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Wesgroup Properties
Suite 910, Four Bentall Centre
Vancouver, BC
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July 10, 2020
File # 15077-GW

Attention: Graham Brewster/Stefan Hertal

Preliminary Hydrogeological Investigation Report – Mixed Use Development
1008 West 41st Avenue and 5763 Oak Street, Vancouver, BC

1.0 INTRODUCTION

We understand that Wesgroup Properties intends to proceed with the redevelopment of the above referenced site. Preliminary design drawings prepared by IBI Group (Canada) Inc. (dated June 8, 2020), indicate the development will consist of a 16-storey tower and an 8-storey building at the north and south of the site respectively, all over three levels of below grade parking. The deepest portion of the P3 slab elevation is shown to be at an elevation of 82.1 m (269.25 ft) geodetic.

The following study presents the preliminary results of our hydrogeological investigation. It describes the soil and hydrogeological conditions at the site and outlines an approach for further investigation into groundwater conditions at the site prior to development. This report has been prepared exclusively for Wesgroup Properties, for their use, the use of others on their design team, and the City of Vancouver in the development and permitting process. Any other use of the report requires the approval of GeoPacific Consultants Ltd.

2.0 SITE DESCRIPTION

The site is rectangular in shape and is located on the southwest corner, at 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 location of the site and existing improvements can be seen in the attached Drawing 15077-GW-01, following the text of this report.

3.0 FIELD INVESTIGATIONS

GeoPacific conducted an initial geotechnical investigation of the site on June 16, 2017. At that time, three test holes were advanced to a maximum depth of 7.6 m below existing grades using a truck mounted auger drill rig supplied and operated by Southland Drilling Co. Ltd of Delta, B.C. All three test holes were

immediately backfilled following the completion of drilling, sampling and logging of soils in accordance with BC Provincial requirements.

A supplementary drill investigation was completed on January 30 and 31, 2020, with a total of three groundwater monitoring wells being installed using a track mounted sonic drill rig supplied and operated by BlueMax Drilling of Surrey, B.C. MW20-01, MW20-02 and MW20-03 were advanced to depths of 18.3 m, 21.3 m and 18.3 m, respectively. Once drilling was completed, monitoring wells and electronic data-loggers were installed at all three well locations. The data-loggers were installed to remotely collect and record water level measurements every hour.

The test hole locations were located, supervised and logged by a member of our technical team. Since the time of drilling, wells have been developed and slug tests have been completed at all three well locations.

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

4.0 SOIL 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 are underlain by the pre-glacial deposits consisting of Quadra sand to silty sand.

4.2 Onsite 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

TH20-01 was located within an asphaltic surfaced driving aisle. The asphalt was noted to be approximately 30 mm thick and 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 material 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 three 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. 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.

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 detailed description of the soil conditions refer to our test hole log in Appendix A, following the text of this report.

5.0 GROUNDWATER CONDITIONS

5.1 General Conditions on Cambie Corridor

In general, there are two groundwater regimes locally: the shallow perched groundwater within the surficial fills and weathered till deposits, and a deep semi-confined groundwater regime within the pre-glacial material known as the Quadra Sands (Aquifer #49). The two regimes are separated by the glacial till deposits which act as a leaky aquitard. In our experience, the static groundwater table is found within the Quadra Sands at depth and the regional groundwater flow direction south of Queen Elizabeth Park follows topography from the north to the south, down gradient towards the Fraser River.

5.2 Groundwater Levels Onsite

The site is underlain by a thin veneer of post-glacial material at the surface, overlying silty sand and gravel till, over medium to coarse pre-glacial sand. As discussed above, there are 2 groundwater regimes thought to be present at the site: the shallow, perched groundwater typically present in the fills and weathered till material at the surface, and a deeper semi-confined groundwater regime in the underlying pre-glacial sands (Quadra sands).

As noted previously, three groundwater monitoring wells were installed as MW20-01, MW20-02 and MW20-03. MW20-01 and MW20-02 were screened within the medium to coarse sands inferred to be part of the Quadra Sands Formation while MW20-03 was screened within the glacial till material.

Groundwater levels were measured using both manual and continuous automated methods. Table 1 is a summary of the manual water level measurements obtained by a handheld water level meter during our site visits and includes well completion details.

Table 1: Manual Groundwater Measurements

Well #	Material Screened	Well Screen Interval	Jan 31, 2020	Feb 21, 2020	Mar 11, 2020	Apr 11, 2020	May 8, 2020	Jun 30, 2020
		Depth Below Ground Surface (m)	Depth to Water Below Ground Surface (m)					
MW20-01	Sand	14.9 - 18.0	14.87	14.56	14.45	14.54	14.62	14.87
MW20-02	Sand	14.6 - 16.1	14.52	14.26	14.15	14.21	14.29	14.55
MW20-03	Sand and Gravel Till	7.0 - 10.0	4.39	Dry	Dry	Dry	Dry	Dry

As summarized in Table 1, the monitoring well at MW20-03 was installed in the glacial till deposits and found to be dry. The static groundwater table was encountered at depths ranging between 14 and 15 m below existing site grades within the Quadra sands underlying the glacial till deposits, screened at MW20-01 and MW20-02.

Figure 1 is a summary of the automated data collected from MW20-01 and MW20-02. The deepest portion of the P3 slab elevation at 82.1 m (269.25 ft) geodetic, as shown on architectural drawings provided by IBI Group (Canada) (dated June 8, 2020), is included for reference. MW20-03 is dry and therefore there is no data to present.

Figure 1: Automated Water Levels at MW20-01 and MW20-02

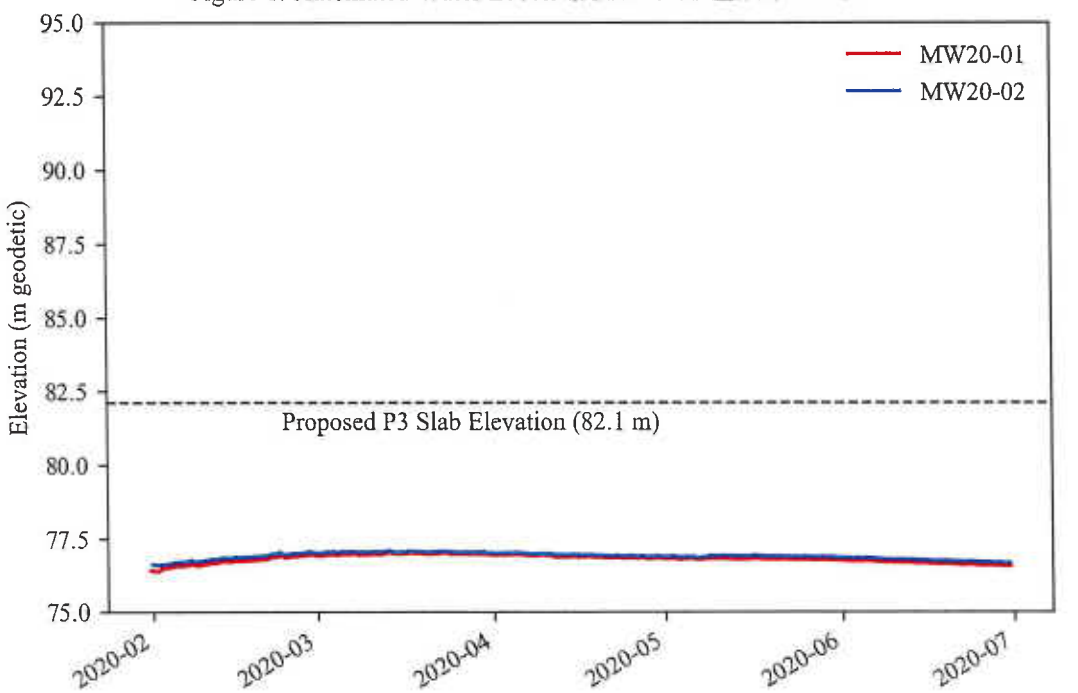


Figure 1 shows daily groundwater levels with respect to geodetic elevation. Negligible fluctuations in groundwater levels were found at MW20-01 and MW20-02 during the 5-month monitoring period. The static groundwater table, measured at MW20-01 and MW20-02, is at least 5 m below the deepest portion of the P3 slab elevation.

