

GAMAN CONSULTANTS INC.

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March 7, 2023

SCAL Properties Ltd.
46 Lepage Court
Toronto, Ontario
M3J 1Z9

Attention: Mr. Amir Soleimani, Executive VP and COO

Dear Sirs:

Re: Hydrogeology Evaluation
Phase 2 Limen Head Office
15123 Woodbine Avenue
Town of Whitchurch-Stouffville, York Region
Our File 21013.02

GAMAN Consultants Inc. was retained by SCALS Property Ltd. to complete a hydrogeological report for two buildings proposed on separate future lots for the above noted development.

It is proposed to service the site with a drilled well for water supply, an on-site subsurface sewage disposal system and stormwater pond. A stormwater management report and sewage system report will be prepared as part of separate investigations for the site by other consultants. GAMAN prepared reports to evaluate: (i) water supply, (ii) assess the effects of sewage effluent on shallow groundwater and (iii) water balance for this site.

The proposed development is located east of Aurora fronting on Woodbine Avenue on a 4.02 ha parcel of land as shown on Figures 1 and 2. The site will be developed to support the Limen Head Office on the Phase 2A site of 1.52 ha and a future building on Phase 2B site on

2.50ha. It is proposed to service these future lots, subject of severance applications to the Town, with individual drilled wells for water supply, individual on-site subsurface sewage disposal systems and a stormwater pond. A stormwater management report and sewage system report will be prepared in support of planning applications for the site by other consultants. This report was prepared to summarize the effects of development on the groundwater resources.

A: SCOPE OF WORK AND OBJECTIVES

The purpose of this evaluation was to assess hydrogeological conditions beneath the site and assess the potential effects of development on surrounding receptors to support the planning applications and building permit. The work documented in this report is based on compiling information from three GAMAN Consultants Reports; (i) Water Supply Evaluation, (ii) MECP D-5-4 Evaluation, and (iii) Water Balance Evaluation that collectively provide the background hydrogeological information for this report.

The scope of work was comprised of evaluating existing information augmented with site-specific investigations for shallow soil and groundwater. The sources of information for this evaluation included:

- 1) MECP water well records.
- 2) Oak Ridges Moraine Groundwater Program Website.
- 3) Shallow soil and groundwater data obtained from site investigations.
- 4) Other readily available sources of information on the deeper aquifer that is a source of water for this site.

B: PHYSICAL SETTING

The site is situated within the Schomberg Clay Plains Physiographic Region as described by Chapman and Putnam (1984) and just north of the Oak Ridges Moraine. The clay plain in the vicinity of Newmarket is described as drumlinized till plain. The surficial geology illustrated

in Figure 3 shows the presence of drumlins in the vicinity of the site. The site is also located near the northern boundary of the Oak Ridges Moraine so there are sandy surficial deposits that extend onto the site and into the surrounding area.

Drainage is north to northwest through a tributary of the East Branch Holland River. The Holland River eventually discharges into Lake Simcoe at Cook's Bay.

C: SHALLOW GROUNDWATER

Shallow groundwater movement is a reflection of local topography and drainage. The Oak Ridges Moraine Groundwater Program (ORMGP) is an interactive web-site analytical tool used to evaluate hydrogeological data at a high scale. Figure 4 is an interpretation of shallow groundwater movement based on shallow groundwater monitors and wells in the database. The overall direction of shallow groundwater movement is northward through the site at a regional scale.

Groundwater monitoring at the site is ongoing and the groundwater levels are presented in Table 1. The early groundwater levels were collected from shallow monitors installed by a previous consultant for the previous property owner. GAMAN reached out to the consultant for the borehole records; however, they were not provided to the project team. The groundwater monitors are shallow and were used to sample shallow groundwater for nitrates and to refine groundwater levels for seasonal water table fluctuations. Soil-Eng completed a geotechnical investigation of the property and added three additional groundwater monitors in 2022 as shown in Figure 5. Groundwater level monitoring has been ongoing at the site for more than one year to document seasonal variations. During the summer of 2022, site grading and improvements to drainage occurred mostly on Phase 2 near BH2 and BH22-8. Most of the land north of these monitors was flooded with runoff because of man-made obstructions along the natural drainage path at the north property boundary. Groundwater levels may have been artificially higher for longer periods of time due to these issues. Groundwater levels from October 2022 to March 2023 show groundwater levels in Phase 2 were mostly greater than one metre below grade in the south and east sides of Phase 2. There is evidence of deeper groundwater levels on the central and north areas of Phase 2a;

however, poor drainage may contribute to groundwater mounding during the winter at BH2 and BH22-2. Groundwater level monitoring is ongoing for the site.

D: HYDROSTRATIGRAPHY

Aquifers are sources of groundwater yielding enough water to supply a well. Aquifers are commonly derived from saturated sand and/or gravel deposits within overburden and also from fractured bedrock. Aquitards are barriers to groundwater movement and can provide protection to aquifers from sources of contamination. Aquitards are commonly comprised of silt, clay, till or bedrock. Figure 6 is a stratigraphic cross section from west to east through the site. The section was created from the Oak Ridges Moraine Groundwater Program (ORMGP) website and extends from just west of Woodbine Avenue to Warden Avenue.

There are three hydrostratigraphic units of interest to this investigation.

- The Newmarket Aquitard
- The Oak Ridges Aquifer Complex
- The Thorncliffe Aquifer Complex

The Newmarket (Till) Aquitard is the uppermost stratigraphic unit beneath the site. This unit is expected to behave as an aquitard that protects or buffers deeper sources of groundwater from contamination.

