsurface soil conditions refer to the test hole logs provided in Appendix A. A cross section showing the inferred site stratigraphy and the measured groundwater conditions are presented in Appendix B. The location of where the section transects is shown on Drawing No. 15077-GW-01 from A-A'.

5.0 PROVINCIAL GROUNDWATER ATLAS

A search of the BC Water Atlas was conducted on October 4th, 2021. The nearest registered well, having Well Tag Number (WTN) 71196 was found approximately 450 m east of the site. WTN 71196 was installed in June 1958, as a geo-exchange well at Oakridge Mall, formerly known as Woodward's Stores Ltd.

The soil logs for WTN 71196 indicate that glacial till like soils to approximately 10.4 m below grades, overlying sand, interpreted as being preglacial sediments. The groundwater level presented on the log in 1958 is approximately 6.5 m below grades. However, we understand that groundwater pumping from the geothermal exchange wells at the Oakridge Mall development has been ongoing since 1968 and has lowered groundwater levels locally. It is also understood that ongoing pumping is required to drain the soils around the Canada Line to prevent uplift as the tunnel was not constructed to withstand hydrostatic pressures. As a result, groundwater levels in the area must be maintained at or below 77 m geodetic.

A summary of the BC Water Atlas search and the resulting well logs can be found in Appendix C.

6.0 GROUNDWATER CONDITIONS

6.1 General Comments

The site is located approximately 1,400 m southwest of a bedrock outcrop at Queen Elizabeth park, which is a regional topographic maximum at approximately 130 m geodetic. The outcrop is part of a greater groundwater divide that distinguishes flow to the north towards False Creek and to the south towards the Fraser River. Groundwater flow at the site is generally expected to follow regional topography and flow from Queen Elizabeth park, downslope to the southwest towards the site and eventually south towards the Fraser River.

Generally, the soils encountered on site are silty sand and gravel glacial till overlying preglacial sand. Based on our previous work in the area there are thought to be two groundwater regimes locally: the shallow perched groundwater found within the surifical soils and weathered till deposits, and the deep semi-confined aquifer within the preglacial sediments known as the Quadra Formation (Aquifer #49). The granular soils found at depth at the site are inferred to be of the Quadra Formation.

6.2 Manual Water Level Measurements

Groundwater levels have been measured at the site using both manual and continuously automated methods since January 30, 2020. Table 1 presents manually measured water level depths at the site, established by a handheld water level meter. The manual measurements are intended to confirm and complement the automated data collected from the automated data loggers.

Table 1: Manual Groundwater Measurements

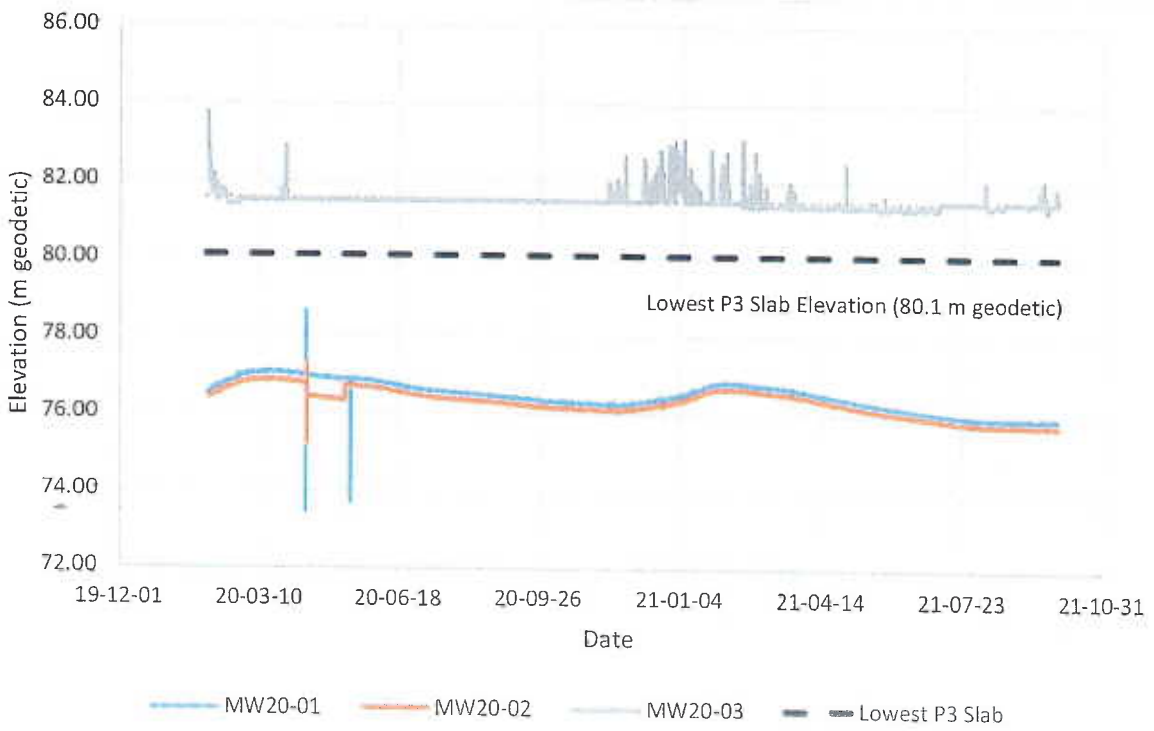
Well #	Estimated Well Head Elevation (m geo)	Screened Interval Elevation (m geo)	Jan 31, 2020	Mar 11, 2020	Sep 28, 2021
			Groundwater Depth (m bgs) **Groundwater Elevation (m geo)**		
MW20-01	91.5	76.6 to 73.5	14.9 **76.6**	14.5 **77.0**	15.6 **75.9**
MW20-02	91.0	76.4 to 74.9	14.5 **76.5**	14.2 **76.8**	15.3 **75.7**
MW20-03	91.0	84.0 to 81.0	4.4 **86.6**	Dry	9.5 **81.5**

According to manually obtained water level measurements recorded at MW20-01 and MW20-02, static groundwater levels at the site range from approximately 75.7 m geodetic to 77.0 m geodetic. The initial elevated measurement recorded at MW20-03 is likely resultant from water injected during the sonic drilling process.

6.3 Automated Measurements

Remotely monitored dataloggers were installed at each monitoring well location to record groundwater levels at the site. The results of the groundwater monitoring from January 30th, 2020 to September 28th, 2021 are displayed graphically in the figure below. Architectural drawings prepared by IBI Group (Canada) Inc. show the lowest P3 slab elevation to be approximately 80.1 m geodetic, this slab elevation is included in the graph below for reference.

Figure 1: Automated Groundwater Level Data



Groundwater levels recorded at MW20-01 and MW20-02 indicate that the proposed parkade is to constructed approximately 3 m above the peak static groundwater elevation recorded at the site. MW20-03 was screened within the glacial till at the site and was observed to be dry during numerous site visits. The

fluctuations recorded at MW20-03 appear to only occur during the rainier months of the year are thought to be caused by precipitation entering the well head. The pressure recorded between these precipitation spikes matches the value recorded by our barometer. This indicates that the groundwater within the well is below the data-logger at these times. Thus, the data suggests that MW20-03 was essentially dry for extended periods during our monitoring program.

6.4 Hydraulic Conductivity Testing

Slug tests were performed at MW20-01 and MW20-02 on April 11, 2020 to determine the hydraulic conductivity of the formation soils at depth. The electronic data-loggers were changed to 0.5 second sampling rates and an initial water level recorded. The falling head test utilizes a solid slug of a known volume that is dropped into the well to produce an instantaneous change in head. The groundwater elevation is then measured as it reaches equilibrium. The test is then reversed with the subsequent removal of the slug, which causes a negative displacement to the water column. Each time, water levels at MW20-01 and MW20-02 were allowed to recover to those found originally before an estimate of hydraulic conductivity determined. Due to the rapid rate of recovery, the rising head tests were largely unsuccessful at MW20-01 and therefore not included in our analysis. MW20-03 was omitted from testing as the well was observed to be dry on April 11th, 2020 and was observed to have insufficient hydraulic head to conduct testing on multiple other site visits.

The data from the slug testing was analysed using Aquifer Test Pro 9.0 and the results are presented in Table 2. A visual representation of the test results is found in Appendix D.