5.3 Aquifer Testing

MW20-01 and MW20-02 were developed using a weighted PVC hand bailer on March 11, 2020. Well development is conducted in order to remove any fine particles smeared along the well bore wall as a result of drilling processes and prepares the well for hydraulic conductivity testing. Both well locations were bailed until a total of three well volumes of water were removed before slug testing was conducted. Following well development, groundwater levels at MW20-01 and MW20-02 were allowed to recover completely, despite there being no noticeable change in the height of the water column.

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.

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

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.

5.4 Groundwater Management Plan

5.4.1 Temporary Conditions

The results of our preliminary groundwater investigation indicate that the static groundwater level will be at least 5 m below the final depth of excavation. If the current design does not change significantly, we do not anticipate the need for any specialized dewatering equipment during construction.

Any groundwater ingress from perched groundwater and accumulated precipitation during construction should be directed to a sump. The sump is typically constructed at the low point(s) of the excavation to the specifications outlined on the Erosion and Sediment Control Plan. Water is then 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 will need to be monitored daily using a flow meter and reported to monthly to groundwater@vancouver.ca.

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

5.4.2 Permanent Conditions

Based on the current design drawings, the excavation is not anticipated to penetrate the static groundwater table. Therefore, post-construction groundwater ingress is expected to be negligible. In our experience, we expect any perched groundwater trapped within more permeable sandier zones of the glacial till to drain during temporary works and subsequently controlled using permanent below slab sumps and sump pumps, as specified by the mechanical designer. 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. Any condensation that accumulates on the outside of the foundation walls should 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.

5.5 Impact Assessment

To satisfy the City of Vancouver's *Groundwater Bulletin*, GeoPacific conducted a preliminary impact assessment to discuss any significant risks or impacts which could result from the development or from groundwater extraction/diversion:

I. *Dewatering and Ground Subsidence*

In some cases, dewatering can cause ground subsidence which can in turn have negative impacts on adjacent properties and City infrastructure. As we do not expect any active dewatering to occur at the site, we do not expect ground settlement to occur due to the lowering of the groundwater table.

II. *Impacts to Nearby Wells*

A search of the BC Water Atlas was completed by GeoPacific on July 9, 2020. No registered wells were found to be within 500 m of the site. The development will not impact any known or potential drinking water aquifers. A summary of the BC Water Atlas search can be found in Appendix C.

III. *Historic Streams*

According to *Vancouver's Old Streams Map,* there are no historic streams within the proposed development area. The closest stream appears to be over 800 m to the southeast of the site. Refer to Appendix D for a map of the site location in relation to historic streams.

6.0 DISCUSSION AND FUTURE REQUIREMENTS

Preliminary architectural drawings provided by IBI Group (dated June 8, 2020) indicate that the deepest portion of the P3 slab elevation is expected to be at 82.1 m (269.25 ft) geodetic. Based on the current design and our groundwater monitoring to date, the development will be founded at least 5 m above the static groundwater level. Perched groundwater found within more permeable zones within the glacial till material is expected to produce relatively low inflows during the construction but will readily be managed by sumps and sump pumps. We anticipate that these perched groundwater levels could vary seasonally, generally with higher groundwater levels in the wetter months of the year. Continued monitoring of the groundwater wells over is expected to confirm these details.

In order to continue to meet the requirements set out in the City of Vancouver's *Groundwater Management Bulletin*, we suggest the subsequent steps be followed:

- Continuation of groundwater monitoring until development permit application
- Seepage analysis if required
- Final Hydrogeological Investigation Report
- Updated Groundwater Management Plan

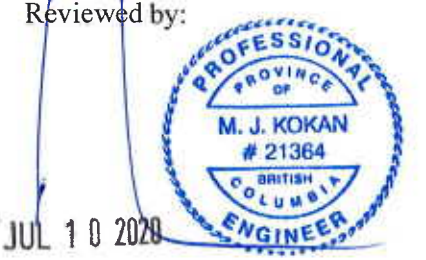
7.0 CLOSURE

This study is prepared exclusively for Wesgroup Properties and for the City of Vancouver for the purposed 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 we trust that our comments and recommendations are both helpful and sufficient for your current purposes. If you would like further details or would like clarification of any of the above, please do not hesitate to call.

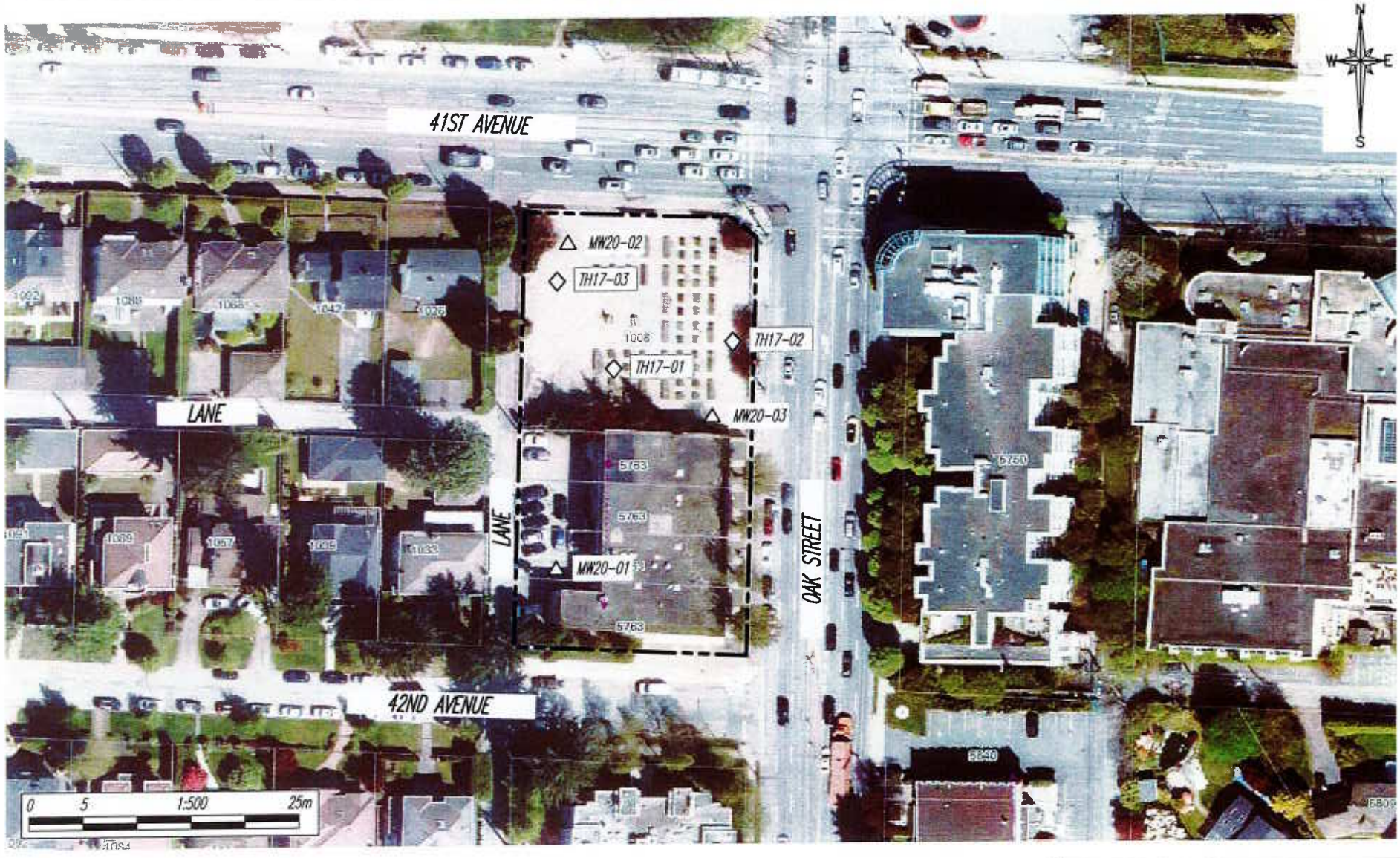
For:
GeoPacific Consultants Ltd.