The Oak Ridges Moraine is a source of groundwater for municipal, communal, and individual wells and is referred to as the Oak Ridges Aquifer Complex (ORAC). It is a major recharge area for deeper aquifers and a source of recharge for the headwaters to many streams originating on or down hill of the Moraine. The ORAC is exposed at surface east of the site as shown in Figure 6.

The Thorncliffe (Formation) Aquifer Complex is an aquifer where its composition is comprised of coarser deposits of saturated sand and/or gravel. Locally, the Thorncliffe Aquifer Complex (TAC) is a source of groundwater to municipal, communal and individual

wells in the vicinity of Aurora, Newmarket and the Town of Whitchurch-Stouffville. The TAC is a proposed source of groundwater for this site as described later in this report.

The west to east Cross-Section shows deeper stratigraphic units comprised of other aquitards or aquifers. These deeper deposits are below the hydrostratigraphic units relevant to this hydrogeological evaluation.

E: WATER SUPPLY

GAMAN prepared a report dated February 11, 2023 to document the water supply requirements for the site. The evaluation proposed drilling a water well for each building with the capacity to supply up to 9,000 L/day per building. The evaluation was based on 20,000 L/day to be conservative and provided the following conclusions:

- 1) The deep aquifer referred to as the TAC would be the target aquifer for water supply.
- 2) The majority of wells extend into the Thorncliffe Aquifer Complex (TAC). The average test rate of wells terminating in the TAC and appearing in Figure 7 is 68 L/min and exceeds the average demand of 6.25 L/min for each building.
- 3) Water quality appears reasonable.
- 4) Predicted changes in groundwater levels to neighbouring wells should be acceptable.

F: GROUNDWATER QUALITY

The well records in the vicinity of this site document water quality as fresh. Water quality analysis will be completed at the future well at this site to verify the need for treatment according to Ontario Regulation 170/03 as Amended.

Samples of groundwater were collected from two shallow boreholes to document background shallow groundwater quality. The two boreholes BH4 and BH8 are located on the south sides of the entire property. Water quality was discussed in the Water Balance Evaluation by GAMAN Consultants. Nitrates and nitrites were at low background concentrations in shallow groundwater.

G: EFFECTS ASSESSMENT

This hydrogeological report summarizes the effects of groundwater taking and development of the site on receptors such as local wells and recharge to the water table. The Groundwater Supply Evaluation and the Water Budget Evaluation reports prepared by GAMAN provide additional details.

The Water Supply Evaluation report documented the potential effects of pumping a well to service this site. The Thorncliffe Aquifer Complex is a thick and productive aquifer in this study area. The water supply report documents a cone of depression to 0.5 metres of drawdown extends less than 200 metres from the wells. There is more than 20 metres of available drawdown for wells terminating in the Thorncliffe Aquifer. This small change in groundwater level around the two proposed wells is not expected to have an adverse effect to neighbouring wells including dwellings serviced with shallow dug wells or sand points.

The Water Budget Evaluation considered the effects of creating impermeable surfaces on reductions to groundwater recharge. The recharge deficit for this site is calculated at 2,517 m³/year, equivalent to a 65% reduction in recharge. This volume of water requires the use of LID systems to be established during detailed design of the site to capture runoff from the office buildings. The volume of roof from the buildings alone could provide enough make-up water to off-set the recharge deficit.

Tertiary treatment including nitrate reduction will be needed to reduce sewage effluent to acceptable concentrations at the property boundary.

H: SUMMARY

The updated hydrogeological evaluation documented in this report provides evidence showing the site can be developed without causing adverse impacts to groundwater quantity and quality. Groundwater monitoring across the site between October 2022 and March 2023 show some areas of the site provide more than 1 metre of separation from grade to the water table. Additional monitoring is occurring at the site.

The proposal to develop this site will result in a loss in infiltration that will be offset by Low Impact Development (LID) systems. The stormwater management team will explore the use of suitable systems such as infiltration trenches and/or permeable pavement to off-set the recharge deficit.

Groundwater from the Thorncliffe Aquifer appears to be available to service these buildings and will be confirmed in the future. Nitrate reduction will be needed to treat sewage effluent prior to discharge to the sewage disposal systems.

We trust that this is satisfactory.

Yours truly,

GAMAN Consultants Inc.

Gary R. Hendy, P.Eng.

Consulting Engineer

Grh

Attachments



NOTES

SITE LOCATION

Hydrogeology Evaluation, Phase 2 Limen Head Office,
15123 Woodbine Avenue
For SCAL Properties Ltd

Date:	Mar-23	Scale:	as shown
Project:	21013.02	Ref No:	

GAMAN Consultants Inc.

Figure

KEY MAP



SITE STATISTICS (PHASE 2 - 2A)

DESCRIPTION

BLOCK 19, REGISTERED PLAN 65M-2571
PART LOT 20, CONCESSION 4
TOWN OF WHITCHURCH-STOUFFVILLE
REGION OF YORK

RE ZONING REQUEST

'EBP' EMPLOYMENT BUSINESS PARK
SUBJECT LOT (2A) AREA = 1.52 HECTARES
/ 3.75 ACS

PROPOSED BUILDING AREA/GFA/INDOOR
STORAGE = 1456 S.M / 15672 S.F

PROPOSED LANDSCAPED AREA = 7034.6
S.M., 46.2% (10% REQ'D)

PARKING SPACES PROPOSED = 134
SPACES (INCL. 6 B/F SPACES)
PARKING SPACES REQUIRED = 146
SPACES (INCL. 6 B/F SPACES)

SITE STATISTICS (PHASE 2 - 2B)