Table 2: Hydraulic Conductivity Test Results at MW20-01 and MW20-02

Testing Method	Well	Screened Material	Screened Interval (m below existing grades)	Hydraulic Conductivity K (m/s)
Falling Head 1	MW20-01	Medium to coarse sand	14.9 – 18.0	7.44×10^{-4}
Falling Head 2	MW20-01			1.35×10^{-3}
Falling Head 3	MW20-01			5.82×10^{-4}
Falling Head 1	MW20-02	Medium to coarse sand	14.6 – 16.1	1.35×10^{-5}
Falling Head 2	MW20-02			6.70×10^{-6}
Falling Head 3	MW20-02			5.36×10^{-6}
Rising Head 1	MW20-02			3.61×10^{-5}
Rising Head 2	MW20-02			2.84×10^{-5}
Rising Head 3	MW20-02			3.18×10^{-5}
Average		Medium to coarse sand		3.11×10^{-4}

The average hydraulic conductivity of the Quadra sand deposits at MW20-01 and MW20-02 was found to be 3.11×10^{-4} m/s.

6.5 Site Summary

As indicated previously, the lowest proposed P3 slab elevation is 80.1 m geodetic. A total of 3 monitoring were installed at the site and water levels have been monitored for approximately 20 months. The depth to the top of the deepest portion of the P3 slab varies due to existing site grades. Due to the variance in existing site grades, we anticipate that the bulk excavation depth will range from approximately 11.0 m to 12.0 m below existing grades. Architectural plans by IBI show that the elevator shaft is to extend down slightly below the lowest P3 slab to approximately 79.2 m geodetic.

Table 3 summarizes the elevations of the P3 slab, anticipated nominal excavation and approximate groundwater levels at the site. We assume that the nominal excavation elevation will be approximately 0.6 m below the proposed P1 slab elevation, to account for building foundation elements. The groundwater observed within MW20-03 is likely resultant from precipitation entering the well head. However, our automated data suggests that the average groundwater elevation at MW20-03 is approximately 83.6 m geodetic.

Table 3: Elevation of Foundation, Excavation and Measured Groundwater Level

	Top of Slab	Excavation	Static Groundwater Table	Perched Groundwater
Elevation (m geodetic)	P3 = 80.1	80.1 – 0.6 = 79.6	~ 75.9 to 77.0	~ 83.6

The results of the groundwater monitoring conducted at the site indicate that the static groundwater level within the preglacial sediments ranges from 75.9 m geodetic to 77.0 m geodetic. The deepest proposed P3 slab elevation is 80.1 m geodetic and the anticipated nominal excavation will extend down to approximately 79.6 m geodetic. The building core is expected to extend down below the P3 slab to approximately 79.2 m geodetic. The groundwater data collected at the site suggests that the static groundwater level is below the proposed slab elevation, anticipated bulk excavation elevation and proposed building core elevation. Some perched groundwater may be encountered within the till during the rainier months of the year.

Refer to our attached Drawing No. 15077-GW-01 for the proposed development area, monitoring well locations and approximate slab elevations.

7.0 GROUNDWATER SEEPAGE

In order to obtain an initial estimate of the inflow rates which may be expected during excavation at the site, GeoPacific completed a seepage analysis using a finite element computer program SEEP/W (GeoStudio 2021). Based on the subsurface soils and the expected geometry of the excavation, a simplified 2-dimensional seepage model was developed and our measured hydraulic conductivity for the soil layers was applied in the model.

The excavation was modelled in a north-south cross section using data from MW20-01 and MW20-02. Based on the selected subsurface model and considering our experience in the area and the onsite testing completed, the following assumptions were considered in the analysis:

1) The hydraulic conductivity of the surficial soils was assumed to be 1.0×10^{-6} m/s.
2) The hydraulic conductivity of the glacial till was assumed to be 3.0×10^{-7} m/s.
3) The hydraulic conductivity of the preglacial sediments was estimated to be 3.11×10^{-4} m/s, based on our slug test results.
4) The hydraulic head within the glacial till was set to 83.6 m geodetic, based on the average values recorded by our automated dataloggers at MW20-03.

5) The hydraulic head within the preglacial sediments was set to 77.0 m geodetic, based on the highest recorded values at MW20-01.
6) The excavation area was modelled as a rectangle with dimensions of 81 m x 43 m.
7) The bulk excavation elevation was set to 79.5 m geodetic for the entire excavation.
8) The calculated seepage volumes are based on inflows from subsurface groundwater only. Inflows as a result of precipitation are not included.

The results of our seepage analysis indicate that groundwater inflows expected will be approximately 3 L/min during temporary works. As the glacial till drains during excavation, this value is expected to reduce to less than 1 L/min under post construction conditions.

The graphical representations of our seepage analysis is included in Appendix E.

It should be noted that the seepage analysis has been undertaken based on some assumptions and in conjunction with the limitations of the software which include analysis in two-dimensional space with a somewhat simplified soil stratigraphy. Slight variations in elevations, soil conditions, and fluctuating groundwater levels will ultimately impact the actual flow volumes encountered in the excavation.

8.0 GROUNDWATER MANAGEMENT PLAN

As outlined in Section 6.5, our measurements indicate the static groundwater level at the site is below the anticipated bulk excavation elevation and the proposed elevator pit elevation. However, some perched groundwater may be encountered within the glacial till. We recommend that the mechanical design assume an inflow of 20 - 30 L/min into the excavation for sizing of the sump pump.

It is anticipated that sumps and sump pumps will be able to remove any groundwater ingress and precipitation from the excavation during construction. The sump is to be constructed at the low point(s) of the excavation to the specifications outlined on the Erosion and Sediment Control Plan. Water will then be pumped from the sump to the onsite water treatment system which includes CO_2 adjustment, settling tanks and mechanical filtration. Discharge water will then be directed to a catch basin adjacent to the site. Discharge flow rates should be monitored daily using a flow meter and reported to groundwater@vancouver.ca as required.

GeoPacific must be notified a minimum of 2 weeks prior to the commencement of the excavation in order to ensure that the Groundwater Management Plan is correctly in place and that flow rates can be recorded and submitted to the City of Vancouver.

Post construction inflows are expected to be minimal, on the order of less than 1 L/min. Any condensation that accumulates on the outside of the foundation walls will be removed using damp proofing methods such as drainage board and directed towards a weep hole at the footings where it will enter the foundation drainage system. We expect that groundwater inflows will be sporadic and occur typically during the rainier months of the year as precipitation derived surface water migrates down the foundation wall.

9.0 IMPACT ASSESSMENT

To satisfy the City of Vancouver's *Groundwater Bulletin*, GeoPacific conducted an impact assessment to demonstrate the no significant impacts result from groundwater extraction.

I. *Ground Subsidence*

No active dewatering is anticipated at the site, as such, no ground subsidence related to dewatering is expected at the site.

II. *Impacts to Nearby Wells*

Our field investigation confirms that the proposed parkade structure is to be constructed above the measured static groundwater level. As a result, we are of the opinion the development will not impact any known or potential drinking water aquifers or any nearby wells.

III. *Historic Streams*

According to *Vancouver's Old Streams Map,* no historic creeks or streams are indicated to have existed within at least 800 m of the site. Additionally, based on our site-specific drill investigation, there is no evidence on site to support the presence of a stream on the property.

10.0 DISCUSSION AND CONCLUSION

We understand that a new residential development is proposed for the above referenced site. Drawings prepared by IBI Group (Canada) Inc. show that the new development will consist of a 16-storey tower and an 8-storey mid rise building constructed over a common 3 level parkade. The lowest P3 slab elevation is shown as 88.1 m geodetic. Considering the design slab grades and existing site grades, we expect the excavation depth will range from approximately 11.0 m to 12.0 m below existing grades.

Three monitoring wells were installed down to a maximum elevation of 73.5 m geodetic and indicate that both the proposed parkade and building core will be constructed above the peak static groundwater elevation recorded during our monitoring program. However, some perched groundwater within the glacial till during excavation. We expect that pumped sumps will be a sufficient means to temporarily control minor inflows from the draining of perched groundwater during excavation. A perimeter drainage system will be required for the below grade structure to prevent the development of water pressure on the foundation walls and the basement floor slabs under normal conditions.

Lastly, monitoring wells can create preferential pathways for groundwater to travel and flow from zones of higher pressure towards areas with lower pressure and therefore it is recommended that any wells installed at the site be decommissioned in accordance with Provincial requirements.