Reviewed by:



Nathalie Sahakyan, 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
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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.

DESIGNED FOR 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
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INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Groundwater / Well	Remarks
0 / 0		Ground Surface			
		Asphalt (150 mm)	0.0		
		Sand Sand, some gravel, trace to some silt with depth, brown, compact, moist, fine-grained sand	1.2		
		Silt Silt, some sand, mottled brown-grey, stiff, moist	1.8		
		Sand and Gravel [TILL] Sand and Gravel, some silt, grey-brown, dense, moist, fine to coarse subrounded gravel, fine-grained sand			
		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

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Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Groundwater / Well	Remarks
41–43 (13)		***Sand*** Sand, trace fine gravel, trace silt, light brown-grey, dense, moist			
44–46 (14)		***Sand*** Sand, trace to some silt with depth, light brown-grey, dense, moist, medium-grained sand	13.7		
47–49 (15)					The screen was installed between 49 ft (14.9 m) and 59 ft (18.0 m)
50–52 (16)		***Sand*** Sand, some gravel, light brown-grey, dense, moist, fine to coarse subrounded gravel, medium-grained sand, coarsening with depth	15.2		
53–56 (17)					
57–59 (18)					
60–61		End of Borehole	18.3		
62–64 (19)					
65–67 (20)					
68–69 (21)					
70–72 (22)					
73–75 (23)					
76–78 (24)					
79–80					

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

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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		
7 / 2		***Sand [TILL]*** Sand, some fine gravel, some to trace silt with depth, grey-brown, dense, moist, medium-grained sand			
10 / 3					
13 / 4		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			
20 / 6					
23 / 7		6.0 m to 7. 3 m - cobbles			
26 / 8					
29 / 9		9.1 m to 10.6 m - trace to some silt			
33 / 10					
35 / 11			10.7		
39 / 12					
40					

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

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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 End of Borehole	21.3		The screen was installed between 48 ft (14.6 m) and 53 ft (16.1 m)

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

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INFERRED PROFILE

Depth (ft)	Depth (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			
10	3			3.0		
			Sand and Gravel [TILL] Sand and Gravel, some silt, grey, dense, moist, fine to coarse rounded gravel, medium-grained sand 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			The screen was installed between 23 ft (7.0 m) and 33 ft (10.0 m)
36	11			11.0		
			Sand Sand, trace to some silt, light brown-grey, dense, moist, medium-grained sand coarsening with depth			
40	12					

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

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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		***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		

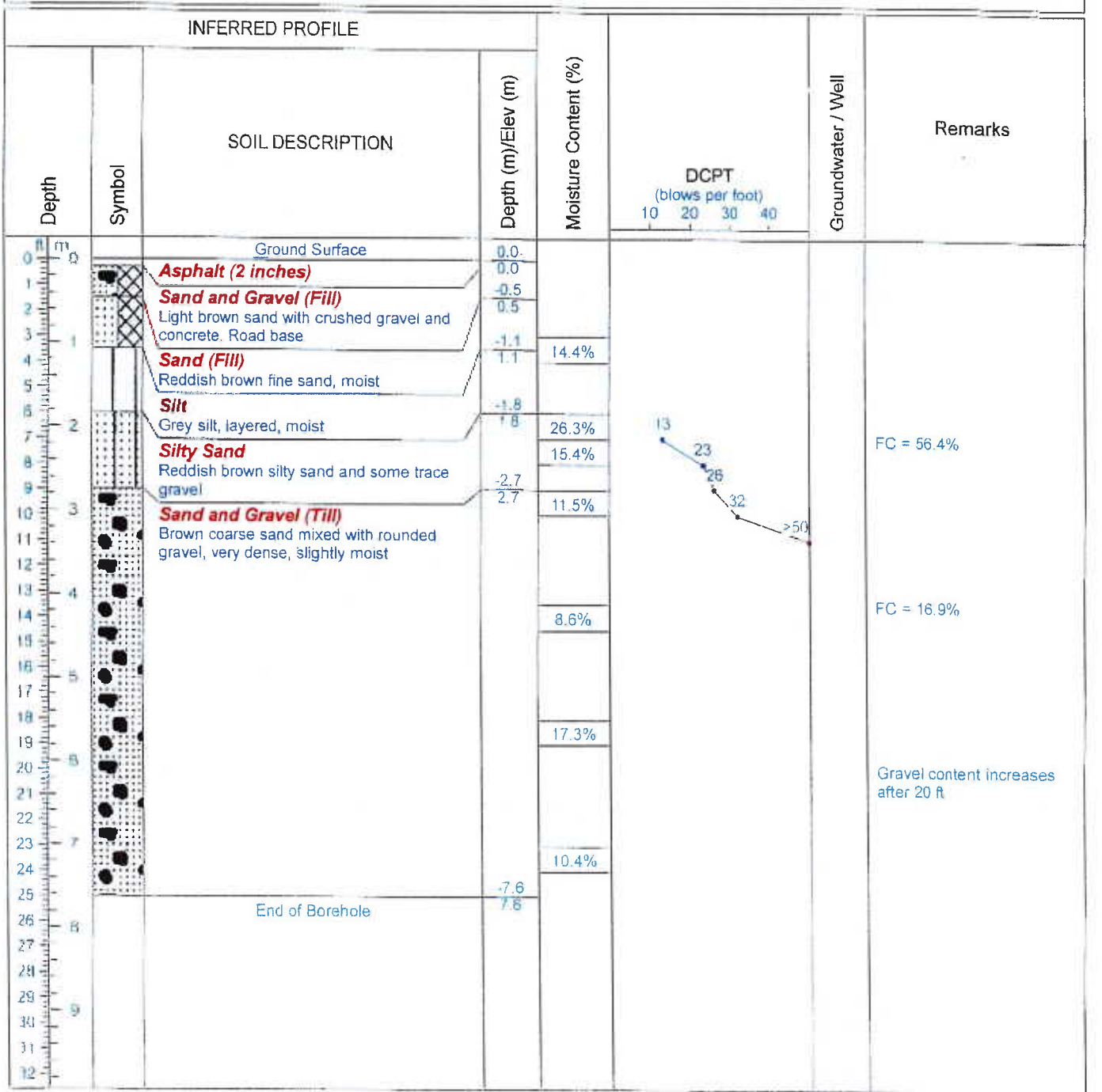
Logged: NP
Method: SONIC DRILING
Date: JANUARY 31, 2020