DESCRIPTION

BLOCK 19, REGISTERED PLAN 65M-2571
PART LOT 20, CONCESSION 4
TOWN OF WHITCHURCH-STOUFFVILLE
REGION OF YORK

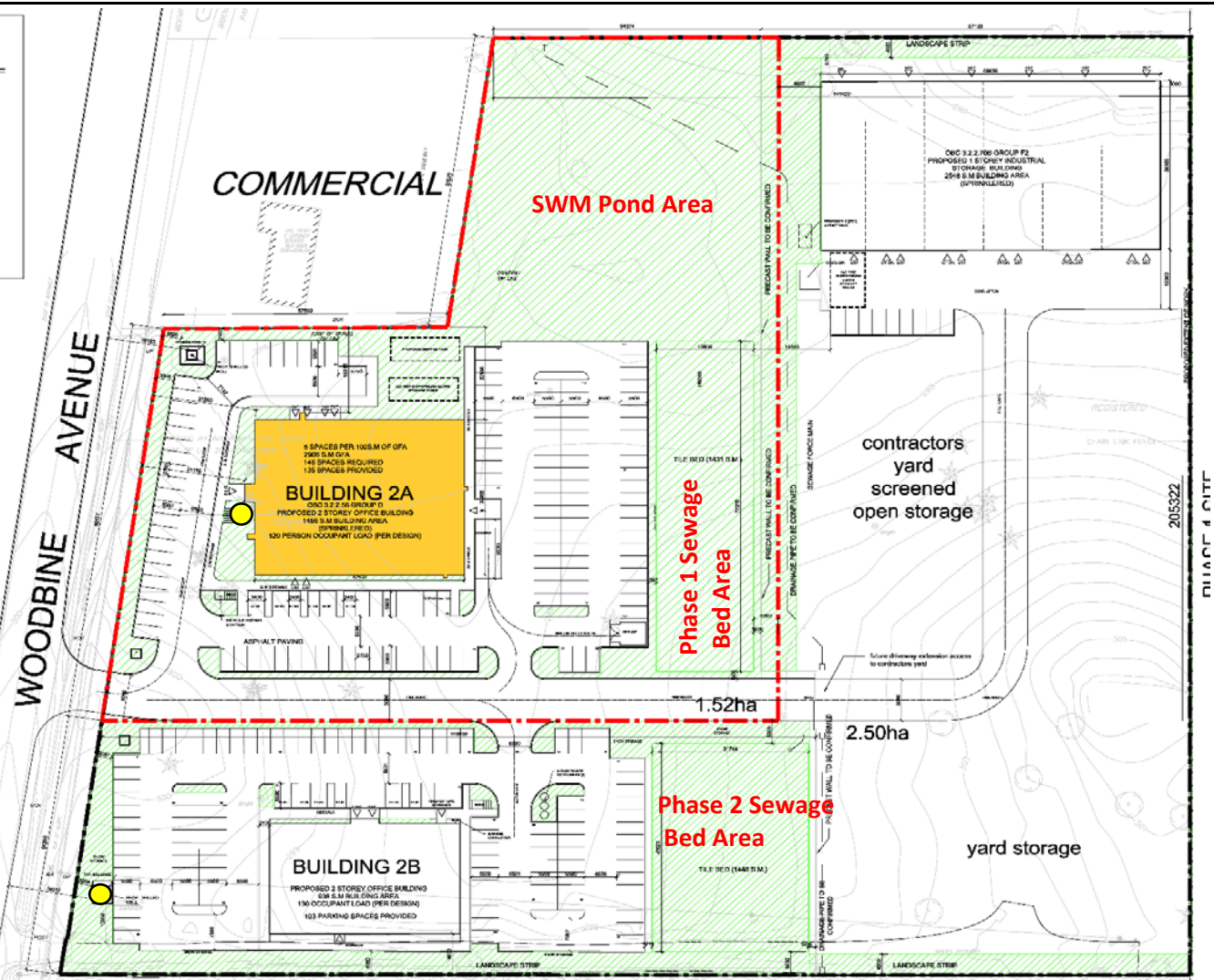
RE-ZONING REQUEST

'EBP' EMPLOYMENT BUSINESS PARK
SUBJECT LOT (2B) AREA = 2.50 HECTARES
/ 6.17 ACS

PROPOSED BUILDING AREA/GFA/INDOOR
STORAGE = 3486 S.M / 37523 S.F

PROPOSED LANDSCAPED AREA = 4260
S.M., 17.0% (10% REQ'D)

PARKING SPACES PROPOSED = 103
SPACES (INCL. 6 B/F SPACES)
PARKING SPACES REQUIRED = 96 SPACES
(INCL. 6 B/F SPACES)



NOTES



Future Drilled Well Locations



Areas where infiltration can occur.

Site Plan

Hydrogeology Evaluation, Phase 2 Limen Head Office,
15123 Woodbine Avenue
For SCAL Properties Ltd