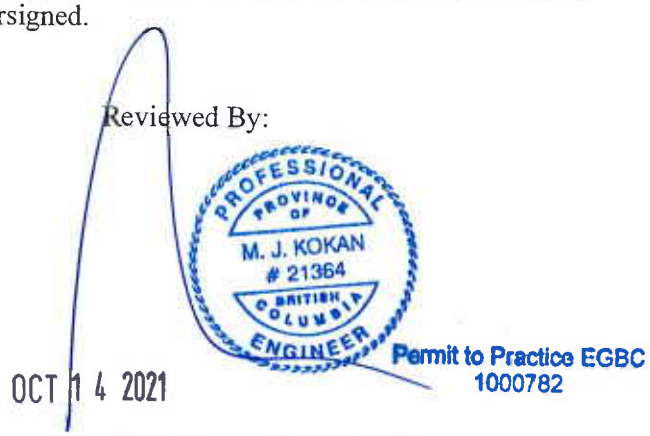
11.0 CLOSURE

This study is prepared exclusively for Wesgroup Properties and the City of Vancouver for the purposes of providing hydrogeological recommendations for the City of Vancouver's *Groundwater Management Bulletin,* released April 20, 2020.

We are pleased to be of assistance to you on this project and trust that our comments and recommendations are both helpful and sufficient for your purposes at this time. If you require any further details or clarifications, please do not hesitate to contact the undersigned.

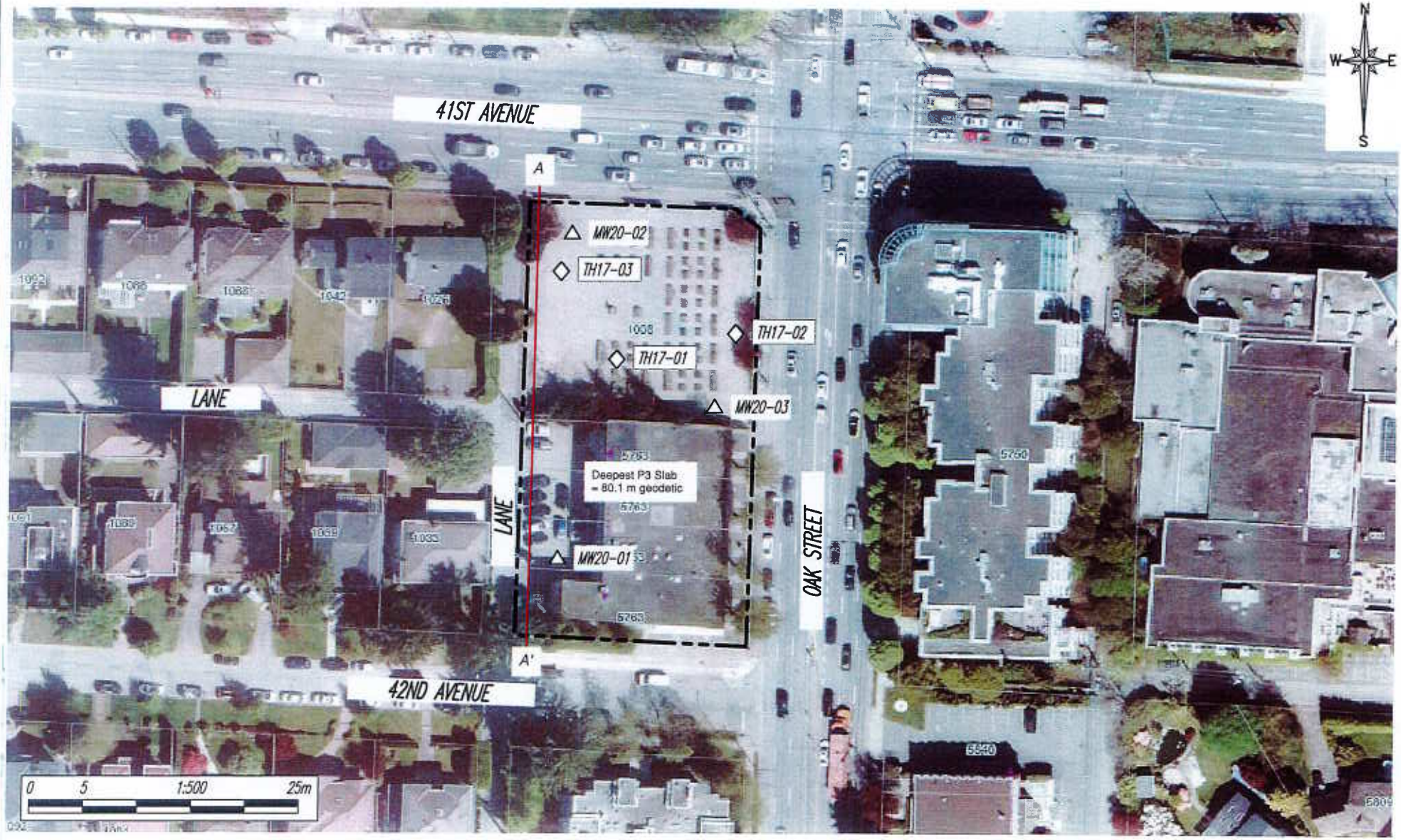
For:
GeoPacific Consultants Ltd.

Reviewed By:



Adam Zywotkiewicz, B.Sc., GIT
Hydrogeologist

Matt Kokan, M.A.Sc., P.Eng.
Principal



LEGEND:

△ MW20-# – MONITORING WELL (MW) LOCATION (2020)

◇ TH17-# – TEST HOLE (TH) LOCATION (2017)

SITE PLAN

SCALE = 1:500

*TEST LOCATIONS ARE APPROXIMATE

REFERENCE:

- VANMAP

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY
1779 W. 75th Avenue
Vancouver, B.C. V6P 6P2
P 604.439.0922
F 604.439.9189

DATE:	FEBRUARY 4, 2020	
DRAWN BY: N.P.	APPROVED BY: M.J.K.	REVIEWED BY: N.S.
SCALE:	AS SHOWN	

GROUNDWATER INVESTIGATION

1008 W. 41ST AVE. & 5763 OAK ST., VANCOUVER, BC

MONITORING WELL LOCATION PLAN

FILE NO.: 15077-GW

DWG. NO.: 15077-GW-01

REVISIONS:
A.
B.
C.

ORIGINAL PAPER SIZE 8.5"x11"

APPENDIX 'A'

Test Hole Log: MW20-01

File: 15077-GW
Project: GROUNDWATER INVESTIGATION
Client: WESGROUP CONTRACTING LTD.
Site Location: 1008 W. 41ST AVENUE & 5763 OAK STREET, VANCOUVER, BC

GEOPACIFIC CONSULTANTS
1779 West 75th Avenue, Vancouver, BC, V6P 6P2
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Groundwater / Well	Remarks
0 / 0		Ground Surface			
		Asphalt (150 mm)	0.0		
3 / 1		***Sand*** Sand, some gravel, trace to some silt with depth, brown, compact, moist, fine-grained sand	1.2		
7 / 2		***Silt*** Silt, some sand, mottled brown-grey, stiff, moist	1.8		
10 / 3		***Sand and Gravel [TILL]*** Sand and Gravel, some silt, grey-brown, dense, moist, fine to coarse subrounded gravel, fine-grained sand			
16 / 5		***Sand and Gravel [TILL]*** Sand and Gravel, trace to some silt, light brown-grey, dense, moist, fine to coarse subrounded to rounded gravel, medium-grained sand, coarsening with depth 6.1 m to 6. 4 m - Sand lense, medium to coarse-grained sand	4.9		
40 / 12			12.2		

Logged: NP
Method: SONIC DRILING
Date: JANUARY 30, 2020

Datum: EXISTING GROUND
Figure Number: A.01

Test Hole Log: MW20-01

File: 15077-GW
Project: GROUNDWATER INVESTIGATION
Client: WESGROUP CONTRACTING LTD.
Site Location: 1008 W. 41ST AVENUE & 5763 OAK STREET, VANCOUVER, BC

GEOPACIFIC CONSULTANTS
1779 West 75th Avenue, Vancouver, BC, V6P 6P2
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Groundwater / Well	Remarks
41–80 (13–24)		***Sand*** Sand, trace fine gravel, trace silt, light brown-grey, dense, moist			
		Sand Sand, trace to some silt with depth, light brown-grey, dense, moist, medium-grained sand	13.7		
		Sand Sand, some gravel, light brown-grey, dense, moist, fine to coarse subrounded gravel, medium-grained sand, coarsening with depth	15.2		The screen was installed between 49 ft (14.9 m) and 59 ft (18.0 m)
		End of Borehole	18.3		

Logged: NP
Method: SONIC DRILING
Date: JANUARY 30, 2020

Datum: EXISTING GROUND
Figure Number: A.01

Test Hole Log: MW20-02

File: 15077-GW
Project: GROUNDWATER INVESTIGATION
Client: WESGROUP CONTRACTING LTD.
Site Location: 1008 W. 41ST AVENUE & 5763 OAK STREET, VANCOUVER, BC