Datum: EXISTING GROUND
Figure Number: A.03

Test Hole Log: TH17-01

File: 15077
Project: 1008 W 41st Ave and 5763 Oak St. Proposed Residential Development
Client: Wesgroup
Site Location: 1008 W 41st and 5763 Oak St., Vancouver

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



Logged: MK
Method: Truck Mounted Auger
Date: 6/16/2017

Datum: Ground Level
Figure Number: 1
Page: 1 of 1

Test Hole Log: TH17-02

File: 15077
Project: 1008 W 41st Ave and 5763 Oak St. Proposed Residential Development
Client: Wesgroup
Site Location: 1008 W 41st and 5763 Oak St.

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INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 / 0		Ground Surface	0.0				
		Asphalt (2.5 inches)	0.0				
		Sand and Gravel (Fill) Road base of sand mixed with crushed gravel and concrete	-1.1				
1		***Sandy Silt*** Grey fine silt mixed with some sand, moist	1.1				
			-1.8	22.3%			FC = 81.8%
2		***Silty Sand*** Brown fine-medium sand with some silt, medium dense, slightly moist	1.8		26, 16, 20, 25, >50		
				11.9%			FC = 41.6%
3			-3.0				
		Sand and Gravel (Till) Greyish brown coarse sand and gravel, very dense, slightly moist	3.0				
4				7.4%			
5							
				7.2%			FC = 13.8%
6			-6.1				
		End of Borehole	6.1				
7							
8							
9							

Logged: MK
Method: Truck Mounted Auger
Date: 6/16/2017

Datum: Ground Level
Figure Number:
Page: 1 of 1

Test Hole Log: TH17-03

File: 15077
Project: 1008 W 41st Ave and 5763 Oak St. Proposed Residential Development
Client: Wesgroup
Site Location: 1008 W 41st and 5763 Oak St.

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Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 / 0		Ground Surface	0.0				
		Asphalt (2 inches)	0.0 / -0.5				
		Sand and Gravel (Fill) Sand mixed with crushed gravel and concrete. Road base	0.5 / -0.9	17.5%			
1		**Sand (Fill)** Reddish brown fine sand with trace silt, moist	0.9				
2		**Silty Sand** Reddish to dark brown medium sand with some trace gravel, stiff, moist	-2.1 / 2.1	18.3%	8		FC = 23.4%
				5.8%	24 32 >50		FC = 16.1%
3		**Sand (Till)** Till-like brownish grey sand with silt and trace rounded to subangular gravel. Dense, dry	-3.0 / 3.0				
		Sand and Gravel (Till) dark grey coarse sand mixed with gravel, very dense, slightly moist		5.9%			FC = 11.1%
5				8.3%			
7				8.3%			
		End of Borehole	-7.6 / 7.6				
8							
9							