Date: Mar-23

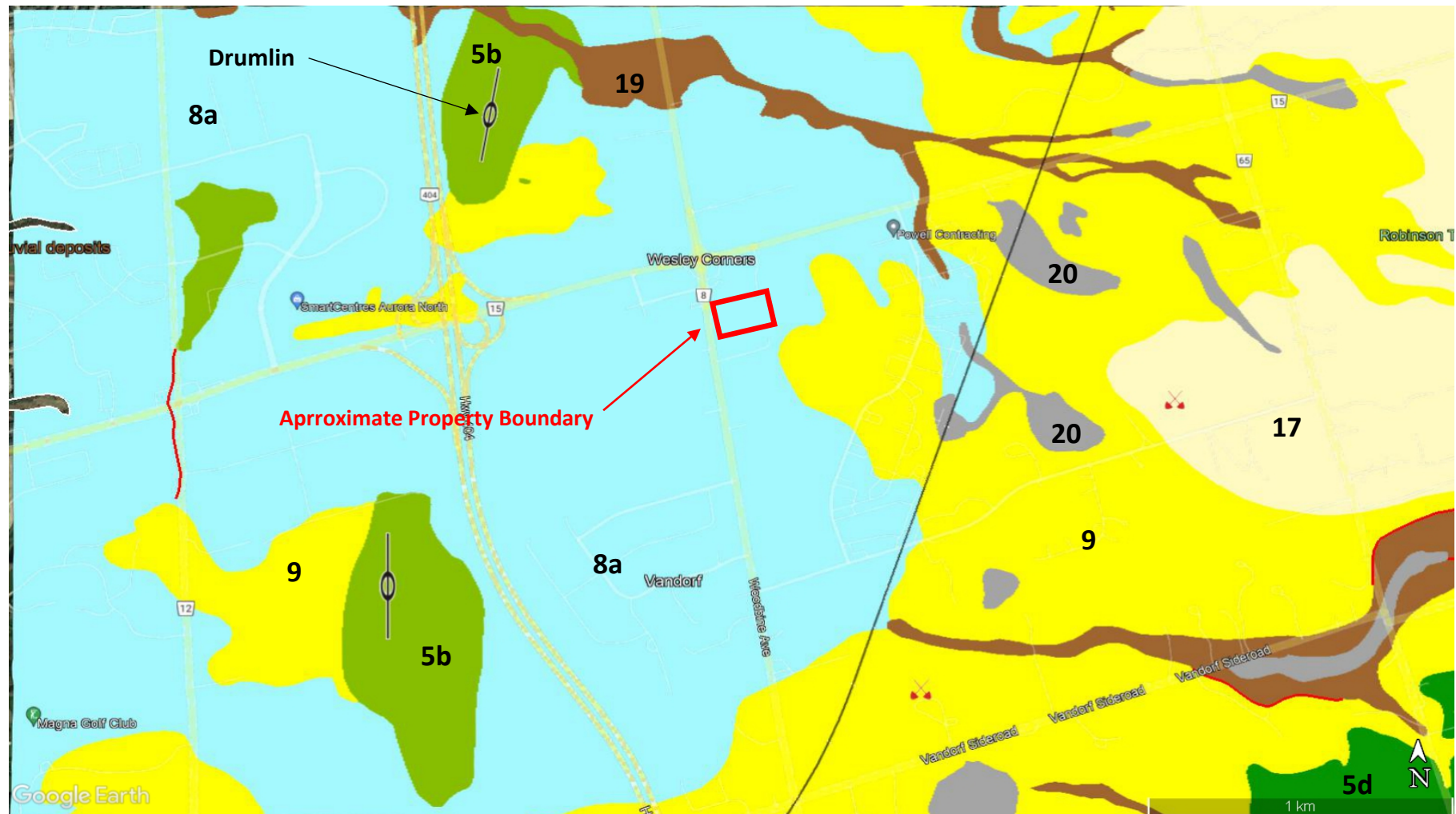
Scale: as shown

Project: 21013.02

Ref No:

GAMAN Consultants Inc.

Figure



NOTES

5b	Sandy silt to silty sand till
5d	Clay to silt textured till
8a	Fine Textured Glaciolacustrine Deposits (silt & clay, trace sand/gravel)
9	Coarse Textured Glaciolacustrine Deposits
17	Fine to very fine sand and silt
19	Modern Alluvial Deposits (gravel sand, silt, clay)
20	Organic Deposits (peat, muck marl)