GEOPACIFIC CONSULTANTS
1779 West 75th Avenue, Vancouver, BC, V6P 6P2
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Groundwater / Well	Remarks
0 / 0		Ground Surface			
		Sand and Gravel Sand and Gravel, trace silt, brown, compact, moist	0.0		
3 / 1		***Silt*** Silt, trace fine gravel, trace fine-grained sand, light brown-grey, stiff, moist	1.8		
10 / 3		***Sand [TILL]*** Sand, some fine gravel, some to trace silt with depth, grey-brown, dense, moist, medium-grained sand 2.4 m to 3.0 m - Sand and Gravel, fine to coarse gravel	4.0		
16 / 5		***Sand and Gravel [TILL]*** Sand and Gravel, trace to some silt with depth, light brown-grey, dense, moist, fine to coarse rounded gravel, medium-grained sand, coarsening with depth 6.0 m to 7. 3 m - cobbles 9.1 m to 10.6 m - trace to some silt			
35 / 11			10.7		
40 / 12					

Logged: NP
Method: SONIC DRILING
Date: JANUARY 30, 2020

Datum: EXISTING GROUND
Figure Number: A.02

Test Hole Log: MW20-02

File: 15077-GW
Project: GROUNDWATER INVESTIGATION
Client: WESGROUP CONTRACTING LTD.
Site Location: 1008 W. 41ST AVENUE & 5763 OAK STREET, VANCOUVER, BC

GEOPACIFIC CONSULTANTS
1779 West 75th Avenue, Vancouver, BC, V6P 6P2
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Groundwater / Well	Remarks
41 42 43 13 44 45 46 14 47 48 49 15 50 51 52 16 53 54 55 17 56 57 58 59 18 60 61 62 19 63 64 65 20 66 67 68 69 21 70 71 72 22 73 74 75 23 76 77 78 79 24 80		***Sand*** Sand, some to trace fine gravel with depth, light brown-grey, dense, moist, medium to coarse-grained sand, rounded gravel 12.8 m to 15.2 m - medium-grained sand 16.7 m to 18.3 m - coarse-grained sand			The screen was installed between 48 ft (14.6 m) and 53 ft (16.1 m)
		End of Borehole	21.3		

Logged: NP
Method: SONIC DRILING
Date: JANUARY 30, 2020

Datum: EXISTING GROUND
Figure Number: A.02

Test Hole Log: MW20-03

File: 15077-GW
Project: GROUNDWATER INVESTIGATION
Client: WESGROUP CONTRACTING LTD.
Site Location: 1008 W. 41ST AVENUE & 5763 OAK STREET, VANCOUVER, BC

GEOPACIFIC CONSULTANTS
1779 West 75th Avenue, Vancouver, BC, V6P 6P2
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Groundwater / Well	Remarks
0 / 0		Ground Surface			
		Sand Sand, trace silt, reddish brown, compact, moist fine-grained sand, some organics	0.0 – 0.6		
		Silt Silt, trace fine gravel, trace fine sand, mottled brown-grey, stiff, moist	0.6 – 3.0		
10 / 3		***Sand and Gravel [TILL]*** Sand and Gravel, some silt, grey, dense, moist, fine to coarse rounded gravel, medium-grained sand	3.0		
		4.0 m to 6.0 m - silty Sand and Gravel			
		6.0 m to 6.7 m - medium-grained sand seam			
		8.2 m to 9.1 m - medium to coarse-grained sand			
36 / 11		***Sand*** Sand, trace to some silt, light brown-grey, dense, moist, medium-grained sand coarsening with depth	11.0		
40 / 12					The screen was installed between 23 ft (7.0 m) and 33 ft (10.0 m)

Logged: NP
Method: SONIC DRILING
Date: JANUARY 31, 2020

Datum: EXISTING GROUND
Figure Number: A.03

Test Hole Log: MW20-03

File: 15077-GW
Project: GROUNDWATER INVESTIGATION
Client: WESGROUP CONTRACTING LTD.
Site Location: 1008 W. 41ST AVENUE & 5763 OAK STREET, VANCOUVER, BC

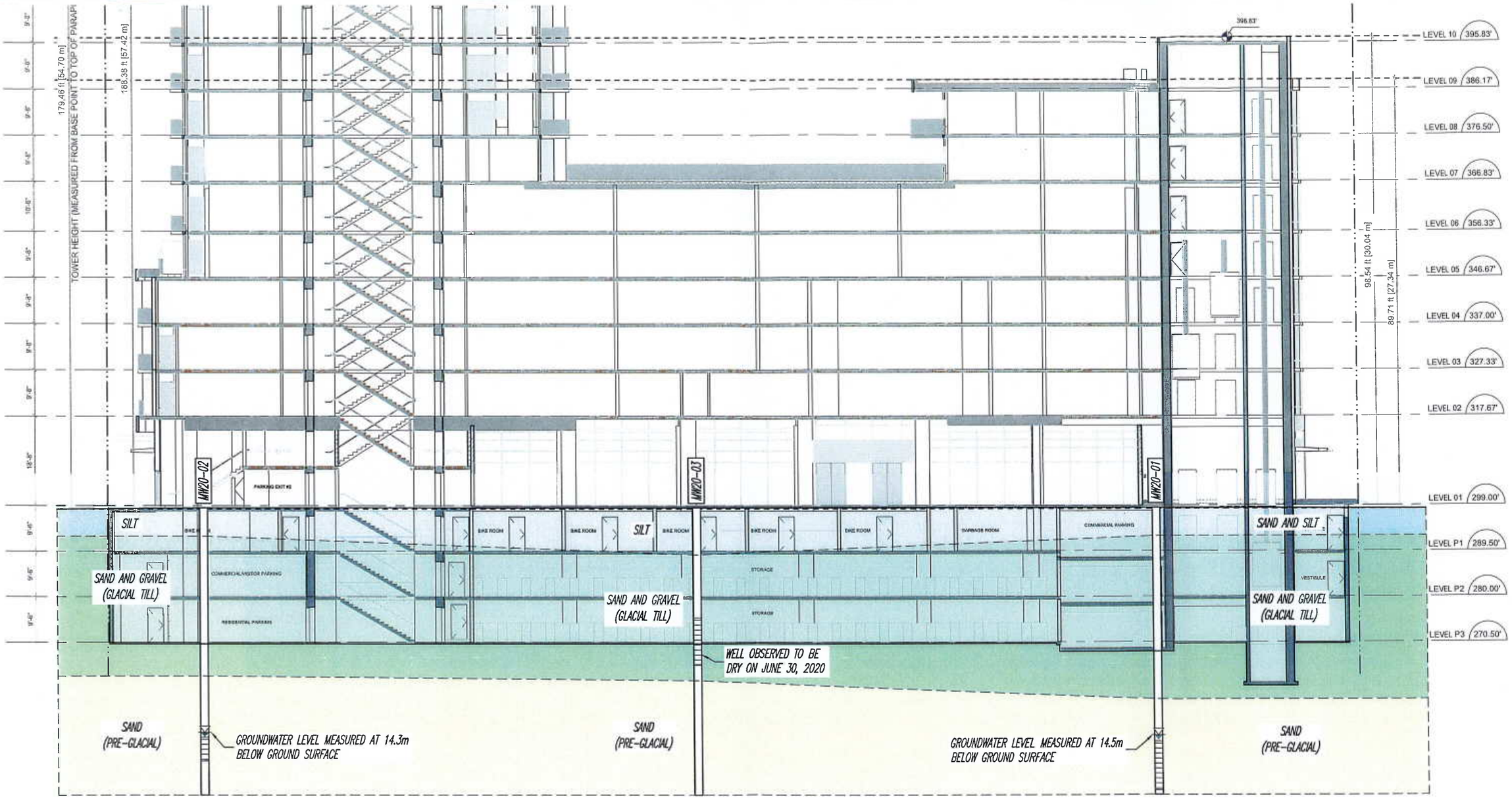
GEOPACIFIC CONSULTANTS
1779 West 75th Avenue, Vancouver, BC, V6P 6P2
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE					
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Groundwater / Weil	Remarks
41 42 43 13 44 45					
46 14 47 48 49 15 50 51 52 16 53 54 55 17 56 57 58 59 18 60		***Sand*** Sand, trace to some fine gravel with depth, light brown-grey, very dense, medium to coarse-grained sand with depth	13.7		
61 62 19 63 64 65 20 66 67 68 69 21 70 71 72 22 73 74 75 23 76 77 78 79 24 80		End of Borehole	18.3		

Logged: NP
Method: SONIC DRILING
Date: JANUARY 31, 2020

Datum: EXISTING GROUND
Figure Number: A.03

APPENDIX 'B'