Logged: MK
Method: Truck Mounted Auger
Date: 6/16/2017

Datum: Ground Level
Figure Number: 3
Page: 1 of 1

APPENDIX B

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

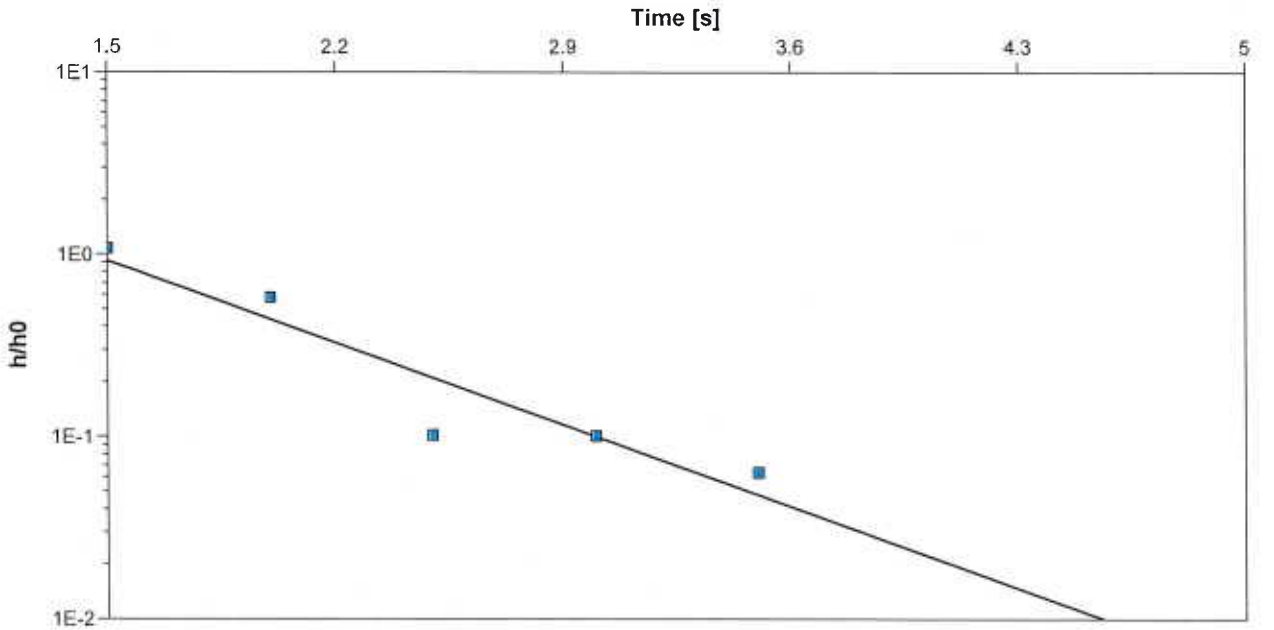
Slug Test Analysis Report

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

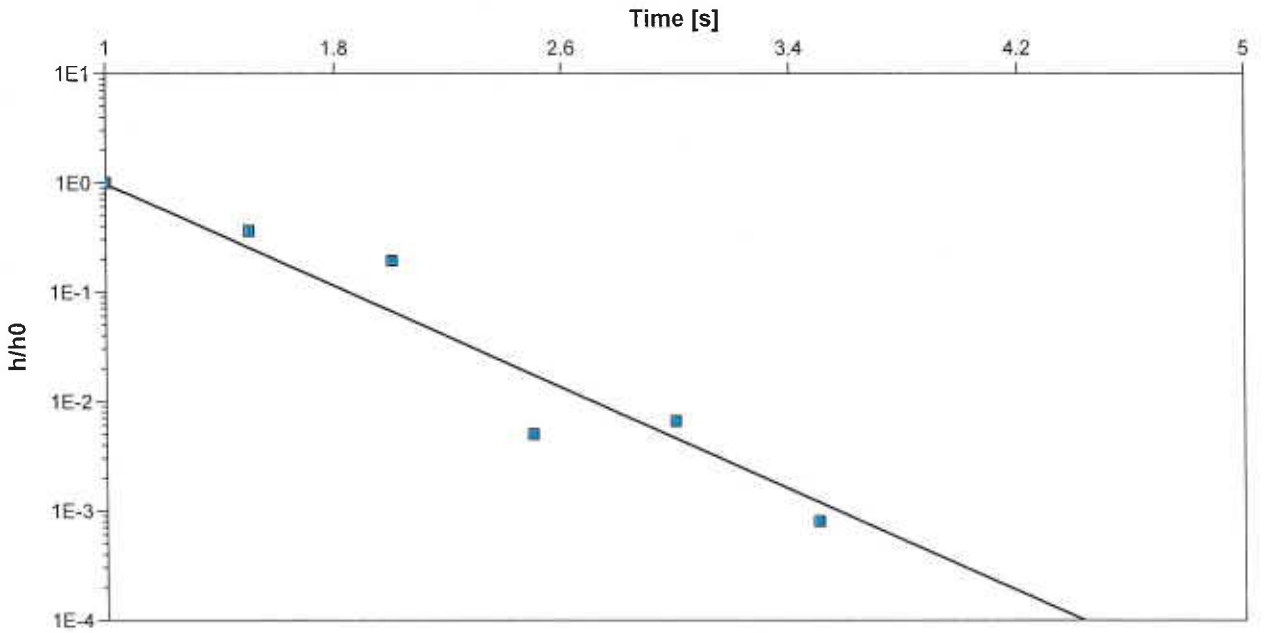
Slug Test Analysis Report

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

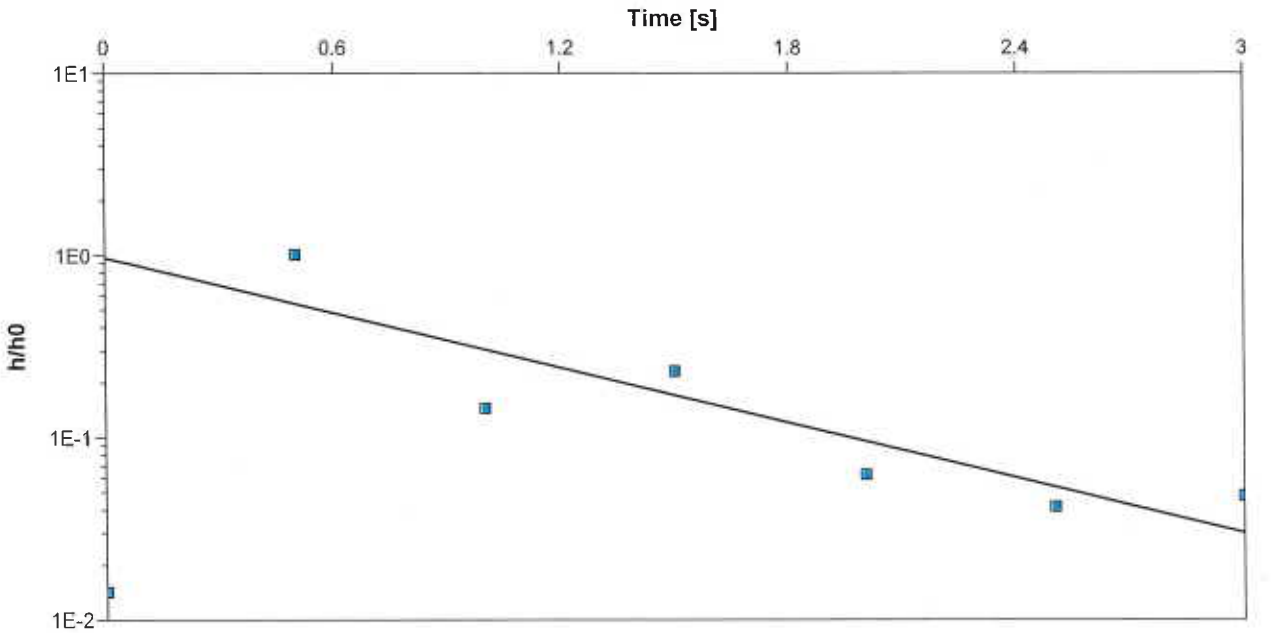
Slug Test Analysis Report

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

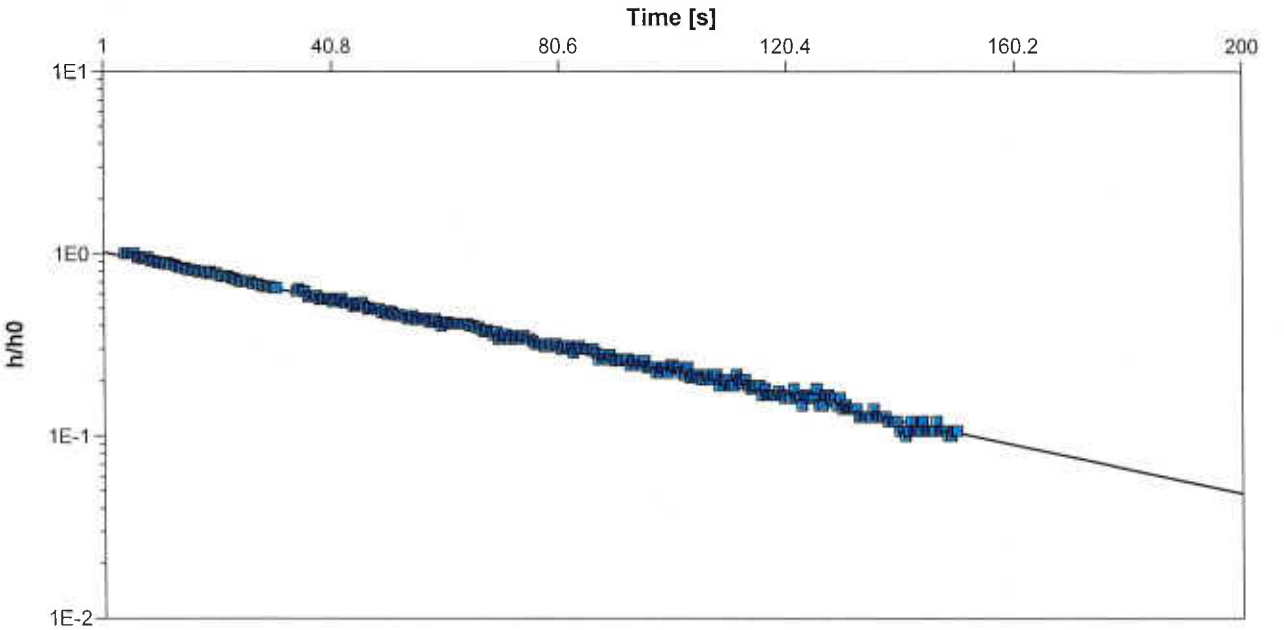