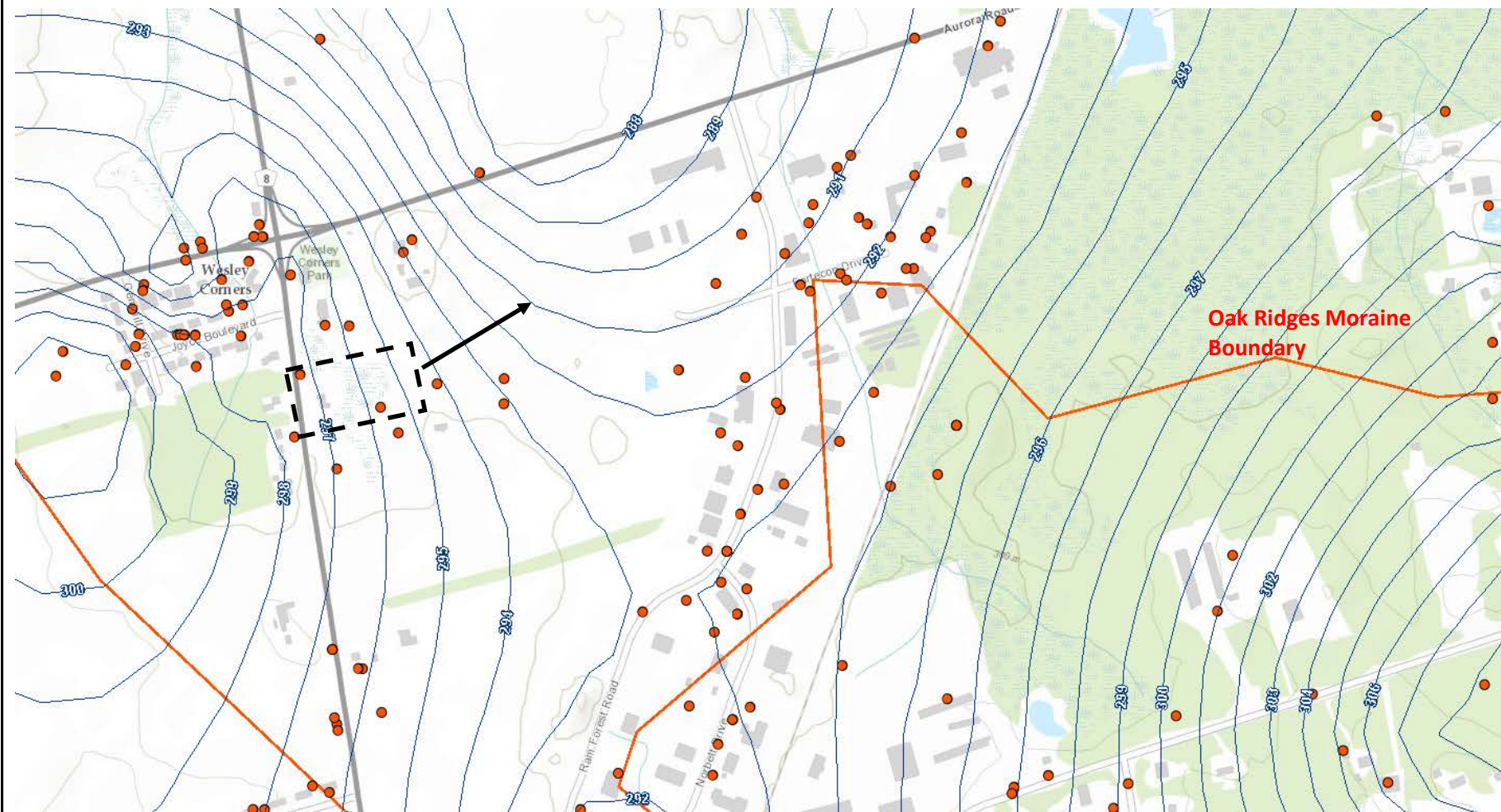
Surficial Geology

Hydrogeology Evaluation, Phase 2 Limen Head Office,
15123 Woodbine Avenue
For SCAL Properties Ltd

Date:	Mar-23	Scale:	as shown
Project:	21013.02	Ref No:	

GAMAN Consultants Inc.

Figure



NOTES

Groundwater Table Elevations -Oak Ridges Moraine Groundwater PGM



Approximate Site Boundary



Interpretion direction of shallow groundwater movement

Shallow Groundwater Movement

Hydrogeology Evaluation, Phase 2 Limen Head Office,
15123 Woodbine Avenue
For SCAL Properties Ltd

Date: Mar-23

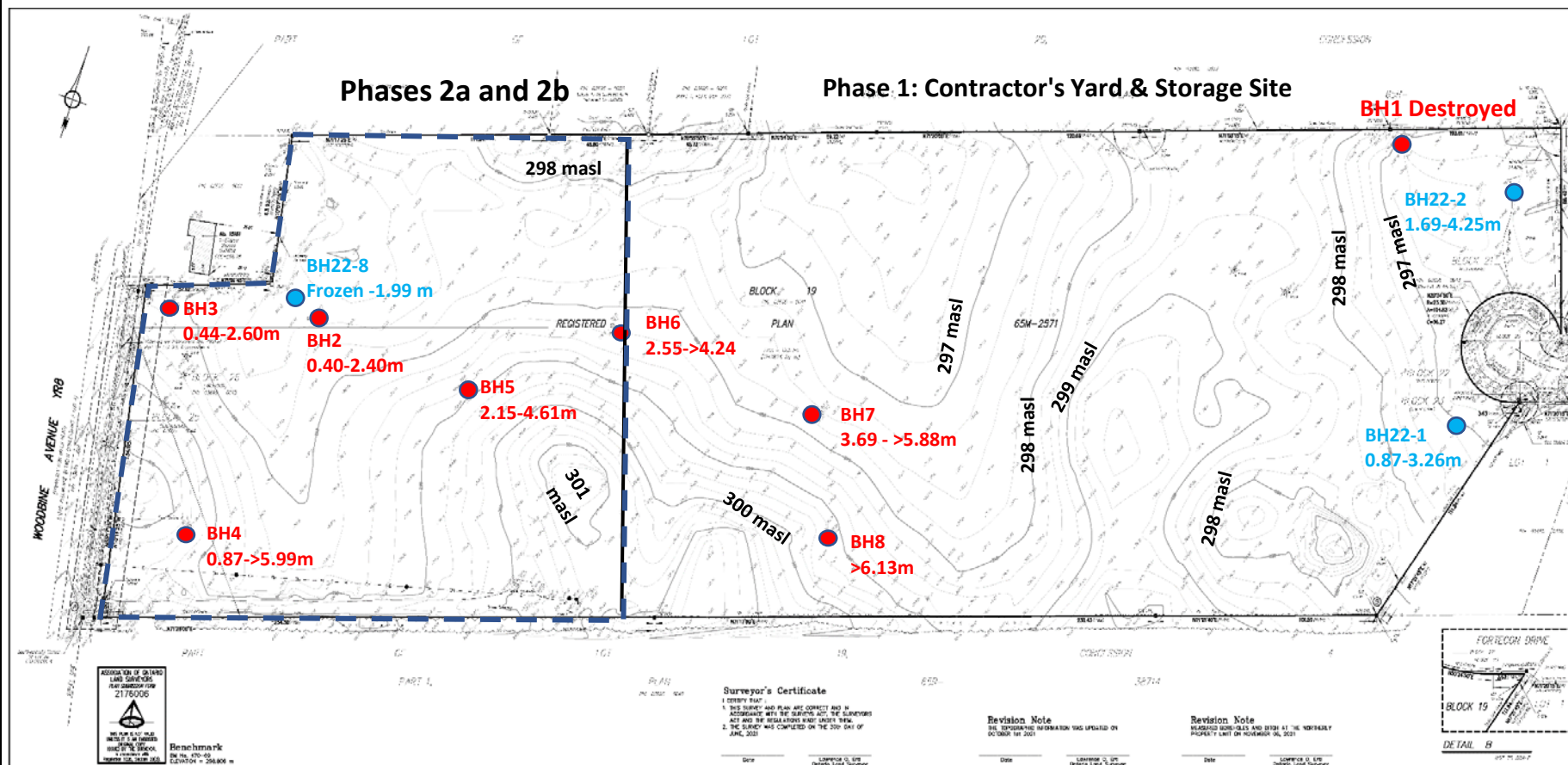
Scale: as shown

Project: 21013.00

Ref No:

GAMAN Consultants Inc.

Figure



Notes

- >6.13** depths to groundwater, metres below ground surface
- BH8** ● **>6.13** Borehole Designation (BH Logs not available)
- BH22-1** ● **3.26** Soil-Eng Borehole Designation, groundwater mbgl
- Borehole locations are approximate
- 300 masl topographic contour metres above sea level



Phase 2 Boundary (Approximate)

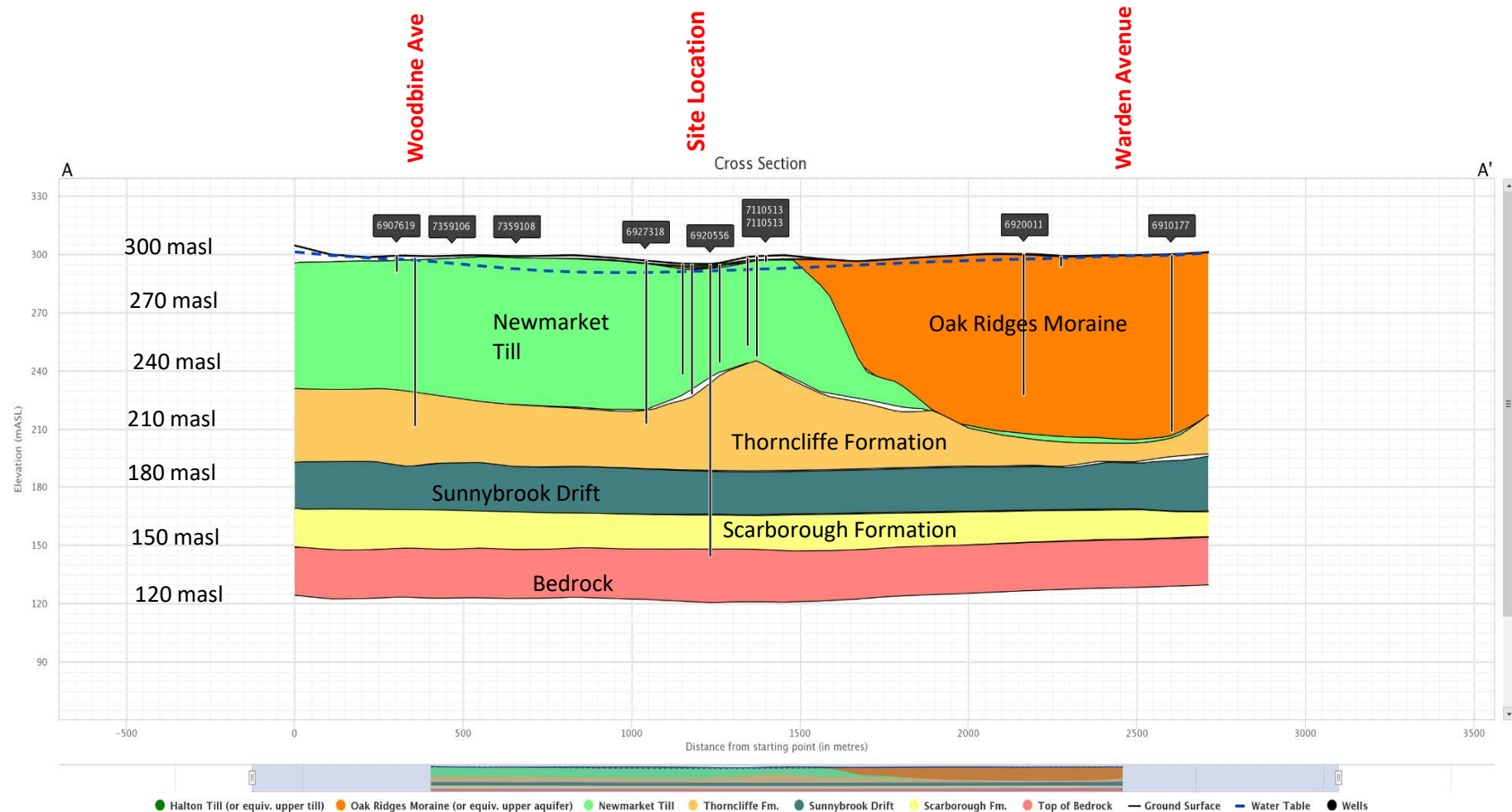
Depths to Groundwater Oct 2022 to Mar 2023

Hydrogeology Evaluation, Phase 2 Limen Head Office,
15123 Woodbine Avenue
For SCAL Properties Ltd

Date:	Mar-23	Scale:	as shown
Project:	21013.02	Ref No:	

GAMAN Consultants Inc.