CROSS SECTION

1:100

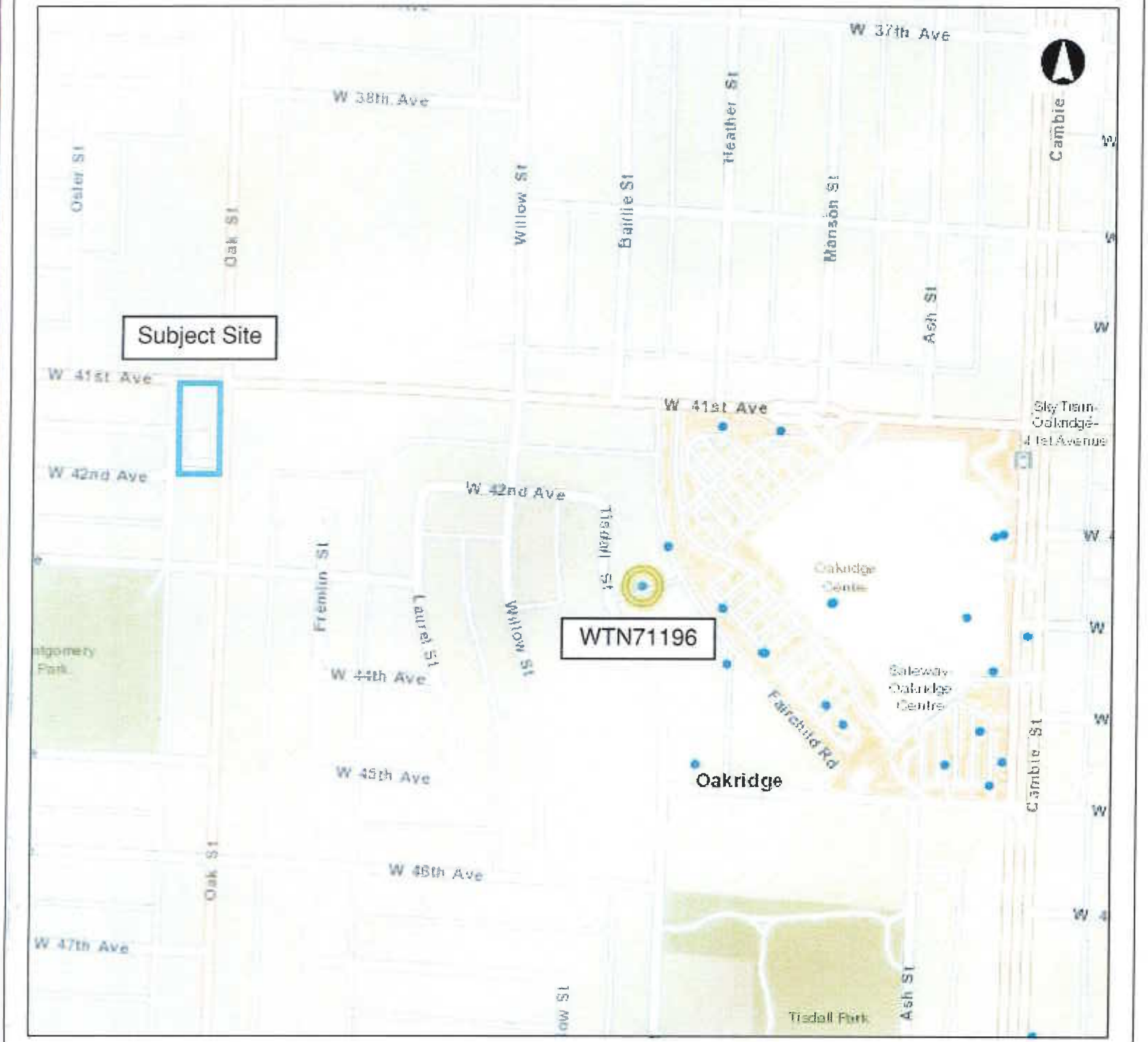
LEGEND:

- SILT
- SAND AND GRAVEL (GLACIAL TILL)
- SAND (PRE-GLACIAL)

ORIGINAL PAPER SIZE 11"x17"

REFERENCE: IBI GROUP ARCHITECTS INC. PROJECT NO. 123068 SHEET NO. 1-3.01 SEPTEMBER 23, 2021	GEOPACIFIC CONSULTANTS	DATE: OCTOBER 1, 2021	PROPOSED DEVELOPMENT 1008 WEST 41ST AVENUE & 5763 OAK STREET, VANCOUVER, B.C. GROUNDWATER CROSS SECTION	FILE NO.: 15077-GW	REVISIONS: A. B. C.
		DRAWN BY: N.K. / APPROVED BY: M.J.K. / REVIEWED BY: A.Z.		DWG. NO.: G-GW1	
		SCALE: AS SHOWN			

APPENDIX 'C'



BRITISH COLUMBIA

Water Resources Atlas

Legend

Groundwater Wells - All

ARTESIAN_IND

- Reported Artesian Well
- Well

0 0.18 0.37 km

1: 9,028

Copyright/Disclaimer

The material contained in this web site is owned by the Government of British Columbia and protected by copyright law. It may not be reproduced or redistributed without the prior written permission of the Province of British Columbia. To request permission to reproduce all or part of the material on this web site please complete the Copyright Permission Request Form which can be accessed through the Copyright Information Page.

CAUTION: Maps obtained using this site are not designed to assist in navigation. These maps may be generalized and may not reflect current conditions. Uncharted hazards may exist. DO NOT USE THESE MAPS FOR NAVIGATIONAL PURPOSES.

Datum: NAD83
Projection: BC Albers

Key Map of British Columbia



APPENDIX 'D'

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

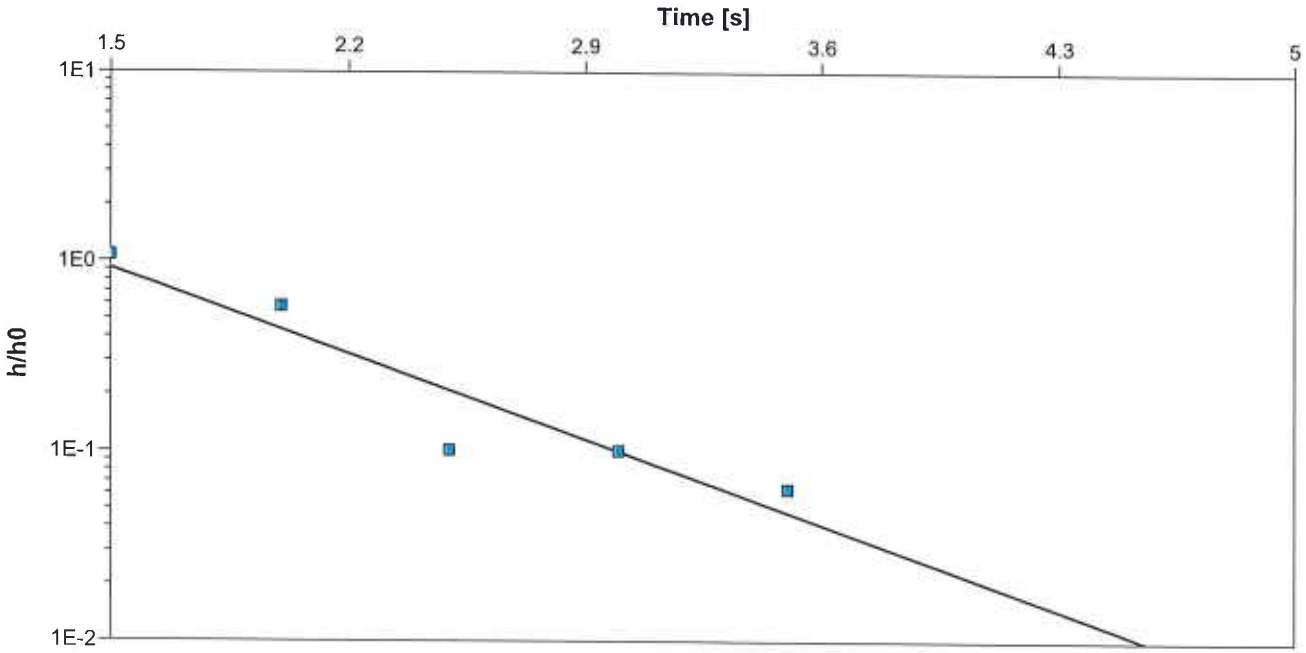
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-01
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Falling Head 1	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-01	7.44×10^{-4}	