Slug Test Analysis Report

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

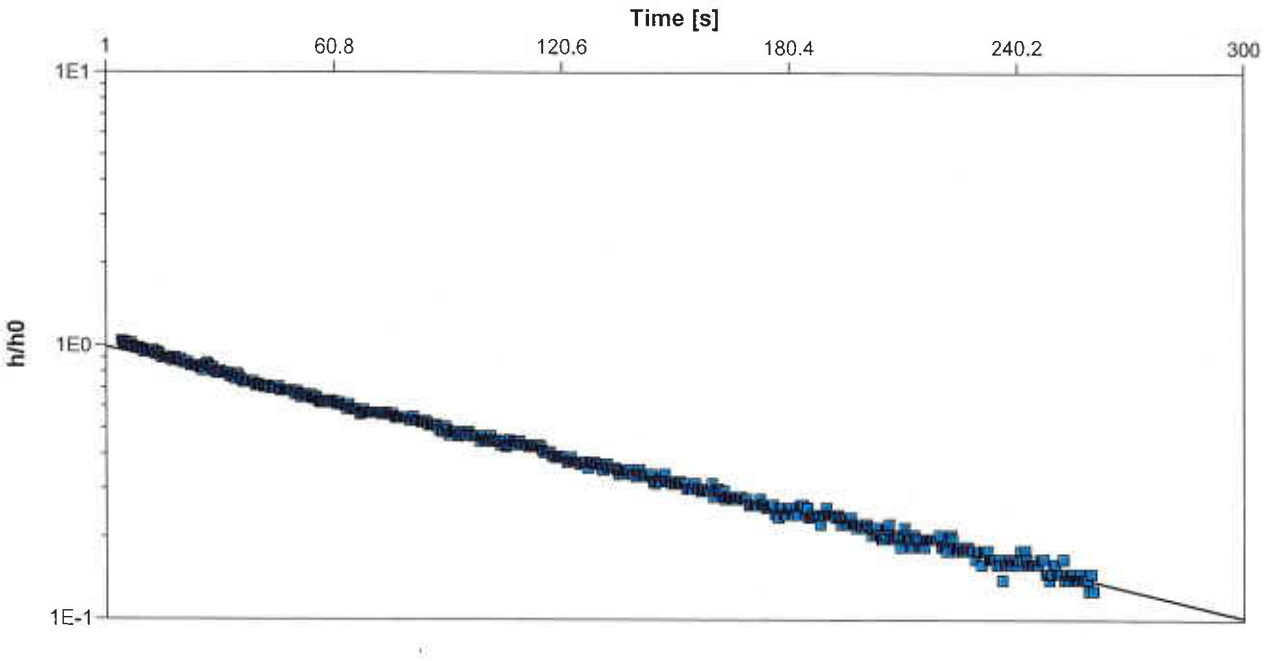
Slug Test Analysis Report

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

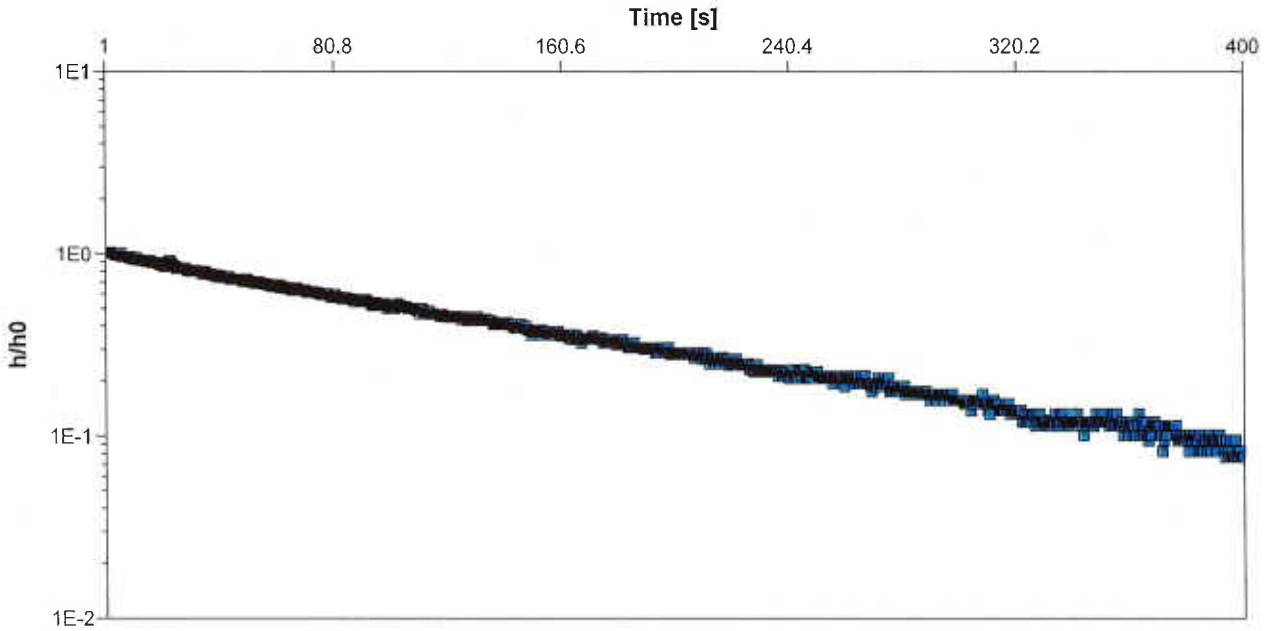
Slug Test Analysis Report

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

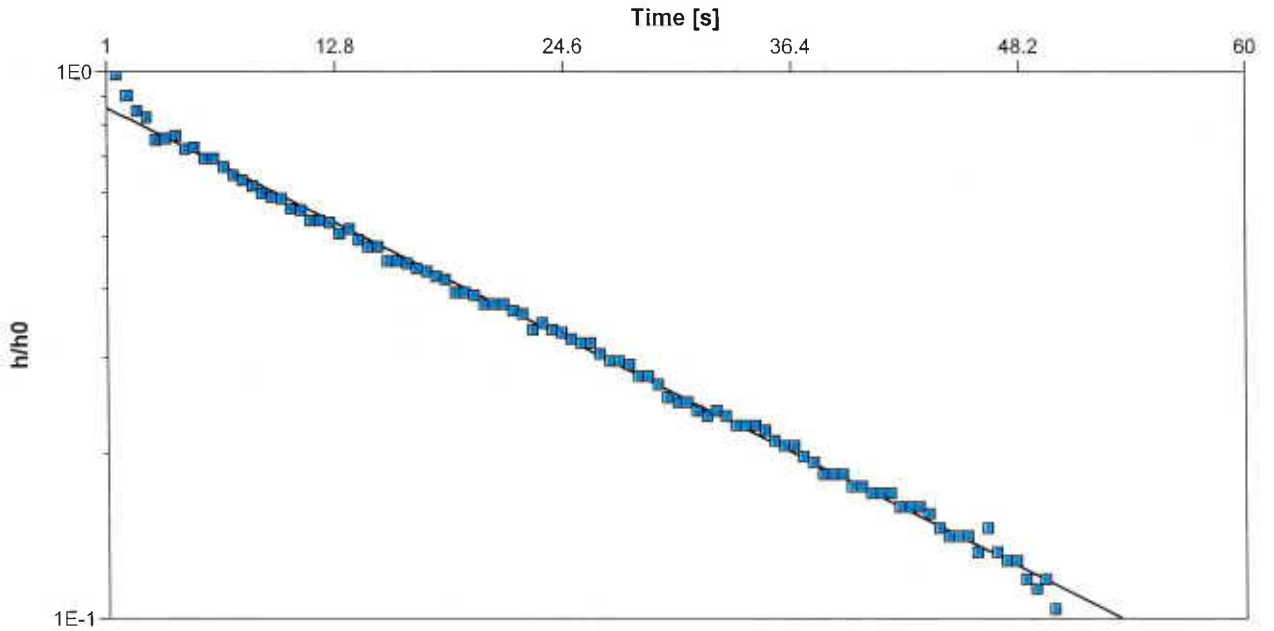
Slug Test Analysis Report

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

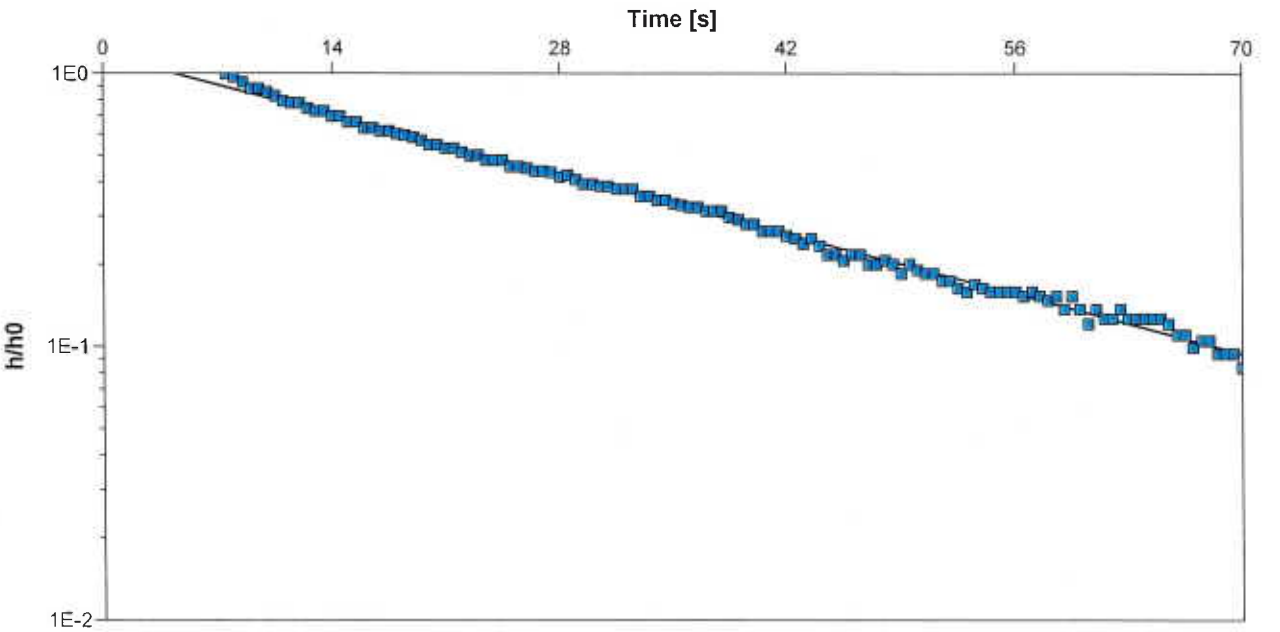
Slug Test Analysis Report

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