Figure 5



NOTES

Source of Information: -Oak Ridges Moraine Groundwater Program

Cross Section A-A'

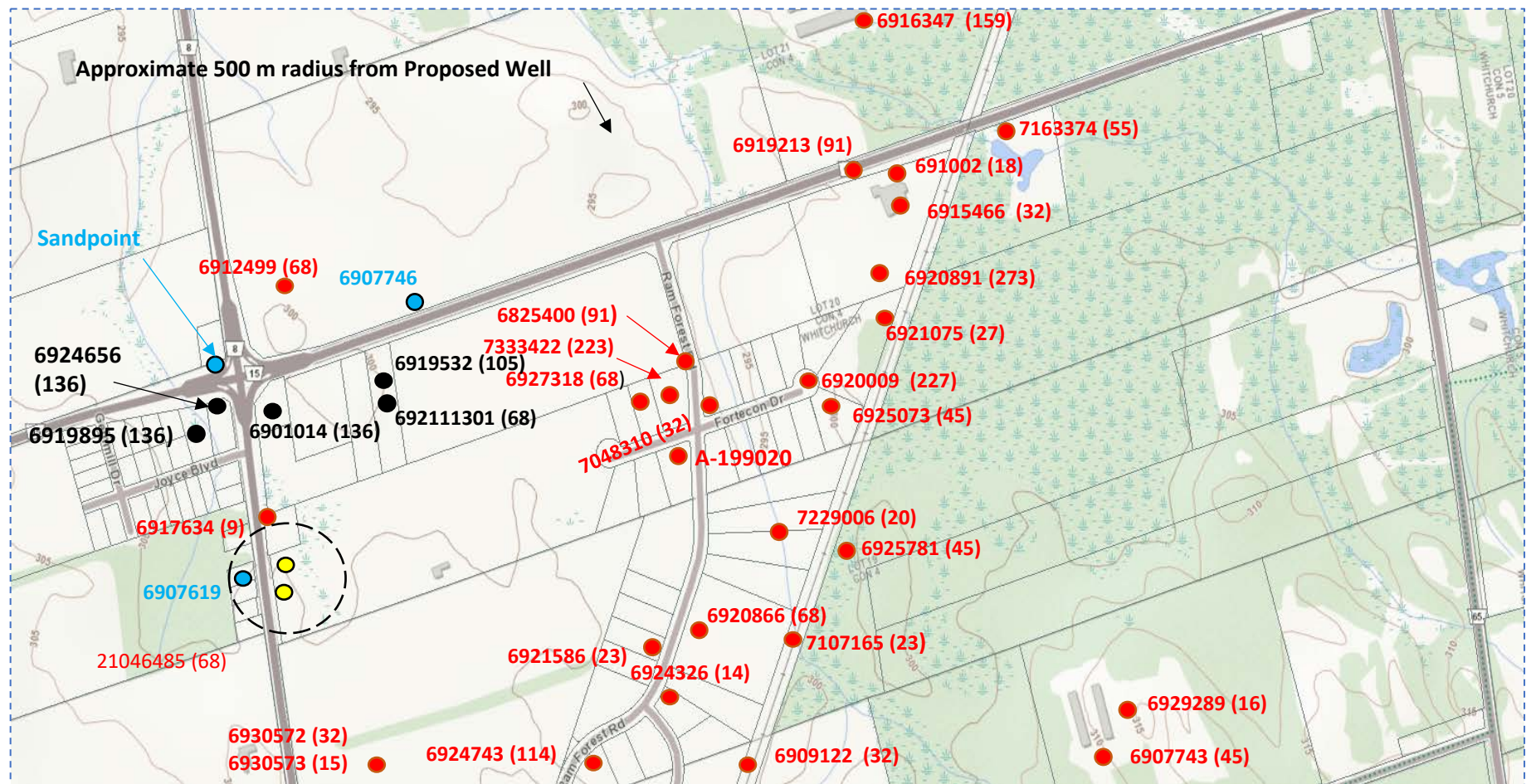
Hydrogeology Evaluation, Phase 2 Limen Head Office,
15123 Woodbine Avenue
For SCAL Properties Ltd

Date: Mar-23 Scale: as shown

Project: 21013.00 Ref No:

GAMAN Consultants Inc.

Figure



NOTES

- Proposed Well Locations (approximate)
- Wells terminating Thorncliffe Aquifer Complex (test rate L/min)
- Dug Well
- Drilled Wells Less Than 30m Deep (test rate L/min)

○ Predicted Zone of Influence to 0.5 metres for drawdown at 20,000 L/day combined pumping Phases 2A/2B

Water Well Location Map

Hydrogeology Evaluation, Phase 2 Limen Head Office,
15123 Woodbine Avenue
For SCAL Properties Ltd

Date: Mar-23 Scale: as shown

Project: 21013.02 Ref No:

GAMAN Consultants Inc.

Figure

TABLE 1 MONITOR DETAILS & GROUNDWATER LEVELS

Project: Hydrogeology Phase 2 Limen Head Office
15123 Woodbine Ave. (21013.02)