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

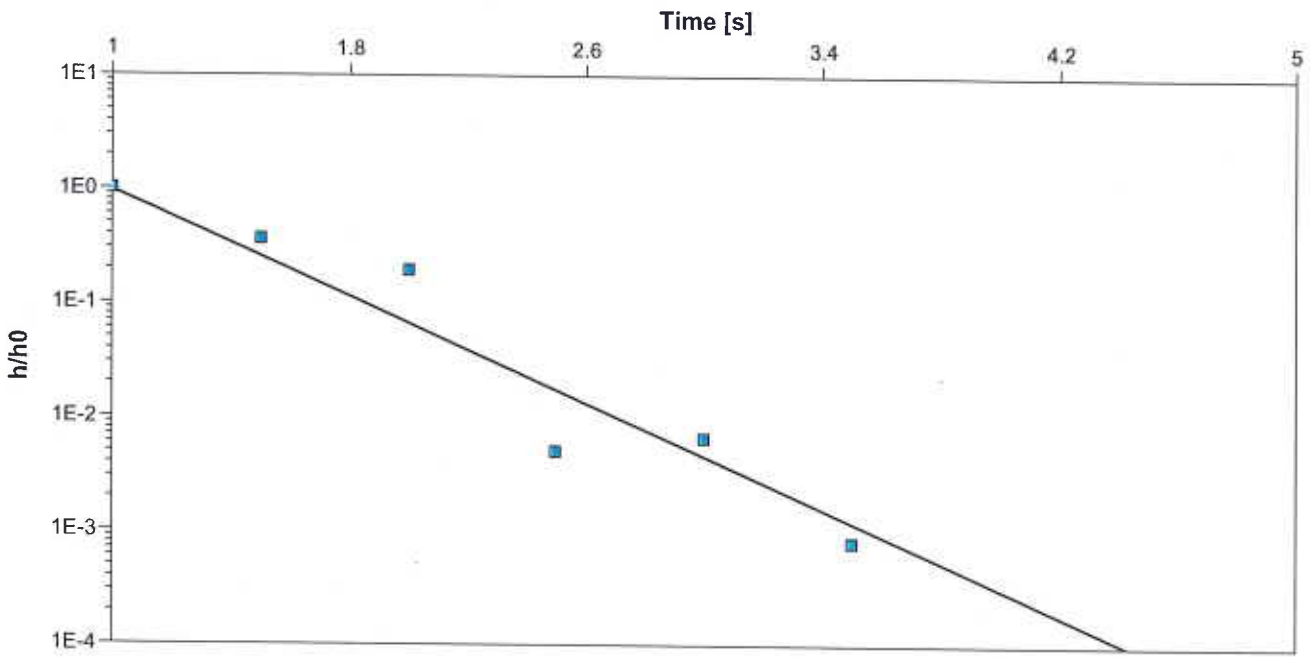
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-01
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Falling Head 2	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-01	1.35×10^{-3}	

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

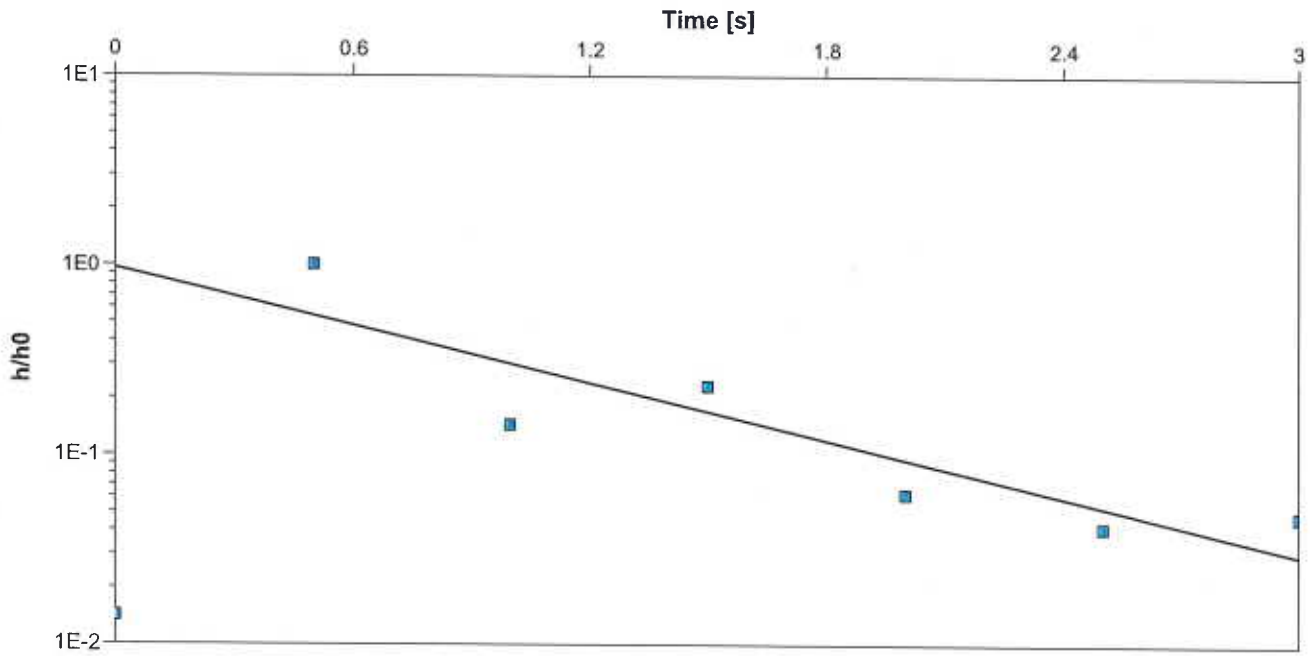
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-01
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Falling Head 3	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-01	5.82×10^{-4}	

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

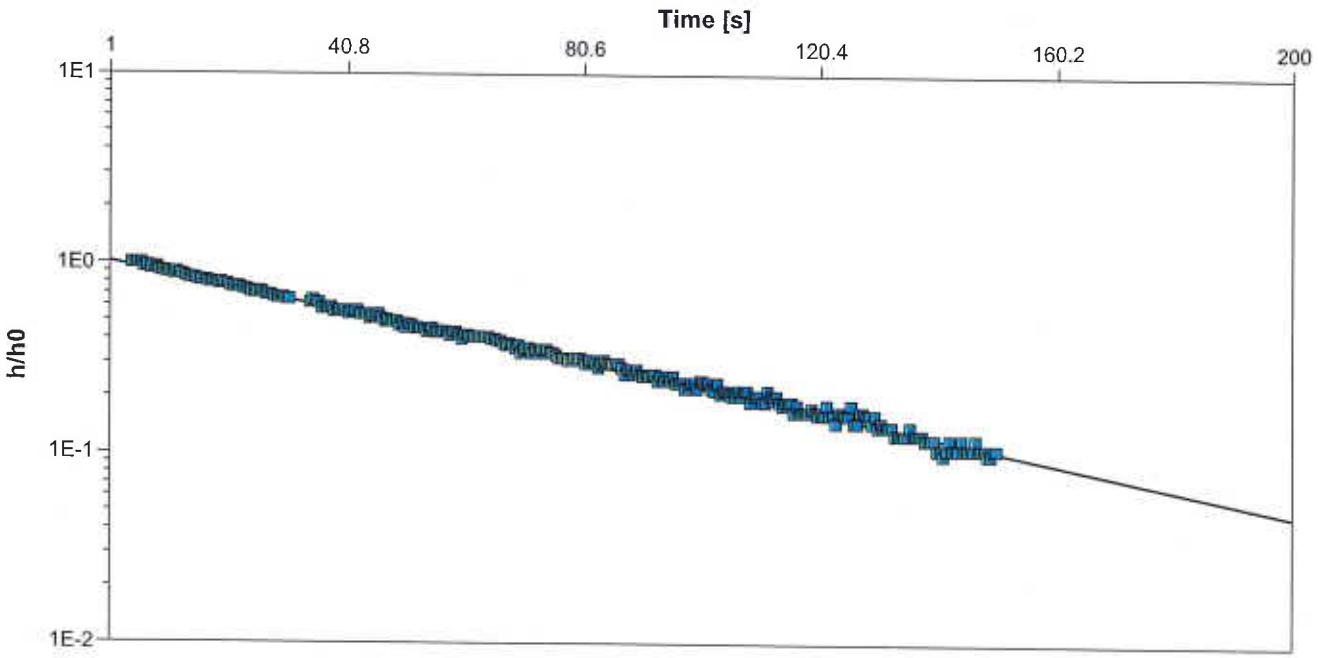
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-02
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Falling Head 1	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-02	1.35×10^{-5}	