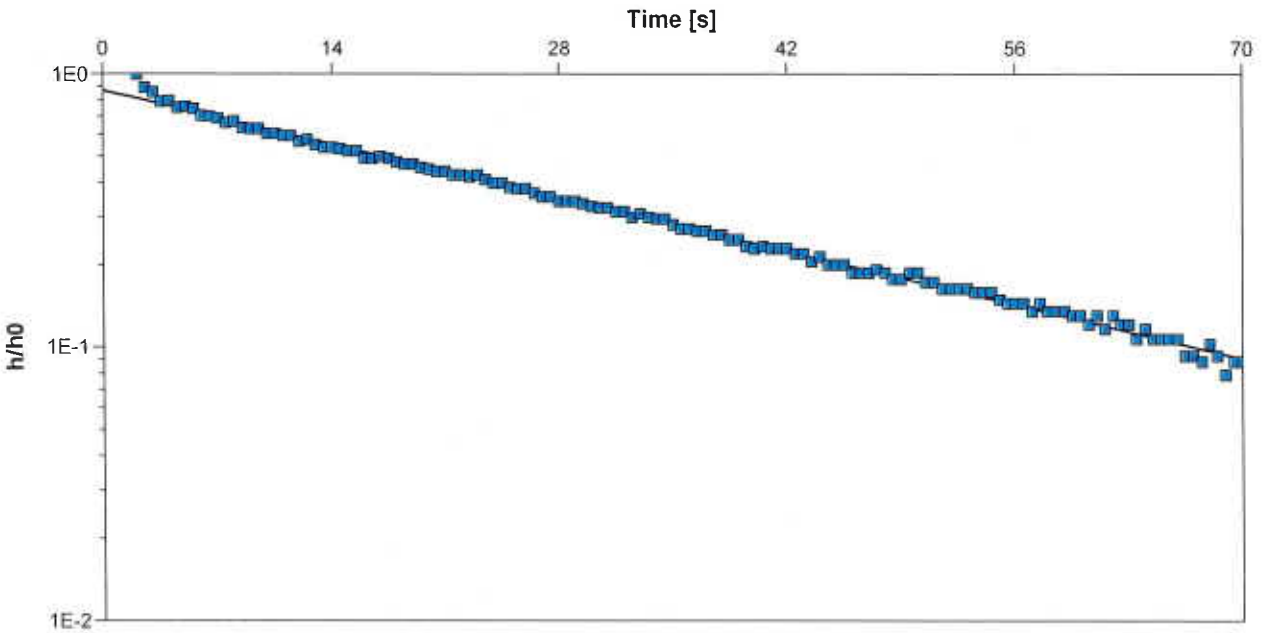
Slug Test Analysis Report

Project: Mixed-Use Development

Number: 15077-GW

Client: WesGroup

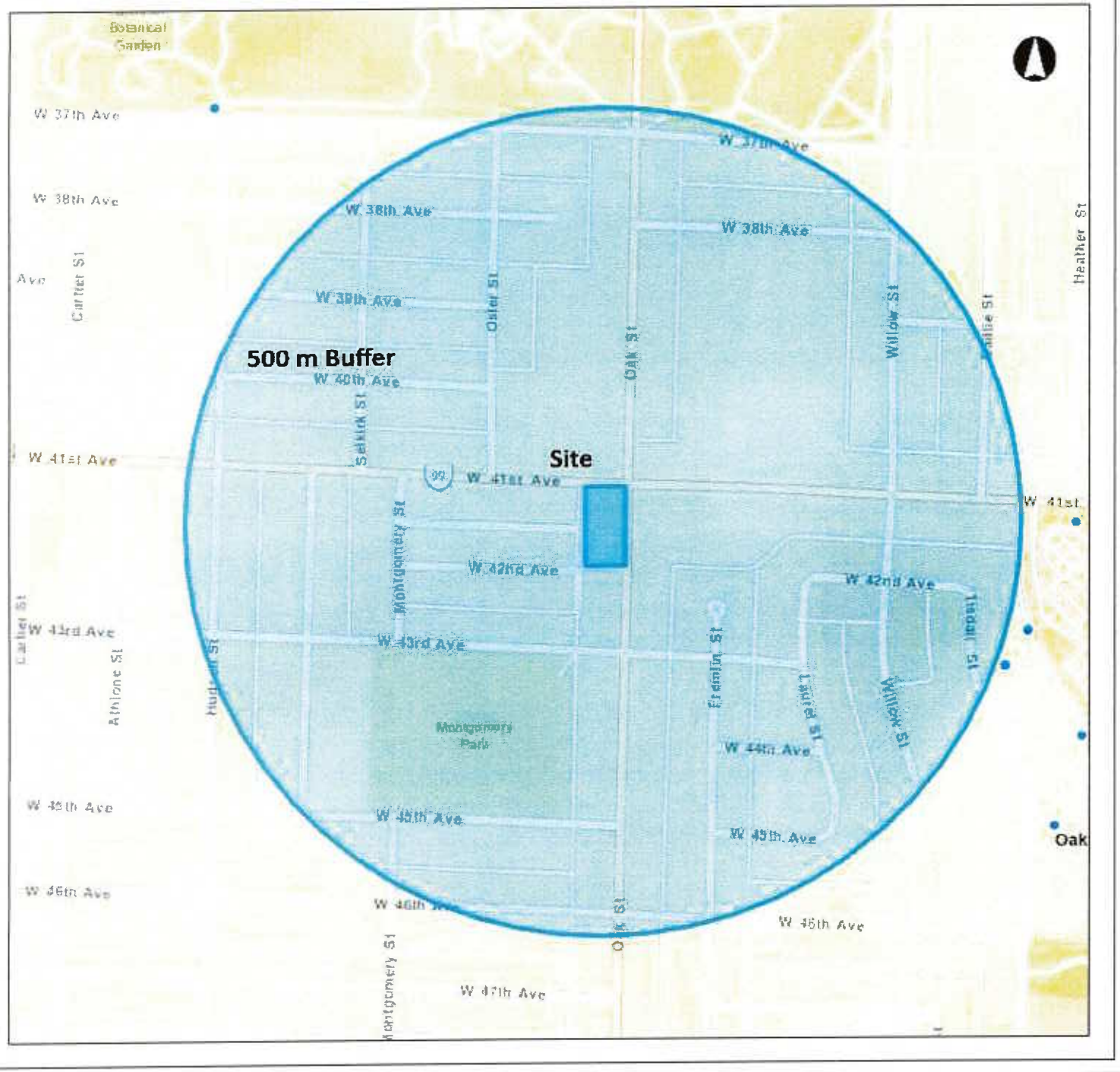
Location: 1008 W 41st Ave, Vancouver, BC	Slug Test: Falling Head Test	Test Well: MW20-02
Test Conducted by: NS		Test Date: 2020-04-19
Analysis Performed by: NS	Rising Head 3	Analysis Date: 2020-04-19
Aquifer Thickness:		



Calculation using Hvorslev

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

APPENDIX C



BRITISH COLUMBIA

Water Resources Atlas

Legend