Monitor Details						15-Sep-21			21-Nov-21			12-Mar-22		
Monitor	Well Depth (mbtoc)	Casing Stickup (magl)	Casing Elev.	Ground Elev.	Depth (mbgl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev. (masl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev. (masl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev. (masl)
BH1	4.52	0.67	299.34	298.67	3.85	3.28	2.61	296.07	destroyed			destroyed		
BH2	4.69	0.69	298.52	297.52	4.00	1.84	1.15	296.69	2.96	2.27	295.56	0.67	Frozen	
BH3	4.79	0.73	299.00	298.12	4.06	1.78	1.05	297.22	1.04	0.31	297.96	0.73	Frozen	
BH4	6.69	0.70	300.45	299.60	5.99	4.78	4.08	295.67	1.64	0.94	298.81	1.33	0.63	299.12
BH5	5.98	0.78	299.61	298.67	5.20	4.57	3.79	295.04	2.02	1.24	297.59	2.02	1.24	297.59
BH6	5.05	0.81	299.00	298.09	4.24	3.64	2.83	295.36	1.66	0.85	297.34	1.62	0.81	297.38
BH7	6.78	0.90	298.33	297.44	5.88	4.30	3.40	294.03	1.65	0.75	296.68	1.88	0.98	296.45
BH8	6.80	0.67	299.99	299.15	6.13	5.64	4.97	294.35	2.27	1.60	297.72	1.74	1.07	298.25
BH22-1	5.36	0.86	298.26	297.40	4.5							1.03	0.17	297.23
BH22-2	5.36	0.86	297.86	297.00	4.5							1.47	0.61	296.39
BH22-8	5.46	0.96	298.56	297.60	4.5							0.75	Frozen	297.81

mbtoc = metres below topp of casing

mbgl - metres below ground level

BH22-1, BH22-2, BH22-8 are Soil-Eng Borehole Monitors and construction data are from the Borehole Logs

TABLE 1 MONITOR DETAILS & GROUNDWATER LEVELS**Project: Hydrogeology Phase 2 Limen Head Office****15123 Woodbine Ave. (21013.02)**

Monitor Details						24-Apr-22			5-May-22			15-Jun-22		
Monitor	Well Depth (mbtoc)	Casing Stickup (magl)	Casing Elev.	Ground Elev.	Depth (mbgl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev. (masl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev. (masl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev. (masl)
BH1	4.52	0.67	299.34	298.67	3.85	destroyed			destroyed			destroyed		
BH2	4.69	0.69	298.52	297.52	4.00	0.95	0.26	297.57	1.24	0.55	297.28	1.19	0.50	297.33
BH3	4.79	0.73	299.00	298.12	4.06	0.91	0.18	298.09	0.93	0.20	298.07	1.10	0.37	297.90
BH4	6.69	0.70	300.45	299.60	5.99	1.51	0.81	298.94	1.42	0.72	299.03	1.59	0.89	298.86
BH5	5.98	0.78	299.61	298.67	5.20	1.62	0.84	297.99	1.72	0.94	297.89	2.27	1.49	297.34
BH6	5.05	0.81	299.00	298.09	4.24	1.47	0.66	297.53	1.78	0.97	297.22	1.98	1.17	297.02
BH7	6.78	0.90	298.33	297.44	5.88	1.22	0.32	297.11	1.31	0.41	297.02	2.18	1.28	296.15
BH8	6.80	0.67	299.99	299.15	6.13	1.35	0.68	298.64	1.43	0.76	298.56	1.89	1.22	298.10
BH22-1	5.36	0.86	298.26	297.40	4.5	1.09	0.23	297.18	1.14	0.28	297.12	1.44	0.58	296.82
BH22-2	5.36	0.86	297.86	297.00	4.5	1.20	0.34	296.66	1.21	0.35	296.65	1.35	0.49	296.51
BH22-8	5.46	0.96	298.56	297.60	4.5	0.99	0.03	297.57	1.04	0.08	297.52	1.01	0.05	297.55

mbtoc = metres below topp of casing

mbgl - metres below ground level

BH22-1, BH22-2, BH22-8 are Soil-Eng Borehole Monitors and
construction data are from the Borehole Logs

TABLE 1 MONITOR DETAILS & GROUNDWATER LEVELS

Project: Hydrogeology Phase 2 Limen Head Office
15123 Woodbine Ave. (21013.02)

Monitor Details						24-Oct-22			10-Dec-22			2-Mar-23		
Monitor	Well Depth (mbtoc)	Casing Stickup (magl)	Casing Elev.	Ground Elev.	Depth (mbgl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev. (masl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev. (masl)	Water level (mbtoc)	Water level (mbgl)	Water level Elev.
BH1	4.52	0.67	299.34	298.67	3.85	destroyed			destroyed			destroyed		
BH2	4.69	0.69	298.52	297.52	4.00	3.09	2.40	295.43	2.36	1.67	296.16	1.09	0.40	297.43
BH3	4.79	0.73	299.00	298.12	4.06	3.33	2.60	295.67	2.47	1.74	296.53	1.17	0.44	297.83
BH4	6.69	0.70	300.45	299.60	5.99	dry	dry	dry	6.12	dry	dry	1.57	0.87	298.88
BH5	5.98	0.78	299.61	298.67	5.20	5.39	4.61	294.22	4.12	3.34	295.49	2.93	2.15	296.68
BH6	5.05	0.81	299.00	298.09	4.24	dry	dry	dry	na	na	na	3.36	2.55	295.64
BH7	6.78	0.90	298.33	297.44	5.88	dry	dry	dry	dry	dry	dry	4.59	3.69	293.74
BH8	6.80	0.67	299.99	299.15	6.13	dry	dry	dry	dry	dry	dry	damaged		
BH22-1	5.36	0.86	298.26	297.40	4.5	3.72	2.86	294.54	4.12	3.26	294.14	1.73	0.87	296.53
BH22-2	5.36	0.86	297.86	297.00	4.5	5.11	4.25	292.75	2.96	2.10	294.90	2.55	1.69	295.31
BH22-8	5.46	0.96	298.56	297.60	4.5	2.95	1.99	295.61	2.02	1.06	296.54	frozen at grade		

mbtoc = metres below topp of casing

mbgl - metres below ground level

BH22-1, BH22-2, BH22-8 are Soil-Eng Borehole Monitors and
construction data are from the Borehole Logs