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

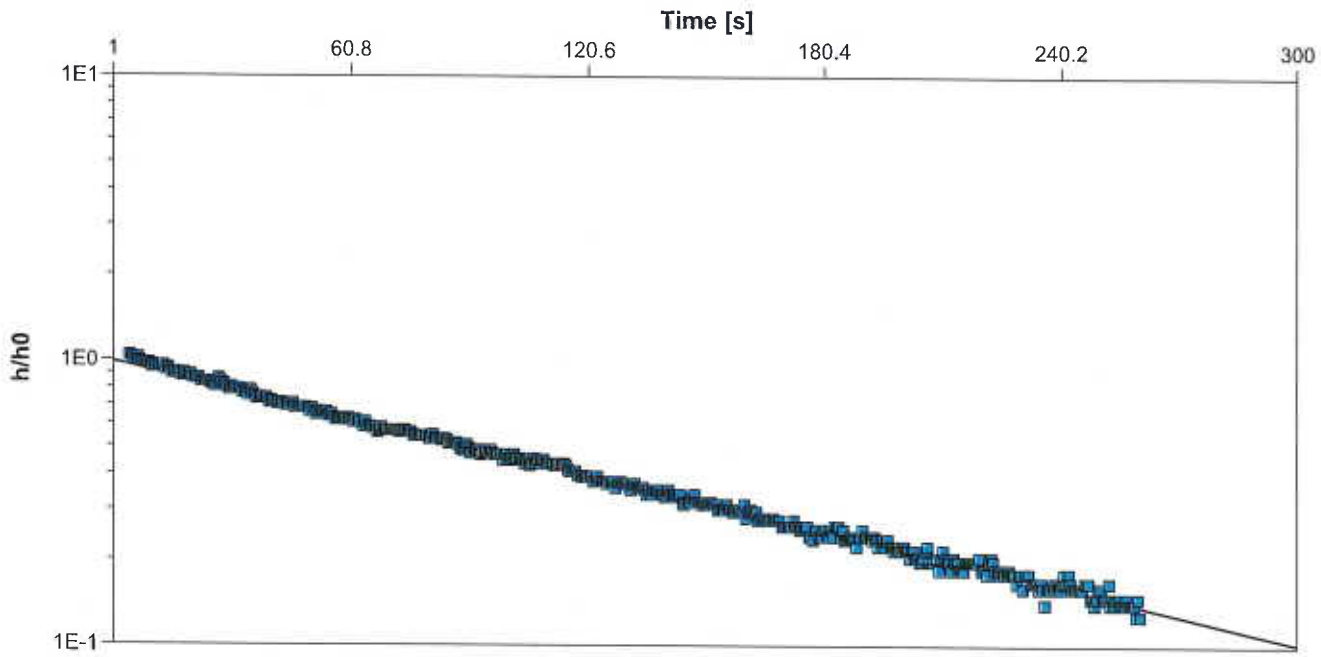
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-02
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Falling Head 2	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-02	6.70×10^{-6}	

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

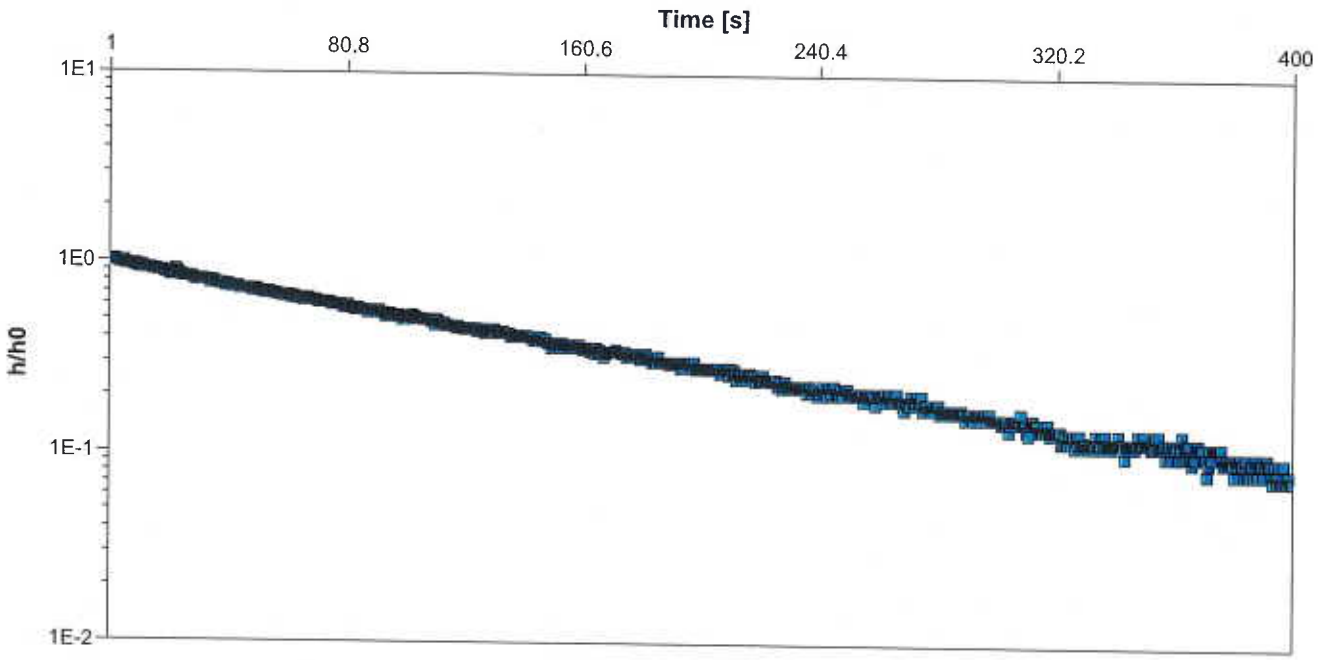
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-02
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Falling Head 3	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-02	5.36×10^{-6}	

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

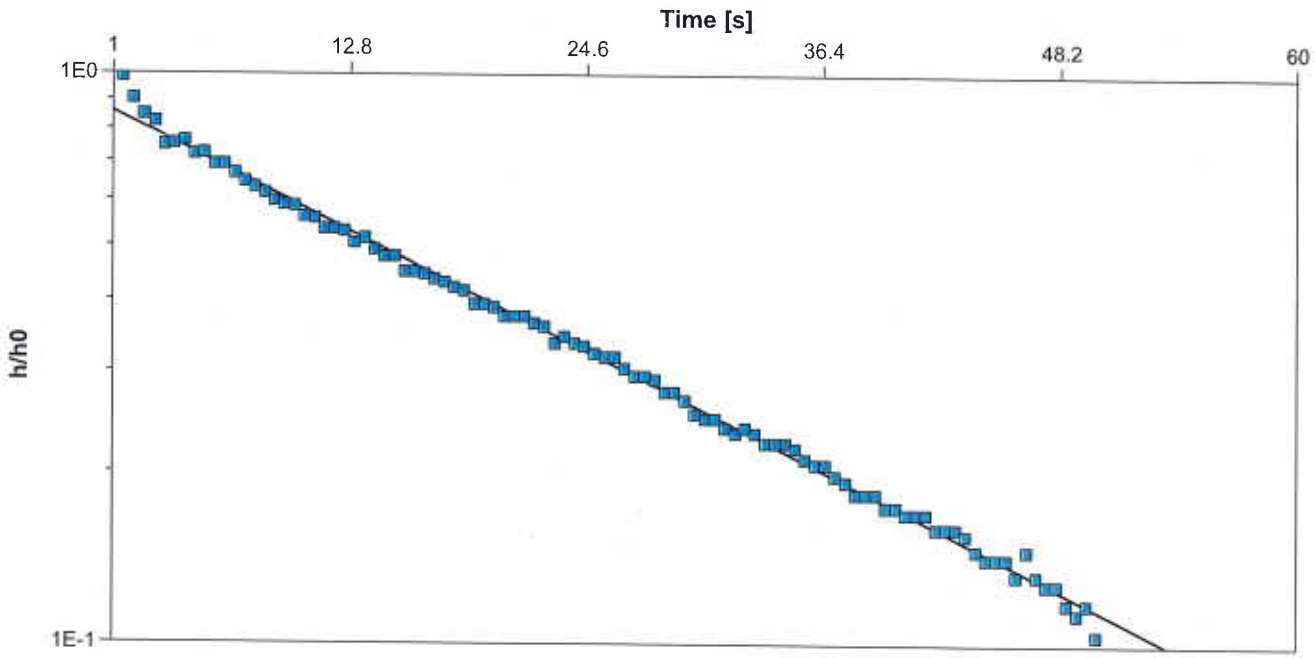
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-02
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Rising Head 1	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-02	3.61×10^{-5}	