Groundwater Wells - All

ARTESIAN_IND

- Reported Artesian Well
- Well

0 0.20 0.41 km

1: 10,000

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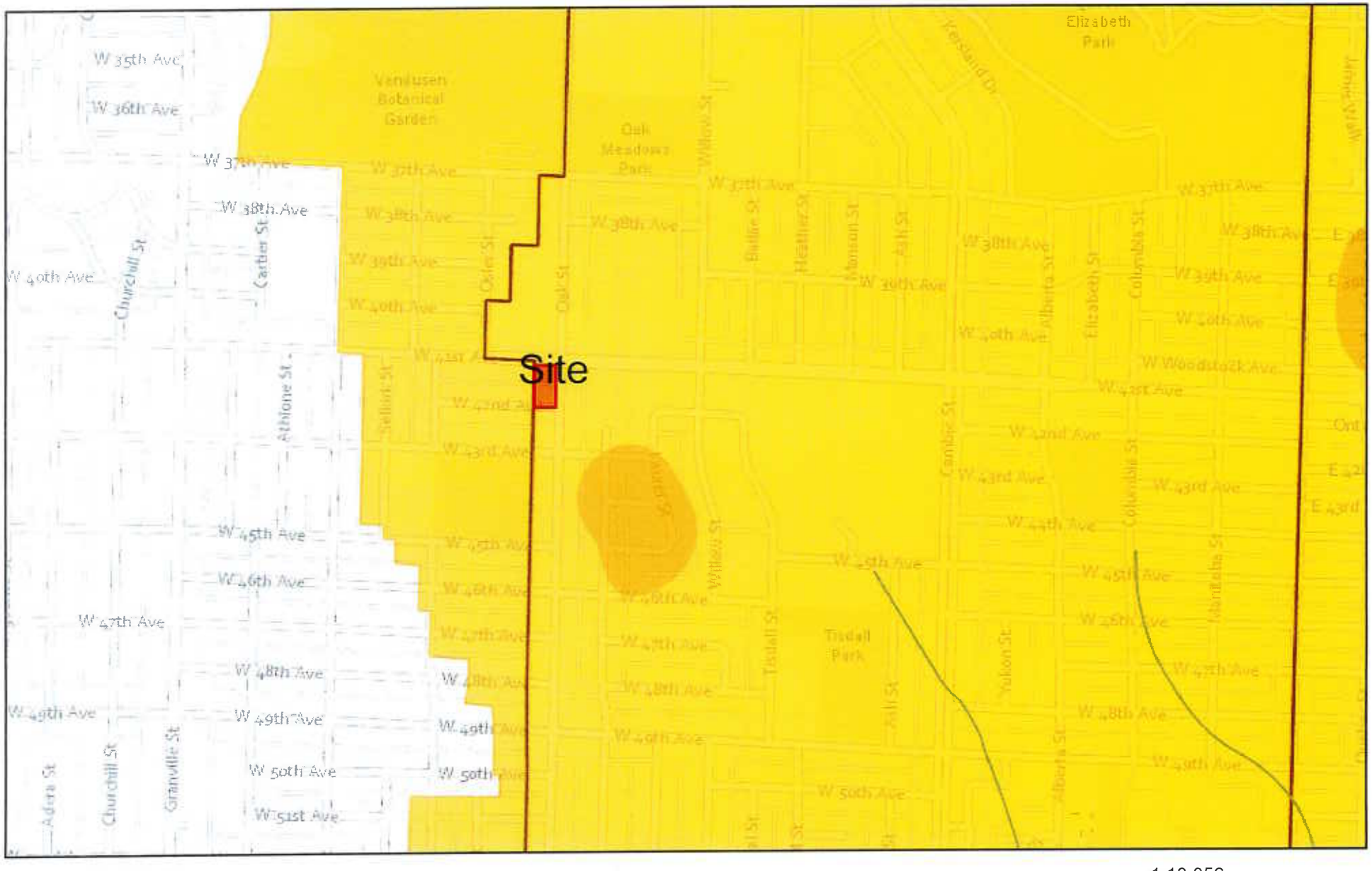
Datum: NAD83
Projection: BC Albers

Key Map of British Columbia



APPENDIX D

Groundwater Areas of Concern



2020-06-29, 5:29:15 p.m.

1:18,056

0 0.1 0.2 0.4 mi

0 0.15 0.3 0.6 km

Cambie Corridor Study Area Boundary

Potential Flowing Artesian Conditions (Province of BC Advisory)

Sewershed within the Cambie Corridor

Designated Floodplain

Web AppBuilder for ArcGIS