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

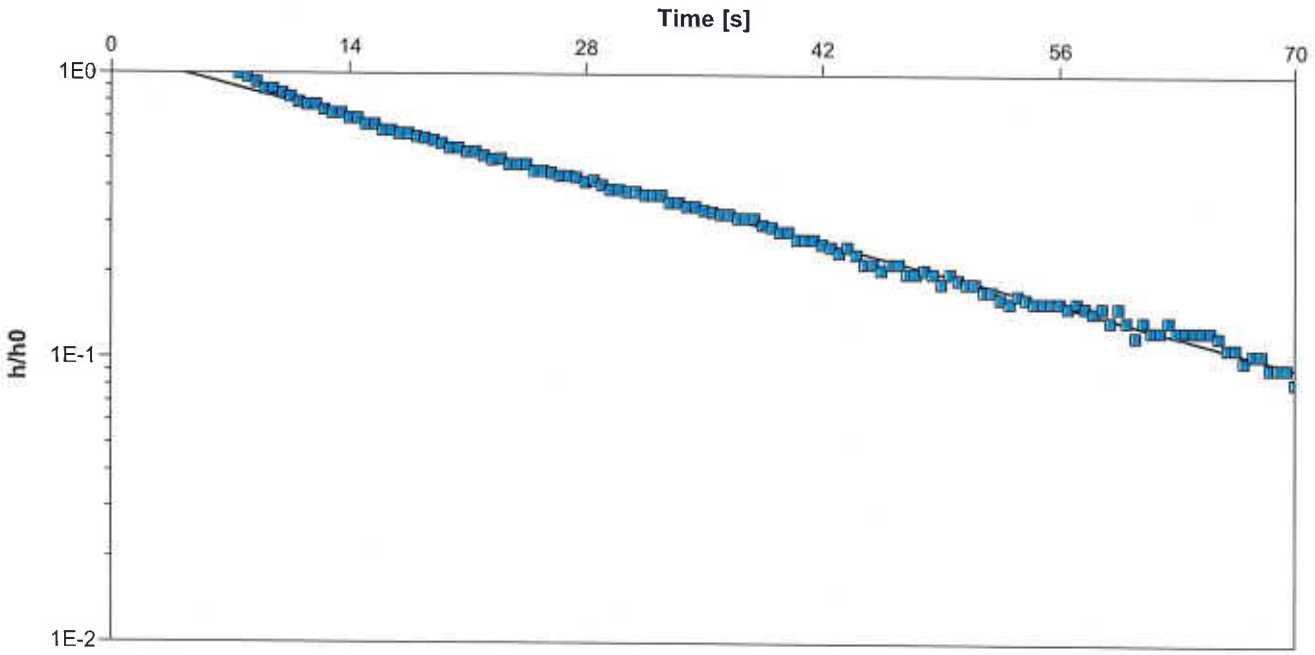
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-02
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Rising Head 2	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-02	3.18×10^{-5}	

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

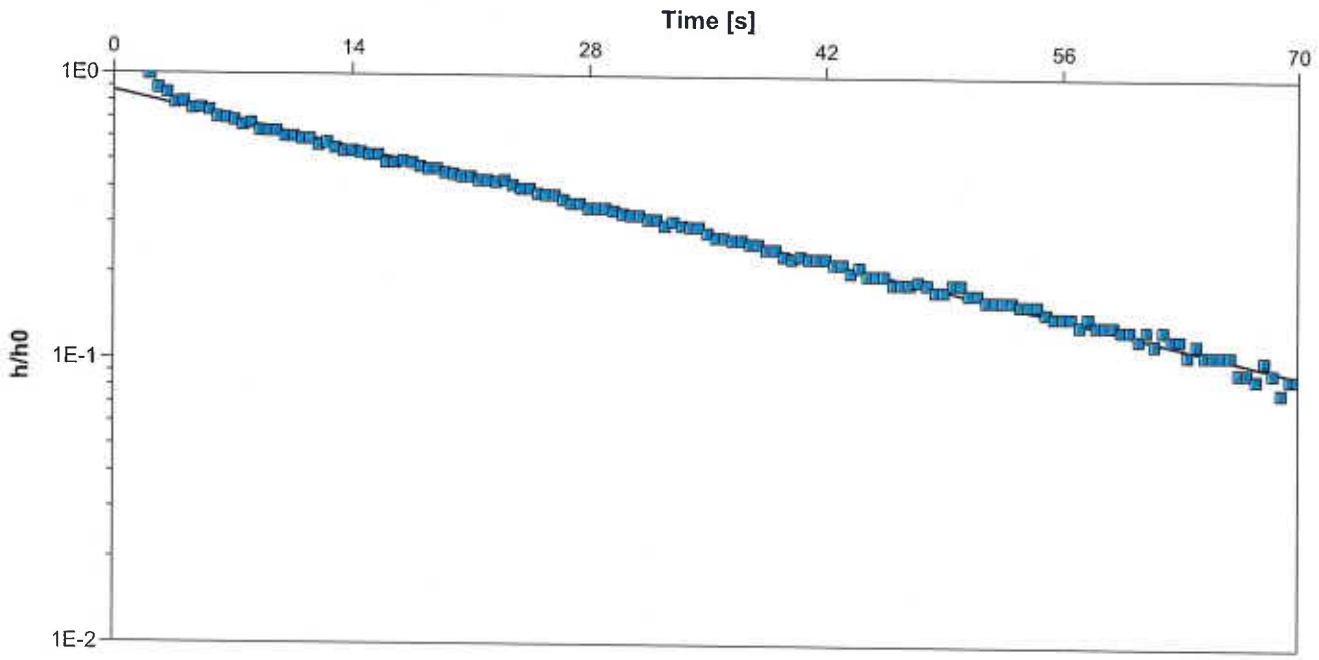
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-02
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Rising Head 3	Analysis Date: 2020-04-19
Aquifer Thickness:		

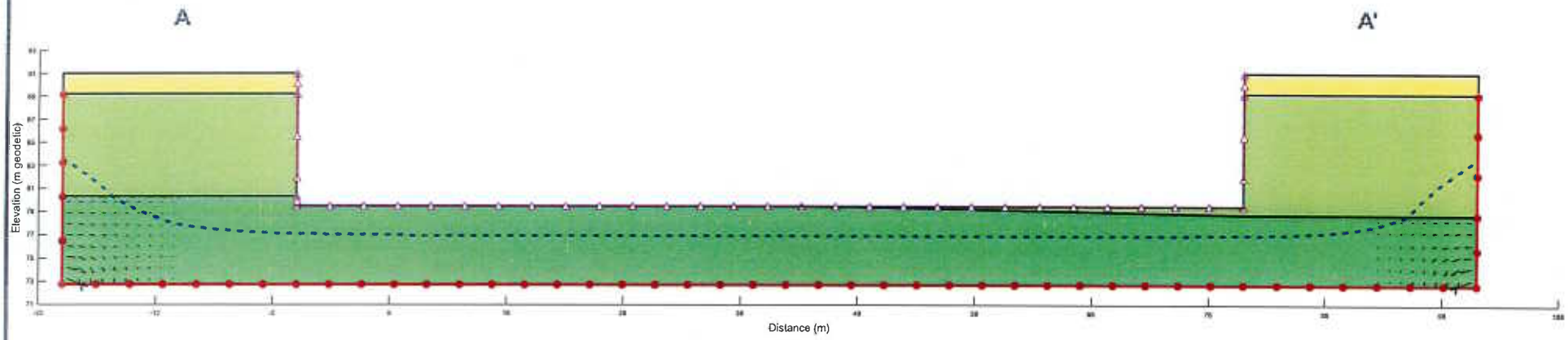


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
MW20-02	2.84×10^{-5}	

APPENDIX 'E'

Estimated Temporary Inflow Rate = <3 L/min



Color	Name	Material Model	Sat Kx (m/sec)
	1 - Surficial Soils	Saturated Only	1e-06
	2 - Silty Sand and Gravel (Glacial Till)	Saturated Only	3e-07
	3 - Sand (Preglacial)	Saturated Only	0.000311

Project:Proposed Residential Developement	**Job No.: 15077-GW**
Model: SEEP/W Analysis	Date: October 4, 2021
Method: Steady-State	Scale : 1:527
Site Address : 6444 Silver Ave, Burnaby, BC	Analysis by: AZ

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY
1779 W. 75th Avenue
Vancouver, B.C. V6P 6P2
P 604.439.0922
F 604.439.9189

15077-GW - SEEP - 2021-10-04.gsz